

A DOMESTIC P.A. SYSTEM—See Page 123

Practical and Amateur Wireless

3^D
EVERY
WEDNESDAY

Edited by F.J. CAMM

a GEORGE
NEWNES
Publication

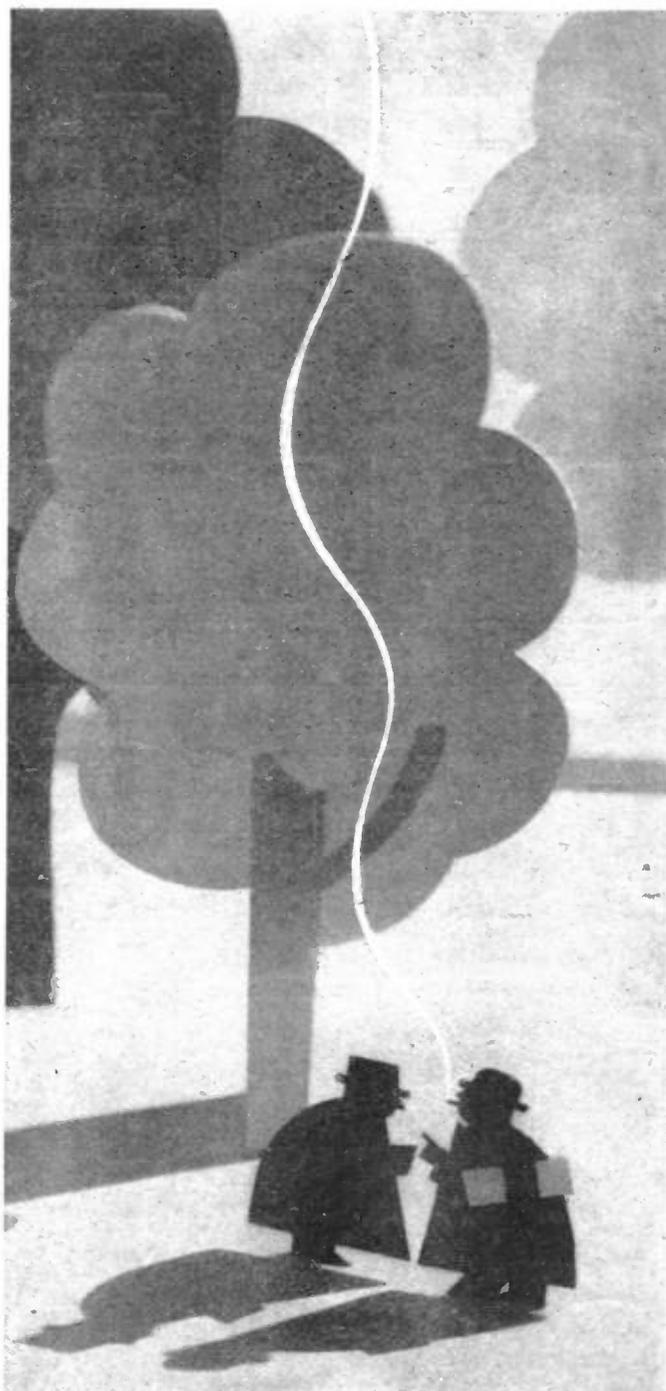
Vol. 10, No. 240.
April 24th, 1937

AND PRACTICAL TELEVISION

Microphone Methods *Made Plain*

NEWNES MOTORISTS' ROAD MAP OF LONDON

The Map of the Year for Every Motorist. See Cover ii.



"Wills" Gold Flake
 — now there's a
CLEAN SMOKE
 for you"

CLEAN AND SMOOTH TO THE PALATE

G.F.B. 95

NEWNES MOTORISTS' ROAD MAP OF LONDON and Surrounding Country

*A Real Investment
 for Coronation Visitors*

Every hiker, cyclist and motorist, and all people who get their pleasures from "going places," know that a good map is almost as essential as fine weather.

Since we cannot make the weather for you, we can merely wish you the best of the sunshine, and offer you the best of maps. A good map is always a fascinating possession. To study the way you will go is almost as pleasant as going.

The Maps:—

MAP ONE—Six hundred square miles of the London area, showing the principal thoroughfares and new arterial and by-pass roads, with explanatory list of map references to the chief places of interest, golf courses, and other sports centres.

Scale 1 mile to 1 inch.

MAP TWO—Map of the country surrounding London from Colchester to the South Coast.

Scale 4 miles to 1 inch.

Special Features:—

Printed in four colours on specially reinforced "canvas paper." Landmarks and points of interest clearly shown, as well as adjacent railways and stations. Types of road clearly differentiated in colour. The entire map calibrated in three-inch squares for easy scale reading. Folded to pocket size.

Only **2'6** net.

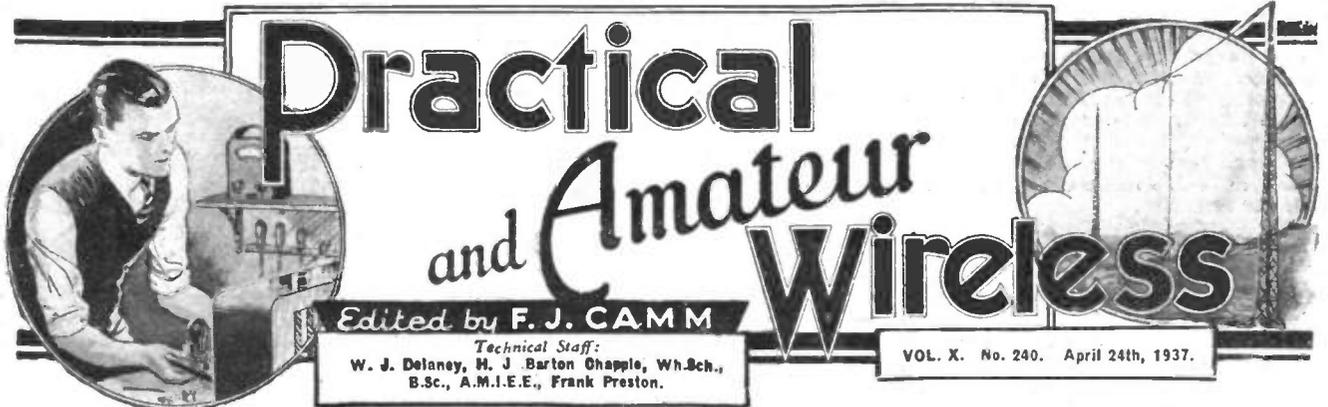
(post free 2'9)

From all Booksellers and Newsagents, or post free from the publishers, Tower House, Southampton Street, Strand, London, W.C.2.

NEWNES

TRANSMITTING TOPICS

See Page 125.



Practical and Amateur Wireless

Edited by **F. J. CAMM**

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

VOL. X. No. 240. April 24th, 1937.

ROUND *the* WORLD of WIRELESS

Using a Microphone

MANY beginners experience difficulty when they try to use a simple microphone for home-broadcasting purposes. They find that the speech is distorted, or that bad feed-back occurs, giving rise to a howl which, apparently, cannot be prevented. Furthermore, a number of amateurs are now building small public-address equipments for relaying band programmes in dance halls, and find that the distribution of sound is very difficult. All of these points have been met with by those who are experienced in public-address work, and it has been found that there is a definite technique which has to be followed, not only in the circuit and wiring arrangements which are employed, but also in the method of arranging the accessories and of using them. In this issue, the whole subject is treated extensively, and with the aid of the details given no difficulty should be experienced either in arranging for a small home broadcast, or in relaying the performance of a dance band over a large hall. The different types of microphone are explained and circuits are given showing the method of connecting the mike and of arranging the various incidental circuits.

Reorganisation in Denmark

FROM the beginning of this month broadcasting in Denmark passed under the control of a new Director-General. He is Mr. F. E. Jensen, an ex-Government official who has been a popular figure for a long time in Danish broadcasting headquarters.

Six Stations for Norway

SIX 150-watt transmitters are to be erected on the coast of Norway, to operate on a wavelength between 80 and 200 metres. The stations are to be used for the benefit of shipping and will utilise both telephony and telegraphy. The contract for building these stations has been placed with Philips Radio.

Midday Television

IT is stated that the B.B.C. will shortly commence to radiate a television programme of one hour's duration commencing at 11 a.m. Representations have

been made to the Corporation by the Radio Manufacturers' Association in order that manufacturers and others may have additional programme matter with which to carry out tests and demonstrations.

Philco Balloons

WITH reference to the recent note concerning the release of balloons from the Philco factory, we are informed that cards are now being received by Philco from various parts of the world. The first to be received was from St. Albans, but they are slowly arriving from

The programme will run from 10.15 p.m. until 1 a.m., and will begin in London. After a quarter of an hour, listeners will be switched over to a band in another part of the country, then back to London, and so on throughout the session. Each of the bands will represent a part of the United Kingdom, and will be on the air for approximately a quarter of an hour.

Eric Maschwitz Back Soon

THE B.B.C. Director of Variety is expected to return next week after a visit to a Californian ranch, where he has been recuperating. His immediate concern when he returns will be the final preparations for the elaborate Coronation Variety programmes for which his department will be responsible. We hope to give the full details of these programmes next week.

Don Rico's Ladies' Band

THE main item in the Variety broadcast from the Coventry Hippodrome in the Midland programme on April 29th will be Don Rico and his Ladies' Band. Apart from its original tone colour, this is one of the very few bands composed entirely of the "weaker" sex touring the halls.

Shetland Islands and Radio Communication

LITH ship-owners have complained to the Postmaster-General about the absence of communication with the Shetland Islands. They suggest that Lerwick should be brought into communication with the mainland by means of radio. Serious delays have been caused by the absence of communication during recent gales when steamers ran into Lerwick for shelter.

New Prague Podedbrady Call-signs

Make a note of the call-signs and wavelengths allotted to the Czech short-wave transmitters: OLR6A, 13.08 m. (22.94 mc/s); OLR5B, 19.58 m. (15.32 mc/s); OLR5A, 19.69 m. (15.23 mc/s); OLR5C, 19.79 m. (15.16 mc/s); OLR4D, 25.21 m. (11.90 mc/s); OLR4C, 25.26 m. (11.875 mc/s); OLR4A, 25.34 (11.84 mc/s); OLR4B, 25.51 m. (11.76 mc/s); OLR3A, 31.41 m. (9.55 mc/s); OLR3B, 31.57 m. (9.504 mc/s); OLR2B, 49.75 m. (6.03 mc/s); and OLR2C, 49.92 m. (6.01 mc/s).

Britain Dances

THE Dance Music on Coronation night will be played by Henry Hall and the B.B.C. Dance Orchestra and by a number of bands throughout the country.

ON OTHER PAGES.

	Page
A Domestic "P.A." System ..	123
Constructional Details of "P.W." Receivers ..	124
Transmitting Topics ..	125
Thermion's Page ..	127
Television Notes and News ..	129
Readers' Wrinkles ..	131
Microphone Methods Made Plain ..	132
Making a Universal Transportable ..	134
Short-wave Section ..	135
Club Reports and News ..	138
Readers' Letters ..	140
Questions Asked and Answered ..	142

ROUND the WORLD of WIRELESS (Continued)

Island Radio

RATHLIN ISLAND, which faces the Atlantic about six miles off the North Antrim coast, is now equipped with an up-to-date short-wave wireless installation working on a wavelength of 79 metres. There are about 400 inhabitants on the island, and before the radio was installed flares were the chief means of communicating with the mainland.

"Favourites" for Coronation Party

WE understand that Leonard Henry, Wynne Ajello, Davy Burnaby and Michael North will be among the artists taking part in the 75 minutes Coronation Party which Charles Brewer will produce on Coronation Night (May 12th). With Elsie and Doris Waters, Clapham and Dwyer, and The Two Leslies, who have already been announced as members of the show, they will re-create the hilarious atmosphere of the popular radio parties at Christmas in recent years.



Geo. Clarke, the well-known comedian, listens to a Yankee joke from Schenectady on his Pye receiver, model QAC3.

Television Bridge

A GAME of bridge will be played in television for the first time on April 24th, when Mr. Hubert Phillips, the well-known expert, will play a three-handed match with the television camera in the position of "dummy." Although the camera cannot transmit colour, the red cards will be easily distinguishable by their different tone value. As a concession to the small viewing screen specially large cards are being made for the occasion.

Midland Parliament

THE guest-speaker on April 22nd in Midland Parliament's discussion on "Modern Advertising and Industry" will be Sir Charles Higham, a well-known figure in publicity circles and author of several books on advertising and distribution. Sir Charles Mander will be in the chair. W. M. W. Thomas will speak for the

INTERESTING and TOPICAL NEWS and NOTES

employers' side and George Jones for Labour. Another speaker has yet to be chosen.

Concert from Bath

THE Bath Pump Room Orchestra, led by Norman Rouse and conducted by Maurice Miles, will broadcast a concert from the Pump Room, Bath, on April 22th.

Music-hall Music

ON April 30th William Pethers will conduct the Coventry Hippodrome Orchestra in an evening concert of music-hall music. This broadcast is arranged to illustrate various features such as acrobats, the Chinese conjuror, and dancers of various kinds.

Dance Interlude

IN a Dance Interlude on April 26th, listeners to the Western programme will hear Reginald Williams and his "Futurista" Dance Band, with Francis Crayman, Leonard Elliott and the Three Majors.

African Natives to Hear Coronation Broadcasts

IT has just been announced in London that the General Electric Company has received orders for the installation of wireless equipment that will form a network over a very large part of British West Africa. It will be completed in time for hundreds of thousands of natives to hear the Coronation broadcasts. The chief feature of this installation will be a permanent radio relay service that will provide the British Government with a powerful means of propaganda among the native peoples.

The service will operate, through 5,250 loudspeakers, from seven centres. Installations at Lagos, Accra, Cape Coast, Sekondi

and Freetown have already been completed, and those at Koforidua and Kumasi, as well as other towns, are in course of construction.

Town Tour

JOHAN BETJEMAN is revisiting Plymouth, and on April 26th, in the series entitled "Town Tour," he will broadcast from there his opinions about its architectural amenities.

Concert from Torquay

ANOTHER popular concert by the Torquay Municipal Orchestra will be broadcast from the Pavilion, Torquay, on April 27th. Laurence Holmes (baritone) will be the vocalist.



June Knight photographed whilst recording two new songs from the film "Lilac Domino" at the H.M.V. studios. The titles of the record are "Lilac Domino Waltz Song," and "My Heart will be Dancing" on H.M.V. B.8555.

SOLVE THIS!

PROBLEM No. 240

Temple built a simple 3-valver of the H.F. Pentode, Detector, Pentode type, using a 2-gang condenser and a 2-gang coil unit having a wave-change switch mounted in the base. Reception was satisfactory on the long-wave band, but only a weak signal from the local station could be picked up on the medium-wave band. What was the probable cause of the low M.W. sensitivity? Three books will be awarded for the first three correct solutions opened. Address your solutions to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 240 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, April 26th, 1937.

Solution to Problem No. 239

The anode socket of the outside valve-holder was touching the metal chassis, thereby short-circuiting the bias resistance.

The following three readers successfully solved Problem No. 238 and books are accordingly being forwarded to them: G. A. Dickinson, 102, Sidcup Hill, Sidcup, Kent; E. Broming, The Shrubbery, Totnes, S. Devon; A. E. Royle, 23, Mornington Road, Chingford, E.4.

Glyndebourne Opera Broadcasts

WE are informed that arrangements have been completed to broadcast the following operas of Mozart from Glyndebourne during the coming season:—

May 19th: *Don Giovanni* (Act 2).

May 27th: *The Magic Flute* (Act 1).

June 3rd: *Figaro* (Act 3).

Two further broadcasts from Glyndebourne will take place later in the season, details of which will be announced in due course.

Mendip Cave Crawl

AN interesting broadcast will be given in the Western programme on May 1st, when an attempt will be made to descend with microphones into Swildon's Hole.

Listeners will be taken through 400ft. of narrow tunnels and "squeezes" through which only a small man can pass, with occasional deep streams, waterfalls and caves, all hundreds of feet below ground. Besides being a thrilling sport, speleology has its practical aspects for archaeologists in their search for caves which have been inhabited, and for those who follow the courses of streams.

A Domestic "P.A." System

Details of a Scheme which Enables Room-to-room Conversations to be Carried Out on a Standard Receiver By W. J. DELANEY

THE following arrangement was installed during the illness of one member of the family and was originally designed to avoid running backwards and forwards from the sick-room. The idea was developed and finally an interesting "public address" system was evolved which has since proved so useful that the details are given to enable others who may be interested to make use of the various ideas incorporated in the system. The first requirement is one or more extension listening points, and in my case there is such a point in each room. Ordinary 5-amp electric lighting sockets are mounted

to the extension listening points, a standard plug being fitted to the lead for the purpose. It will thus be seen that either the built-in or the extension speakers may be used singly or together, and to ensure correct matching the extension speakers are of the type provided with a ready-matching transformer.

Input Arrangements

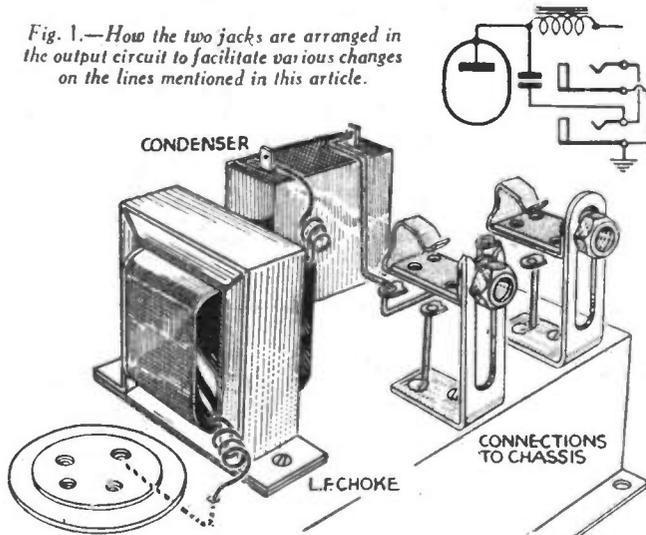
On the input side, the pick-up terminals on the chassis are connected to a jack mounted on the motor-board of the receiver (which is, of course, of the radiogram type) and this jack is arranged close to the pick-up which is in normal use. The jack employed in this position is one of the Igranic components which, unfortunately, is not now easily obtained, and is of the type in which opposite pairs of contacts are normally joined together, but the insertion of a plug opens these contacts and enables the component connected to the plug to be joined to one pair of contacts. The arrangement is shown in Fig. 2. It will thus be seen that when the plug is withdrawn from the jack the pick-up is connected to the receiver, but upon inserting the plug into the jack any other component may be joined in place of the pick-up. Alternative makes of jack of this pattern may, of course, be utilised.

without raising the voice, although naturally not of the very high quality associated with a properly-designed microphone. The extension plug at the receiver is therefore removed from the socket and changed with the mike plug on the motor-board, the leads being sufficiently long to permit of this and the change being carried out in a second. The person at the distant point naturally waits a moment or so before replying, although this slight defect could easily be obviated by fitting a double-pole change-over switch. I do not think this is necessary, however, and rely upon the simpler scheme of changing plugs. I have found this plug and jack arrangement possesses many other advantages, and have also employed it for the home-recording arrangements recently described in these pages. The pick-up plug is inserted into the extension speaker socket, leaving the existing speaker in circuit to act as a guide to the volume being obtained, and the microphone or an additional pick-up from another record being plugged into the pick-up jack. By connecting a mixer circuit one is thus able to blend speech with recorded music in making a record to any desired arrangement, and, additionally, the plug may be withdrawn, or the radiogram switch operated so that the radio programme may be recorded.

Advantages of the System

It will thus be seen that this simple arrangement has unlimited possibilities and is at the same time exceedingly simple to fit up. No unwanted or lengthy leads have to be accounted for (which would probably be the case if switches were employed for the various changes); rapid changes for test purposes may be made on the input or the output side; and the wiring to the receiver does not need altering for any of the tests, thus preventing difficulties which

Fig. 1.—How the two jacks are arranged in the output circuit to facilitate various changes on the lines mentioned in this article.



on the skirting board and wired between rooms with flat twin flex, and incidentally these are so arranged that when required they also carry the electric supply for the use of standard and other portable lamps, in cases where the existing room plug is in use or when lighting is required in an odd corner. Separate leads are employed for the extension loudspeakers to avoid confusion between lights and wireless, and standard 5-amp plugs are fitted to these. On the receiver chassis an output filter is employed, and it was not found in my case practicable to utilise a separate earth at each point and this accounts for the twin leads to each point.

Output Arrangements

Only two extension speakers are in use, and these are changed from one room to another when required, sufficient length of lead being provided on the cabinets to permit of plugging in the appropriate socket in each room. On the rear of the chassis carrying the amplifier stage of the receiver two brackets are mounted and these carry two Bulgin Single Open Circuit jacks. These are wired in parallel, one side being connected to earth and the other to the condenser. The arrangement is shown in theoretical and pictorial form in Fig. 1. The built-in loudspeakers (of the balanced pair type) are provided with a short lead to the end of which a standard plug is fitted and this is normally inserted into one of the jacks, the other being reserved for the lead

How the Arrangement is Used

This plug and jack scheme permits of rapid changes of pick-ups to be made for test purposes and also enables a microphone to be used in place of the pick-up. For use in the room-to-room communication scheme, the microphone and associated battery are connected permanently to a plug and kept on the motor-board and when required the plug is inserted into the jack, with the result that one can speak via the extension leads to any room in which a speaker is connected. To reply, the speaker is employed as a microphone, and the sensitivity of the average moving-coil speaker is such that speech may be heard from the remotest corners of the room

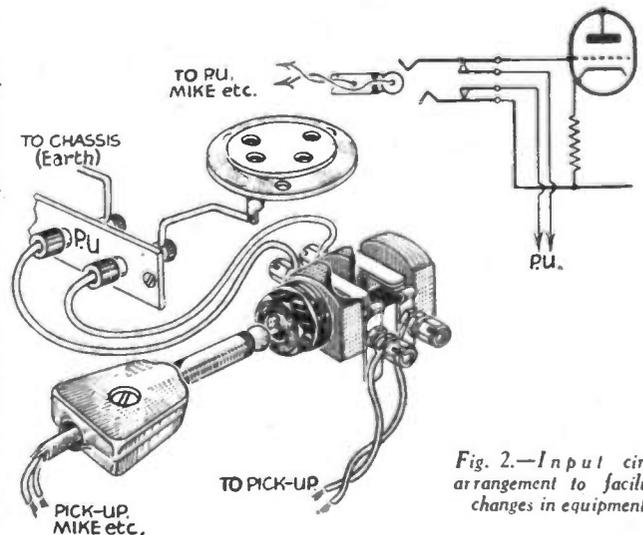


Fig. 2.—Input circuit arrangement to facilitate changes in equipment.

sometimes arise when connections are being continually changed or altered. No doubt further modifications to the basic scheme will occur to the keen experimenter.

TRANSMITTING TOPICS

In this Article the Operation of a 2½-W. Transmitter on A.C.; A Modified 7½-W. Transmitter; and a Headphone Monitor are dealt with.

By L. ORMOND SPARKS

REPORTS received indicate that the 2½-watt transmitter, recently described in these pages, is proving highly satisfactory, and that it has been the means of many keen amateurs entering the transmitting sphere of radio. There are, however, many who wish to make up an A.C.-operated outfit, but they have come up against the difficulty of securing a B.V.M.A. valve suitable for the design; therefore, the details given below will be of some assistance.

If the range of American valves is examined it will be noted that the 6A6 and the 53 are of the "twin triode amplifier" types, otherwise known as Class B valves. The only difference between these is that the 6A6 has a 6 volt .3 amp. heater,

for a little experimenting, the application of bias, by the usual resistance in the cathode circuit arrangement, but it is not essential for operation though a slightly higher output efficiency can be obtained by applying a small bias. I would suggest 250 ohms and 500 ohms as suitable resistance values to try. While considering this part of the circuit, it should be noted that the grid resistance is much greater than in the original and, bearing in mind that a certain bias is applied by virtue of the

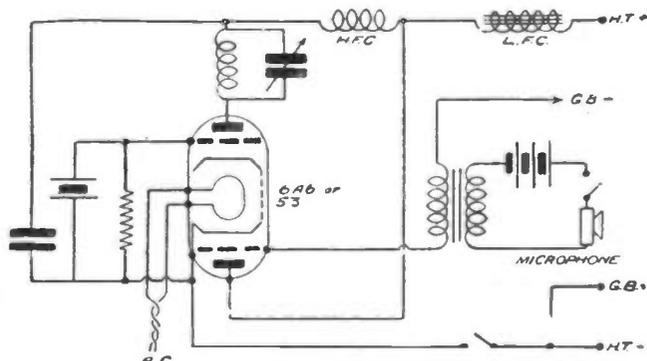


Fig. 2.—An A.C. mains version of the 2½-watt transmitter.

"mike" is used with the usual high-ratio step-up transformer.

Aerial

The simple "End-on Hertz" or the "Zepp" types are quite suitable, providing the details previously given are followed, and care taken in the measurements.

The 7½-watt Transmitter

Several constructors have raised the point about "frequency doubling" with the circuit I suggested for the above transmitter, to enable them to operate on more than one wavelength without the trouble or, rather, cost of additional crystals.

It will be remembered that two valves were specified in the transmitter section, a C.O. (crystal-oscillator) and a P.A. (power amplifier), and such an arrangement is not satisfactory, as it stands, for "doubling," so I give below the slight modification necessary.

The circuit shown in Fig. 3 is the original suggestion, while Fig. 4 shows the modified form, embodying another valve and simple switching arrangements to allow other wavebands to be covered.

(Continued overleaf)

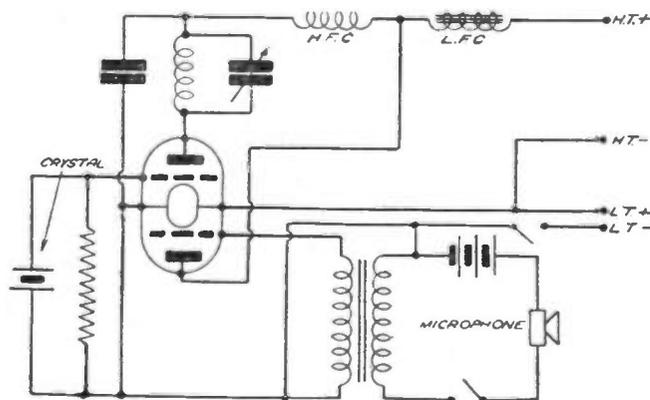


Fig. 1.—Circuit diagram of the 2½-watt battery transmitter recently described in these pages.

while the 53 requires 2.5 volts at 2 amps. The output, which is given as 8-10 watts, is identical in both cases.

The valves can be obtained in the normal manner from most large retailers, and as their cost is very low, compared with a similar B.V.M.A. type, the whole outfit comes out at a very reasonable figure. The circuit is shown in Fig. 2, while Fig. 1 shows the original battery-operated version, and it will be seen that very little alteration is necessary.

If the 6A6 is used, and I would suggest it in preference to the 53, a small filament transformer can be obtained for a few shillings, thus allowing a standard H.T. arrangement to be used. If a valve rectifier is embodied, 250/0/250 volts at 60 mA will be quite suitable, and as that is a widely used output, it is quite possible that the necessary components will be on hand in the spares box.

Batteries or a metal rectifier can, of course, be used according to individual requirements and gear available, but I would not advise batteries from the point of view of economy and falling source of supply.

Method of Keying

The keying circuit has not been shown, but that can be inserted in the same way, with filter, as for the original battery model. There is only one item which calls

grid current flowing through the resistance, various values should be tried.

In spite of the greater output, the 6A6 can be modulated quite satisfactorily with the one triode section if a sensitive carbon

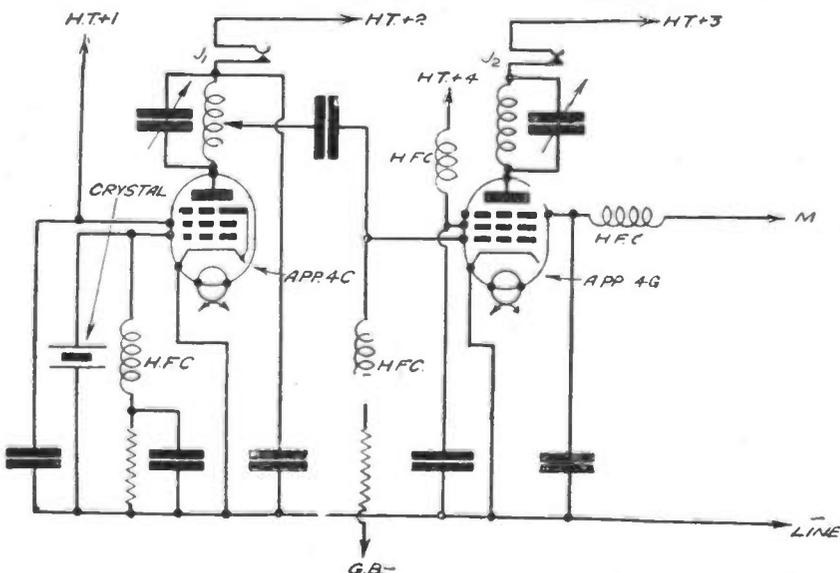


Fig. 3.—The crystal oscillator and power amplifier originally described.

TRANSMITTING TOPICS

(Continued from previous page)

Operation

If the input to the grid of a valve has sine-wave characteristics, and the valve is adjusted to operate on the straight part of its curve, a similar waveform will be produced in the anode circuit, or, in other words, no distortion will be introduced. Supposing, however, that the valve is so biased that it is operating on the bottom bend of its curve, then the anodic variation curve will no longer be a true reproduction of the input; in fact, if the curves are compared, it will be found that the frequency

necessary drive is available. The additional bias can be provided by batteries, which have certain advantages in this type of circuit, or by using a rather high-resistance grid leak, for example, the leak should have a value of three to four times the value of that specified for normal operation of the type of valve concerned.

There is one point to watch with "grid-leak" bias arrangements. If the drive or excitation of the "doubler" fails, an excessive anode current will flow, sufficient, in fact, to cause harm to the doubler valve, especially if high anode voltages are being applied. With the battery system, this risk

Headphone Monitor

One of the most essential pieces of apparatus for a transmitting station is some means of checking the transmission, and, while it is possible to make use of very elaborate gear, it is also possible to make very good use of the simple arrangement mentioned below. An examination of the circuit diagram, Fig. 5, will show that it is nothing more than a detector and L.F. amplifier, using a double diode triode across a plain tuned circuit. The headphones are connected between the output condenser and earth, no D.C. flowing in this circuit. It is essential that headphones are used, as feed-back into the "mike" circuit will be obtained if a loudspeaker is used. The tuned circuit can be formed with any suitable coil and condenser combination, providing the frequency of the transmitter comes within the tuning band.

It will be found that the arrangement is quite sensitive, and that ample output is provided to enable accurate checks to be made on the quality of transmission, modulation experiments, adjustments, hum, and other undesirable noises, while it will

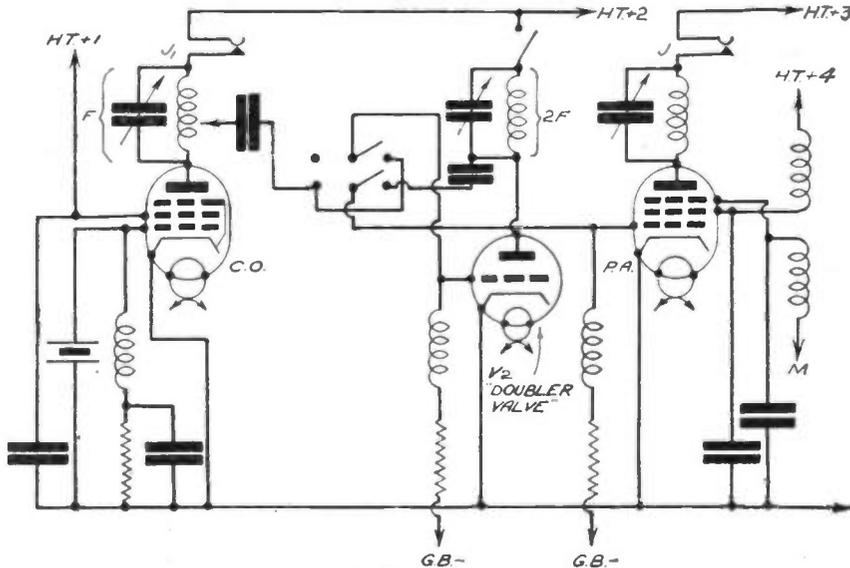


Fig. 4.—How to modify the C.O. and P.A. shown in Fig. 3.

of the anode curve represents a "harmonic," usually the second, of the input or fundamental frequency.

If, in the anode circuit, a coil with variable condenser in parallel is connected, and the arrangement tuned to double the input frequency, a barrier will be presented to the component at the higher frequency, and it will be possible to feed it into the P.A. stage via the usual inter-valve coupling.

It must be appreciated that a valve used for frequency doubling is really operating as a "generator of harmonics" and, as the anode circuit is tuned to a different frequency from that of the grid, it is not likely to act as an oscillator or become unstable, and, therefore, ordinary triodes are quite satisfactory.

is, of course, not present, and, therefore, as both methods have certain desirable features, it is quite common for a combination of the two to be used. i.e. bias applied from a battery to keep the anode current within safe limits, and a grid leak, connected in series with the battery, to provide the extra bias needed for operating conditions during normal excitation.

Regarding the anode or "tank" circuit, it is necessary to use a coil capable of tuning to double the input frequency with a variable condenser having rather a low capacity. It is advisable not to exceed, say, 50 micro microfarads, while the valve, for preference, should be of the high amplification factor type.

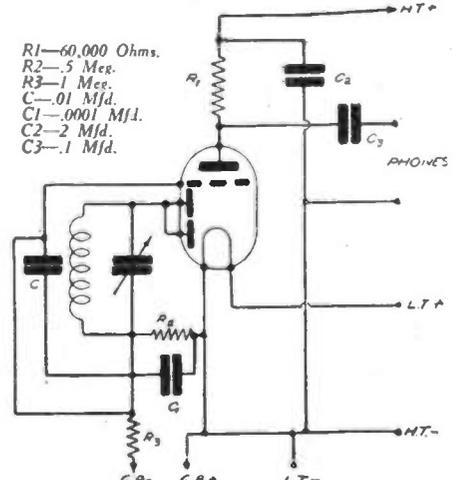


Fig. 5.—A simple headphone monitor.

also serve, providing the tuned circuit is properly designed, as a frequency check. The layout is not critical, but I would suggest that it is built as a self-contained unit, whether batteries or mains are used. Although batteries are looked upon by many as being rather troublesome, they do possess the advantage of dead silent operation, a rather valuable feature in a rig of this type.

Little Gain

While such an arrangement can be looked upon as a "straight amplifier," apart from actual operating conditions, it is not usual to obtain much gain from the stage, in fact, in many instances, no gain at all is obtained, the efficiency falling off as the higher harmonics are reached. For a simple "doubler," i.e., second harmonic, the "driving" power should be two or three times as great as that required for ordinary amplification. It will be obvious, in view of the nature of the circuit requirements, that it is not advisable to use valves in push-pull, owing to the freedom of the second harmonic content in their output; parallel arrangements are quite efficient.

To obtain a large harmonic output, it is necessary to bias the valve right down to the "cut-off" point of the anode current curve, in fact, it is quite usual to apply double the "cut-off" bias, providing the

TELEVISION AND BROADCAST WAVELENGTHS!

HITHERTO only those in possession of ultra-short-wave receiving sets within the service range have been able to tune in to the sound section of the Alexandra Palace transmissions. Plans are developing, however, and will materialise shortly, whereby the national and regional transmitters on the medium and long waves will radiate some of the television programmes. The best artists are used whenever possible for television, and although the prime factor is sight, with sound as an essential complement, listeners can enjoy the sound signals. Incidentally, this should prove a valuable advertisement for the television service, and is yet another angle whereby receiver sales may be stimulated. In addition, realising the extra quality

of the ultra-short-wave sound broadcasts because of the absence of sideband limitation, efforts are being made to radiate ordinary radio programmes on these bands. A low-powered transmitter is installed on the roof of Broadcasting House, and although only rated at 250 watts many special tests have been undertaken in conjunction with the equipment, and it seems certain that some form of public service will be possible later on. The benefits accruing from the more faithful reproduction of the audio frequencies will then become apparent, and readers of PRACTICAL AND AMATEUR WIRELESS who have studied the weekly short-wave section will be in a position to take immediate advantage of any transmissions of this nature.



On Your Wavelength

By **TAERMION**

Sheer Cussedness

MY friend the Secretary of the New Zealand Short-Wave Radio Club asks me to ask you if it has ever occurred to you that a man's life is full of cussedness. He comes into the world without his consent, goes out against his will, and the trip between is extremely rocky. When he is little the big girls kiss him; when he is big the little girls kiss him; if he is poor he is a bad manager; if he is rich he is a crook. If he is prosperous everybody wants to do him a favour; if he needs credit they hand him a lemon; if he is in politics it is for graft; if out of politics he is no good to his country. If he does not give to charity he is tight-fisted; if he does it is for show; if he is religious he is a hypocrite, and if he takes no interest in religion he is a heathen; if he is affectionate he is soft; if he cares for no one he is cold-blooded; if he dies young there was a great future before him; if he lives to an old age he missed his calling. If he likes girls he is a flirt; if he doesn't he is a misogynist. Well, I have asked you the question; if you want to supply the answer write to the New Zealand Short-Wave Radio Club.

My Pet Aversions

ONE or two readers have written to ask if I have any more pet aversions besides crooners. Yes, I have! I simply loathe grown-up girls who talk about their daddy and their mummy. I despise men who wear suede shoes and silk underwear. I execrate those poor nitwits who spend their time writing letters to the Editors of daily papers on every subject under the sun; I hate young men who spend all their spare time dancing. I hate the sporty boys who drive low-built sports cars; I dislike jazz music and, equally, classical music is anathema to me. I do not like people

who say scon for scone, or pruen for prune. I could easily add to this list, but that's

enough to go on with.

New Wireless Clubs

LAST week the Editor published a full page of names and addresses of wireless clubs. This is the most complete list ever published, but it is incomplete in that in some cases we are without the names and addresses of the officials. Will you do the necessary if you can help? Mr. H. A. Brown, of 12, Stourport Road, Kidderminster, wishes to form a club in his district. Will local readers get into touch with him? Several of the secretaries of wireless clubs have written me deploring the lack of interest in club life. Mr. J. J. Maling, of The Southall Radio Society, tells me that they have found that at Southall to keep enthusiasm at a high pitch it is essential to have a constant stream of new members. They encourage visitors to meetings, but never ask them to join the society; the approach must come from the visitor. The Secretary of the Smethwick Wireless Society, Mr. E. Fisher, M.A., of 33, Freeth Street, Oldbury, Nr. Birmingham, tells me that his society holds a transmitting licence (G2GX), and for some time have been conducting tests on the 10-metre and 5-metre bands. The Smethwick Wireless Society is a very old one, but has had great difficulty in keeping going, for in spite of their public lectures, demonstrations, advertisements, and practical experiments, the backbone of the society still consists of those diehards who have been members for years, and who regard the society as being something that really belongs to them. He is very pleased to see that this journal is taking an active interest in societies. This journal has without a break since its inception regularly published wireless reports of clubs. Our difficulty has not been to find

space for them, but to get secretaries sufficiently interested to take advantage of the free publicity we offer. If a secretary is so lax that he cannot send reports to the wireless papers he must expect the club to die. Local advertisements may be all very well in their way, but a report in a national journal such as P. and A. W. will put every club in touch with the most desirable type of prospective member—the enthusiast.

Poor Components

HEREWITH a letter from L. B. J., of Weston-super-Mare, which speaks for itself:—

"I have taken PRACTICAL WIRELESS since it first came out and also PRACTICAL AND AMATEUR WIRELESS and I have frequently noticed comments by yourself about the poor components which are sold to home constructors.

"I have been constructing now for over ten years, but I won't bother you with details of faulty speakers, valves, fixed and variable condensers, potentiometers, although I have had more than my share of them, but I should like to give you a brief summary of my experiences with coils and to ask you what on earth is the matter with them all.

"1927 or 1928. Built a widely advertised set, my first set. Coils faulty, gave up constructing for some months, except with plug-in coils which never gave any trouble.

1931. Built a set employing a pair of—Coils, had two faulty pairs sent me in succession, scrapped them and returned to plug-in coils, and the firm refunded the money for the Coils.

"1933. Decided to try the iron cored coils and to build a set described in a journal, using a pair of—coils. One coil turned out faulty. I wrote Messrs. — and for some reason they suggested that I exchange them for a pair of ganged coils — for the Ether Searcher in *Amateur Wireless*, January, 1934. This they offered to do, and charge

no extra, these coils being dearer than the pair they were exchanging.

"I did so, and received a pair in which the switch was hopelessly faulty—medium on long-wave, high-wave everywhere. I took the coils out and returned them, and the next pair they sent me were connected together the wrong way round. After a week or so trying to make the set go I scrapped the coils, and wrote them down as a dead loss. I finally got the set going with a pair of — coils, —, but not before I had to return one for a broken connection.

"All those months I had been wearily struggling to get my set finished, continually being held up with the faulty coils and thoroughly fed up, and owing to a growing horror of buying coils I have kept my set as it is ever since 1934.

"But I have a spare small 3-valve set, and I have had very similar bother.

"I first built the — and had much switch trouble, changed to — iron-cored type, but the selectivity was so poor I decided to remodel the set and use a pair of — coils. The reaction winding in one of these was shorting and I returned it. Three times it came back to me, and each time in the same condition. I then got wild and wrote to the firm declining to have any more of it and asking for the 10s. back. They were very contrite, said those responsible would be reprimanded, and returned me the 10s. I next bought a pair of Unigen coils, and, wonderful to relate, they were both in order.

"During this last week I have been building another small 3-valve set—Det. and two L.F.—and I sent for another — coil, asking the makers to be sure and test before sending. I roughly tested the coil for continuity, built the set, and then on trying out found the coil was faulty, and on test the terminals were found to be shorting between 2 and 3. I am now held up pending the arrival of another 'faulty' coil.

"What can one do? I have given up dealers because they do not cater for the constructor, and the big London firms take an appalling time to execute orders, often send the wrong or broken component, so I invariably buy straight from the makers.

"I often feel tempted to build sets as set forth in your paper, but I do not feel I can cope with the worry and bother of the coil question.

"I would rather give up wireless than listen to commercial sets, and



Notes from the Test Bench

H.F. or I.F. Stage?

THE most common type of superhet in use to-day employs four valves; a frequency-changer, an H.F. pentode as I.F. amplifier, a double-diode or a double-diode-triode, and a pentode in the output stage. The popularity of the all-wave type of set during the past few months has caused the manufacturers to experiment with additional stages, however. The standard four-valve type is quite good enough for reception on the broadcast bands, but it leaves room for great improvement on the short-wave bands. Some manufacturers favour the addition of an H.F. stage, whereas others prefer to add an extra I.F. stage.

Up to the present there are more sets available with an H.F. stage than with two I.F. stages, but it is probable that this order will be reversed during the coming season. An extra I.F. stage will certainly increase the sensitivity to a greater extent than an H.F. amplifier, but it is difficult to control, and unless very effective screening is used optimum amplification cannot be obtained. This difficulty is being overcome by manufacturers, however, but the home constructor is advised to use an H.F. stage and one I.F. stage for the present. Perhaps before the end of the year suitable components for effectively employing two I.F. stages will be available and sufficient room should therefore be allowed for the addition of an extra valve and I.F. transformer—it will be much easier to add an I.F. valve than an H.F. valve.

Frame Aerials

MANY of our readers seem to be very doubtful concerning the correct use of the frame aerial. It is very commonly believed that the frame aerial is merely a coil of wire wound round the receiver case and connected to the aerial terminal in the same way as an outside aerial. This type of aerial is sometimes used in transportable receivers having a large cabinet, but is unsuitable for a small portable. For the latter type of receiver, a correctly-designed frame aerial should be used, one end being connected to the fixed vanes of the first tuning condenser and the other end to the moving vanes, the coil normally connected across the condenser being omitted. Approximately 70 feet of wire should be used for medium-wave reception, and the turns should be spaced about $\frac{1}{4}$ in. apart for best results.

Everyman's Wireless Book

3/6, by post 4/-
helps you to trace that fault!

besides, half the fun is in building but I see no option but to give it up and hang on to my present sets until they fall to pieces.

"I thought my experiences might be of some interest to you."

Sir Thomas Beecham

I READ that Sir Thomas Beecham has been having a slash at the B.B.C. because, in his opinion, three parts of the broadcast matter is nonsense. That is an arguable point. I think that a very high proportion of the matter broadcast by the B.B.C. is excellent, but I agree that a high proportion of the music is jazz. Sir Thomas Beecham is not in any position to judge what wireless listeners want. The B.B.C. is, and because it believes in giving the public what it wants, and not what Sir Thomas Beecham thinks it ought to have, that is a point in its favour. If Sir Thomas Beecham were in charge of the B.B.C. Music Department, I have no doubt that the wails from listeners would be more voluminous than they are to-day about crooning and jazz. We must also remember that there was less interest in the style of music which Sir Thomas Beecham purveys before broadcasting started than there is to-day, so radio must have done orchestras a bit of good. I do not think that Sir Thomas Beecham, in his efforts to fan the lost cause of promenade concerts and classical music, does his case a lot of good by lashing the B.B.C. in this way. It is not the first occasion on which he has let himself go!

A Challenge

THE Secretary of the Southend and District Radio and Scientific Society held a Coronation Year Radio Exhibition on April 2nd and 3rd. They produced an excellent programme of this, and on page 5 I note the following: "Every important town in England has its Radio Society or Club, founded with the object of enabling those interested in the art and science of Radio Communication to get together, exchange ideas, and improve their knowledge of this vast subject. Some of these are solely 'Short-wave Clubs,' consisting only of the people interested in certain aspects of radio work, others are purely scientific bodies, but, as far as we are aware, ours is the only Society in the country which not only embraces all aspects of Radio and allied scientific studies, but also carries out a comprehensive programme of charitable work. We rely on the generosity of visitors to our exhibitions for the greater part of the funds which are needed to carry on this work."

Practical Television

April 24, 1937. Vol. 3. No. 47.

Those Standards

IN many quarters it is a matter of mystery how the standards of definition for the line dissection of television pictures is arrived at. Why choose what is an apparently abstruse odd number when on the surface any other should suffice? For example, we have a B.B.C. standard of 405 lines interlaced in this country, whereas to the uninitiated a figure of 403 or 407 should do just as well. The decision, however, is not so simple as it seems at first sight. First of all, assuming that interlacing is to be preferred to sequential scanning owing to its reduction of flicker, readers will appreciate from the various diagrams published in these pages that an odd number of lines is an advantage, since it enables the intermeshing to occur better with the one line halved and the two pieces positioned at the top and bottom of the scan. With an even number of scanning lines the time-base generator would be complicated, as it would be essential to shift the scan position bodily up and down each frame (half picture scan) to enable the odd and even lines to intermesh. Secondly, the master oscillator which generates the line and frame scanning frequencies is locked to the A.C. mains for its prime frequency. This is 50 in this country, and to obtain the required high-definition line frequency, harmonic multiplication takes place, the selection being of the lower order of harmonics because of the higher efficiency of the selecting filter circuits working under these conditions.

There are a whole series of graded numbers which fulfil these conditions and 405 is one of them, so that, briefly, is the reason for the present choice. It is known that the Americans are trying to secure some form of international agreement on standards of definition, picture and frame frequency, and also picture ratio of length to height. In this way it is claimed that the commercial field of exploitation will be extended very considerably. Many of their Press demonstrations have been undertaken on a standard of 343 lines, but more recently the American R.M.A. have recommended to the Federal Communications Commission that this should be changed to 441. Both these figures are based on an interlaced picture and differ from this country because the standard A.C. mains frequency in the States is 60. It has been stated quite frequently that in America there is a desire to avoid any possibility of rapid obsolescence of television receivers due to altered standards, coupled with the wish to bring television to a higher state of perfection before initiating any wide scale public service. This certainly is a good policy, but is a form of conservatism which may result in the United States being left behind by those European countries who have already started transmissions. Valuable experience is being gained in England, France, Italy and Germany, and public co-operation, together with unbiased Press criticism, especially when of a constructive nature, keeps the project alive to such an extent that there is little likelihood of a stalemate occurring here.

Breakdowns

IT is a matter of regret that there have been one or two breakdowns in the television transmissions from Alexandra Palace. On the last occasion, an evening transmission, a sound programme was radiated by the artists, but this only seemed to emphasise the importance of the pictures and show how radiated intelligence depends to such a large extent on the appeal to the eye. Since the B.B.C. as a result of the recent Advisory Committee decision, have duplicate radio transmitters, etc., it would seem a better plan to have this equipment always standing by and so preserve a continuity of service which is so essential in the early days.

Cable Tests

THE Post Office engineers are determined to make sure that the coaxial cable which is now being laid between some of the principal cities in this country is capable of carrying the wide range of signal frequencies for which it was originally intended. To this end equipment has been bought for the purpose of simulating signals embracing the ultra-high frequencies included in every good quality television signal. In this way a direct comparison between input and output signals can be made and a careful examination made for any form of phase distortion or amplitude mutilation. No doubt the best course for this purpose will be to use a cathode-ray oscillograph and either watch the signal shape on the screen or alternatively make photographic records on a special type of film camera for subsequent enlargement on to a cinema screen. It is stated that the equipment can reproduce signal frequencies considerably in excess of those already present in the B.B.C. television service picture. This is to prepare for the future when improved standards of definition are certain to materialise.

French Progress

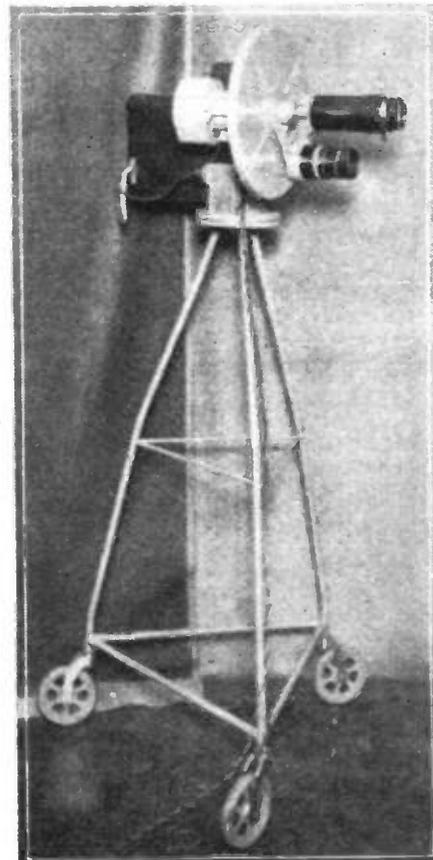
A LARGE exhibition is being organised to take place in Paris this year, and it is now learned that a new and powerful television transmitting station is to be erected at the base of the Eiffel Tower so as to be in operation in time for the exhibition. The power is given as 30 kilowatts, but it is not known whether this figure is for the mean aerial dissipation or peak power. The company from whom the equipment has been ordered is Le Material Telephonique, and the aerials will be over one thousand feet above the ground. This should ensure a good service range, and the studios housing the scanning equipment will be built in the Radio building of the Paris exhibition as well as in the P.T.T. broadcasting station. Visitors will thus be able to see some of the latest developments and no doubt compare the studio scene itself with the received pictures shown on various sets. It is not yet known what standards of definition will be employed, but no doubt they will be an improvement on the early ones of 180 lines with consecutive scanning.

An Early Portable Camera

WITH the degree of flexibility and portability associated with the

present forms of electron cameras accepted now as a natural part of their function, one is apt to overlook the early efforts made in this connection when the B.B.C. were radiating their low-definition television service. This was brought to light by the recent appearance of Jack Payne and his band at the Alexandra Palace. Although this was the band's initial appearance on high-definition receivers, it was by no means the first occasion on which they were brought face to face with the television camera. In October, 1931, the band inaugurated a series of weekly half-hour television transmissions by the Baird process from the old B.B.C. building at Savoy Hill. A newly-designed portable scanner was installed in one of the studios, and not only was Jack Payne seen conducting and announcing, but several members of the band were seen in concerted numbers. The actual equipment used on this occasion is seen in the accompanying illustration. It consisted of an automatic arc lamp, in front of which was an encased scanning disc driven by a steady speed motor. Two lenses on an adjustable arcuate arm enabled extended and close-up scenes to be featured, while portability was ensured by having the whole scanner mounted on a tubular tripod with rubber-tyred wheels. Horizontal panning was allowed for by incorporating a small turntable at the top of the tripod and the results at that time were outstandingly good when the degree of definition was borne in mind. This "camera" was used for several months together with the associated banks of photoelectric cells, and quite rightly can be regarded as the forerunner of present-day portable television scanners, although not of the modern electronic form.

(Continued overleaf)



The first portable television scanner used by the B.B.C. over five years ago at Savoy Hill.

(Continued from previous page)

In Berlin

RADIO executives from most of the important European countries attended Berlin recently for a meeting of the International Broadcasting Union. The conference took place in Berlin's luxury hotel, The Adlon, and a special television demonstration was witnessed. This was not too impressive as the Germans are still radiating an experimental service with only 180 lines, 25 frames, 25 pictures per second, and the results were very inferior to what is now possible in this country. This consistent maintenance of one standard by Germany for so many years is difficult to understand, for they were first in the field with a high-definition experimental service, and with Government backing it is hardly possible that progress has not been made beyond this point. Perhaps the authorities are waiting for an opportune moment to inaugurate a service which will be even better than the present B.B.C. one, or alternatively the improved equipment is being retained for Government purposes.

Television Cost

WHEN the B.B.C. television service was first inaugurated it was impossible to arrive at any definite figure for the cost involved. The purchase of equipment, alterations to the chosen site, the appointment of staff, etc., were unknown factors in terms of money. Now that the service has been in operation for some months, however, a closer approximation to the sum involved for a year's operation is possible, and in a recently published report, the B.B.C. estimate the cost as £300,000. This is a large sum, but it seems certain

that economies will be effected by using suitable television items as broadcast material on the ordinary medium and long-wave stations. Properly organised, with the requirements of both viewers and listeners adequately catered for, a scheme of this nature is sure to develop, and experiments in this connection will be watched with interest. Viewers are certainly helping in programme compilation by their letters to the B.B.C. and the replies to the Question Forms which were sent out recently. One

The Coronation Procession.

It is hoped to televise the Coronation procession at Apsley Gate, Hyde Park Corner, on the return journey from Westminster Abbey. A running commentary will accompany the broadcast, which will open with crowd scenes and last approximately an hour.

The B.B.C. anticipates using three cameras. One of these, installed on the plinth of Apsley Gate, will give overhead views of the advancing procession, while a second camera, operated from the pavement immediately to the north of the Gate, will provide close-ups as the procession passes through the arch. Another camera facing southwards from Apsley Gate will show the end of the procession crossing Piccadilly towards the Green Park and Constitution Hill.

thing is very apparent, however, and that is that it is going to be almost as difficult to satisfy viewers as it is listeners, owing to the wide variety of tastes.

O.B. Preparations

THE present aerial array at Alexandra Palace is positioned at the top of a mast which is 300ft. high. This is to be capped, however, by another slender pole, at the summit of which will be attached the most efficient form of modern ultra-short-wave receiving aerial. A scheme of this character is necessary in order to pick up the signals from the fleet of mobile television vans now nearing completion. This aerial, the highest receiving aerial in the country but not the highest transmitting aerial, since the South Tower of the Crystal Palace has three or four aeriels nearly 700ft. above sea level, will feed the received signals from the ground level van to the modulation amplifiers for re-radiation by the normal Alexandra Palace equipment. Apart from test work, its first real function will be in connection with the televising of the Coronation procession. In one van will be accommodated the sensitive electron cameras, while a second van will act as the ultra-short-wave transmitter with its aerial undoubtedly "beamed" in the direction of Alexandra Palace. This independence of land lines will make the equipment much more flexible in character and extend considerably the field over which outside broadcasts can be undertaken. To meet situations where electrical power is not readily available a special van will be built with a power plant to furnish the necessary supplies to the radio transmitter, cameras, control plant, etc. When complete, viewers can look forward to the inclusion of many interesting items in the broadcasts and the regular portrayal of sporting and other events which have been impossible so far.

TELEVISION NOTES**Interference from an Aeroplane**

REPORTS are coming in of an entirely new form of interference peculiar to television. When an aeroplane passes over or along a line drawn between transmitter and receiver, the picture slides all over the place. Serious interference of this nature can be caused by an aeroplane a mile or more away, and with a flight of 'planes, it has been observed when they are five miles from the receiver. It is evidently not interference from the magneto, but appears to be caused by the 'plane reflecting a sky wave down on to the receiver aerial, and causing the aerial to pick up transmission in the normal way, but reflected out of phase, resulting in the picture appearing normal on the screen, and then displaced.

Assuming the 'plane to be travelling along a line between receiver and transmitter, the picture is displaced to the maximum extent for approximately 25ft. of the aeroplane's travel. As this interference is in no way connected with the electrical apparatus on the machinery, but is caused entirely by the mass of metal of which the 'plane is built, it would seem extremely difficult to foresee how such a form of interference could be cured.

What Happens to the Electrons?

READERS will be familiar with the fact that in a television tube the electron stream impinges upon the fluorescent screen, causing it to glow and form the light parts of the picture. Few, however, stop to

wonder what happens to the electrons afterwards. If they remained on the screen, the screen would become so negative after a time that the beam would be deflected away by repulsion. Obviously the electrons cannot flow back to the cathode in the ordinary way, as the screen

is, of course, insulated by the glass bulb, and is not connected in any way. The bulk of the electrons get "lost" by secondary emission. The electrons in the electron beam impinge on the screen so violently that they knock off electrons from the molecular structure of the screen, which, being free and started off in the downward direction are picked up by the positive electrodes, and/or the "silver" lining fitted to many tubes. In addition to this a certain amount do actually leak along the inside of the glass, and return to the electrodes by this means.



A recent television broadcast included a Casino scene, and the above illustration shows Russell Swan, the illusionist, entertaining the visitors.



SHORT WAVE SECTION

BAND-SPREAD TUNING FOR BEGINNERS

The Advantages of Band-spread Tuning as Associated With Short-wave Receiving Apparatus, Cannot be Over Emphasised, and Various Systems which may be Adopted to Suit Individual Requirements are Described in this Article.

By A. W. MANN

BOTH mechanical and electrical methods of band-spreading are in common use, and the extra trouble and modest additional outlay are more than justified.

Dealing first with mechanical methods, the average slow-motion dial has a ratio of about 16 to 1, and whilst a useful compromise, it cannot be regarded as a satisfactory arrangement from the short-wave enthusiast's point of view. There are, however, a number of specially designed open scale twin ratio dials available, employing ratios of 18 to 1 and 100 to 1 or 150 to 1. Thus quick band-getting and slow searching over the bands is possible. A further aid in some instances is the fitting of an extra graduated dial scale. There are also the popular slow-motion driving heads, which are fitted with a comparatively long indicating pointer and a large calibrated scale.

Where space is definitely limited, so that the incorporation of electrical band-spreading components is impossible, the use of mechanical methods will prove to be a great advantage so far as ease of tuning and station logging are concerned.

Electrical Methods

Whilst appreciating the advantages of mechanical systems as outlined, the writer realises their limitations, and much prefers electrical methods incorporating them whenever it is possible to do so.

There are various methods of incorporating electrical band-spreading both simple and complicated, depending mainly upon the type of receiver, and the operator's requirements. For example, large communication type short-wave receivers in which elaborate coil switching units are included, add to the designer's problems, and call for the introduction of equally elaborate and complicated methods of applying band-spreading.

Such arrangements are definitely reliable because of sound engineering and design, but are somewhat beyond the scope and ingenuity of the average home constructor and experimenter. I propose, therefore, to confine my remarks to methods well within their scope.

Fig. 1 shows the popular parallel method in common use. When this method is used, the band setting condenser A should be of .0001 mfd. or .00016 mfd. capacity, and condenser B, which is the band-spreader, of 15 mmfd., or even lower capacity. Fig. 2 shows the series condenser method, C being the band-setter and D the spreader,

the respective capacities being .00016 and 15 mmfd. or lower. The disadvantage of this method is that in the case of one of the variable condensers, both sides with respect to H.F. currents are alive, and ebonite bushing is therefore necessary when an aluminium panel is used.

to find the correct tap position, and once this is ascertained, the trimming adjustment will enable the amount of spread to be adjusted to suit individual requirements within reasonable limits.

Condenser Values

It should be remembered that in dealing with various systems of band-spreading, the suggested condenser capacity values will not always hold good. For example, coil design and circuit differences, especially in home-constructed receivers using home-constructed coils, must be taken into account.

If, however, commercially manufactured coils are used in the receiver in which it is desired to incorporate band-spread tuning, the coil manufacturers will be only too willing to advise as to the most suitable values to use in conjunction with their products.

This brings to mind the fact that certain manufacturers of short-wave coils also market specially designed band-setting and spreading variable condensers for use in conjunction with their own particular coils.

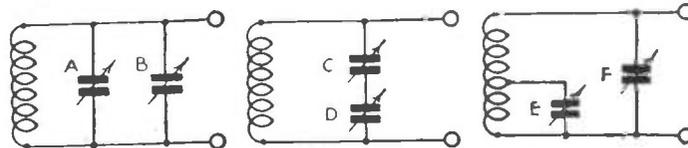
Due to careful choice of capacity values and care in design of coils, users of such products are enabled to undertake the inclusion of band-spread tuning, confident of satisfactory results, and a definite spread coverage per coil.

Sufficient spread over various ranges is a very important factor. The user of commercial coils and their associated tuning condensers will, however, experience no difficulties in this respect. Others, using home-made coils and various types of tuning condensers, are less fortunate, and must undertake the necessary spade work, using cut and try methods.

Bearing this in mind, the reasons why some favour band-spreading whilst others who have tried it do not, are fairly obvious. The subject is another example of viewing matters from the wrong angle. Not willingly, perhaps, but due to being misled and placing a too literal interpretation on the statement that one form of band-spread consists of a small capacity vernier condenser wired in parallel with the main-tuning condenser.

The explanation is simply that unsuitable values of setting and spreading capacities are used in conjunction with a particular coil, and the result is that the wanted bands are put right off the dial in some instances,

(Continued overleaf)



Figs. 1, 2, and 3 show various methods of arranging the tuned circuit in order to obtain a spreading of the tuning, or band-spread as it is now called.

Fig. 3 shows a different arrangement in which a tapped coil is used. This is a very adaptable system, especially for specialised amateur reception, but great care in the selection of suitable coils and correct tapping point is most desirable. Condenser F is included for trimming purposes.

A little experiment is necessary in order

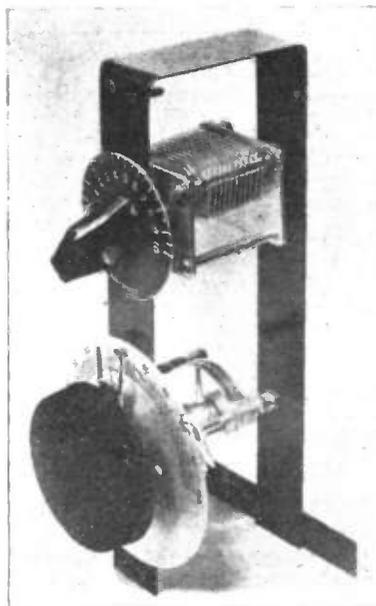


Fig. 4.—The Eddystone Band-spread Assembly which greatly facilitates the tuning of a band-spread circuit.

SHORT-WAVE SECTION

(Continued from previous page)

due to too high a value of band-spreader being used.

Problems of this nature can be overcome if a midget type .0001 mfd. tuning condenser, which can be dismantled, is to hand.

All that is necessary, when the parallel method is chosen, is to reassemble the midget condenser as a two-fixed and one-moving plate double-spaced condenser, and run a practical test. If it is found that the desired amount of spread is not obtainable, the condenser should be taken out and one of the fixed vanes removed, and a further test carried out, etc.

Generally it will be found that by the adoption of cut and try methods, matters can be so arranged that a useful degree of band-spread is obtainable over various ranges. The popular 15 mmfd. type of band-spreading condenser now available will be found to meet most requirements, and can, if desired, be modified without difficulty to meet special requirements.

Instances come to mind in which experimenters incorporate band-spread tuning, but complain that the amount of spread appears to be very limited. Examination usually discloses that a plain knob that is without calibrated markings is fitted to the band-spreader, and in these circum-

stances it is difficult to determine the exact amount of spread obtainable.

Whether it is desirable to invariably fit slow-motion dials to band-spreaders is a matter of opinion, depending on various other factors about which more will be said.

Multi-stage Receivers

The application of band-spreading to multi-stage receivers of the T.R.F. type may appear at sight to be difficult. In the case of receivers incorporating a single S.C., H.F. stage, it is a more or less simple undertaking.

For example, the H.F. stage in a well-designed receiver, will be arranged so that it does not tune sharply, but with more of a volume-control effect, yet not too broad so as to make the set unselective. In this case it will be found that band-spreading need only be applied to the detector stage, because the comparatively small increase in capacity due to the spreading effect of the additional condenser will not have an adverse effect on the tracking of the detector and H.F. stage to any appreciable extent.

The correct method is, of course, to incorporate ganged band-spreading condensers according to the number of tuned stages, and the above applies to home-constructed receivers of the single H.F. type, and is suggested as a compromise.

Band-spreading undoubtedly increases the usefulness of any receiver, and makes all the difference between DX with ease or difficulty.

When using electrical methods, it is sometimes difficult to decide on which condenser to fit an illuminated or other S.M. dial. Various problems of design will govern the final choice. A slow-motion drive, fitted to the tank condenser with a direct drive, using a graduated dial in conjunction with the band-spreader, will be found quite satisfactory when it is desired to keep panel dimensions to a minimum, and in addition has the further advantage of combining mechanical and electrical methods, yet allowing calibration with a useful degree of accuracy to be carried out.

Whilst the writer is aware of, and appreciates the advantages of, the various midget slow-motion devices now available, he is personally of the opinion that there is room for further developments in the design of small panel-mounting dials of the old Ethovernier or Epicyclic type.

In conclusion, the beginner and more experienced experimenter will find that once having incorporated electrical methods of band-spreading, and realised the advantages and simplicity, its incorporation in subsequent receivers will be carried out as a matter of course.

More Coronation Broadcasts

ON May 12th the Schenectady (N.Y.) short-wave stations W2XAD, and W2XAF, on respectively 19.57 m. (15.33 mc/s) and 31.48 m. (9.53 mc/s), will rebroadcast the Coronation ceremony of King George VI, between B.S.T. 12.15 and 18.00. It is expected that the transmission will be taken by all U.S.A. broadcasting stations.

Both Powerful and Late

One of the lesser logged U.S.A. broadcasters is W9XF, of Downer's Grove, entrusted with the relay of the WENR, Chicago, programmes. The station is on the air daily (except Sundays) from B.S.T. 05.00-08.00 with a power of 10 kilowatts, on 49.18 m. (6.1 mc/s). It belongs to the N.B.C. network, and uses the same interval signal, namely, three notes (G.E.C.), as Schenectady. On signing-off in the morning the call is given out in seven or eight different languages. When experiments are carried out the call letters W9XQ are used.

Fiji's New Transmitter

Radio Suva, so far operating on 22.94 m. (13.075 mc/s), is now trying out a new and more powerful transmitter on 34.44 m. (8.71 mc/s). Tests have been heard between B.S.T. 12.00-13.00. The programmes open with the *Song of the Islands* and broadcasts are frequently given of native tribal chants accompanied by the beating of tom-toms. Fijian music, be it said, is for the most part in a minor key. The station announces in English and closes down with the playing of *God Save The King*.

A Worth-while Catch

On 33.94 m. (8.84 mc/s) concerts are broadcast between B.S.T. 08.00-14.00 by the S.S. *Avatea*, plying between Sydney (N.S.W.) and Wellington (N.Z.). Announcements between items usually include the slogan: *The Voice and Ears of Tasmania*. The programme consists of dance and orchestral music relayed from

Leaves from a Short-wave Log

the ship's cafeteria and restaurant, and of which the broadcasts have been picked up by listeners on the North American continent at greater volume than those from the five-times more powerful VK2ME, Sydney, station. When closing down, the announcer, after giving the ship's name and call-letters (ZMBJ), greets the world on behalf of the officers and crew. The best time to listen is from B.S.T. 08.30-09.30.

"The Voice of Spain"

During the past few weeks listeners may have noticed the disappearance of signals from EAQ, Madrid, which, for some considerable time, have been so well heard on 30.43 m. (9.86 mc/s). The transmitter was situated at Aranjuez, some thirty miles distant from the Spanish capital, and at present in a violently contested area. As a substitute the Spanish Government is now using the 20 kW. EDZ, Valdeas, station, and on every Tuesday and Friday between B.S.T. 20.45-22.00, as well as on Sundays at 21.00, you may hear under the call-letters EAQ2, "The Voice of Spain," an orchestral concert or "canned" music, followed by a war news bulletin in the English language. The channel now used is 31.65 m. (9.48 mc/s).

Re-allotment of Venezuelan Call-signs

As already reported in these columns, many transmitters in Venezuela have had new call-signs given to them. The number following the International prefix (YV) now indicates the district, and thus considerably facilitates identification. It is worth while making a note of the following:

(1) Maracaibo and Valera; (2) San Cristobal; (3) Barquisimeto; (4) Valencia and Maracay; (5) Caracas; (6) Bolivar. Moreover, the end letter of the call indicates whether you are listening to an officially recognised broadcaster or to an experimental amateur. The first is shown by the letter R, and the latter by the final A.

YVIRH, Maracaibo, on 46.95 m. (6.39 mc/s)—formerly YVIRV—may be picked up easily at this period of the year between B.S.T. 24.00-07.00. You will recognise the broadcast by its five or six chimes struck before the announcement and call, which usually includes the words: *Emisora Philco*. Every Sunday between B.S.T. 05.00-05.30 the studio transmits a special English programme destined to listeners in the United States. If you want a veri the address is: Radio emisora YVIRH, Apartado Postal, 261, Maracaibo, Venezuela.

Listen Nightly to Japan

Excellent reception of the special broadcasts to Europe is now obtained through the two Nazaki stations, JVM, 27.93 m. (10.74 mc/s) and JZJ, 25.42 m. (11.8 mc/s), which work nightly from B.S.T. 20.30-21.30. The Japanese announcer gives full details in English, and the programme consists of instrumental and vocal music items given by native artists; in some instances, western compositions form part of the entertainment. Towards the end of the broadcast they switch over to Tokio for a Japanese news bulletin. The choice of channels has not yet been definitely fixed, as occasionally JZJ, 31.46 m. (9.535 mc/s); JVP, 39.95 m. (7.51 mc/s) and JVH, 20.56 m. (14.6 mc/s) are also used. As a rule you will find that an S.B. is given on two different wavelengths for the sake of comparison. The transmissions end with an orchestral rendering of the National Anthem in which you will not fail to recognise a famous aria included in Puccini's opera *Madame Butterfly*.

The CYCLIST - - 2d.
Every Wednesday.

Important Broadcasts of the Week

NATIONAL

Wednesday, April 21st.—Symphony Concert.

Thursday, April 22nd.—"The Quaker Girl," a musical comedy by James Tanner.

Friday, April 23rd.—Speeches following the Luncheon on the occasion of the Annual Shakespeare Birthday Celebration, from the Conference Hall, Stratford-upon-Avon.

Saturday, April 24th.—Final Game in Seven-a-Side: A running commentary from Twickenham.

REGIONAL

Wednesday, April 21st.—Variety programme, from the Palace Theatre, Plymouth.

Thursday, April 22nd.—Midland Parliament: Modern Advertising and Industry, a discussion.

Friday, April 23rd.—Speech at the Royal Society of St. George's Banquet, from the Connaught Rooms.

Saturday, April 24th.—King Arthur, an historical programme by D. G. Bridson, music by Benjamin Britten.

MIDLAND

Wednesday, April 21st.—Midland Football Clubs: Wolverhampton Wanderers—a sketch of the Club's history, policy and players, past and present.

Thursday, April 22nd.—Midland Parliament: Modern Advertising and Industry, a discussion.

Friday, April 23rd.—The International Six Days' Contest: Behind the Scenes in a Midland Motor-Cycle Factory.

Saturday, April 24th.—English Song Writers, Elgar: Orchestral concert.

WESTERN AND WELSH

Wednesday, April 21st.—"The Prisoner of Newgate," a play by Froom Tyler.

Thursday, April 22nd.—Pafiliwn Caernarfon: Caernarvon Pavilion—a programme of some of its memorable events.

Friday, April 23rd.—Over Carmarthen Bridge: Sound-pictures of Carmarthen Town.

Saturday, April 24th.—Birds of the West Country, a talk.

NORTHERN

Wednesday, April 21st.—Variety programme, including excerpts from the Lyceum Theatre, Sheffield, the Palace Theatre, Huddersfield, and the Argyll Theatre, Birkenhead.

Thursday, April 22nd.—A Loyal Address: a programme from the Yorkshire village of Thorne.

Friday, April 23rd.—Part of the Armthorpe Schools Musical Festival, from the Armthorpe Methodist Church.

Saturday, April 24th.—Roaming Rhythm: Dance Band programme.

SCOTTISH

Wednesday, April 21st.—Variety programme from the Empress Playhouse, Glasgow.

Thursday, April 22nd.—Organ recital, from St. Machar's Cathedral, Aberdeen.

Friday, April 23rd.—Orchestral programme.

Saturday, April 24th.—Choral programme.

MAKING A UNIVERSAL TRANSPORTABLE

(Continued from page 134)

are not important. It is important, however, that the valve heaters should be wired in the sequence shown, although it is not the most usual one. The main point is that the detector heater is connected directly to the earth line; if this is not the case, hum and instability will probably prove troublesome.

H.T. Supply

Perhaps it would be wise to make reference to the rectifier, because the type indicated is designed to give a maximum output of 136 mA when connected as shown, whereas in this particular circuit the total H.T. current consumption is only about one-half of this. When used at half load, the U.30 provides a voltage output of about 220, for a mains input of approximately 240 volts. This is high enough to allow for a voltage drop across the 25-henry smoothing choke having a D.C. resistance of not more than 500 ohms. Thus, an adequate anode voltage can be supplied to all the valves to ensure that they operate at a high degree of efficiency.

More care should be taken with the construction of a universal set than is necessary with a battery or A.C. receiver. One important reason is that a considerable amount of heat is developed by the valves and barretter when the set has been running for a short time. This means that the valves should be situated so that there can be a stream of air passing round them. This is generally arranged by leaving the back of the cabinet partly open, or by covering it with a form of grille, or per-

forated sheet of fibre. A method which is sometimes better is to leave an opening in the bottom of the cabinet, and to fit the top so that there is an open space through which the warm air can pass. Another method is to make the cabinet as shown in Fig. 1, a design which looks well.

Avoiding Heat

Another point which should be closely watched, on account of the heat which is given off by the valves, is that tubular fixed condensers, L.F. transformers and coils should be kept fairly well away from the valves. These parts often have wax in their construction and this might melt, with consequent damage. As far as possible, these parts should be placed on the underside of the chassis, where they are out of range of the rising heat.

CONSTRUCTIONAL DETAILS OF "PRACTICAL WIRELESS" RECEIVERS

(Continued from page 124)

for this receiver, and an important point should be noted in this respect. A metal panel is specified and this is obviously at earth potential. Consequently, the fact of mounting the components on the panel automatically connects them to earth. The tuning condensers have to be earthed, as also does the reaction condenser, but the volume control must be mounted with the insulated bushes provided or it will be short-circuited. If, however, a wooden chassis and insulated panel are employed, it will be necessary to connect to earth the moving vanes of the tuning and reaction condensers. A list of components is attached for this particular receiver.

PETO-SCOTT

VITESSE

5-VALVE ALL-WAVE KIT "A" YOURS FOR **10/-** DOWN

Comprising complete Kit of Parts exactly as specified by Mr. F. J. Cunn, including ready-drilled chassis, but less valve, cabinet and speaker. Cash or C.O.D. Carriage Paid £6:6:0 or Deposit 10/- and 11 monthly payments of 11/6.

NEW 4-valve S.G., Det., Pen. A.C. ALL-WAVE CHASSIS

WITH 4 BRITISH VALVES. 3 WAVEBANDS: 18-52, 200-550, 900-2,100 metres.

Overall dimensions: 8 1/2" high; 11 1/2" wide; 5" deep.

12 MONTHS GUARANTEE

- Bandpass Tuning
- Air-plane illuminated dial (stations and wavelengths)
- Slow motion drive
- Rotary low-capacity switch with silver-plated contacts ensures trouble-free switching.

BRIEF SPECIFICATION: 4 British Valves; Variable Mu H.F. Pentode, Screened-Grid Detector, High Efficiency Output Pentode and Rectifying Valves, Meel Chassis, Sensitivity and volume control, 3 watt undistorted output, Gramophone Pick-up sockets. For A.C. Mains only, 200-250 volts; 40/100 cycles. Complete with valves. Cash or C.O.D. Carriage Paid, £5:5:0 or 7/6 down and 12 monthly payments 9/-. Or complete with Moving-Coil Speaker, Cash or C.O.D. Carriage Paid, £6:5:0 or 7/6 down and 12 monthly payments 10/6.

7/6 DOWN

Peto-Scott SHORT-WAVE 4 KIT

Covers Television Sound and American Amateurs.

7 TO 77 METRES

Entirely new design in Battery Short and Ultra S.W. Kits. Just what the keen DX fan has been waiting for. Provides for the reception of world-wide Short-Wave Stations, and the Television sound channel. Stove enamelled steel chassis and screen.

With eight 6-pin coils.

5/- DOWN

KIT "A" 63/-

Cash or C.O.D. Carriage Paid Or 5/- down and 11 monthly payments of 5/9. Complete Kit of components less valves and cabinet. 4 valves, £1/8/6 extra, or add 2/7 to deposit and each monthly payment.

W.B. 1937 SPEAKERS

Model 37S. Amazing reproduction provided by new magnet and exponential moulded cone. Micro-tube matching device. Cash or C.O.D. Carr. Paid £2/2/0, or 2/6 down and 11 monthly payments of 4/-. Model 37J. Matches any receiver as principal or extra speaker. Cash or C.O.D. Carr. Paid £1/12/6, or 2/6 down and 11 monthly payments of 3/-. Model 37SG. A cabinet instrument giving superb reproduction, with power handling capacity of up to 5 watts undistorted. The turn of a switch adjusts it to match any set made. With volume control. Cash or C.O.D. Carr. Paid £3/3/0, or 5/- down and 11 monthly payments of 5/9.

2/6 DOWN

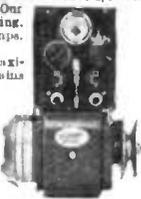
5/- DOWN

All postal orders must be crossed and currency registered.

PETO-SCOTT Co. Ltd., Established 1919
77 (Pr. W.31) CITY ROAD, LONDON, E.C.1.
(Linsold 9875-6-7.
62 (Pr. W.31), HIGH HOLBORN, LONDON, W.C.1.
Holborn 3248

ELECTRADIX BARGAINS

Whitworth Stocks and Dies. Set in wood case, 2" to 1", New, 45/-.
 Engine Graph Indicators by Dobbie and Elliott, 50/-.
 12v. Electric Waiatcoats fitted heating elements, 7/6.
 Cooker Hot Plates, 12" for 110v., 7/6. Big workshop Vacuum Cleaner or Exhauster on trolley with dust chamber and 1 H.P. motor, £8 10s.
 Large Switchboard Meters, 22/- each.
 Switchboard Circuit Breakers for 800 amps, 60/-, for 10 amps, 10/-.
 Wall Type Outdoor Speakers, fully waterproof, Brown's Navy type, 2 to 5 watts, 15/-.
 35 mm. Projector, complete with motor drive and stand, £8 10s.
 Portable Lecture type Ensign ditto, £8.
 Air Compressors, Foot type, 37/6. No. 1 Electric, £5 15s. 6d.
 Kamm Motor Compressor on trolley, £8.
 2 Element Oscillograph hotwire, £9 10s.
 Belling Clothes Drying Electric Rack, 25/-.
 Rotary Sign Flashers by G.E.C. and Strand Co., motor driven, cheap. Big Neon Sign coloured Butterfly, see working, with transf. Sult Coronation display, 12" Red and Green Glass Discs, 1/6 each.
A BARGAIN IN DYNAMOS. Type "C." Our latest for Bungalow, Yacht or Cell Charging.
 140 watt. Enclosed Dynamo, 12-20 v. 12 amps.
 Bell Bearings, Vee Pulley, 25/-.
 Marine Type Switchboard with Ammeter, maximum and minimum Auto Cut-out Main Switch and Fuse, Field Regulator, 25/-.



SMALL HANDY MOTORS.
 A.C. Mains Motors. Enclosed, self-start on load.
 A.C. commutator, 180 h.p. with pulley. Type 40, 1,500 revs., 18/6. Type 36, ditto, 1/25 h.p., G.E.C., 3,500 revs., 27/6.
 Induction 1/10 h.p., 2,500 revs., 35/-.
 1/2 h.p., self-starting, 1,425 revs., 49/-.
 1/2 h.p., 6,000 revs., for polishers, 35/-.
 D.C. Mains Motors. 1/40 h.p. Type 60, 220 v., K.B. series, 1,750 revs., 15/-.
 Ditto, 1/40 h.p., G.E.C., 230 v. series, 2,000 revs., 18/-.
 Ditto, 1/12 h.p., Croydon, 110 and 230 v., about, 1,700 revs., 30/-.
 M.G. for A.C., 220 v. to 100 v. 1 amp. D.C., 60/-, 100 v., 15/-.
 6 v. motors, 7/6.
DOUBLE CURRENT DYNAMOS.—D.C. 600 volt 100 m.a., 32/6.
ROTARY CONVERTERS for A.C. sets on D.C. mains. 7-watt P.M. model, 35/-.
 15-watt 220 V.C./220 A.C., ball bearings, lamin. field, silent running, enclosed, 65/-.

Special 12 p. List "A." 110 Illustrations. Free for stamp.
ELECTRADIX RADIOS,
 218, Upper Thames St., London, E.C.4.
 Phone: Central 4611

RADIO CLUBS AND SOCIETIES

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

The Croydon Radio Society

THE Croydon Radio Society's meeting on Tuesday, April 6th, was devoted to a talk on the design and use of valves by Mr. J. H. Owen Harries, of Harries Thermionics, Ltd. It took place in St. Peter's Hall, Ledbury Road, S. Croydon, with the Vice-Chairman, Mr. G. A. Hoskins, presiding. The designer's task was to obtain the most advantageous balance of the relationship existing between the electrodes of a valve. Mr. Harries discussed the theory of the diode valve, and went on to deal with the triode and historical development. The talk became even more interesting when he reached the topics of anode space and critical distance. Here he showed the society a valve with a sliding anode, and its experimental uses were obvious enough. By shaking it the anode could be located at any position, while its distance then could be measured and characteristics noted. He had also much to say on the behaviour of electrons and how they were controlled.

Hq. Pub. Sec.: E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

any limitation in membership, a step which seemed likely before, due to the rapid increase of members—over 50 per cent. in the last three months.

The officers were elected as follows:—
 President: Douglas Walters (G5CV).
 Chairman: Arthur J. Stephens (2CCH).
 Vice-presidents (subject to them accepting office): John Clarricoats (G6CL), H. V. Wilkins (G6WN), Harley Carter, H. Rayner, H. W. Ancrum, C. Rapsey. Hon. Secretary: H. F. Reeve. Hon. Treasurer: H. Deane. Hon. Programme Secretary: J. J. Maling (G5JL). Hon. Publicity Manager: J. T. Pinsent. Committee: R. Guy (2CGS), H. Cook, A. Harris, W. G. Lee (2BLX).

Meetings will continue at the new headquarters each Tuesday until further notice. Visitors will be welcomed. Hon. Secretary: H. F. Reeve, 26, Green Drive, Southall.

Portsmouth Wireless and Television Society

AT the sixth annual meeting of the above society, held recently at 1A, Hudson Road, many points were discussed about the ensuing year's programme. A library of technical books was started, and several gifts of books were promised. As the society has now four members holding transmitting licences it was decided to apply for a licence for building and operating a 10-watt transmitter for experimental purposes. The President, Vice-presidents, and honorary members were re-elected. Mr. A. Parsons being elected Vice-president—as an appreciation of the valuable work he had done for the society—Mr. Harold Leigh as Chairman, Mr. Kentsbeer, Vice-chairman; Mr. F. L. Moore, Hon. Secretary and Treasurer; and Mr. Marsh, Assistant Hon. Secretary. The following committee were also elected: Messrs. Leigh, Kentsbeer, Moore, Marsh, Batt, Wright, Bull, Bettinson, Evans, and Pegler.—Harold Leigh, 20, King Street, Southsea.

Exeter and District Wireless Society

AT the last meeting of the above society a very interesting and instructive lecture was given by Mr. Bateman, of the local G.P.O. telephones, on Modern Telephony Methods. Mr. Bateman traced the history of telephony from Graham Bell's first attempts at communication between points connected by wire, and many lantern slides indicated the enormous strides which have taken place in the development of telephony. Pictures were also given of the mechanism of modern exchanges, meters for registering the number of calls by subscribers, power plant, batteries and repeater stations.

Mr. Bateman's final remarks were devoted to modern cables, and he gave a very interesting outline of the work which cable ships carry out in their search for, and repair of, breakdowns in whatever part of the world they may take place.

These lectures are held every Monday at 8 p.m. at 3, Dix's Field, Exeter, and intending members should communicate with the Secretary, Mr. W. J. Ching, 9, Sivell Place, Heavitree, Exeter.

Wellingborough and District Radio and Television Society

THE final lecture meeting of the present winter programme was held at the Midland Hotel, Wellingborough, on Wednesday evening, April 7th, when a large and interested audience listened to a lecture given by Mr. A. Freeman, of Kettering, and entitled "Sound on Film." Mr. Freeman prefaced his lecture by a

Tottenham Short-Wave Club

THE above club has held a series of very interesting meetings during the winter months and recently celebrated its second anniversary, at which the newly-elected President, Mr. Batt, was presented with the first prize for the DX phone competition, held on the two middle week-ends in March, during which he succeeded in logging 52 countries.

The club has arranged a programme of Field Days for the summer months at which visitors will be welcome. It is being arranged for a special 5-metre section to be active at these, and transmitting members in the locality will be looked out for if they care to let me know if they will be on the air on these various Field Days.

The club meetings are well attended, and lectures together with practical experiments in transmitting are being given by the secretary. Morse practice is progressing very well, and members are proving quite good at speed tests. The Log Dept., which has been mentioned in our previous reports, has now been collecting valuable data for the last 18 months, and a very comprehensive list of stations and conditions over this period has been obtained.

I wish to thank this journal for all the help it has given us since the club's beginning, and for the way in which it has encouraged the club spirit among its readers. Also, I wish to thank the various clubs at home and abroad that have written to me.

Full particulars of membership, fees, meeting nights, etc., can be obtained by writing to the Hon. Secretary, S. Woodhouse 57, Pembury Road, Bruce Grove, Tottenham, N.17.

Southall Radio Society

THE Annual General Meeting of the above society was held on April 6th. It was announced that a new and more spacious headquarters had been found at the Three Tuns Hotel, The Green, Southall. A large hall is available for the use of the society, and it will not be necessary to make

Cried Smithson, "What's this that I've got? Is it Mars, or Australia, or what?" But his pal merely said, "You've got crackle, instead Of the Fluxite your wiring did not!"

See that FLUXITE is always by you—in the house—garage—workshop—wherever speedy soldering is needed. Used for 30 years in government works and by leading engineers and manufacturers. Of Ironmongers—in tins, 4d., 8d., 1/4 and 2/8. Ask to see the FLUXITE SMALL-SPACE SOLDERING SET—compact but substantial—complete with full instructions, 7/6. Write for Free Book on the art of "soft" soldering and ask for Leaflet on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE.

TO CYCLISTS! Your wheels will NOT keep round and true, unless the spokes are tied with the fine wire at the crossings AND SOLDERED. This makes a much stronger wheel. It's simple—with FLUXITE—but IMPORTANT.

THE FLUXITE GUN

is always ready to put Fluxite on the soldering job instantly. A little pressure places the right quantity on the right spot and one charging lasts for ages. Price 1/6.

ALL MECHANICS WILL HAVE

FLUXITE

IT SIMPLIFIES ALL SOLDERING

FLUXITE LTD. (Dept. W.P.) DRAGON WORKS, BERMONDSEY STREET, S.E.1

EASY TERMS

WE OFFER THE LOWEST TERMS FOR ALL RADIO SETS. Radiograms, Loudspeakers, Valves, and all accessories. It will pay you to secure our quotations—Send list of requirements and we will quote by return. Prompt Delivery. Cash and C.O.D. Established 1925 (Phone Number 1977)

THE LONDON RADIO SUPPLY CO., 11, Oat Lane, Noble St., London, E.C.2.

few remarks upon the history and progress of the Sound on Film patents, and mentioned that, strangely enough, the first patent was granted to a lady for such a system in 1909. Since that date until recent years very little advance had been made, but with the advent of the possibility of the talking picture, great strides had been made.

The basis of reproduction was the photo-electric cell, universally called the Electric Eye, and it was this cell, with its rapid sensitivity to changes in the intensity of light, that made the talking picture the model of perfection that it was to-day. Mr. Freeman then went on to explain in detail, with explanatory diagrams, the problems of recording, and gave instances of how these difficulties in transferring sound waves to light waves and then recording them on a sensitive film, had been overcome in recent years. Hon. Sec., Mr. L. F. Parker (G5LP), 127, Jubilee Crescent, Wellingborough, Northants.

Nottingham Amateur Radio Society
ON Tuesday, April 6th, the above society was given a lecture, illustrated by lantern slides, on "Aerials and Interference." As Nottingham suffers from interference and man-made static this lecture was a welcome enlightenment to the members. New members will be welcomed at the society's headquarters at 2, Bridgford Road, West Bridgford, Nottingham. Hon. Sec.: C. Lambert, 199, Sherwood Street, Nottingham.

Halifax Experimental Radio Society
AT their last meeting the members of the above society were entertained to a very interesting and instructive lecture kindly given by Mr. C. Berg, of Alkum Storage Batteries, Ltd., Halifax, on "The Alkaline Battery." He described how research work started in Sweden in 1893, required 16 years to produce a practicable and commercial alkaline battery, and developments which have since taken place. The main type of Alkaline batteries were described and illustrated and their many applications discussed in detail. Particulars were given of both the nickel-iron and the nickel-cadmium battery as used for miscellaneous services, and in this connection the Milnes H.T. Unit, miners' lamp batteries, and some of the largest alkaline batteries ever made, such as for the sister ship of the *Queen Mary*, were described.—J. B. Bedford, Hon. Sec., Oak House, Triangle, Nr. Halifax.

Morpeth Amateur Radio Society
WE wish to extend our heartiest thanks to all readers of PRACTICAL AND AMATEUR WIRELESS who co-operated in our tests announced in these columns a few weeks ago.

The response to our request was unprecedented, and we regret the delay, in some cases, in the despatching of certificates. However, we hope that all reports will be acknowledged by the time this appears. The majority of reports contained excellent data—many containing temperature and barometer readings, also detailed graphs and charts.

We hope to submit in the near future our conclusions re the weather effects on short-wave reception from the data now to hand, and this we feel sure will be of interest to many readers.

Meanwhile we wish to express our thanks to the Editor for allowing us space, and also to those readers who so kindly offered us their help and assistance.—Chas. L. Towers, Hon. Sec., 2, Edward Street, Morpeth, Northumberland.

11 NEW N.T.S. BARGAINS!

COMPONENT BARGAINS

Amazing value in brand new components at prices unequalled elsewhere. Few only available. Order immediately.

N.T.S. SHORT WAVE COILS. Interchangeable plug-in coils. Low-loss material ribbed formers. N.T.S. coils are expertly wound with high-grade copper wire, to ensure accurate distributed self capacity, 100% efficient.
 4-pin: 12-26, 22-47, 41-94, 76-170 metres. List Value 2/9. Bargain Price 1/9.
 6-pin wavelengths as for 4-pin types. List Value 3/6. Bargain Price 2/6.

Diagrams of circuits with which N.T.S. Coils are suitable are free with every order.

Ormond Slow-motion Dial R362. List price 2/8. Bargain 1/9. 10 to 1 Slow motion illuminated scale. 0-180 degrees. Burnished mechanism as illustrated. For all standard tin condenser spindles. Fitted with bracket for single condenser and with knob.
3 rank .0005 Condenser (fully screened). List value 1/6. Bargain 4 11. Die cast throughout. .00065 adjustable trimmer to each section.

Ideally suited for all-wave receivers. End Vanes of each section split for perfect balancing. Tested to 500 volts. Complete with tin operating spindle and removable cover. (Size of case 4 1/2" long; 2 1/2" wide; 3 1/2" high.)

2 gang .0005 Condenser (unscreened). List value 12/-. Bargain 3/11. Each section fitted split end vanes and separate adjustable trimmers. 1" operating spindle. Size of case, 2 1/2" long; 3 1/2" wide; 2 1/2" high. Tested to 500 volts.

Class "B" Output L.F. Transformer (3.5 to 1). List value 10/6. Bargain 2/6. Exceptionally heavy core. Finest quality laminations. Section wound on 3 large ebonite bobbins. Low resistance secondary winding centre tapped for Class "B" output. Tested 500 volts between windings. Designed to follow driver valve of the 121 class and to precede all standard Class "B" output valves.



1/9 EACH



Amazing New Short-Waver! 3-valve BANDSPREAD * SHORT WAVE KIT *

LIST VALUE 60/- BARGAIN

● Del. and 2 L.F. Aperiodic Aerial Circuit, Pentode Output. ● Slow motion bandspread tuning SIMPLIFIES WORLD RECEPTION!
 ● Efficient reaction condenser. ● Air-spaced bandspread and tank condensers. ● SPECIAL ANTI BLIND-SPOT CONDENSER. ● 3 scales calibrated in degrees.

WORLD WIDE RECEPTION 12-94 metres **2/6 DOWN** and 11 monthly payments of 3/6.

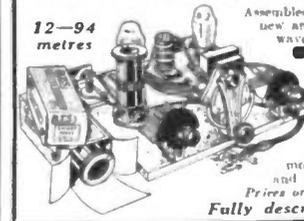


NEW DESIGN! WONDERFUL PERFORMANCE! The latest Bandspread wide-tuning system incorporated into an ultra-modern aperiodic aerial short-wave circuit... and this amazing kit is yours at almost half the list value!
KIT comprises every part for assembly, including 3 4-pin Coils, wiring and assembly instructions, less valves only. Cash or C.O.D. 37/6 or 2/6 down and 11 monthly payments 3/6.
 With 3 British valves. 22 15 0 or 12 monthly payments 5/-.
 If N.T.S. Headphones required, add 7/6 to Cash Price or 8/- to deposit and each monthly payment.
 Fully described in Free Booklet offered below.

New 2-valve BANDSPREAD SHORT WAVE KIT LIST VALUE 59/6 BARGAIN

12-94 metres **32/6 DOWN** and 11 monthly payments 3/6.

Assembled by a novice in an evening, this wonderful receiver, of entirely new and unique design, will bring you a lifetime of fascinating short-wave entertainment. Send your order now. Delivery from stock.
 ● Reacting Detector and Transformer coupled circuit. Power Output.
 ● Slow motion bandspread tuning SIMPLIFIES WORLD RECEPTION!
 ● Air-spaced bandspread and tank condensers. ● SPECIAL ANTI BLIND-SPOT CONDENSER. ● 3 scales calibrated in degrees.
KIT comprises every part for assembly, including 3 4-pin Coils, wiring and assembly instructions, less valves only. Cash or C.O.D. Carr. Pd., 32/6 or 2/6 down and 11 monthly payments 3/6. With 2 British Valves 22/19 or 4/- down and 11 monthly payments 3/6. If N.T.S. Headphones required, add 7/6 to Cash Price or 8/- to deposit and each monthly payment.
 Fully described in Free Booklet offered below.



A.C. 4 RECEIVER

with Valves, Speaker in Cabinet illustrated Ready to play LIST PRICE £8:8:0 BARGAIN

£4:19:6 **5/- DOWN**

200-2,000 metres. ● For A.C. Mains ONLY. 200-250 volt 40-60 Cycles. ● Fully equipped cabinet complete with Celestion Field Energised Moving Coil Speaker, ready to play. Don't miss this amazing offer! An A.C. Bandspas S.G.4 receiver with wonderful selectivity and sensitivity, at almost half-price: 5/- down secures balance in 12 monthly payments of 8/9.

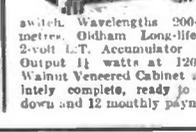


CLASS "B" 4 RECEIVER

with Valves, Speaker, Cabinet and Batteries—ready to play LIST PRICE £8:18:6 BARGAIN

£4:19:6 **5/- DOWN**

4 BRITISH VALVES of guaranteed life. ● Single knob tuning. ● Circular Airplane Dial. ● Amazing purity of tone and volume rivaling that of powerful all-mains models. ● Wide choice of foreign stations. ● The perfect mains quality battery receiver. Moving-coil Speaker. Slow-motion tuning, bronzed scale. New type switch. Wavelengths 200-550 and 900-2,100 metres. Oldham Long-life 120-volt H.T. and 2-volt L.T. Accumulator and G.E. Batteries. Output 11 watts at 120 volts. Exquisite Walnut Veneered Cabinet as illustrated. Absolutely complete, ready to play. Yours for 5/- down and 12 monthly payments of 8/9.



B.T.S. 1937 SHORT WAVE ADAPTOR List Price £2:12:6

Brings Short Waves to your Present Set! BARGAIN 39/6 Ready for instant use—just plug in for World reception

HEAR AMERICA direct on your existing receiver. This amazing unit simply plugs into your battery or A.C. Mains set. No alterations necessary. 100-1 ratio aerial tuning and slow-motion reaction: for use either as Plug-in or Superhet Adaptor. Walnut finished Cabinet (illustrated). With 2 plug-in coils. 12-26, 22-47 metres. Ready built and tested. Yours for 2/6 down and 10 monthly payments of 4/-.



FREE! Write today for free Booklet describing in full, with actual photographs, 5 entirely new N.T.S. Bargain Short-Wave Kits, and range of Bargain Short-Wave Components, including the 2 and 3-valve Bandspread Receiver Kits offered above.

EST. **NEW TIMES SALES CO.** 56 (Pr.W.16), Ludgate Hill, London, E.C.4. 1924.

LETTERS FROM READERS

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

Suggested Club for East Sheen

SIR,—A few friends and myself, being interested in S.W. listening and radio generally and who have been readers of PRACTICAL AND AMATEUR WIRELESS for the past eighteen months, would like to get in touch with other S.W.L.'s and amateur transmitters, if any, in this district with the object of forming a local club. As our ages average about 15 years we would rather older readers co-operated with us. Will anyone interested either call at my address between 6.30 and 7.30 p.m., except on Wednesdays, or drop me a line; and also, if possible, forward suggestions as to where a club H.Q. could be held.—N. G. ANSLOW (35, Gilpin Avenue, East Sheen, S.W.14).

Good DX Reception in Forest Gate

SIR,—I have been taking your paper from the first issue, and must congratulate you on the fine articles published, especially the Amateur Transmitter series, which I hope to see continued.

As I have not seen a log from this part of London, I enclose the best DX received here this month. All the stations were between R5-8 here, and QSA5.

The receiver used is an 0-v-1, S.G. det., and pentode, battery-operated.

I enclose a photo showing a corner of my den.

Again thanking you for the fine articles and information and wishing PRACTICAL AND AMATEUR WIRELESS further success.—H. J. CARTER, 2BPC (Forest Gate).

[We were very interested in your log, which was, however, too long to publish.—ED.]

Terminals, Plugs and Sockets

SIR,—We have read with great interest the article under the heading, "Terminals, Plugs and Sockets—There's No Connection," appearing in the issue of PRACTICAL AND AMATEUR WIRELESS for April 3rd, 1937, but we are somewhat surprised that a service engineer of such wide experience as the contributor of this article should not be acquainted with the undermentioned Clix lines, which have been consistently advertised in your journal and which meet the various points that were raised by him.

(1) *Clix 5 amp. 2-pin Wall Plug ("M" type).*

In addition to providing a positively non-collapsible pin with great versatility of fit in varying socket diameters and centres, it has a simple but most effective wiring device holding the wire strands in 100 per cent. vice-like grip.

We may add that we have contracts in hand which will ensure that during the coming season a very large percentage of manufacturers will standardise this plug,



Amateur station 2-BPC, operated by a reader, Mr. H. J. Carter, of Forest Gate.

CUT THIS OUT EACH WEEK.

Do you know

—THAT when breaking circuits carrying a high current a Q.M.B. (quick make-and-break) switch should be employed.

—THAT a rough method of calculating grid bias voltage is to divide the H.T. voltage by double the amplification factor of the valve.

—THAT care should be taken to prevent the metallised coating of indirectly-heated valves from coming into contact with earthed surfaces.

—THAT the reason for the above precaution is that grid-bias circuits may be short-circuited by earthing the coating.

—THAT copper tubing, half-an-inch in diameter, is ideal for a television dipole aerial.

—THAT it is often desirable to include a fuse in the G.B. leads of a powerful mains receiver.

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

but there is still a very large replacement market unsatisfied.

(2) *Heavy Duty Master Plug.*

This plug, which allows for the use of leads up to 3-16in. diameter without stripping insulation tape, enables aerial and earth leads to be taken direct to sets. The pin on the other hand being standard 1/4in. size.—BRITISH MECHANICAL PRODUCTIONS, LTD. (Westminster, S.W.1).

[Our contributor is fully acquainted with the excellent Clix components mentioned in this letter, and he stated that the "average" mains plug was at fault. The split pin in the Clix patent does definitely overcome the difficulty of fractured wires caused by the locking screw, and provides a definite and certain contact with the mains socket throughout its life. We ourselves have had no trouble whatsoever with these components, but know only too well how the ordinary type of plug can give rise to noises as mentioned in the article.—ED.]

Received on Our Single-valver

SIR,—I enclose a log of stations received on my single-valve set recently. It is the one described in your issue for January 23rd, 1937, the only modification being a 20-80-metre dual range coil.

On 20 m. (Amateur): OF1AW, EI4L, PY2EJ, VE1GH, VE3CK, SV1KE and 20 W stations.

On 30-50 m.: DJN, DJD, DJQ, GSD-F, EAQ, 2RO, CT1AA, W2XAF, W2XAD, W1XAL, W4XB-W, RW59, HAT4, and W3XAL. Belgrade 49.18 m., and several G stations on 40 m.

All these stations were received at R4-5, and the aerial is 30ft. long (W.-E.).—L. SANDOZ (Moseley, Birmingham).

Singapore S.W. Station ZHI

SIR,—In your issue of March 13th, 1937, page 761, mention was made of Singapore Station ZHI on 49.92 m. (6.01 mc/s). This station ceased operating at the end of last year. Station ZHL, of the British Malaya Broadcasting Corporation, Ltd., has taken its place. It is on daily for 36 hours a week. Weekdays, 6 to 10.15 p.m. Saturdays, 12.45 to 2 p.m. and 5 to 11.15 p.m. Sundays, 10.15 a.m. to 2 p.m. and 6.30 p.m. to 10 p.m. local time. (Malayan time is 7 hours 20 minutes ahead of G.M.T.)

Chinese, Malay or Tamil music are on from 6 to 7 p.m. daily. The station which is operating on a wavelength of 225 metres serves Singapore Island and South Johore. On March 1st, 1937, the station was opened by His Excellency the Governor, Sir Shenton Thomas.—TAN BIN HUSSAIN (Ipoh, Perak, Federated Malay States).

A Good Log from Bedfordshire

SIR,—My short-wave reception results on the Cambs-Beds border may be of interest to other readers of your excellent publication. During the past two months, listening on the amateur bands, over 900 calls were heard. These include 490 North American phones, with many W6 and 7. Among the South Americans are HI, HK, LU, VP1, 2, 5, 6, 9, OA, CO, CE, YV, PY, K4, K6, and NY calls. Oceanic phones include VK2, 3, 4 and 5 stations.

In one week, on 28 mc/s, over 100 of the commoner U.S.A. phones were heard, with some DX, such as W6JEY, 6MAF, W7BEJ, 6BQX, ZU6P, ZS6Q, ZE1JR, PY2AC, PY4AC, VP5PZ, VP9G and LU7AZ.—S. G. ABBOTT (Sandy, Bedfordshire).

BRIEF RADIO BIOGRAPHIES—7

By RUTH MASCHWITZ

Leonard Henry

Leonard Henry started his career as a budding young scientist working twelve hours a day for a firm of manufacturing chemists. However, an explosion put a stop to his activities, and when he sufficiently recovered he was sent to Southend to complete the cure. Strolling along the front one afternoon he was attracted by the strains of a concert party, and discovered that a friend of his was a member of the company. They chatted together, and Leonard made the suggestion that he should try out a few songs at the piano for a joke. So he borrowed his friend's dress clothes and carried out his plan. Such was his success that the concert party engaged him for the season. Then followed musical comedy engagements, revue and more concert parties. For years he worked under Charlot's management—in fact, he was part-author of Charlot's Hour for the microphone. Now he is busy filming, recording, rehearsing, and devising new songs and patter.

Leonard is well known for his kindness of heart, but he really felt that things were going a little too far when, just as he was going on for the Royal Command performance, an old lady telephoned from Tooting and in a quavering voice asked if he would go down and put her wireless set right as she was having a great deal of trouble with it!

Being in the public eye is not all beer and skittles, but on one occasion it kept Leonard from being marched off to prison! He came home unexpectedly from the country without the keys of the house, and was just trying to climb through the kitchen window when a heavy hand was laid upon his shoulder.

"What are you up to?" asked a gruff voice, and a burly policeman towered above him in a most menacing manner. "This is my house, and I've just come back unexpectedly," said Leonard.

"You can't put that over," was the reply. "You're not Mr. Henry! You'd better come along with me!"

Leonard was nonplussed. Suddenly he had a bright thought, and took from his pocket a packet of cigarettes which he had bought on the way from the station. "Perhaps you'll believe me now," he said, and produced a cigarette card on which was a picture of himself!

Wynne Ajello

As a child Wynne Ajello's great ambition was to become a dancer, and it was quite by chance that it was discovered that she had a singing voice. While training for the ballet she took singing lessons, and her teacher was so impressed by her ability that she was encouraged to take up the art seriously.

Her first public appearance as a singer was at a competition for children at the seaside, when she carried off the prize, a book entitled "Picturesque Views of the Town." She was the first member of her family—who were all musical—to take up singing professionally, and at first the idea was viewed with disfavour, but her enthusiasm was so great that her parents eventually gave way.

Wynne first broadcast in 1925 and faced a more than usually terrifying ordeal, for she had to sing four coloratura arias with orchestra in succession—and she had never had an orchestral accompaniment before! However, she made an immediate success, and was asked to repeat the programme a fortnight later. Wynne was one of the first singers to make a reputation entirely through the microphone. She is possibly unique in being heard on the air five nights in succession.

She decided to develop her scope by combining acting with singing, and so, in addition to her serious work, she has been the heroine in numerous musical shows and operas.

Returning by train from one of the provincial stations recently, she fell into conversation with a fellow passenger who asked her opinion of "that Wynne Ajello who sings on the air."

She did not reveal her identity, and was gratified to find that her interlocutor considered Wynne was "pretty good."

Her hobbies are motoring, swimming and dancing, and her pet aversions are snobs and bridge!



Stability, n.
The quality of being steady or constant, having durability or permanence.
—Dictionary

Let the dictionary guide you in the choice of your

CONDENSERS

MANY have been the makes of condensers... all good to look at... some good performers—for a time. Why aren't they on the market now? Because they lacked the quality of permanence... Inadequate experience, doubtful materials or unskilled workers left the job in some way incomplete... they failed in the test of time.

T.C.C. Condensers are the product of over 28 years' specialisation in condenser design and manufacture. That experience—that solid foundation is behind every T.C.C. Condenser. The result is a range second-to-none plus a reliability that is pre-eminent. For safety's sake use T.C.C.

T.C.C.

ALL-BRITISH

CONDENSERS

The Telegraph Condenser Co. Ltd., Wales Farm Road, N. Acton, W.3.

1633 CA

REPLIES IN BRIEF

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

T. R. (Southend-on-Sea). We regret that we cannot trace the coils in question and are therefore unable to give you the connections.

G. N. L. (Sidcup). The I.F. was 110 kc/s. No details are now available for this receiver, and we have no blueprints of any equivalent type of receiver.

W. J. F. (Nettleton). In view of all of the tests you have made the trouble must be due to the damping of the aerial system, and you should try some alternative.

A. J. S. (Leeds). The control would have to be across the speech coil of the extension speaker and should be approximately the same resistance.

L. C. L. (E.2). If you strip off turns the reading on the dial will decrease, or in other words you will have the receiver tuned to a lower wavelength if you do not alter the condenser setting. To include a high wavelength or to increase the condenser reading turns should be added to the coil.

V. F. (Bedminster). The diaphragms may be obtained from Electradix Radios, whose advertisement appears in each issue. The gauge of wire is immaterial, but one winding should have thirty times as many turns as the other. The small winding is the primary and the large winding the secondary.

M. H. G. (Bow). The only satisfactory way would be to obtain a converter, in order to change the D.C.

supply to A.C. We do not advise you to try to modify the circuit in this case.

A. W. (Hove, 4). The trouble is due to your aerial-earth system, and you should include a variable condenser in the aerial lead in order to reduce some of the damping effects imposed by it.

A. H. M. (nr. Skipton). You should be able to hear the North Regional and Droitwich on the long waves. The switch costs 4s. and the condenser 5s. 6d. complete with dial.

D. F. R. (N. 14). The apparatus works on the hysteresis principle, with a length of iron tape, but the details are too involved to enable it to be dealt with satisfactorily under this section.

T. A. J. (Rottingdean). In your particular case it would probably be found best to use a short horizontal aerial, about 15ft. in length with a direct lead-in as vertical as possible.

T. B. (Liverpool, 5). We regret that we cannot trace any coil of the type mentioned in our records. Are you certain regarding the maker's name?

L. J. G. (Dulwich, S.E.). We are shortly publishing some quality circuits for local-station receivers which will no doubt meet your requirements.

T. G. D. (Edinburgh). The easiest solution would be to obtain a modern dual-range coil, preferably with a self-contained switch to avoid difficulty in wiring this. The coil could then be substituted for that now in use and would give you the desired improvement.

R. G. (Weybridge). The circuit does not utilise a frame aerial. Valve types are XD and XI. (H.Vac).

J. H. (N. 1). It is impossible to answer your question without further details. The circuit appears correct, but the set may be unstable and thus burst into oscillation at certain settings of the volume control.

IS YOUR SET PERFECTLY TUNED?



Perhaps you are losing half your stations with mistuned I.F. Transformers. . . . Don't waste any more time searching for faults. Get those I.F.s lined up—easily and accurately.

465 kc/s I.F. LINER

SELF-CONTAINED, consuming but a fraction of a milliamp, this handy gadget will take the place of an expensive modulated test oscillator. Plugged in to any D.C. supply of 200 volts or over—or even run off an A.C. set's own rectified H.T.—it renders both easy and quick the skilled, important job of re-trimming Intermediate Frequency Transformers. A workshop instrument which the Serviceman or Experimenter simply must add to his kit!

List No. V.T.17.

14/7

To A. F. Bulgin & Co., Ltd.,
Abbey Road, Barking, Essex.
Please forward me a copy of your complete catalogue No. 134 for which I enclose 3d. in stamps.

Name:

Address:

N

Send this Coupon Now

Fault Tracing with precision

Don't let faults stump you. Every cause of trouble is accurately revealed by the AvoMinor. Thirteen Meters in One. Provides unique testing facilities. Milliamp ranges sufficient for testing all valves and apparatus. Six voltage ranges for all radio voltage tests. Ohms ranges adequate for all resistance tests. In case, with leads, testing prods, crocodile clips, and Instruction Booklet.

13 Meters in One



Current
0-6 m/amps
0-30 ..
0-120 ..

Voltage
0-6 volts
0-12 volts
0-120 volts
0-240 volts
0-300 volts
0-600 volts

Resistance
0-10,000 ohms
0-60,000 ohms
0-1,200,000 ..
0-3 megohms

Price **45/-**
Deferred terms if desired.

BRITISH MADE

The D.C. AVOMINOR

Write for descriptive pamphlet and details of Easy Terms.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD.,
Winder House, Douglas St., London, S.W.1.
Vik. 34047.



QUERIES and ENQUIRIES

Short-wave Tuning

"Could you please tell me which of the three 'Apex Economy' condensers I should use in your 'One-valve Short-waver' for tuning, either 15 mmfds., 40 mmfds., or 100 mmfds.?"—G. H. W. (Gt. Malvern).

To obtain results similar to those given by the condenser arrangement specified for this receiver the 100 mmfd. condenser should be used. Tuning would be simplified if you used a much smaller capacity (15 mmfds.) in parallel to form a band-spread device, but this is not essential. The two condensers used in the receiver provide a capacity equivalent to that given approximately by a 150 mmfd. condenser.

Amateur Transmitting

"Could you please inform me of the regulations of amateur transmitting, and for a full licence do you have to pass a Morse test if you do not wish to transmit Morse? Has a small battery transmitter been described in your paper?"—J. W. H. (Harwich).

FULL details concerning a transmitting licence may be obtained from the Engineer-in-Chief, Radio Section, G.P.O., Armour House, London, E.C.1. For use

Tantalum Charger

"Could you please give me instructions for making a tantalum charger, size of strip, etc.? I have tried to get a back copy of the issue in which this was described, but find that it is out of print."—J. M. (Rawmarsh).

FOR the charger in question the tantalum strip is 3½ in. long by ¼ in. wide, and about the thickness of stout notepaper. The lead strip measures 5 in. long by 1 in. wide and ¼ in. thick. These two electrodes are immersed in a glass jam jar containing ordinary accumulator acid. It is desirable to pour a small quantity of heavy oil on top of the acid to prevent creeping, and a small quantity of iron filings may be placed in the acid to improve conductivity. The cell should be fed from a small transformer of the "bell" type delivering about 5 volts at ½ amp. To obtain satisfactory results, the metals and the acid must be as pure as possible. The tantalum strip may be obtained from Blackwell's Metallurgical Works, Ltd., Speke Road Works, Garston, Liverpool.

Pick-up and Amplifier

"I have built a small 2-valve amplifier (circuit attached) which gives excellent results when used with a crystal set. I am unable to understand why, with a pick-up, the loud passages on records fade severely, and terrible distortion sets in. These faults are not present in the crystal set. Can you say what is wrong?"—J. G. R. (W.13).

THE circuit is quite straightforward, but no form of volume control is fitted to either stage. Consequently, the loud passages on gramophone records are sufficient to overload the input valve and the only satisfactory way of overcoming that is to fit a volume control across the input circuit. The fact that a high resistance is included in the anode circuit of the first valve reduces the H.T. applied to that stage, and the valve would handle a greater input if the H.T. were increased. The only satisfactory way of doing this, without increasing the size of the H.T. battery, would be to use transformer coupling.

Valves for the "Colt"

"I have three valves taken from a dismantled set. At present I am building the 'Colt' all-wave three, and I should like to know whether these valves may be used for it. They are Mullard PM1HL (two), and Osram HL210."—J. S. (Barrhead).

NONE of the valves mentioned by you is equivalent to those specified for the Colt. It might be possible to obtain results with the first two valves in the first two positions, but you could not use any of them in the output stage. Furthermore, the valves may not be in good condition if they have been taken from a receiver which has been in use for some time, and thus you may be introducing trouble to the new receiver from the start. We advise you to obtain the specified valves.

RULES

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

- (1) Supply circuit diagrams of complete multi-valve receivers.
- (2) Suggest alterations or modifications of receivers described in our contemporary.
- (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. Requests for Blueprints must not be enclosed with queries as they are dealt with by a different department.

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

The Coupon must be enclosed with every query.

with an Artificial Aerial, the cost is 10s. per annum, and no tests have to be passed. Certain technical details have to be entered upon the application form. A full licence costs £1 per annum plus an initial 10s., but you are restricted to a power not exceeding 10 watts and must pass a test in Morse, sending and receiving at 12 words per minute. There is no exemption from this rule, and the test has to be carried out for five minutes. A small battery transmitter (2½ watts) was described in our issues dated December 26th, 1936, January 2nd and January 9th, 1937.

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

Practical and Amateur Wireless BLUEPRINT SERVICE

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

Issues of Practical Wireless ..	4d. Post paid.
Amateur Wireless ..	4d. "
Practical Mechanics ..	7d. "
Wireless Magazine ..	1s. "

The index letters which precede the Blueprint Number indicates the periodical in which the description appears: thus PW refers to PRACTICAL WIRELESS, AW to AMATEUR WIRELESS, PM to PRACTICAL MECHANICS, WM to WIRELESS MAGAZINE.

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

PRACTICAL WIRELESS.		Date of Issue.		No. of Blueprint	
CRYSTAL SETS.					
Blueprint, 6d.					
1937 Crystal Receiver	9.1.37	PW71			
STRAIGHT SETS. Battery Operated.					
One-valve : Blueprint, 1s.					
All-wave Unijen (Pentode)	—	PW31A			
Two-valve : Blueprint, 1s.					
Four-range Super Mag Two (D, Pen)	11.8.34	PW36B			
Three-valve : Blueprints, 1s. each.					
The Long Range Express Three (SG, D, Pen)	24.4.37	PW2			
Selectone Battery Three (D, 2 LF (Trans))	—	PW10			
Sixty Shilling Three (D, 2LF (RC & Trans))	—	PW34A			
Leader Three (SG, D, Pow)	—	PW35			
Summit Three (HF Pen, D, Pen)	8.8.34	PW37			
All Pentode Three (HF Pen, D (Pen), Pen)	22.0.34	PW39			
Hall-Mark Three (SG, D, Pow)	—	PW41			
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48			
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) All-Wave Three	13.4.35	PW49			
Genet Midget (D, 2 LF (Trans))	June '35	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 (RC))	—	PW55			
The Monitor (HF Pen, D, Pen)	—	PW61			
The Tutor Three (HF Pen, D, Pen)	21.3.30	PW62			
The Centaur Three (SG, D, P)	—	PW64			
The Gladiator All-Wave Three (HF Pen, D (Pen), Pen)	29.8.30	PW66			
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.30	PW69			
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	5.12.30	PW72			
Four-valve : Blueprints, 1s. each.					
Fury Four (2 SG, D Pen)	—	PW11			
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17			
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	6.1.34	PW34B			
Fury Four Super (SG, D, Pen)	—	PW34C			
Battery Hall-Mark 4 (HF, Pen, D, Push-Pull)	—	PW46			
F. J. Camm's "Lion" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67			
Mains Operated.					
Two-valve : Blueprints, 1s. each.					
A.C. Twin (D (Pen), Pen)	—	PW18			
A.C./D.C. Two (SG, Pow)	7.10.33	PW31			
Selectone A.C. Radiogram Two (D, Pow)	—	PW19			
Three-valve : Blueprints, 1s. each.					
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23			
D.C. Ace (SG, D, Pen)	—	PW25			
A.C. Three (SG, D, Pen)	—	PW29			
A.C. Leader (HF Pen, D, Pow)	7.4.34	PW35C			
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B			
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A			
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38			
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50			
"All-Wave" A.C. Three (D, 2 LF (RC))	17.8.35	PW54			
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56			
Mains Record "All-Wave" 3 (HF Pen, D, Pen)	5.12.30	PW70			
Four-valve : Blueprints, 1s. each.					
A.C. Fury Four (SG, SG, D, Pen)	—	PW20			
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D			
A.C. Hall-Mark (HF, Pen, D, Push-Pull)	—	PW45			
Universal Hall-Mark (HF, Pen, D, Push-Pull)	9.2.35	PW47			
SUPERHETS.					
Battery Sets : Blueprints, 1s. each.					
£5 Superhet (Three Valve)	—	PW40			
F. J. Camm's 2-valve Superhet Two-Valve	13.7.35	PW52			
F. J. Camm's £4 Superhet	—	PW58			
F. J. Camm's "Vitesse" All-Wave (5-valver)	27.2.37	PW75			
Mains Sets : Blueprints, 1s. each.					
A.C. £5 Superhet (Three-valve)	—	PW43			
D.C. £5 Superhet (Three-valve)	1.12.34	PW42			
Universal £5 Superhet (Three valve)	—	PW44			
F. J. Camm's A.C. £4 Superhet 4	—	PW59			
F. J. Camm's Universal £4 Superhet 4	—	PW60			
"Qualltone" Universal Four	16.1.37	PW73			
SHORT-WAVE SETS.					
Two-valve : Blueprint, 1s.					
Midget Short-Wave Two (D, Pen)	15.9.34	FW38A			

Three-valve : Blueprints, 1s. each.					
Experimenter's Short-Wave Three (SG, D, Pow)	—	PW30A			
The Perfect 3 (D, 2 LF (RC and Trans))	—	PW63			
The Bandspeed S.W. Three (HF Pen, D (Pen), Pen)	29.8.30	PW68			
"Tele-Cent" S.W.3 (SG, D (SG), Pen)	30.1.37	PW74			
PORTABLES.					
Three-valve : Blueprint, 1s.					
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	16.5.36	PW65			
Four-valve : Blueprint, 1s.					
Featherweight Portable Four (SG, D, LF, Cl. B)	—	PW12			
MISCELLANEOUS					
S.W. Converter-Adapter (1 valve)	—	PW48A			
AMATEUR WIRELESS AND WIRELESS MAGAZINE					
CRYSTAL SETS.					
Blueprints, 6d. each.					
Four-station Crystal Set	12.12.30	AW427			
1934 Crystal Set	—	AW444			
150-mile Crystal Set	—	AW450			
STRAIGHT SETS. Battery Operated.					
One-valve : Blueprints, 1s. each					
H.B.C. Special One-valver	—	AW387			
Twenty-station Loudspeaker One-valver (Class B)	—	AW449			
Two-valve : Blueprints, 1s. each.					
Melody Ranger Two (D, Trans)	—	AW388			
Full-volume Two (SG det. Pen)	—	AW392			
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A			
Big-power Melody Two with Lucerne Coil (SG, Trans)	—	AW388A			
Lucerne Minor (D, Pen)	—	AW426			
A Modern Two-valver	July '36	WM409			
Three-valve : Blueprints, 1s. each.					
Class B Three (D, Trans, Class B)	—	AW386			
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394			
Home-built Coil Three (SG, D, Trans)	—	AW404			
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410			
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412			
1934 Ether Searcher; Baseboard Model (SG, D, Pen)	—	AW417			
1934 Ether Searcher; Chassis Model (SG, D, Pen)	—	AW419			
Lucerne Ranger (SG, D, Trans)	—	AW422			
Cosor Melody Maker with Lucerne Coils	—	AW423			
Mullard Master Three with Lucerne Coils	—	AW424			
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435			
Lucerne Straight Three (D, RC, Trans)	—	AW437			
All-Britain Three (HF Pen, D, Pen)	—	AW448			
"Wireless League" Three (HF Pen, D, Pen)	3.11.34	AW451			
Transportable Three (SG, D, Pen)	—	WM271			
£6 6s. Radiogram (D, RC, Trans)	—	WM318			
Simple-tune Three (SG, D, Pen)	June '33	WM327			
Economy-Pentode Three (SG, D, Pen)	Oct. '33	WM337			
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351			
£3 3s. Three (SG, D, Trans)	Mar. '34	WM354			
Iron-core Band-pass Three (SG, D, QP21)	June '34	WM362			
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371			
PTP Three (Pen, D, Pen)	June '35	WM398			
Certainty Three (SG, D, Pen)	Sept. '35	WM393			
Minute Three (SG, D, Trans)	Oct. '35	WM396			
All-wave Winning Three (SG, D, Pen)	Dec. '35	WM400			
Four-valve : Blueprints, 1s. 6d. each.					
65s. Four (SG, D, RC, Trans)	—	AW370			
"A.W." Ideal Four (2 SG, D, Pen)	16.9.33	AW402			
2 H.F. Four (2 SG, D, Pen)	—	AW421			
Cruisers' A.V.C. 4 (2 HF, D, QP21)	18.8.34	AW445			
(Pentode and Class B Outputs for above: Blueprints, 6d. each)	25.8.34	AW415A			
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)	—	WM381			
The H.K. four (SG, SG, D, Pen)	Mar. '35	WM384			
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	April '36	WM404			
Five-valve : Blueprints, 1s. 6d. each.					
Super-quality Five (2 HF, D, RC, Trans)	May '33	WM320			
Class B Quadradyne (2 SG, D, LF, Class B)	Dec. '33	WM344			
New Class-B Five (2SG, D, LF, Class B)	Nov. '33	WM340			
Mains Operated.					
Two-valve : Blueprints, 1s. each.					
Consoelectric Two (D, Pen) A.C.	—	AW403			
Economy A.C. Two (D, Trans) A.C.	—	WM286			
Unicorn A.C./D.C. Two (D, Pen)	Sept. '35	WM394			

Three-valve : Blueprints, 1s. each.					
Home-Lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383			
S.G. Three (SG, D, Pen) A.C.	—	AW390			
A.C. Triodyne (SG, D, Pen) A.C.	19.8.33	AW399			
A.C. Pentaquester (HF Pen, D, Pen) A.C.	23.6.34	AW439			
Mantovani A.C. Three (HF Pen, D, Pen) A.C.	—	WM374			
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	Jan. '36	WM401			
Four-valve : Blueprints, 1s. 6d. each.					
All-Metal Four (2 SG, D, Pen)	July '33	WM326			
Harris Jubilee Radiogram (HF Pen, D, LF, P)	May '35	WM386			
SUPERHETS.					
Battery Sets : Blueprints, 1s. 6d. each.					
Modern Super Senior	—	WM375			
Varsity Four	Oct. '35	WM395			
The Request All-Wave	June '36	WM407			
1935 Super Five Battery (Superhet)	—	WM379			
Mains Sets : Blueprints, 1s. 6d. each.					
1934 A.C. Century Super A.C.	—	AW425			
Heptode Super Three A.C.	May '34	WM359			
"W.M." Radiogram Super A.C.	—	WM366			
1935 A.C. Stenode	Apr. '35	WM385			
PORTABLES.					
Four-valve : Blueprints, 1s. 6d. each.					
Midget Class B Portable (SG, D, LF, Class B)	20.5.33	AW389			
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393			
Family Portable (HF, D, RC, Trans)	22.9.34	AW447			
TWO H.F. Portable (2 SG, D, QP21)	June '34	WM363			
Tyers Portable (SG, D, 2 Trans)	—	WM367			
SHORT-WAVE SETS—Battery Operated.					
One-valve : Blueprints, 1s. each.					
S.W. One-valver converter (Price 6d.)	—	AW329			
S.W. One-valve for America	23.1.37	AW429			
Rome Short-Wave	—	AW452			
Two-valve : Blueprints, 1s. each.					
Ultra-short Battery Two (SG det., Pen)	Feb. '36	WM402			
Home-made Coil Two (D, Pen)	—	AW440			
Three-valve : Blueprints, 1s. each.					
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355			
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438			
Experimenter's Short-wave (SG, D, Pen)	Jan. 19, '35	AW463			
The Carrier Short-waver (SG, D, P)	July '35	WM390			
Four-valve : Blueprints, 1s. 6d. each.					
A.W. Short-Wave World-Beater (HF Pen, D, RC, Trans)	—	AW436			
Empire Short-Waver (SG, D, RC, Trans)	—	WM313			
Standard Four-valver Short-waver (SG, D, LF, P)	Mar. '35	WM383			
Superhet : Blueprint, 1s. 6d.					
Simplified Short-waver Super	Nov. '35	WM397			
Mains Operated.					
Two-valve : Blueprints, 1s. each.					
Two-valve Mains short-waver (D, Pen) A.C.	—	AW453			
"W.M." Band-spread Short-waver (D, Pen) A.C./D.C.	—	WM368			
"W.M." Long-wave Converter	—	WM480			
Three-valve : Blueprint, 1s.					
Emigrator (SG, D, Pen) A.C.	—	WM352			
Four-valve : Blueprint, 1s. 6d.					
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	Aug. '35	WM391			
MISCELLANEOUS.					
Enthusiast's Power Amplifier (1/6)	June, '35	WM387			
Listener's 5-watt A.C. Amplifier (1/6)	Sept. '35	WM392			
Radio Unit (2v.) for WM392	Nov. '35	WM398			

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," Tower House, Southampton Street, Strand, London, W.C.2.

RECEIVERS, COMPONENTS AND ACCESSORIES
Surplus, Clearance or Secondhand, etc.

RADIOMART
SHORT-WAVE MANUAL

Packed with short-wave information and circuits of mains and battery receivers, including straight, superhet and 5-metre transmitters, modulators, etc. Information on transmitting licences, aerials, Class B amplifications, neutralizations, superhet alignment, etc. The most comprehensive manual published, written by practical engineers, price 6d., post free, 7d. including catalogue.

1937 Short-wave Catalogue only (3 times enlarged) price 1½d., post free.

44, HOLLOWAY HEAD, BIRMINGHAM 1

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

ALL goods previously advertised are standard lines, still available. Post card for list free.
VAUXHALL UTILITIES, 163a, Strand, W.C.2. Over Denny's the Booksellers. Temple Bar 9338.

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

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

RADIO CLEARANCE
63, HIGH HOLBORN, W.C.1.

HOLBORN 4631
Final End of Season Clearance of High-class Receivers and Components.

Lissen A.C./D.C., plus Rectifier Receiver, fitted in Handsome Walnut Cabinet, Clock Face Tuning, etc. A really fine Receiver, to clear, £3/17/6.
LISSEN DITTO, BUT ALL-WAVE (3 wavebands covered, Short, Medium, and Long), £4 19s. 6d.
REGENTONE ALL-WAVE 4-VALVE A.C. RECEIVER, fitted in Handsome Walnut Cabinet. Circuit: H.F. Pentode, Detector, Pentode Output, Valve Rectification, Large Type Moving-Coil Speaker, £4 12s. 6d.
BUSH A.C.23. 4-Valve Band Pass Receiver, fitted in Handsome Walnut Cabinet. A really up-to-the-minute Job, to clear at 4 gns.
The Following High-Class Surplus Stocks are Offered.
POLAR 3-Gang Straight Condenser, fully Screened, Top Trimmers. Three .0005 Sections. A Handy-sized Job, to clear, 4/11.
PLESSEY DITTO, 4/3.

COSSOR 2-Gang two .0005 Sections, with separate Vernier control. Both Main and Vernier Control operated from the Panel, 5/6.
5-Pin Chassis or Baseboard mounting Valveholders. A really First-class Job. 3d. each.
7-Pin Ditto, 7d. each.

PHILCO VALVE SCREENS. 1-Piece type, with Separate Base, 4d. each.
Enquiries 1½d. stamp if reply expected.
Hours of Business, 9 a.m. to 7 p.m. Saturdays, 9 a.m. to 1 p.m. All Orders 5/- or over, Post Free. Orders under 5/- must be accompanied by a reasonable amount for postage.

C.O.D. Orders under 5/- cannot be accepted. Orders from Ireland and Special Parts of Scotland are subject to certain increased rates of postage, and Customers are advised to apply for details of Postage before ordering.
RADIO CLEARANCE, 63, HIGH HOLBORN, W.C.1.
HOLBORN 4631.

PREMIER
SUPPLY STORES

All goods guaranteed perfect; carr. paid over 5/-; under 5/- postage 6d. extra.

ALL POST ORDERS TO JUBILEE WORKS, 167, LOWER CLAPTON RD., LONDON, E.5. Phone: Amherst 4723.

CALLERS, AS USUAL, TO 165 & 165a, FLEET ST., E.C.4 (Next door to Anderson's Hotel) Central 2833. New Branch: 50, HIGH ST., CLAPHAM, S.W.4 (Macaulay 2381).

Have you had our **GIANT ILLUSTRATED CATALOGUE AND VALVE LIST?** Send 4d. IN STAMPS FOR THIS BARGAIN LIST.

SHORT-WAVE COILS. 4- and 6-pin types. 13-20, 22-47, 41-94, 70-170 metres. 1s. each, with circuit. Special set of 3 S.W. Coils, 14-150 metres. 4s. set, with circuit. Premier 3-band S.W. Coil, 11-25, 19-43, 38-86 metres. Simplifies S.W. receiver construction, suitable any type circuit. 2/6.

COIL FORMERS, in finest plastic material, 1½in. low-loss ribbed, 4- or 6-pin. 1s. each.

SUPER CERAMIC CONDENSERS, 8 L. P., .00016, .0001, 2/9 each; double-spaced, .00005, .000025, .000015, 3/- each. All brass with integral slow motion, .00015 tuning, 2/9; .00015 reaction, 2/9. S.W. H.F. CHOKES, 9d.

MAINS VALVES, famous Europa 4 v. A.C. types, 4/6 each. H.L., L., S.G. Var.-Mu-S.G., H.F. Pens. Var.-Mu-H.F. Pens. 1, 3 and 4-watt A.C. directly heated output Pentodes. Full-wave rectifiers, 250 v. 60 m.a. A.C./H.C. types. 20-volt 18 amp. S.G. Var.-Mu-S.G., H., H.L., Power and Pen. Following types all 5/8 each. Full-wave rectifiers, 350 v. 120 m.a. and 500 v. 120 m.a. 2½ watt indirectly-heated Pentodes. Octode Frequency Changers.

BATTERY VALVES, 2 volts. H.F., L.F., 2R. Power Super-Power, 2R. S.G. Var.-Mu-S.G., 4- or 5-pin Pentodes, H.F. Pens., V.-Mu-H.F. Pens., 5/-, Class B, 5/-.

AMERICAN VALVES. Genuine American HYTRON and TRIAD first-grade Valves. 3 months' guarantee. All types in stock, 5/8 each. 210 and 250, 8/8 each. New Metal-Glass Valves, all types, 6/8 each. Genuine American DUOTRON Valves, all types, 3/8 each. Valve holders for all above types, 6d. each. OCTOL bases, 9d. each.

3-WATT A.C. AMPLIFIER, 2-stage for mike or pick-up. Complete kit of parts with 3 valves, 40/-.

7-WATT A.C./D.C. AMPLIFIER, 3-stage high-gain, push-pull output. Complete kit of parts with 5 specially matched valves, 54/4s. Completely Wired and Tested. £5/5/0.

COSMOCORD PICK-UPS, with tonearm and volume control, 10/6 each. PICK-UP HEADS only, 4/8 each.

PREMIER MAINS TRANSFORMERS, wire-end type with screened primaries, tapped 200-250 v. Centre-tapped Filaments. Guaranteed one year. H.T. 8 & 9 or E.T. 10 with 4 v. 4 a. C.T. and 4 v. 1 a. C.T., 8/8. 250-250 v. 60 m.a. 4 v. 1 a., 4 v. 2 a., and 4 v. 4 a., all C.T., 9/6. 250-250 v. 120 m.a., 4 v. 1 a., 4 v. 2 a., and 4 v. 4 a., all C.T., 10/8. Any of these transformers with engraved panel and N.P. terminals 1/6 extra. 500-500 v. 150 m.a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 3-4 a., all C.T., 17/6. SPECIAL OFFER PHILIPS MAINS TRANSFORMERS. 250-250 v. or 300-300 v. at 80 m.a., 4 v. 5 a. C.T.; 4 v. 1 a. Tapped Primary 100-250 volts. 6/11. 450-450 v. at 150 m.a. or 500-500 v. 100 m.a., 4 v. 4 a. C.T., 4 v. 4 a. and 4 v. 3 a. Screened Primary. Tapped input 300-250 v., 12/6. AUTO TRANSFORMERS, step up or down, 60 watts, 7/8; 100 watts, 10/6. SMOOTHING CHOKES, 25 m.a., 2/8; 40 m.a., 4/6; 60 m.a., 5/8; 150 m.a., 10/6. 2,500 ohms, 60 m.a. Speaker Replacement Chokes, 5/6.

Electric SOLDERING IRONS, 200-250 v., A.C./D.C., 2/3.

SPECIAL OFFER. LISSEN TWO-GANG SCREENED ALL-WAVE COILS, 12 to 2,000 Metres, complete with switching and wiring diagrams, 6/11 per set.

TELSEN Multi-meters, 50 and 300 m.a., 8, 16 and 240 v., 9/6 each. Reads A.C. and D.C.

Special Offer **BTE Energized Moving Coils.** 10½in. diam. 1,650 ohms field. Power or Pentode transformer (state which), 14/8.

ROLA latest type P.M.A. 15/-, **GOODMANS'** 8in. mains energized 1,000 ohms field, 10/6 each; **JENSEN P.M.A.**, 10/6.

TRANSFORMERS, latest type Telsen R.G.1 (list 12/6), 2/8. Lissen Hypernik Q.P.P. (list 12/6), 3/6.

OUTPUT TRANSFORMERS for Power or Pentode, 2/6; Multi-Ratio, 4/6.

TUBULAR CONDENSERS, non-inductive, all values up to 5 mfd., 6d. each.

Wire-end **RESISTORS,** any value, 1 watt, 6d.; 4 watts, 1/8; 8 watts, 1/6; 15 watts, 2/-; 25 watts, 2/6 each.

Reliable **MORSE-KEYS** with Morse Code engraved on bakelite base, 2/- each.

Bakelite case **BUZZERS,** 1/6; Walnut case "Lood-tone," 2/8 each.

Super Quality lightweight **HEADPHONES,** 3/9 pair.

TELSEN DISC DRIVES, W 184, 1/- each.

W.B. 1936 STEREOGRAM SPEAKERS. Standard model (list 32/6), 22/8. Senior model (list 42/-), 28/8. Brand new in original sealed cartons.

GRAMOPHONE MOTORS. Collaro Gramophone Unit consisting of A.C. motor, 100-250 v., high quality pick-up and volume control, 45/-; Collaro motor only, 30/-; Collaro Universal Gramophone Motor, 100-250 v. A.C./D.C., 48/6; Edison Bell double-spring motor, including turntable and all fittings, 15/-; Cosmo-cord Gramo. unit, comprising A.C. motor, pick-up and volume control (list 55/-), 55/9.

PLESSEY or POLAR 2-gang (2 x .0005) Condensers with Unikaob trimmer and Disc Drive, 5/11.

RECEIVERS, COMPONENTS AND ACCESSORIES
Surplus, Clearance or Secondhand, etc.

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

VIDOR 3-valve Battery Portable Receivers, complete with 3 Osram valves, special Vidor long life batteries and accumulator, moving coil speaker, brand new, in sealed cartons; £3/17/6.

LUCILLE.—5-valve American Midget sets, complete with 5 valves, moving coil speaker, ready for use on any mains 100-250 volts A.C./D.C., long and medium waves; £3/15, new, in sealed cartons.

RECORD CHANGERS.—Garrard Model R.C.4, R plays automatically and changes eight 10in. or 12in. records of any kind; new, in sealed cartons; £6.

SP.E.A.K.E.R.S.—Celestion Soundex permanent magnet, 10/-; Telsen permanent magnet, with 10-ratio transformer, to suit any receiver, 12/6; Telsen loud-speaker units, 2/6; all brand new and boxed.

COILS.—Telsen Iron core, W349 (Midget size), 4/-; type W478 (twin), 9/- pair; type W477 (triple), 16/- per set; type W476 (triple superhet, selector and oscillator), 16/- per set. Telsen dual range H.F. transformer and aerial coils, type W154, 3/- each; all ganged coils complete on base with switch; Telsen I.F. transformer coils, 110 kc/s, 5/-; Telsen dual range coils, with aerial series condenser incorporated, type W76, 4/-; Telsen aerial condensers, with shorting switch, 2/-; all Telsen components brand new, in sealed cartons.

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

MISCELLANEOUS Bargains.—All brand new, in original sealed cartons; Telsen A.C./D.C. multimeters, test anything, radio or electrical, 8/6; Telsen 2-range voltmeters, 3/-; 3-range meters, including milliamps, 4/-; Ace (P.O.) microphones, with transformer, ready for use with any receiver, 4/6; Bell transformers, 200-250 volts input, 3, 5, or 8 volts output, 3/6; Morse signal units, incorporating buzzer, tapper and flash, with international code, complete with batteries and bulb, 3/9 each; lightweight headphones, double-pole, 4,400 ohms each carpiece, 3/- pair.

REGENTONE Eliminators, A.C. 200-250 volts, R type W5a, with trickle charger, 37/6.

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

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

ALCO ELIMINATORS AND CHARGERS.—4 H.T. taps, 18/-, 120 v./150 v., 20/30 m.a. With ½ amp. charger, 25/-; charger alone, 7/6. ½ amp., 11/-, Complete year's guarantee. Details free. P. and D. Radio, 1, Gooding's Road, N.7.

HEADPHONES. Guaranteed. Brown, Sterling; B.T.H., G.E.C., Braudes, etc. 2,000 ohms; 2/6; 4,000, 5/-; postage 6d. SPECIAL. Ericsson, 4,000 ohms, as new, 7/6. Telefunken, adjustable, lightweight, 7/6. CRYSTAL SETS. Burne-Jones. Complete. Guaranteed. 5/6. Ditto, double circuit, 8/-. Sensitive permanent detectors, 1/6. Crystal detectors, complete parts, 1/-. Crystal with whisker, 6d.; postage 1½d.—Post Radio, 183, Caledonian Road, London, N.1.

NEW RECEIVERS, COMPONENTS AND ACCESSORIES

BANKRUPT BARGAINS. List free. All goods brand new. Mullard MB3A receivers, £4/7/6. Burgoyne 5 v. superhets, £4/17/6. Atham 3 v. H.F. all-wavers, 79/6. All less batteries, with valves. Burndept midget portables, 1937, list £5/18/6, to clear, 70/-. Decca 1937 6 v. superhet radiograms, A.C.; 12 gns. Decca 6 v. A.C. superhets, £6/5/-. Decca ditto all-wavers, £7/5/-. Mullard MU35 6 v. A.C./D.C. superhets, £6/15/-. Burgoyne Dragon, 5 v. A.C. superhets, £6. Haleyon 1937, 3 gns. A.C. S.W. converters, with valve, 25/-. Burgoyne A.C. 5 v. table-gram, list 15 gns., for £8/15/-. Cosmo-cord A.C. gramophone motors with pick-up, 35/-. Ferguson, Pilot, Tru-phonic all-wavers, etc. Midget sets, speakers, replacement valves and components. Large stock at keenest prices.—Butlin, 6, Stanford Avenue, Brighton, Preston 4030.

BATTERY CHARGING PLANT

2 VOLT, ½ amp., 8/6; 1 amp., 12/6. Model 302, 6 v., 2 amps., 21/-; CG/122, 12 v., 2 amps., 30/-; many others.

Steel cases, metal rectifiers, 100-110 v., or 200-250 v. A.C. mains. Sent C.O.D. Satisfaction or money refunded.—Brighton Radio Service, 31, Middle Street, Brighton.

REWINDING AND REPAIRS

ANY transformer, choke, field coil, pick-up, armature, rewind, from 2s.; sets, eliminators repaired; alterations, conversions. Guaranteed work.—Brighton Radio Service, 31, Middle Street, Brighton.

KING GEORGE VI MICROPHONE

As originators of Home Broadcast Microphones, we play our part in the great British Pageant of 1937, by introducing a complete home broadcaster in national colours and bearing an emblem of our King's Head.



8'6 POST FREE

This microphone is extremely sensitive, and is a carbon granule type, working on the same principle as the commercially used microphone. Connects to the pick-up terminals of any set. Speech or music reproduction with no background noise. 4½v. battery used for energising (matching transformer supplied in base of microphone). Senior model on 12in. aluminium table stand, 47s. 6d. Send for our Radio Bargain Spring List, 13d. post free. 7 days' approval on all purchases.

SHAFESBURY SUPPLIES,
224, Shaftesbury Avenue, W.C.1. Tel. Bar 4175.
BRITAIN'S FOREMOST MAIL ORDER HOUSE

ENGINEERING OPPORTUNITIES

This unique Handbook shows the easy way to secure A.M.I.C.E., A.M.I.E.E., A.M.I.A.E., A.M.I.W.T., A.M.I.R.E., and similar qualifications. **WE GUARANTEE—NO PASS—NO FEE.** Details are given of over 150 Diploma Courses in all branches of Civil, Mech., Elec., Engineering, Building, Government Employment, etc. Write for this enlightening Handbook to-day **FREE** and post free.

British Institute of Engineering Technology,
409, Shakespeare House, 17, 18, 19, Stratford Pl., W.1.

EARN EXTRA MONEY

by hiring out the M.P.R. 7 Watt Amplifier to dances, societies, etc. Complete with Four Valves, Speaker, and Volume Control. Push-Pull output. Will reproduce Gramophone Recordings or Radio at full Band strength. Supplied ready for connecting to pick-up or microphone. For A.C. mains only. Price £5-5-0 net, or 10/- monthly. Send for full particulars. Phone: Ramford 378. M.P.R. Electrical Co., 252, Victoria Road, Romford, Essex.

FREE ADVICE BUREAU COUPON

This coupon is available until May 1st, 1937, and must be attached to all letters containing queries.

PRACTICAL AND AMATEUR WIRELESS.
24/4/37.

ADVERTISEMENT INDEX	
Automatic Coil Winder and Electric's Equipment Co., Ltd.	Page 142
British Institute of Engineering Technology	Inside Back Cover
Bulgin, A. F. and Co., Ltd.	142
Electradix Radios	138
Fluxite, Ltd.	138
London Radio Supply Co.	138
M.P.R. Electrical Co.	Inside Back Cover
McCarthy Radio, Ltd.	Inside Back Cover
New Times Sales Co.	139
Peto-Scott Co., Ltd.	137
Premier Supply Stores	144
Shaftesbury Supplies	Inside Back Cover
Telegraph Condenser Co., Ltd.	141
Wills, W. D. and H. O.	Inside Front Cover

VALVES

NOTHING better available. **SIX MONTHS' GUARANTEE**, complete range of **BATTERY, A.C. MAINS, RECTIFIERS**, always in stock. 2 volt Det., H.F., L.F., 2/3. **POWER, 2/9. SCREEN GRID PENTODE, H.F., PENTODE, 5/-**. American types, six months' guarantee, 5/6 each. Nos. 18, 24A, 35, 42, 43, 45, 47, 56, 57, 58, 75, 77, 78, 80, 2A5, 2A6, 2A7, 6A7, 2B7, 6C6, 6D6, 25Z5, 25Y5. Write for other prices to Dulci Electrical Co., Devonshire Works, Duke's Avenue, Chiswick, London, W.4.

REPAIRS

ALL British or American sets repaired or modernised by qualified engineers. Satisfied customers throughout the World are your guarantee. Send to-day for free estimate—free collection 10 miles radius of London.—Scott-Sessions and Co., Exchange Works, Dukes Avenue, Muswell Hill, London, N.10. Phone: Tudor 4101.

MISCELLANEOUS

NEW CONDENSERS.—British manufacture. Fixed paper, in Metal Cases. 1,000 volt wkg., 1 mf., 3/-; 2 mf. 5/-; 4 mf. 7/6; 800 volt wkg., 1 mf. 1/9; 2 mf. 2/3; 4 mf. 3/9; 500 volt wkg., 1 mf. 1/3; 2 mf. 1/0; 4 mf. 2/9; 400 volt wkg., 1 mf. 8d.; 2 mf. 1/-; 4 mf. 1/9. 1,000 volt working Tubular Condensers with Soldering Tags and metal bracket for fixing; 1 mf. 10d. ea.; .25 mf. 1/9 ea.; .5 mf. 2/- ea.; 1 mf. 2/6 ea. Guaranteed. Postage 6d. or C.O.D.—Mentone Radio Stores, 364, Fulham Road, South Kensington, S.W.10.

GRAMOPHONE attachments for Radio, electric motors, 25/-; pick-ups, 9/6; portable gramophones, 12/-; spring motors, 4/6, dozen 36/-, 100 £12/10/0, 1,000 £100; walnut pedestal Anexagram, £5; soundboxes, tone-arms, horns, cabinets, needles, gears, springs, accessories, cheapest. Quantity buyers obtain lower prices. Catalogue free.—Regentam, 120, Old Street, London, E.C.1.

JOIN the oldest Radio Society in the world. Membership details free, or with April "Bulletin" (64 pages), 1s. post free.—Dept. "N", Radio Society of Great Britain, 53, Victoria Street, London, S.W.1.

"**NEWNES TOURIST ATLAS** of Great Britain and Route Guide." Edited by John Bartholomew & Son, Ltd., 120 pages of fully coloured contour maps for the whole of England, Scotland, Ireland and Channel Islands, with Index to the principal Motoring and Cycling centres and distances. 2s. 6d. from all booksellers.—George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

VISITORS TO LONDON should get Newnes Handy Pocket Atlas and Street Guide to London. Edited by John Bartholomew & Son, Ltd., 18 coloured Maps, General Index to Streets and Railway Stations. 2s. from all booksellers.—George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

"**WIRELESS FOR THE MAN-IN-THE-MOON**" by Columbus and Decibel. 2s. 6d. net.—Writing about the book the "Midland Daily Telegraph" says: "It is both good fun and sound theory."—At all Booksellers and Libraries, or from George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

"**THE OUTLINE OF WIRELESS**," by Ralph Stranor. Fifth edition, 8s. 6d. net.—This book, which covers the subject from A to Z, is to be recommended to all who desire to master the theory of Modern Wireless. At all Booksellers and Newsagents.—George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

A DICTIONARY OF WIRELESS TERMS, by Ralph Stranor. A Wireless Work of Reference that should be on the bookshelf of every keen amateur. Compiled by a master of lucidity, it gives the meanings of all Technical terms in general use. Price 2s. 6d. from all Booksellers and Newsagents.—George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

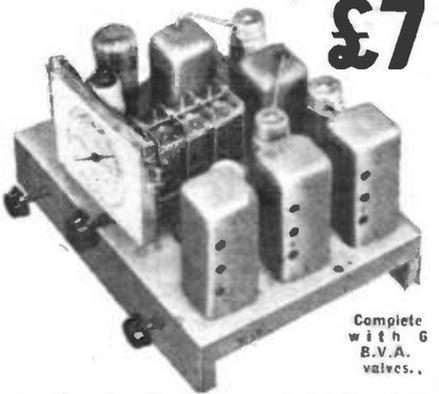
FIFTY TESTED WIRELESS CIRCUITS, by F. J. Camm. 2s. 6d.—This handbook contains every modern circuit, complete with instructions for assembling, component values, and notes on operation. Obtainable at all Booksellers and Newsagents.—George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

THE PRACTICAL MOTORIST'S ENCYCLOPEDIA, by F. J. Camm, 3s. 6d. net. A lucid exposition of the principles, upkeep and repair of every part of the car. 442 illustrations. From booksellers everywhere.—George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.



NEW BATTERY ALL-WAVE SUPERHET

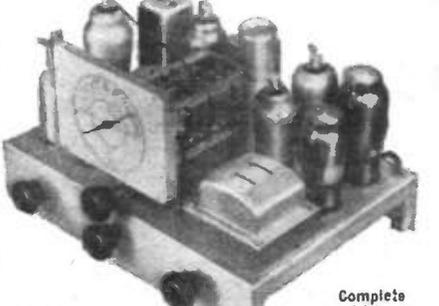
£7



Complete with 6 B.V.A. valves..

The only receiver of its type now on the British market. Results on all 3 wavebands equal to mains receivers of equivalent type. Latest technical developments incorporated in circuit. Latest types valves, transformers, tuning coils, switches, etc. Specification in brief: radio frequency amplifier, first detector with separate triode oscillator, I.F. amplifier, double diode detector, L.F. amplifier, low consumption pentode output. D.A.V.C. volume control and tone control both operative on gramophone. Illuminated dial with station names. Wave-ranges: 16-52, 200-550, 1000-2,000 metres.

ALL-MAINS ALL-WAVE SIX with radio frequency stage



Complete with 6 B.V.A. valves.

£8.5.0

"De luxe" 6 valve receiver, with 8 valve performance (specially recommended for tropical and foreign reception conditions). Built on special cadmium-plated 16 gauge steel chassis. Varley iron-core I.F. coils. Litze-wound tuning coils. 3 wave-ranges—16.5-2,000 metres. Illuminated "Airplane" dial with principal station names. Circuit comprises: Eye-selector radio frequency amplifier (operative on all wavebands), triode-hexode frequency changer, double hand-pans coupled I.F. amplifier, double diode detector, D.A.V.C. applied to 3 preceding valves. L.F. amplifier and pentode output. Variable tone control and volume control operate on radio and gramophone.

Important! The price at which McCarthy Chassis are advertised include Marconi Royalties. Readers should, for their own protection, make sure before purchasing any receiver that the quoted price includes the Royalty payment.

All McCarthy receivers supplied complete with valves, knobs, pilot lamps, leads, mains cable and plug. 12 months' guarantee. Cash with order on 7 days' approval. Deferred terms on application, or through London Radio Supply Co., 11, Oct Lane, E.C.2.

Write for catalogue of complete range of McCarthy receivers.

MCCARTHY RADIO LTD.
44a, Westbourne Grove, London, W.2
Telephone: Bayswater 3201/2



THE STRAND MAGAZINE is an institution—and its Coronation Number a magnificent achievement.

Special Features Include:

HIS MAJESTY KING GEORGE VI

By The Rt. Hon. WINSTON CHURCHILL

Magnificent Photogravure Supplement Dealing with
THE LIFE OF THE KING, IN PICTURES

Fiction:

HAPPY AND GLORIOUS. By Margery Sharp.
FLOURISH OF TRUMPETS. By Denis Mackail.

And stories by

GILBERT FRANKAU, ROLAND PERTWEE,
E. C. BENTLEY, ALEC WAUGH, WARWICK
DEEPIG, etc.

IN THE MAY

STRAND MAGAZINE

Of all Newsagents and Bookstalls, or by post, 1/3½
from the Publisher, George Newnes, Ltd., Tower
House, Southampton Street, Strand, London, W.C.2. **1/-**

George Newnes, Ltd.

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

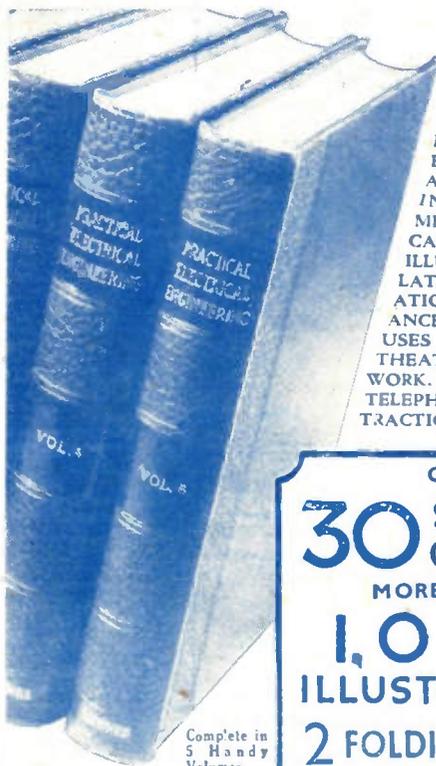
THE OUTSTANDING WORK FOR
ALL ELECTRICAL ENGINEERS

"Practical Electrical Engineering"

IN Electrical Engineering, advancement and success come to the man who is best equipped to tackle and understand the multifarious jobs and problems he may encounter. This new and up-to-date work will help you to acquire the necessary combination of theoretical and practical knowledge. It is invaluable alike to the Student and to the practising Engineer. It shows the approved methods of dealing with every type of work, from the installation, erection, wiring and maintenance of an electrical plant for a small house to that of a large factory replete with most up-to-date equipment. In addition, the most modern applications of electricity, including sound-film reproduction, wireless, etc., are fully dealt with.

*A few of the
important subjects:*

WIRELESS AND
GRAMOPHONES
ELECTRICAL MACHINERY.
GENERATION AND DISTRIBUTION.
INSTRUMENTS AND METERS. WIRES AND CABLES. LIGHTING AND ILLUMINATION. INSTALLATION WORK. OPERATION AND MAINTENANCE WORK. INDUSTRIAL USES OF ELECTRICITY. THEATRE AND CINEMA WORK. TELEGRAPHY AND TELEPHONY. ELECTRIC TRACTION.



Complete in
5 Handy
Volumes.

OVER
30 SPECIALIST
CONTRIBUTORS
MORE THAN
1,000
ILLUSTRATIONS
2 FOLDING PLATES
SECTIONAL MODELS
IN FULL COLOURS
OVER 1,900 PAGES

**POST COUPON
BELOW TO-DAY!**

To the **HOME LIBRARY BOOK COMPANY**
(George Newnes, Ltd.)
Tower House, Southampton Street, London, W.C.2

Please send me, without obligation to purchase, full particulars of **PRACTICAL ELECTRICAL ENGINEERING** and details of your scheme of Easy Payments with immediate delivery.

Name

Address

P. Wireless 24.4.37

If you do not wish to cut your copy, send post card mentioning "Practical Wireless" to address above.