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May 2nd, 1936.

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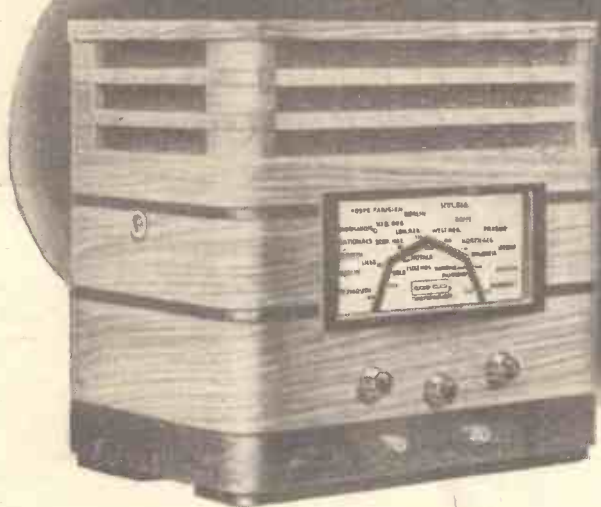
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Practical and Amateur Wireless

Edited by F. J. CAMM

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VOL. VIII. No. 189. May 2nd, 1936.

ROUND *the* WORLD of WIRELESS

The Radio Exhibition

IT is now announced that there will be only one R.M.A. exhibition this year, and it will be held at Olympia, as in previous years. It has been decided that no R.M.A. exhibition will be held at either Manchester or Glasgow, but local bodies may decide to inaugurate exhibitions in these localities. The actual date of the Olympia opening has now been fixed, and will extend from Aug. 26th, to Sept. 5th, inclusive. The period during which the exhibition will be open will again be ten days.

B.B.C Plans for the Near Future

IT is fully expected that the new 50-kilowatt North Scottish broadcasting station will be ready by next autumn, and that the tests of the North-West relay at Bangor (North Wales) will also take place this year. This station will also serve as a model for the Plymouth and Bournemouth relays which are to replace the existing transmitters in these regions. The power of North-West Regional has

An Omni-directional Aerial

FOR the transmissions carried out by the E.I.A.R. Rome short-wave stations tests are being made with a new aerial consisting of a metal globe some thirty-three feet in diameter. It is perched on the top of an 800ft. mast, and it is anticipated that the service area of the transmitters will be greatly increased.

A Babel of Tongues

THE English, Greek, Amharic, Coptic, Armenian, Arabic and Latin languages were used in a broadcast made

to foreign broadcasts in the capital. The Athens police has now decreed that from 11.0 p.m. there is to be no diffusion of radio programmes by loud-speakers in outdoor restaurants, and so on, overlooking streets and public places. By the same edict motorists are also forbidden to sound their horns after that hour. All of which is, of course, absurd.

Future of the Old 2LO Studios

THE original Savoy Hill headquarters of the B.B.C. are being completely transformed for the use of the technical section of the Air Ministry. In these former offices will be housed the A.M. staff dealing with radio and other kindred matters appertaining to aircraft.

World's Largest Radio Network

BY acquiring control over six more transmitters the National Broadcasting Company of America now owns ninety-seven stations in seventy-one different cities connected by twenty thousand miles of special cables. The gross output of the transmitters in this huge network is 1,741,400 watts. Broadcasts over the system are heard daily by over fifty-one million listeners. In addition, the N.B.C. disposes of eleven short-wave transmitters, or a grand total of 108 stations!

Only One Broadcaster in Morocco

ALTHOUGH reports to the effect that two further transmitters have been installed in Morocco, it is now definitely stated that so far Rabat is the only one providing a radio programme. Studios have been opened at Marrakesh and Fez, and this fact may have given rise to the rumour.

The Musician at the Gramophone

IN this series, Dr. Henry Coleman, Organist and Master of the Choristers at Peterborough Cathedral, will give the next talk on May 1st, illustrated by some of his favourite gramophone records. He has occupied his present position at Peterborough since 1921, and has broadcast organ recitals both from the Cathedral and from the small organ in the Song School. Dr. Coleman is a composer of church music and is the author of two books on choir training.

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during the Easter Festival from the new Jerusalem station, when a service was given by the Patriarchs, or head priests, of the different communities to which the listening population belongs.

Where Parliamentary Debates are Broadcast

IN view of the popularity achieved by the relay of speeches from the New Zealand House of Representatives, the authorities have decided to make them a regular feature, and are seriously considering the question of using a special station solely for these transmissions.

Peace, Perfect Peace!

ALTHOUGH Greece only possesses a small "broadcaster" at Salonica, there exists a large listening community

ROUND the WORLD of WIRELESS (Contd.)

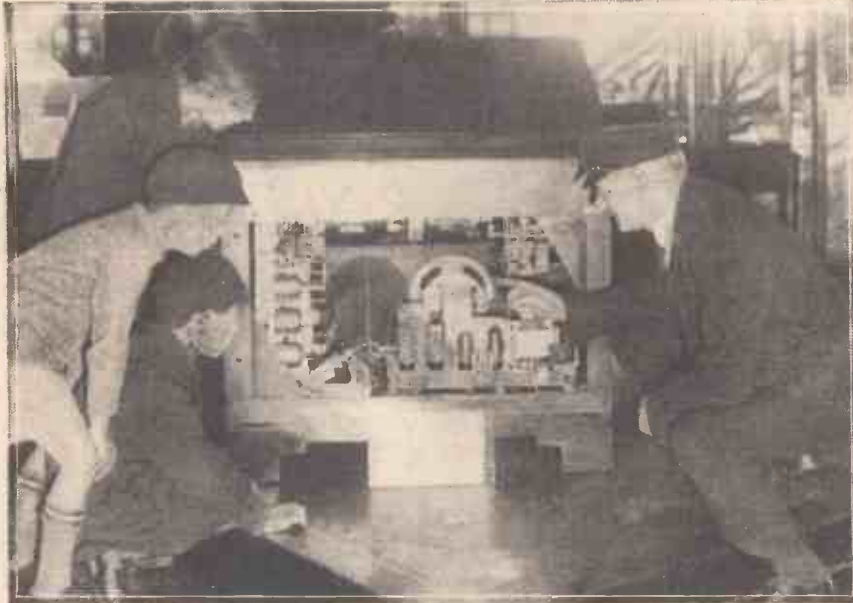
Empire Day Programme

THE fourth in the series of Empire Day broadcasts will be given in the National programme on May 24th. The first of these programmes came from this country in 1933. In 1934 there was a relay from Australia, and in 1935 one from Canada. This time it is South Africa's turn, and details of the programme she will provide will shortly be available.

INTERESTING and TOPICAL PARAGRAPHS

(coloured vocalist) of "Soft Lights and Sweet Music" fame, Shaw and Weston (Scottish comedians), Ray Saxe (American musician), and Stuart Hire and Eaton (harmonising and comedy).

A SUPER RADIOGRAM



One of the attendants at the Science Museum, South Kensington, showing three young visitors the newest exhibit—an "H.M.V." 15-valve Auto-radiogram. It represents the latest developments in radio and gramophone research.

Birmingham City Police Band

THIS Band, the foremost among Police Bands in England, will be conducted by Richard Wassell in a programme which includes Winterbottom's arrangement of "Finlandia," by Sibelius. This broadcast will be given from the Midland Regional on May 9th.

R. L. Stevenson

"TREASURE ISLAND," by R. L. Stevenson, has been adapted as a radio play by E. M. Delafield, and will be produced by Cyril Wood in the National programme on May 6th and in the Regional and Western programmes on May 7th. It is of particular interest that the West Country figures in the story—the *Hispaniola* sailed from Bristol—and the lively dialogue will be heightened by a strong tinge of Devon and West Country dialect.

"Brand New"

THE Northern Revue Orchestra, conducted by Thomas Matthews, will present a new kind of programme on May 8th. Its title is, in fact, "Brand New," and it will consist for the most part of new tunes by Northern composers. The works will all be of the type which is popularly known as "symphonic jazz."

Variety from Blackpool

VARIETY will be broadcast from the Palace Theatre, Blackpool, on May 7th. It is not yet possible to give definite details, but the bill from which an excerpt will be taken will include Elisabeth Welch

The City of Bristol Orchestra

THIS well-known orchestra, conducted by Maurice Alexander, will broadcast for the first time on May 9th, from the Western Regional. The orchestra was formed in March, 1935, but has not yet made a public appearance. Maurice Alexander was for five years leader of the Queen's Hall Orchestra under the conductorship of Sir Henry Wood. Dorothy Hall (soprano) will be the vocalist at the concert.

Teversall Colliery Band

THIS Band comes from Nottinghamshire to the Birmingham studios on May 4th for its first broadcast. It was formerly known as the Stanton Hill Silver Band, and has had many successes at festivals. In 1931 it was in the prize list at Crystal Palace, Belle Vue, and Leicester. The conductor is J. T. Parkes. In the interludes, Howard Booth, the Derby comedian, will entertain; he has been Jester and King at Derby Hospital Carnivals.

Talk from the Smeaton Tower

PLYMOUTH HOE on a Saturday night will be described by John Betjeman from the Smeaton Tower on May 2nd. In a broadcast of this nature only a weather prophet can predict the nature of the crowd and whether their spirits will be preponderantly cheerful or depressed. Whatever the circumstances may be, however, John Betjeman will describe the scene as it is rather than in the form of a carefully prepared essay.

May Day : Northern Ireland

NORTHERN IRELAND heralds the first of May with a programme characteristic of spring. The B.B.C. Northern Ireland Chorus and Orchestra, led by Philip Whiteway and conducted by E. Godfrey Brown, will give a programme devoted to May Day. It consists of "The Revels," by MacFarren and W. Sterndale Bennett's Pastoral, "The May Queen." The artists taking part are Evelyn Gibb (soprano), who will be the May Queen; May Latimer (contralto), who will be the Queen; John Kentish (tenor), who takes the part of the lover, and Hooton Mitchell (baritone), captain of the foresters.

"Cavalcade"

PREPARATIONS for the broadcasting version of Noel Coward's "Cavalcade" are well advanced, and despite the obvious difficulties of adapting such a complex dramatic panorama for the microphone, it is safe to say that even those listeners who saw the play at Drury Lane cannot fail to be thrilled anew when they hear, without seeing, this great pageant of London and the Empire. Four performances of "Cavalcade" have been arranged; two to take place in June and two in October. Details as to the cast are not at present available.

The Phantom Five

IT is not always easy to find a title for an instrumental combination which will attract the attention of the public, and Mr. Charles H. Lockier got the inspiration for the title "The Phantom Five" as the result of a sailing adventure with Edgar Hawke some months ago. A fog came down very quickly and there were many anxious moments on board the dinghy, during which time various phantom sounds were heard and lights seen. Eventually a safe mooring was made, and it was then Mr. Lockier suggested to Mr. Hawke the name of his new quintet. "The Phantom Five" will be heard in a concert from the Bristol Studios on May 6th.

SMOKE TUNIC

Some Simple "Quality" Circuits

Details are Given of Suitable Circuits for Battery, A.C. and Universal-Mains Operation, and the Chief Requirements of Three-Stage High-Fidelity Receivers are Outlined.

By "THE EXPERIMENTERS"

It is generally agreed that a receiver which is designed for high-quality reproduction must be more expensive than one which is only required to give "good" reproduction. In fact, a "quality" set is often considered as being too expensive for the amateur constructor. This might be the case if the set were wanted to give first-class reproduction as well as having long range and ultra-sharp selectivity, but if one is content to have first-class reproduction from two or three transmissions only, the set need not be too expensive. And since the present-day trend is towards better and better reproduction the simple "quality" receiver is in greater demand than ever.

Simplest Arrangement?

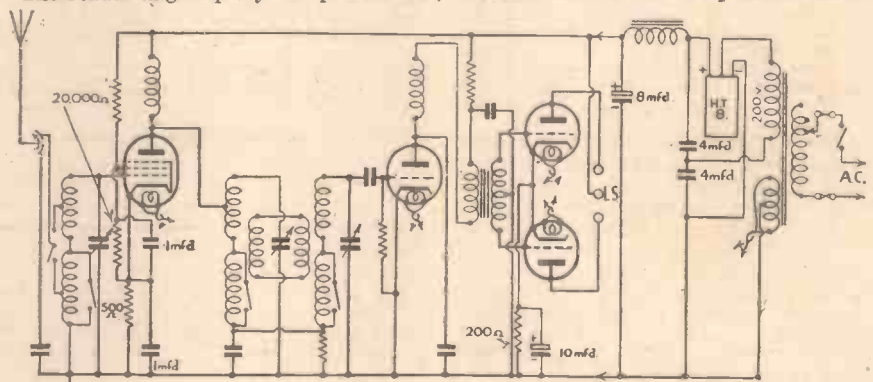
One might well ask: "What is the simplest circuit arrangement for an inexpensive receiver designed expressly for the purpose of giving really good reproduction from the local stations?" Different designers would supply different answers, but it can be taken as being fairly well agreed that the main requirements are: Band-pass tuning, at least one H.F. valve, a power-grid detector, and either a push-pull output stage or one comprising a single super-power valve having a rated undistorted output of not less than 2.5 watts. This general description applies to either a battery or mains-operated receiver, although when considering a battery set it will probably be necessary to be content with an undistorted output of rather less than 1 watt unless an H.T. accumulator or an eliminator is to be used for high-tension supply. If, however, the constructor is prepared to tolerate the very slight amount of distortion introduced by modern high-efficiency pentode valves, an output of nearly 2 watts can be obtained for a total anode-current consumption of 30 mA. or so.

Let us first consider a general circuit arrangement which is suitable for battery, A.C. or universal-mains use. The main features are shown in the skeleton diagram in Fig. 1, from which it will be seen that a screened H.F. pentode follows a single-circuit tuner, and is itself followed by a band-pass filter, a power-grid detector and

a transformer-coupled push-pull stage including a pair of super-power triodes. There is no reaction circuit, for that is better omitted when quality is the first consideration, and only a low value of decoupling resistance is included in the detector anode circuit.

Position of Band-pass Filter

The reader might query the position of



the band-pass filter, thinking that this should be in the aerial-input circuit. In the present case it is better in the position indicated, for it is unaffected by aerial capacity, whilst tuning is not damped to such a great extent by the power-grid detector. Another point is that any slight lack of accurate trimming of the gang condenser is not as important as it would be if the single-circuit tuner followed the first valve. Some may even consider that band-pass is unnecessary in a circuit such as this in which selectivity is not of very great importance. But quality is of little use if there is any sideband interference which produces those annoying "tizzing" sounds, due to interference from a powerful transmission on a near wavelength to that of the local station. In any case, a properly-designed band-pass filter produces smaller

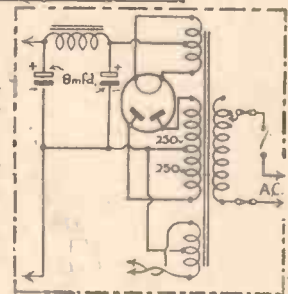
losses of the higher frequencies than does a single-circuit tuner, which is tuned rather too sharply.

There may be many designers who would rather see a double-diode valve in the detector position. It would certainly be almost as good as the power-grid triode, but the connections to it are not quite as simple, and practice suggests that the triode is slightly better in the simpler type of set.

The Battery Circuit

Particular makes of components will not

Fig. 2.—Circuit of the A.C. "quality" set with push-pull output. Inset is shown the circuit for a valve rectifier.



be specified, but any good coils and three-gang condenser can be used—perhaps by slightly modifying the connections according to the particular make chosen. For a battery set the first valve could be one such as the Cossor 210 S.P.T. or Hivac H.P.215; the detector should be of the L.F. type, whilst the two power valves must be chosen according to the output required and the H.T. current available; if the total current is to be less than 30 mA., valves such as the Mullard P.M.202 are very suitable, and these would provide an output of approximately .75 watt when using 120 volts H.T. If a full 1-watt were required the total H.T. current would be in the neighbourhood of 45 mA. (which is too high for dry batteries) and valves such as the Cossor 230 X.P. could be used.

Push-pull

The push-pull transformer is an important component, and this should be a really high-grade instrument with a ratio of not less than 1:3.5. It is assumed that a speaker with built-in centre-tapped transformer would be used, but if the transformer fitted were not of suitable type a good push-pull output choke or transformer would be required.

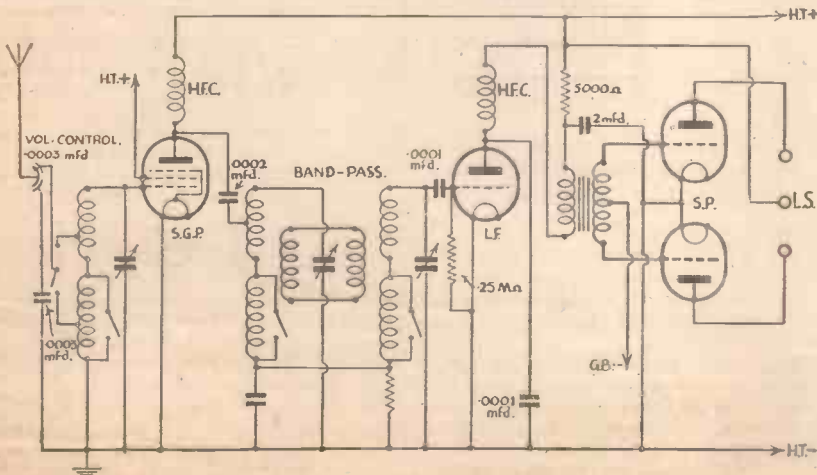


Fig 1.—Skeleton circuit of a simple "quality" set.

(Continued overleaf)

(Continued from previous page)

A.C. Operation

Were the set for A.C. operation the valves would be: First, Cossor M.S./Pen., Osram S.24 or similar; second, Cossor 41M.L.F., or similar; output, Cossor 41M.P., Mazda A.C.P.1 or similar valves taking about 25 mA. at 200 volts. Such a combination could be supplied by a mains transformer and rectifying valve with an

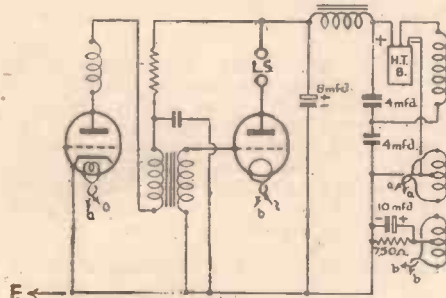


Fig. 3.—The connections required when using a single-valve output stage in the A.C. set. Note the separate L.T. winding for the directly-heated output valve.

output of 250 volts at 60 mA. if a permanent-magnet type loud-speaker were employed. If it were proposed to use an energised speaker the rectifier would have to provide an output of 300 volts or more to permit of the voltage drop across the field coil. This will not be considered, since most constructors of simpler types of receiver prefer to keep to the Class A type of rectifier.

The complete circuit, with approximate component values for the A.C. valves mentioned, is given in Fig. 2, and here a Westinghouse style H.T.8 metal rectifier is indicated, whilst the modified connections required when using a Class A valve rectifier (Ferranti R.A., Osram U.10, for example) are indicated in the inset circuit. The two valves mentioned are rated to give an output of about 270 volts at 60 mA. when fed from a double-500-volt mains transformer. This allows for the necessary grid-bias voltage and the voltage drop across a standard 500-ohm smoothing choke, and the drop across the output transformer, and leaves just about 200 volts for the anodes of the output valves.

Single-valve Output

Those who prefer one large power valve to the push-pull could use the output circuit shown in Fig. 3, where a valve such as the Cossor 4X.P. or Osram P.X.4

is used to provide an output of about 2.5 watts, which is similar to that given by the pair of valves previously suggested used in push-pull. These super-power valves take a maximum anode voltage of 250 at 48 mA., with a grid-bias voltage of about 30, and to ensure that such a voltage reaches the anode it is necessary to use a smoothing choke of rather lower resistance (the Wearite H.T.410—40 henries, 250 ohms is suitable) and to choose a speaker transformer with a reasonably low resistance.

The push-pull arrangement is to be preferred where the extra expense is felt to be justified, but the difference in quality is not very marked provided that high-grade components are used throughout, especial attention being paid to the L.F. transformer, which should be a Ferranti A.F.5 or Varley D.P.3 for preference; these two instruments will carry a fairly high primary current and give the necessary high step-up.

A.C. or D.C. Operation

The push-pull circuit arrangement suggested is most suitable for use with universal valves, a typically-suitable combination being: First, Cossor 13S.P.A.; second, Ferranti D.A.; third and fourth, Cossor

those used for the corresponding battery and A.C. versions, but the choke should be that recommended for use when using a single P.X.4-type valve, since it is better to have the lowest resistance possible in order to ensure the greatest possible H.T. voltage on the anodes of the valves.

Circuits Only

It will be appreciated that in every case the circuits are not intended for use by those who have not had previous experience of constructional work, because complete wiring diagrams cannot in any circumstances be supplied. In any case the layout is not critical, but it is important that components such as bias resistances should be chosen with care according to the exact valves employed. Suitable values are always given in the valve makers' literature, so no difficulty need be experienced in this respect. Should there be any readers who are interested in the construction of a quality set on the lines suggested, and who are not able to work to the theoretical diagrams, it might be added that the "Hall-Mark Four" series of circuits published in these pages in issues dated January 26th and February 2nd, 1935, are of rather similar type and are most nearly in keeping with the main principles which have been detailed. The most im-

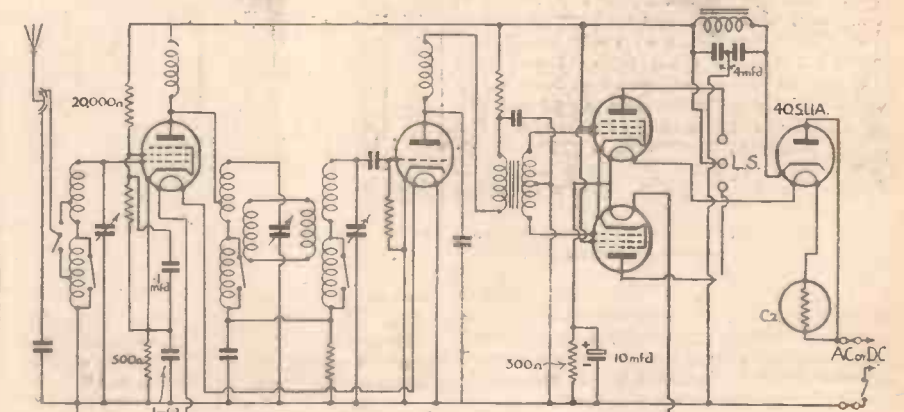


Fig. 4.—This universal-mains circuit compares with the others shown in Figs. 1 and 2.

40P.P.A. The output valves listed are pentodes, as there are no suitable triodes in the universal series. A circuit incorporating these valves is given in Fig. 4, where the rectifier is Cossor 40S.U.A., whilst the barretter is a Philips C.Z.

The other components are the same as

important difference is that those sets did not incorporate a band-pass filter and were thus not quite as selective as might be desired at the present time and when the set is used in conjunction with a fairly long, open aerial situated within a few miles of the local transmitter.

The New Italian Stations

BOLZANO, now 20 kilowatts, was inaugurated simultaneously with the high-power Radio Marconi (Bologna) transmitter, both of which are included in the North Italian network. Bolzano will retain its former channel, 559.7 m. (536 kc/s), but Bologna temporarily will share the wavelength used by Trieste (245.4 m.—1,222 kc/s). Later, Trieste and Turin will be synchronised to work on the same channel, namely, 263.2 m. (1,140 kc/s).

P.T.T. Rennes-Bretagne

THE 120-kilowatt station which the P.T.T. engineers are putting up at Thourie, near Rennes (Brittany), and which is to give an adequate service to western France, will begin testing towards the beginning of May. The station will be gradually brought into operation about June,

ITEMS OF INTEREST

and will work on the present Rennes P.T.T. wavelength of 288.5 m. (1,040 kc/s).

London's Underground Railway

THE most famous subterranean railway in the world, the Underground of London, will feature in the National programme on May 8th.

Felix Felton, B.B.C. Drama Producer, with the co-operation of the London Passenger Transport Board, is exploring the system in order to decide on the treatment. The idea at present in greatest favour is to reinforce the actuality method of treating such a broadcast by giving the

staff who run the railway the opportunity to make the organisation speak for itself. There are many questions passengers put to themselves when rushing through the tunnels, with nothing to occupy their minds but gay advertisements. How is it that one train does not run into another? What happens when all the lights go out? How do you get out of the Underground when shut in after the last train? Where does the conditioned air come from? These are some of the questions that may occur to passengers—and there are many others. The B.B.C. Recording Unit will record a pattern of sound representing all the workings of the railway to lend colour to this broadcast. It is the B.B.C.'s experience that the employees appreciate these programmes and are only too willing to go out of their way to help the producers to give a true picture of the organisation in which they pass a great part of their lives.

FROM MICROPHONE TO LOUD-SPEAKER

An Explanation of Some of the Points Met With in the Production, Transmission, and Reproduction of Wireless Programmes

ONE of the great advantages of a wide band of radio frequencies is that different transmitting stations can select different frequencies for their own use, so that hundreds of programmes may be sent ranging through the ether at the same

Thus a station transmitting at a frequency of 1,000,000 would be said to be using a wave of 300 metres.

With a full understanding concerning the currents and radio waves which are employed in wireless transmission and reception, we can proceed to trace their progress through the successive stages. We know now that the air vibrations produced by the performer are converted by the microphone into an audio-frequency electric current.

How is this done? There are several types of microphone, but for our purpose we will take one of the simplest forms. Most people know that an electric current can only be set up when a force called an "electro-motive" force exists. If a battery or a dynamo, both devices for producing an electro-motive force, is applied to a complete electric circuit, an electric current will flow, and the strength of the current will depend upon two factors—the magnitude of the electro-motive force and the amount of "resistance" offered by the circuit.

current, supplied from a battery, is made to pass through the carbon, and the microphone is so placed that the air vibrations produced by the performer will fall on the diaphragm, causing it to vibrate in sympathy. As the diaphragm vibrates it alternately compresses and releases the carbon granules, thus decreasing and increasing their electrical resistance, and this is reflected in corresponding changes in the strength of the microphone current, which will vary, of course, at audio frequency.

Before the microphone current can be imposed upon the radio-frequency current, which, it will be remembered, produces the radio wave, it must be strengthened or "amplified," as it is termed. This process is performed by one or more valves, the operation of which must now be described.

The Valve

The type of valve employed for amplification is termed a three-electrode valve, and consists of a glass bulb from which every trace of air has been removed, and containing three metal elements. These are, first, a filament, which is similar to the filament of an electric lamp; second, an "anode," which is a piece of metal plate or gauze surrounding the filament but not touching it, and, third, a "grid," which is an open-work metal structure (often a wire spiral) which also surrounds the filament and lies between it and the anode, touching neither.

When the filament is heated by the flow of an electric current through it, quantities of minute electric particles called "electrons" are emitted, these particles being actually small negative electric charges. It is one of the laws of electric science that a positive electric charge will attract a negative electric charge, so by maintaining a strong positive charge on the anode of the valve a large number of the negative electrons will be attracted from the filament to the anode through the vacuous space within the bulb. Electrons in motion are, in effect, an electric current, and the

(Continued overleaf)



Fig. 1.—A view of the amplifiers and control panels of a modern transmitter.

time without serious interference. The process of tuning a receiver is simply a matter of making the receiver, for the time being, specially sensitive to the frequency adopted by the wanted station, and comparatively insensitive to all others.

Frequency Separation

As there is such a wide band of frequencies in the radio frequency range, it would appear a simple matter to prevent any interference at all between different stations, but the actual facts are somewhat different, and at the present time there is much congestion of the ether. For reasons which cannot be gone into at present, it is impossible to separate two programmes and also get good quality reproduction if their carrier frequencies differ by less than 9,000 cycles. As part of the useful wave band has to be reserved for commercial and ships' radio, and others for official use, only a limited wave range is available for broadcasting, and even with 9,000 cycles separation between allotted station frequencies, the ether is overcrowded.

Although it is strictly correct to talk about the frequency of the wave used by different stations, there is another way of describing different waves, which is much used. This is the "wavelength." As a radio wave travels at a speed of 186,000 miles a second, or 300,000,000 metres per second, it is clear that at the end of the one second from the beginning of a transmission, the ether over a radius of 300,000,000 metres could be mapped out into waves equal in number to the frequency of the wave, and that the length of each wave could be found by dividing 3,000,000,000 metres by the frequency.

Simple Microphone

The idea of electro-motive force and resistance can be readily understood if the former is compared with a steadily applied pressure which tends to force water through a system of pipes, and the latter to be the friction of the pipes. It is clear that, other things being equal, an increase of pressure will increase a flow of water in proportion, while an increase in pipe friction will reduce the flow.

The simplest form of microphone consists of a "box" containing a quantity of loosely-packed granules of carbon, the "lid" of the box being a thin diaphragm which is capable of vibration. An electric

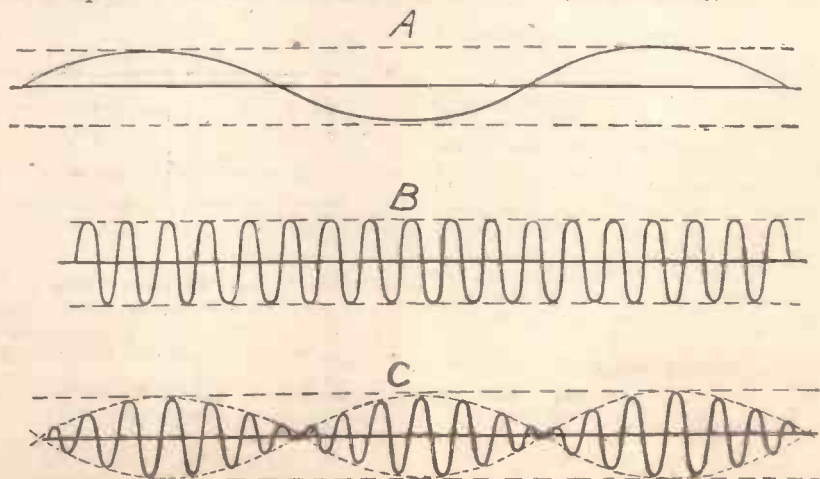


Fig. 2.—In the above diagrams, A represents audio-frequency oscillation, B high-frequency oscillation, and C modulated high-frequency oscillation.

(Continued from previous page)

stream of electrons passing from the filament to the anode form what is termed the "anode" current of the valve, and will flow through any apparatus connected in the external circuit.

Varying the Current

Now the strength of the anode current, like that of the microphone current, depends on several factors, one of which is the value of the positive charge applied to the anode, which is measured by the electro-motive force of the battery which supplies the charge. For a given set of conditions, the value of the anode current will be a certain amount, which will be constant unless the conditions are altered. One way in which we can alter conditions, and hence the value of the anode current, is by applying a negative charge to the grid of the valve, for such a negative charge would tend to neutralise the positive charge applied to the anode, and will reduce the value of the anode current.

When it is desired to use a valve to amplify a signal, the signal to be amplified—in this case the microphone current—is made to supply a varying negative charge to the grid of the amplifying valve, the variations of this charge being, of course, at audio frequency. The consequent variations in anode current will also be at audio frequency and in sympathy with the variations of the microphone current, but by suitably arranging circuit conditions the anode current variations can be made much greater than the changes in microphone current, or, in other words, the valve has amplified the signal.

In the next stage, it will be remembered, the programme, which now takes the form of an audio-frequency current of considerable power, is combined with another current which vibrates at a constant radio frequency—a frequency which is selected as the standard frequency of the particular broadcasting station.

Producing the High-frequency Oscillations

In the production of the radio-frequency current valves also play an important part. The action of a valve as a generator of radio-frequency oscillations depends upon the fact that if a radio-frequency current of quite small strength is applied to the grid of a valve it will be amplified and will appear as a stronger radio-frequency variation in the anode current. If, now, a part of the radio-frequency energy in the anode current is returned to the grid it will be re-amplified by the valve. This effect will be cumulative, and eventually quite powerful oscillations will be generated. Various means are provided for keeping the frequency at the correct value. These cannot be described here, but will be explained more fully under the heading of "tuning."

The generation of free oscillations in a valve can be compared with the production of strong vibrations by applying gentle taps, carefully timed to a pendulum. If each tap is given just as the pendulum has reached the end of its swing and is about to return, the energy of each tap is added to the energy already stored in the pendulum, and gradually a violent swing is built up.

The oscillations produced in the transmitting oscillator valve are of the correct constant frequency, and are also constant in strength or "amplitude." In the next stage the circuit in which the amplified microphone current is flowing is coupled to the circuit carrying the radio-frequency

current in such a way that the audio-frequency energy is combined with the radio-frequency energy. As a result, the radio-frequency current, while maintaining its constant high frequency, changes in strength or "amplitude" in sympathy



Fig. 3.—Regulating the filament current of two large valves used in an amateur short-wave transmitting equipment

with the audio-frequency current. A rough idea of audio-frequency, radio-frequency, and modulated currents can be gained from the accompanying diagram, Fig. 2, where the upper portion represents the comparatively low-frequency audio current, which changes in strength in sympathy with the music; the middle section represents the rapidly-vibrating radio-frequency current of constant amplitude, and the lower portion shows the effect of combining the two.

From the transmitting aerial the wireless wave radiates in every direction, travelling with the speed of light—186,000 miles a second. At the risk of the accusation of undue reiteration, we will repeat that this wave has a constant frequency—chosen separately and maintained accurately for

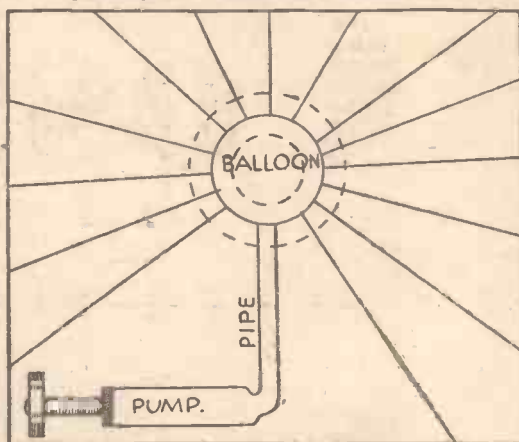


Fig. 4.—The water analogy illustrating the principle of transmission.

each individual station—but the strength or amplitude of the wave varies from instant to instant in accordance with the audio-frequency signals which make up the original programme. Thus, every wave has two distinct properties—the carrier frequency, which identifies it with a particular station, and the modulation, which is, in fact, the programme.

When a wave impinges upon a receiving

aerial, certain phenomena takes place, which are the converse of those taking place in a transmitting aerial. Instead of a radio-frequency current giving rise to a wave, in this case the wave produces a radio-frequency current, so that in the aerial-earth circuit of your receiver flows a current oscillating at radio-frequency and still bearing the programme modulation.

Selecting the Station

Now, as there are several hundred broadcasting stations, each of which sends out its own wave and each producing currents of its own standard frequency in your aerial, the first essential in a receiver is some device whereby it is possible to select the current corresponding to the station to which, for the moment, you are desirous of listening.

This operation is known as "tuning," and it is upon the fact that it is possible to tune electric circuits, and to tune them very accurately indeed, that the success of both radio transmissions and reception depends. To illustrate the effect of tuning, let us consider an example in simple acoustics. If we take an ordinary tuning fork and strike or bow it, it will give out a note—the sound being due to the vibration of the fork—and a given fork always gives out the same note and no other. This is because the fork can only vibrate at one set frequency—a frequency known as its natural frequency.

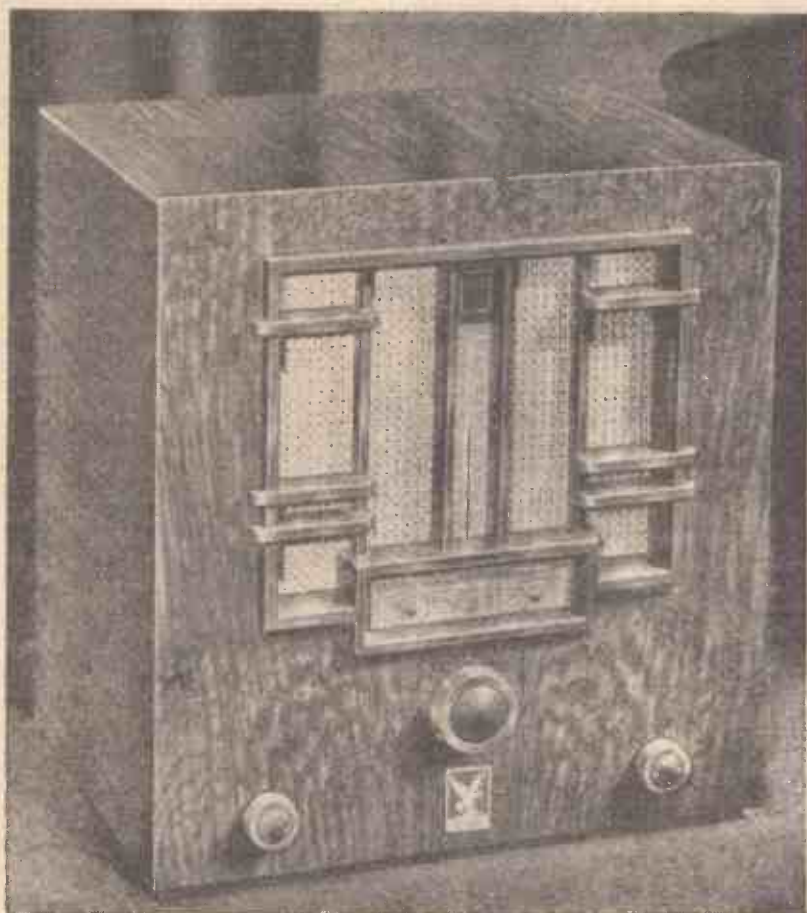
Now, if a second tuning fork, having the same natural frequency as the first, is placed near it, when the first is struck the second will commence to vibrate and to sound. The reason is that the air waves emitted by the first fork, when they reach the second, give it a little jerk and tend to make it vibrate. The amount of energy transmitted by a single wave is very small, but as the incoming waves are of the same frequency as the natural frequency of the tuning fork, each arrives at the correct interval behind the previous one, so that the effects of all the waves are added to each other. As a result, quite a big amplitude of vibration is built up in the second fork. If the second fork had a different natural frequency to that of the first, it would not resonate when the first was sounded, because the successive impulses applied by the first would not be correctly timed to the natural frequency of the second.

Natural Frequency

These properties of natural frequency and resonance can also be possessed by electrical circuits; that is to say, electrical circuits can be so adjusted that they will accept and build up oscillations of one particular frequency, but will not so respond to other frequencies. To understand this it is necessary to know why such systems as pendulums and tuning forks possess a natural frequency.

If you consider for a moment, you will see that when an impulse, such as an air wave, acts on a tuning fork, it will move the prong slightly. But because the fork is springy, or "elastic," as engineers will call it, the prongs will ultimately spring back to their normal position. In so doing, however, the comparatively heavy metal achieves a certain momentum, and, due to its inertia it overshoots the mark and deflects in the opposite direction. Again the elasticity of the fork tries to bring it back to its normal position and, again, inertia forces it past the mark, and for a certain degree of elasticity and inertia a body will have a fixed period of oscillation.

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On Your Wavelength

Max Beerbohm on Speed

IT is not often that I feel incensed at a B.B.C. talk, but the other evening I happened to be listening in to a talk by one Max Beerbohm, and in a preliminary notice in a B.B.C. publication he was referred to as a wit and caricaturist. That being so, I expected a humorous skit on things in general, instead of the serious talk elaborating the views of one who, because he has been out of the country so long, could not be qualified to speak upon it. Max Beerbohm may be an excellent wit and caricaturist—never having inspected any of his work I am unable to say—but I cannot too strongly deprecate the policy of the B.B.C. in allowing anyone but an expert to talk on subjects of which they can only have personal, rather than national, views. Few motorists are interested in what Max Beerbohm thinks about speed and modern traffic, and his views are of no more importance than those of any other citizen. As it is, his views have been elevated to the importance of a national talk and contradict the views of experienced motoring organisations and experts who have been wrestling with these problems all their lives. I was a motorist long before I became interested in wireless and held my first motoring licence in 1903, long before there was any age limit.

Mr. Beerbohm may represent the views of a very few, but he should remember that each succeeding method of road travel has met with the same opposition. As he sets himself up as a critic, he will doubtless remember the famous case of a magis-



The Watchman's S.W. Set.

trate of the martinet type who advised a plaintiff to throw his whip into the wheel of any bicycle which passed him when he was driving a horse-drawn carriage. Bicycles were then the fastest vehicles on the road, and when motor-cycles came along they met with opposition from the cycling interests. Had it not been for the motor-car it is conceivable that Mr. Max Beerbohm would not have been afforded the opportunity of airing his views over the radio. The whole tendency of the world to-day is towards speed, and you cannot speed up our commercial and industrial life by slowing down its means of distribution. Let Mr. Max Beerbohm stick to wit and not endeavour to foist obsolete views upon a public already overburdened with restrictive regulations, harshly treated in the police courts, and subject to a system of justice which would disgrace even the days of the Feudal system. I have never in this

By Jhermion

feature criticised the B.B.C. before, but I feel that it will be well advised not to allow humorists to talk on serious subjects, otherwise we shall have that famous comedian George Robey telling us how to conduct an aerial war. Eddie Cantor, the well-known film star, you will remember, after his interview with Mr. Hore-Belisha, gave somewhat similar views in his broadcast talk. I am sure the Minister of Transport must be highly delighted with this assistance.

That Announcers' Union

MR. G. GREIG, of Kentish Town, after paying me a compliment, disagrees with my remarks under the above title in our issue dated April 18th. He says: "In spite of what you read, I can assure you that no union member would strike for the reason you give. Incidentally, an active union member stands a good chance of being sacked without breaking any law. The millions who are trade unionists are not extremists, but are compelled sometimes to have resort to the obnoxious method of downing tools to obtain the barest minimum of justice. I feel you are not the sort of person who would hit below the belt and your article is unworthy of you." I can assure this reader that I have more than a nodding acquaintance with trade unions, and am by no means so opposed to them as he seems to think; but his reference to justice reminds me that this is a somewhat transitory thing, the standard of which changes with the times. A few years ago it was an offence punishable by hanging to steal a sheep; in Biblical days it was permissible for a man to have a thousand wives; not so many years ago it was an offence to exceed twenty miles an hour, whilst now you may legally do so. Justice is not a question of degree; you cannot have a "barest" minimum; justice is justice: you either have it or you don't.

How Long Ago?

CAN you answer without reference to books the question: When did the B.B.C. make its first broadcast from Savoy Hill? Try this question on your friends and you will receive some astonishing answers. The correct answer, of course, is on May 1st, 1923. This date, thirteen years ago, makes me feel quite old. One or two other anniversaries have just fallen due—Marconi's birthday, for example, was on April 25th, for he was born in 1874. Samuel Morse was born on April 27th, 1791. Marconi was only twenty-two when he first demonstrated wireless to the G.P.O.; this was on May 2nd, 1896,

Hole in the Road

WHO says that the average night watchman is comatose and torpid? I came across one the other night who was minding a hole in the road and who

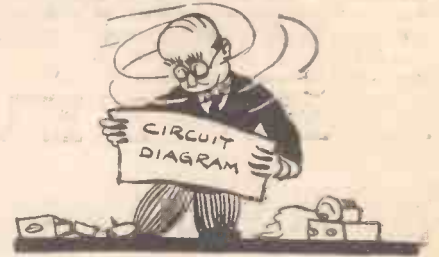
was passing the time listening on a two-valve short-wave set which had accompanied him over nearly the entire south-west district of London. He gave me some interesting details of the variations of reception in certain districts. Whilst he drew a blank from some roads, round the corner station after station would roll in at 'phones-on-the-table strength. He finds W2XAF the most consistent.

Symbols and Strange Devices

THE theorist loves a symbol in the same way as a mathematician likes to complicate the simplest bit of arithmetic. All mathematicians are fools, and what one fool can do another can. Designers of wireless circuits love to make a simple diagram look difficult, and almost daily our list of theoretical symbols has a new one added to it. No one decides what that symbol shall be, and each firm and each designer can invent his own. Someone ought to standardise wireless symbols and ruthlessly scrap half of them. In the early days it was easy to follow the symbols, and now it is almost necessary to consult a book. I saw a diagram the other day of an indirectly-heated double-diode-pentode-variable-mu, and there are very few readers who could put down a symbol for this valve without reference.

An Ingrate

I WAS called into a neighbour's house the other day to vet. a set. Nothing seriously wrong with it, merely that one of



Are we to have any more symbols?

the valves had blown. Showed him how to test the receiver and the valves therefor. Recommended him to buy a good meter such as the Avominor or the Pifco. Located the broken valve and told him what sort to buy. In spite of this valuable professional advice, I have gone down in his estimation because I was not able to waggle the magic wand and put things right. Yes, blow thou winter wind, thou art not so unkind as man's ingratitude.

A Peculiar Fault

READERS who pride themselves on their ability to trace faults might be interested in the following peculiarity which occurred recently in a set to which I was listening. This was a powerful all-mains "quality" set which had been built up to give a high standard of reproduction, but

(Continued on opposite page)

THE NEW H.M.V. RECEIVERS

Some Details of the Modern Refinements which are Incorporated in the Latest H.M.V. Receivers



One of the new Selector Ray receivers. This is Model 445 and shows the new speaker fret as well as the novel tuning dial.

ALTHOUGH the home-constructor is not primarily interested in the commercial receiver, he should familiarise himself with the features which are embodied in the modern commercial set, as he will wish to emulate the principles involved in such features as the tuning indicator, or will desire to keep himself up to date in the knowledge of receiver design. The latest H.M.V. receivers embody a number of features which are completely original and which have not been seen before and therefore we feel justified in devoting some space to a discussion of these features.

The first important feature in these receivers is the tuning indicator, and the principles involved in this have given rise to the name by which the sets are known. The makers have called it the "Station Selector Ray" and this device will go a long way to popularising the receivers amongst non-technical listeners. There have been many ingenious tuning devices seen from time to time, but generally they are of single application. That is to say, they will appeal either to the non-technical user, or to the more keen listener who is concerned with station searching under all conditions. In this new selector ray indicator both categories are adequately catered for, and the illustration of the dial which is shown on this page will show how the location of a station is carried out. First, the names

of the more important stations are spread out more or less at random over the large rectangular panel, which is black and opaque, and the customary scale is given in the centre of the panel in unusual form. Two parallel lines are marked with dots corresponding to the various wavelengths in metres and beneath there is a double-headed arrow which serves as a visual tuning indicator. When the receiver is switched on a thin ray or strip of light is projected from behind the scale on to the marked scale and it extends from one line to the other; this gives an exact indication of the exact wavelength to which the receiver is tuned, but for the listener who is not concerned with wavelengths or frequencies, an additional spot of light is also projected at the same time, and this illuminates a mark at the side of the station name to which the set is tuned. As the tuning control is turned this light spot is extinguished and when the next station is arrived at the appropriate name is illuminated and so on, whilst the ray of light travels slowly across the tuning scale. The accuracy of tuning is controlled by watching the light on the double-headed arrow, and as may be seen by the lettering under this

panel, the set is adjusted for maximum light.

The Loudspeaker

A new feature is also incorporated in the loudspeaker, which has been designed to provide more even amplification and diffusion, and instead of using the customary circular cone the diaphragm in these models is elliptical in shape and has a very wide angle. This results not only in better diffusion but gives improved response due to the fact that the cone is in effect more rigid, and it acts in a totally different manner from the familiar cone having a



This illustration shows the method of tuning indication which is called by the manufacturers "Station Selector Ray."

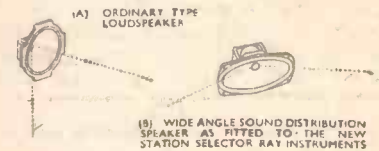


Diagram showing the angles covered by the old and the new speakers.

circular edge. To take full advantage of this new reproducer the speaker fret or opening has also been modified, and in the model shown on this page it is carried round the sides of the cabinet and the appearance as well as the tonal response is enhanced, by using a special metallic gauze in place of the now familiar silk.

A Play by R. C. Sherriff

PURSUING his policy of instituting a personal campaign among famous dramatists for original microphone plays, Val Gielgud has invited R. C. Sherriff, whose "Journey's End" was one of the most sensational theatrical successes of recent years, to write a play specially for broadcasting. Mr. Sherriff has accepted, but will not divulge the plot of his latest venture; it is understood, however, that the play will not deal with the Great War.

"Between Ourselves"

VINCENT LADBROOKE and his music, with Dick Barker, vocalist, will give a programme of sweet harmony under the title "Between Ourselves,"

PROGRAMME NOTES

from the Midland Regional on May 7th. This band had its first studio broadcast about six weeks ago. Mr. Ladbrooke, who was born in Birmingham, is running five bands in the Midlands.

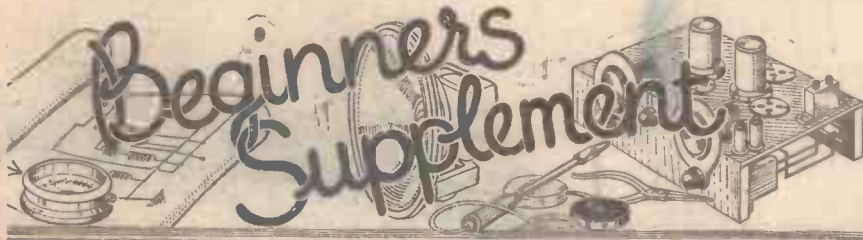
Memories of the Klondike Gold Rush

THE series of talks entitled "I Remember" is being continued in the West of England programmes under the title "Personally Speaking," and on May 5th G. A. Street will give his reminiscences. He has been actor, author, cowboy, and intelligence officer, and his wanderings

have enabled him to speak six languages fluently. He went to Klondike during the gold rush of 1897, and he will tell listeners about the thrilling experiences he had at that time.

B.B.C. Midland Orchestra

REGINALD BURSTON will conduct the B.B.C. Midland Orchestra on May 7th in a programme which is to include the Montague Phillips suite, "In Maytime," and a number of songs. The vocalist, Cuthbert Reveley, is Lord of the Manor of Kinnerley in Herefordshire, and has the record of being the only regular officer to sing in Covent Garden opera. He made his reputation as an operatic singer on the Continent under the name of Carlo Rivoli.



IMPROVING SUMMER-TIME RECEPTION

Although Reception Conditions are Not So Good in Summer As in Winter a Good Deal can be Done to Compensate for Losses in the Transmission as Explained Here.

EACH year at about this time the PRACTICAL AND AMATEUR WIRELESS Technical Staff is besieged with letters from comparatively new listeners who think that their receivers have suddenly become inefficient. The point is that conditions, as far as long-distance reception is concerned, become rapidly worse with the approach of lighter days. It is not necessary fully to explain the reason for the impaired conditions, but it should be made quite clear that signals do not travel anything like as well over any other than short or "local" distances during hours of daylight as they

most of those signals which provided pleasurable reception during winter can still be heard, although perhaps at slightly reduced strength.

Aerial-Earth System

The very best and most fundamental method of improving reception during the lighter months is by increasing the length of the aerial, particularly when this has been cut down to 40ft. or 50ft. in order to obtain the necessary degree of selectivity. This applies to both outdoor and indoor aerials and, where possible, aerials of the latter type should be

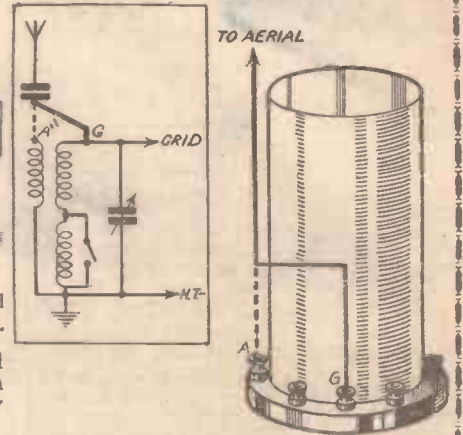


Fig. 1.—Sensitivity can sometimes be improved by modifying the aerial connection as shown above by the heavy lines.

tin box is employed this might be dug up, the wire re-soldered and the plate replaced as low as possible with a mixture of common salt and finely-crushed ashes packed round it; the latter mixture helps to retain moisture and to absorb further moisture, which, during dry spells, should be provided by pouring a bucket of water over the earth connection. The special chemical earthing devices which are obtainable cheaply are particularly good during the summer months, because the chemicals used have the property of attracting moisture and ensuring good connection between the earth plate and the surrounding soil. Even when a chemical earth has been in use before, it is a good plan to replace it, since the chemicals do become exhausted after a time.

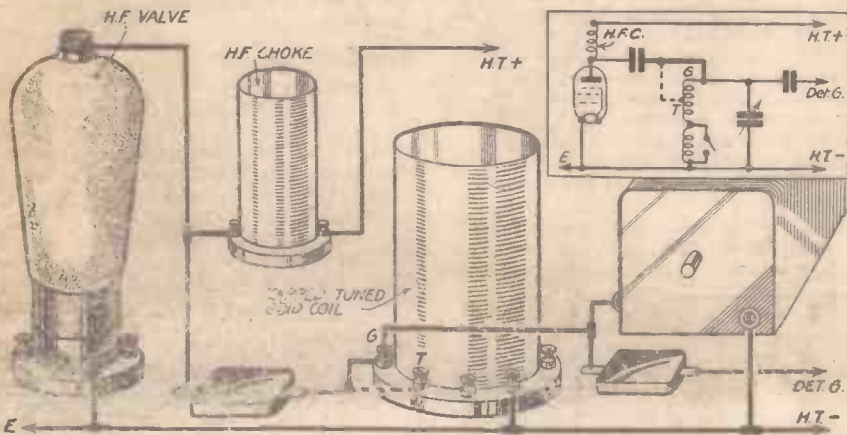


Fig. 2.—Another method of improving sensitivity by altering the connection to the tuned-grid coil.

do after dark. The chief reason is that that portion of the transmitted signal which is radiated in an upward direction is not reflected back in the same manner as it is when the ionised upper atmosphere known as the Heaviside Layer is in darkness and acts as a satisfactory "mirror."

Selectivity Less Important

But it is not the reasons for the impaired reception which interest the average reader, but the methods of compensating in whatever measure is possible for the conditions, by modifying the receiver or aerial system. It is generally realised that the various methods which are employed for increasing the selectivity of a receiver necessarily have a certain adverse effect on the sensitivity of the set; thus, it is feasible to consider the possibility of dispensing with some of the aids to selectivity, at least, until next winter. In many instances the apparent selectivity will not be reduced when the various sharp-tuning devices are eliminated. This is because the number of transmissions which can be received at comfortable strength is limited, particularly when a receiver of the simpler type is employed. At the same time, it will very often be found that by making slight alterations

replaced by others erected outside the house. Particular attention should also be paid to the earth lead, and if the previous one has been in use for a year or so it will nearly always prove well worth while to replace it. If a buried plate or

Eliminating Selectivity Devices

Where a fixed or variable condenser is used in series with the aerial lead it might satisfactorily be disconnected or increased in capacity for the summer months. If the condenser is variable, the method of increasing the capacity is obvious, but the maximum capacity of the component might not be quite enough. Thus, if the condenser used is rated at less than, say, .0005 mfd. try the effect of putting a .0003-mfd. fixed condenser in parallel with it. Another arrangement which may be tried is to disconnect the aerial lead, or the series condenser, from its usual terminal and to join it instead

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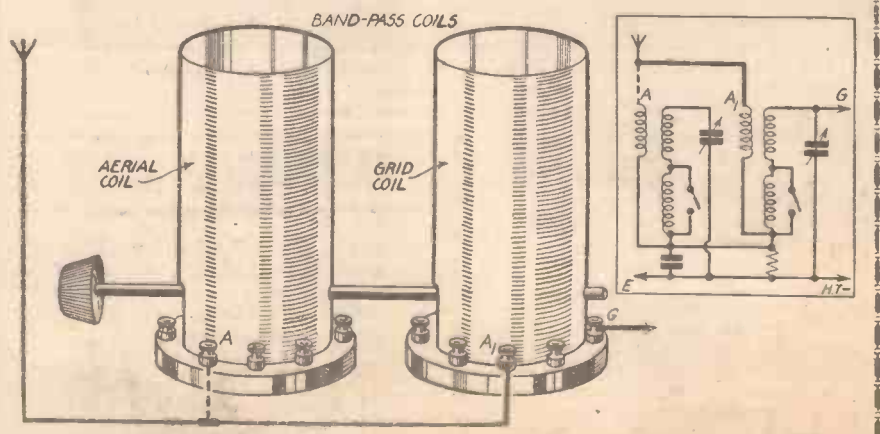


Fig. 3.—When a band-pass filter is used an improvement may often be effected by transferring the aerial connection to the second coil. The connections shown above may have to be modified according to the exact coils used.

BEGINNER'S SUPPLEMENT

(Continued from facing page)

to the fixed vanes of the tuning condenser which operates on the aerial coil, as shown in Fig. 1. It should be remembered that this is not always a satisfactory solution, since in some cases the alteration might affect the ganging when a two- or three-gang condenser is used.

A similar change can be made when the anode of a screen-grid valve is connected to a tapping on the following grid coil; the connection should be changed so that the coupling condenser is joined directly to the grid end of the coil, as shown in Fig. 2. After this has been done it will probably be necessary slightly to modify the settings of the trimmers on the gang condenser. As an alternative or additional modification, the condenser used to couple the anode of the screen-grid valve to the tuning coil might be increased in capacity.

Should a band-pass filter circuit be used it will often be found worth while to eliminate the first tuned circuit by transferring the aerial lead to the second coil

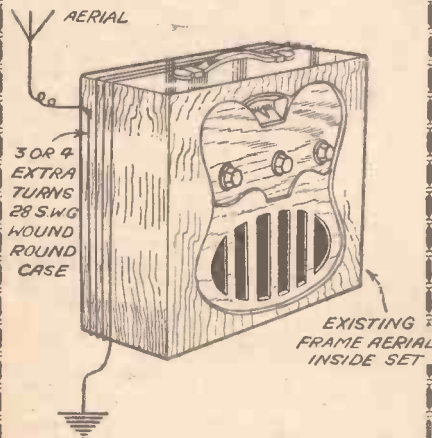


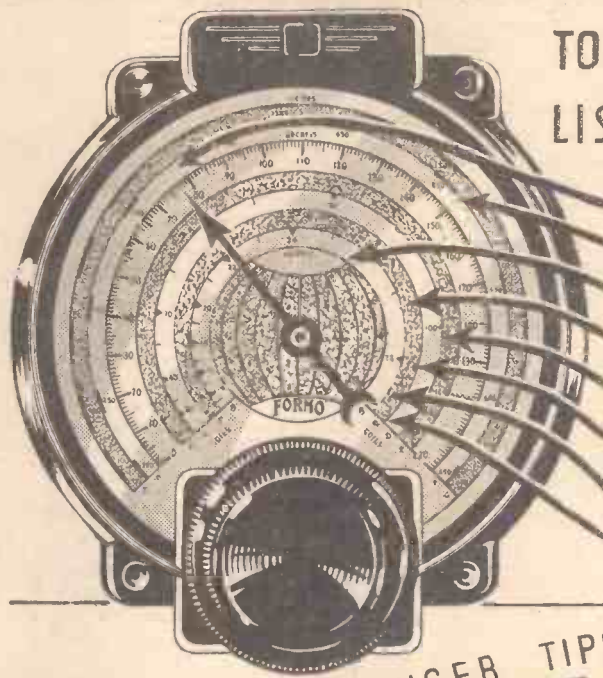
Fig. 4.—A simple and effective method of connecting aerial and earth leads to a portable.

as suggested in Fig. 3. Here again it might be found necessary to modify the trimmer settings, and this can be tried.

With a Portable

In those few cases in which a frame aerial is used—mainly in conjunction with a portable receiver—it will generally be found that by making a very slight alteration summer-time reception can be as good as that obtained in winter. The alteration consists of using an external aerial in conjunction with the frame, the latter serving merely as a tuning coil. One method is to connect the external aerial to the grid terminal of the first valve through a .0002-mfd. fixed or pre-set condenser, and the other is to wind a few turns of wire round the frame, or even round the outside of the containing case, joining the aerial to one end and the earth to the other, as shown in Fig. 4. An additional improvement might be obtained by connecting the earth end of the new winding to the negative terminal of the accumulator, or to H.T. negative in the case of an A.C. mains set; if the receiver is operated from D.C. mains this connection should not be used. The number of turns used for the improvised aerial-coupling winding is not critical and depends largely upon the distance of the turns from the frame aerial winding itself.

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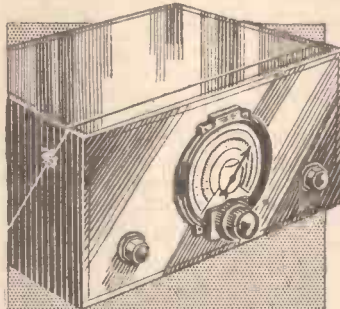


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- COMPLETE RADIO
- RADIO SERVICING
- RADIO EQUIPMENT
- RADIO SERVICING AND SALESMANSHIP
- WIRELESS ENGINEERING
- EXAMINATION (state which)

Name Age

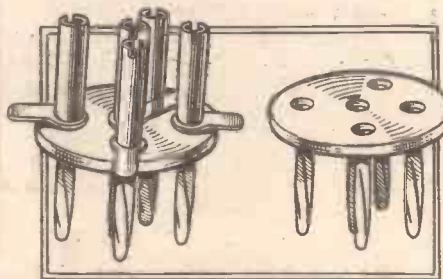
Address



COMPONENTS TESTED IN OUR NEW LABORATORY

New Clix Accessories

TWO new Clix sockets have just been received for review and they are shown below. On the left is the Tapping Adapter, skeleton type, which is designed for any apparatus where it is desirable to include external wiring with a valve and its associated holder. Such examples are to be found in the Short-wave Converter; anode, screen grid, or grid current and voltage readings, etc. As may be seen, the device consists of a disc of paxolin upon which is mounted a combined plug and socket. These are screwed together and a soldering lug is clamped between them. Consequently, the adapter may be inserted into a valveholder and the valve then inserted into the adapter, when any desired lead may be joined to the projecting lugs. In the model submitted to us the lug for the centre connection was brought out between the grid and filament sockets and it needed only a slight twist to loosen it, when it was free to rotate and come into contact with either the grid or filament socket. As there is a risk of this



Two new Clix lines, an adapter and a useful multi-purpose socket.

burning out a valve or causing other damage the constructor should take the precaution of slipping a length of systoflex or similar insulating material over the lead and lug after the lead has been soldered into position.

The remaining component is a miniature Multiplug, skeleton type, and is intended for loud-speaker connections or other multiple connecting or junction point, and the sockets are smaller than standard valve legs to avoid any risk of wrong use. The price of this component is 4d. for the 4-pin, 5d. for the 5-pin, and 6d. for the 7-pin type, whilst the Tapping Adapter costs 9d., 10d., or 1s. for the 4-, 5- or 7-pin model.

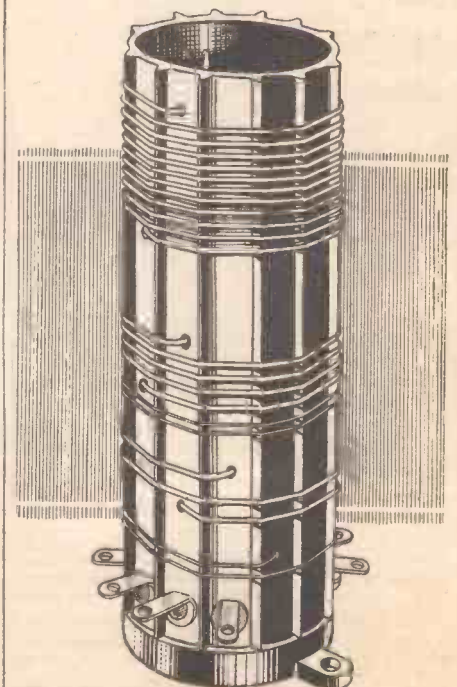
Wearite Price Reduction

THE importance of the design of the H.F. choke is well known, and the use of an iron core to such a component is rather unusual. When properly designed, however, the core enables a higher inductance to be obtained with lower self-capacity and less stray field than a similar type of choke without the core, and in many circuits it will be found that such a component gives a decided improvement. It may be used in all-wave circuits of either the straight or the superhet type, and the Wearite component, type H.F.O.,

has an inductance of 250,000 mH, with a self-capacity of only 3.5 mmfd. The effective range of this choke is from 10 to 2,000 metres, and the D.C. resistance is 190 ohms. The price has now been reduced to 4s. 6d.

Bulgin Triple-range Short-wave Coils

GREATER entertainment is obtained from a short-wave receiver when a large wave-range is covered without the necessity for coil changing, and this applies particularly when more than one coil is employed. The coil illustrated below is designed and manufactured by Messrs. Bulgin and covers three separate short-wave ranges, covering the entire band from 12 to 95 metres in three steps which overlap slightly to avoid blank places in the short-wave range. Each section is complete with grid and reaction winding, and two separate models are made, one designed for the aerial circuit and the other for use as an oscillator coil in a superhet. The grid winding is wound with tinned-copper wire and the remaining winding is of silk-covered wire, and the turns are accurately placed and afterwards cemented to prevent alteration of inductance and consequent modification of tuning points. For wave-changing the Bulgin type S.122 switch will be found admirable. The three wavebands covered are approximately from 12 to 25 metres, from 24 to 49 metres, and from 48 to 95 metres, with a .00015 mfd. tuning condenser. The coils are 1½ in. in diameter and 4½ in. in height, with holding-down lugs moulded into the base. The price is 3s. 6d. each.



The Bulgin 3-range short-wave coil which is reviewed above.

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 GOLDERS GREEN AND HENDON RADIO SCIENTIFIC SOCIETY

MEMBERS of this society paid a visit recently to the laboratories of Mr. J. H. Reyner, B.Sc., A.C.G.I., D.I.C. The tele-cine transmitter was first inspected and explained, and afterwards demonstrated. A cathode-ray scanner using 6,000 volts H.T. is used, the film being analysed by photo cells which are amplified by a seven-stage amplifier containing correcting circuits to compensate for capacity loss and aperture distortion. The receiver used was of great interest in that it could be used to demonstrate a varying number of lines, different picture speeds, and the effect of top and bass loss. A 90-line direct vision transmitter afterwards was demonstrated. A three-foot scanning disc was employed, on to which was focused the image of various members present, and followed by a nine-stage photocell amplifier. A synchronising signal is generated by a separate photocell and amplifier. Battery valves were used throughout. The picture shown on the cathode-ray tube was most pleasant, and although it was placed within a few feet of two 3 kW spot lights, its brilliance was fully adequate.—H. Ashley Scarlett, 90, Pattison Road, Hampstead, N.W.2.

THE CROYDON RADIO SOCIETY

THIS society concluded its reunion on April 7th in St. Peter's Hall, Ledbury Road, S. Croydon, with the annual general meeting, presided over by Mr. G. S. Vellacott, vice-president. Officers elected for next season were: Chairman, Mr. W. J. Bird; vice-chairman, Mr. W. S. Y. Hancock; hon. treasurer, Mr. C. R. Amos; hon. secretary, Mr. H. G. Salter, and hon. publicity secretary, Mr. E. L. Cumbers. The programme committee was re-elected with an additional member in Mr. R. P. Jones, hon. librarian.

After a vigorous discussion on the society's future policy which threatened to become lengthy, Mr. Salter concluded the evening with one of his programmes on records. He said that since his last concert the nation had suffered an irreparable loss, and so the records of speeches of King George V were very fitting. Included were those given on Jubilee Day and Christmas Day, 1935, and it was realised that here was a use of the gramophone for the future when similar historic events could be kept for succeeding generations.

The publicity secretary will be pleased to give PRACTICAL AND AMATEUR WIRELESS readers any information and a welcome to the opening meeting of the next season in October.—Hon. Publicity Secretary, Mr. E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

BRADFORD SHORT-WAVE CLUB

THIS club had a very interesting evening on Friday, April 17th, when Mr. L. A. Warbrick, of Messrs. Lissen, Ltd., gave a lecture and demonstrations of the Lissen Allwave Superhet (A.C. model), and also of their Kit receiver "The Bandsread Three." Mr. Warbrick explained the circuit of the Allwave "Super," how A.V.C. comes into operation, and the use of the variable selectivity control which is incorporated in the receiver, illustrating this with fidelity curves.

The club is now affiliated to the British Short-Wave League, for which the club's secretary is the Yorkshire



Pat. App. No. 19598/35

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MULTI-POLE CONTACT SWITCHES (ALL-WAVE)



THE ACME of Simplicity—Nothing to go wrong, nothing to foul or jam. These switches employ the simplest possible moving parts in an ingenious and effective manner. ★ The Locator section has positive positions—it rotates in either direction.

★ Four types of double-pole contact unit are available—all requirements are covered. ★ Any number of any kind of contact unit can be ganged. Assemblies can be spaced or adjacent. ★ Five circuiting positions are obtained.

★ Switching can be from

2-POLE to 30-POLE (Five Positions)

Contact Units from 216 each.

Drive Units from 2/9 each.

The Complete Bulgin 100-page Catalogue and Manual gives full details of all these switches, and their combinations, on page 8. If you have not got a copy of the THIRD (REVISED) EDITION, don't delay...

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on The British Com...

A series of late evening talks will be "Down to the Sea in Ships: 1. Sea Communications," and at 10.0 p.m. on Tuesdays until June 16th the world of shipping will be reviewed from a wide variety of angles by such speakers as Mr. Leslie Runciman, Sir Richard Holt, "A Seaman," Lord Essendon, and Sir Alan Anderson.

Other evening talks will include the popular "Topics in the Air" (Saturdays: half an hour between 8.0 and 9.30 p.m.) and occasional examples of the series "Is that the Law?"

The new series of weekly talks with the title "World Affairs," which began recently, will continue every Monday at 10.0 p.m. The speakers will include Sir Frederick Whyte, Raymond Swing, and F. A. Voigt.

LETTERS FROM READERS

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



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

Times for Best S.W. Reception

SIR,—Reading the various reports sent in by short-wave amateurs, I noticed the lack of reports of European and DX stations received during daylight hours. I find the hours given below best for receiving the various countries.

7 Mc. (42 metres),

07.00 hours to 12.00 hours—VK, ZL, PA, 12.00 hours to 17.00 hours—F, SM, OZ, YL, W4, PA, OK.

17.00 hours to 19.00 hours—F, HB, ON, W, I, CN, FA, FT, OE, VP3, EA, CT3.

14 Mc. (20 metres),

07.00 hours to 12.00 hours—W, VK, ZL, D, SM, U, LA.

12.00 hours to 17.00 hours—J, ES, LA, VO, W, ZBi (Malta), OK, ZC6, OH.

17.00 hours to 19.00 hours—W, VE, VO, VP6, J, Kai, CM (O), OE.

These stations are received, of course, mostly on C.W. (Morse), but a great number can be received on 'phones if a good receiver is employed.

During the past month I have received the following at good signal strength on the 7 and 14 Mc. bands:—

CM8MN, FA8CC, FT4AG, VO1I, HB9T, HB9P, LA1G, LA4A, ZL4FW, VK2QH, YL3TH, D4DIC, D4SNP, ZB1H, OH3OI, PA0DK, U9QM, U9MJ, OK2PN, ZC6CN, OK2SR, SM6UQ, OZ4J, TS3MA, ES5C, OE3AH. All these stations were received on an 0-V-2 set, with 'phones, and Hertz type aerial.

May I congratulate your paper on being by far the most interesting weekly wireless journal, and for containing such interesting news for the short-wave enthusiast!—**DESMOND M. WHITEHOUSE** (Cannock, Staffs).

A S.W. Log from Buntingford

SIR,—I have been a reader of your excellent paper for two years, and I think it is one of the best wireless papers published. I have not seen a short-wave log from this district, so I forward mine, as follows:—

W2XAD, W2XAF, W8XK, W2XE, W1XAL, W3XAU, W1XK, W3XL, W3XAL, W4XF, W8XAL, WQP, VK3LR, VK2ME, VP3MR, COCD, CJRX, HAS3, VUB, JVM, VQYLO.

All these stations were received during March. I have just received a QSL from VK2ME. I would like to get in touch with another S.W. listener in this district.—**F. C. SMITH** (Church Gate Cottages, Buntingford, Herts.)

Back Numbers Available

SIR,—I have several back numbers of PRACTICAL WIRELESS from No. 1 up to about June, 1935, and also issues from 1931 to 1934 of AMATEUR WIRELESS.

If any of your readers would care to communicate with me I should be happy to forward the issues they may require, if they would enclose postage.—**M. EAST** (23, Seymour Street, Euston, N.W.1.)

"P. and A.W." Volumes for Sale

SIR,—As I shall be shortly leaving this district, I am desirous of selling my seven unbound volumes of PRACTICAL AND

AMATEUR WIRELESS. I may add that this includes all free blue-prints that have been presented from time to time.

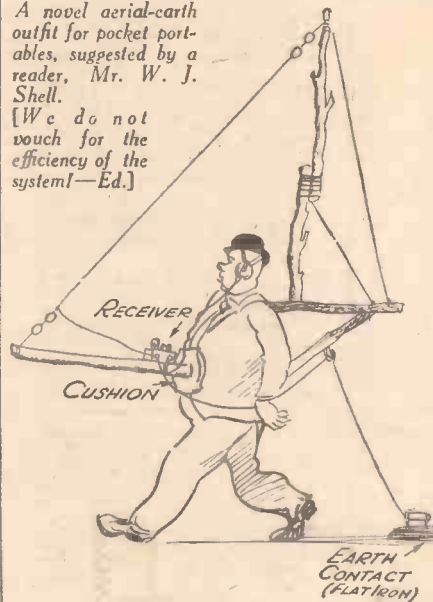
Should any reader like to purchase all or any volume, perhaps he would be kind enough to get in touch with me, through the Editor.—**L. G. SCULLARD** (Boscombe).

Outdoor Radio Up-to-date

SIR,—An efficient aerial-earth system for the "pocket receiver" can be arranged as shown in the accompanying

A novel aerial-earth outfit for pocket portables, suggested by a reader, Mr. W. J. Shell.

[We do not vouch for the efficiency of the system!—Ed.]



sketch. Best results are obtained if the listener walks in the road with the earth trailer on the tram lines.—**W. J. SHELL** (Bath).

"Practical and Amateur Wireless"

Dated 14-7-34

SIR,—I would be very much obliged if any reader could supply me with (or loan or sell) a copy of the above issue, containing details of a "Home-Made Coil Two." I shall be pleased to pay postage, etc.—**H. MOORE** (National Bank House, Donnybrook, Dublin.)

[Will our readers kindly note that several readers have complained of the non-return of loaned copies?—ED.]

Back Numbers of "A.W." Wanted

SIR,—I should be very much obliged if any reader could supply me with a copy of *Amateur Wireless* containing the wiring diagram or blueprint of the Britain's Superhet, October 31st, 1931. I shall be pleased to pay for the book and postage for the same.—**W. PRESCOTT** (5, Strand St. West, Preston, Lancs.)

SIR,—I should be very grateful if any reader will loan me a copy of *Amateur Wireless*, dated May 6th, 1933. I will return it within a week.—**J. FOIRET** (132, Cromwell Road, Kensington, S.W.7.)

JVP (Japan) Wants Reports

SIR,—I have just received a verification from Station JVP (Japan), and in the letter they request me to ask all listeners who have heard this station to report to them and they will receive a QSL card. The address of the station is Kokusai-Denwa Kaisha, Ltd., No. 31 -home, Uchisaiwaicho, Kojimachiku, Tokyo, Japan. At present they broadcast only on Tuesdays and Fridays.—**WILLIAM TENNANT** (Johnstone).

A Challenge!

SIR,—I have often heard that a simple detector-L.F. set on the short-waves is capable of receiving as many countries as a big superhet. So I decided to see how many countries I could get from 00.00 hours on April 1st to 00.00 hours on April 3rd. I succeeded in logging a total of 39 countries as follows: 00.00 hours, April 1st to 00.00 hours April 2nd: W6HEW R6 (Portable); NY2AE, R4; CT2AB, R8; TI2HU, R8; VK2IG, R5; OH3NP, R7; U2AZ, R6; LA4R, R6; OK2AQ, R6; VE1HG, R5; ON4REX, R8; YL2BB, R7; F3CP, R8; D4GND, R8; OZ2N, R5; SM7WS, R8; SP1EB, R7; OM2N, R5; VS8RA, R8; ES5C, R7; OEFH, R7; E18B, R7; VO4X, R6; VQ3FI, R5; HB9AY, R6; ZL4AO, R4; CO8RT, R8; ZB1H, R7; PA0BN, R5; LUIAH, R6.

00.00 hours, April 2nd to 00.00 hours, April 3: PX1A, R6; D3BEN, R6; VP5PZ, R5; EA8AV, R6; ON4EJ, R7; K3HJ, R5; YA1OD, R7; XE2AC, R3; G5NI, R5.

Wavebands used were 20 and 40 metres, and the stations are in chronological order. It will be seen that all continents have been heard as VK2IG represents Oceania, VS8RA represents Asia, VQ3FI represents Africa, D4GND represents Europe, W6HEW represents North America and LUIAH represents South America. Also many lesser-known countries.

Now, you owners of big sets, prove yourselves!—**J. S. TUKE** (Broadway, Worcestershire).

CUT THIS OUT EACH WEEK.

Do you know

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

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.

H. McC. (Glydebank). The figure for the secondary was a misprint, and your component is apparently in order. Your trouble may be due to overloading of the detector or to a too-efficient input circuit, and it may be desirable in your case to fit a further tuned circuit, thus converting the input to band-pass.

G. E. N. (Swinton). For the aerial circuit the aerial is joined to terminal No. 6 and terminals 3 and 5 are earthed. The grid is joined to terminal 1. For the detector stage the H.F. anode is joined to terminal 8 and terminal 5 is joined to H.T. Terminal 1 goes to the grid condenser, terminal 3 to earth, and terminal 4 to the detector anode or reaction condenser. Terminal No. 2 on each coil must be joined to a contact on a three-point switch for wave-change purposes. The coils were employed in the Pentaquester, blueprint AW431.

J. B. (Ringmer). As you already have AW449, we suggest you obtain PW31A, which is an all-wave two-valve, or one of the ordinary two-valve sets as shown in the list of blueprints published each week.

J. O. (Pandy). Two chokes will be required in the anode circuit in order to use the set as a converter. It could, however, be used in place of the detector stage in your four-valve set and would then act as an adaptor and enable you to hear the short-wave stations.

R. J. T. (Ealing). The only satisfactory solution is to fit an H.F. stage. The additional amplification has made the flatness of tuning of the detector stage more apparent and therefore you would no doubt find that an H.F. stage and the exclusion of your added L.F. stage would be well worth while.

S. H. B. (Purley). The trouble would appear to be due to H.F. instability and therefore the wiring on the H.F. side should be modified and the leads moved about to avoid interaction between them.

R. B. S. (Thorpe Bay). We regret that we have no blueprints or other details of a set on the lines mentioned by you.

R. O. (Islington). The H.F. unit described in our issue dated February 1st last would meet your requirements. The use of this unit on short waves is, however, not recommended, and you will probably find that the present arrangement is all that is needed for short-wave reception. A switch could be incorporated for cutting out the stage when changing wavelengths.

W. A. G. (Mile End, E.1). The connections shown are quite correct, and therefore it would appear either that the switch is faulty or you have not correctly identified the three connecting points. Examine the switch and test it with a battery and bulb in order to locate the two contacts and the change-over arm.

O. C. R. (Bedford). The records are no longer obtainable, and, of course, they have no application now in view of the fact that the 30-line transmissions have ceased and will not be re-introduced.

J. H. (Glasgow). The speaker field is too high for use in this particular arrangement. If you are on D.C. mains it could be joined direct across the mains leads, but you should enquire from the makers regarding the necessary field wattage and take care not to exceed this. The condensers are quite in order, but are not essential.

E. T. (Sheerness). There are several mistakes in your circuit. Firstly, the H.T. at the detector should be 80, not 180 volts, and to obtain reaction effects there should be an H.F. choke between the point P on the L.F. transformer and terminal 5 on the coil. Next, the terminal 4 on the coil should not be joined to No. 1, but should go only to the reaction condenser, the other side of which should be earthed. G.B. plus should be joined to L.T.—and not L.T. plus. We cannot understand the reference to terminal P on V1 being joined to F on V2 as this would burn out the valve.

W. H. A. (South Shields). We regret that we have no blueprint which meets your requirements. In any case you do not mention the type of the coil or the reference number.

W. P. (Preston). It is only necessary to adjust the pointer to "8" on the oscillator unit and then tune in. Failure to obtain any short-wave signals indicates some fault in the set, and if this is quite in order on medium and long waves it would appear that the oscillator coil or the switch therefore is faulty.

A. H. B. (North Harrow). If the two transformers are of different construction the connection of the two would result in interaction between the windings and a consequent balancing out of the hum. If, however, they are identical, it may indicate that one is faulty or that the connection at the terminal is not sound. We do not recommend the substitution of a ganged condenser unless you obtain a new set of coils to match a modern component.

A. G. P. (Epsom). Our £4 Superhet would be suitable, or if you wish to reduce the number of valves the £3 Superhet Three could be adopted. We cannot recommend any simpler type of receiver to give you guaranteed reception of the distant stations.

J. G. H. S. (Edgware). The type of whistle referred to may generally be overcome by reversing the connections to the secondary winding of the L.F. transformer. Sometimes a resistance in series with the output valve grid will cure it, but the change in phase

introduced by the reversed secondary is sufficient in most cases.

T. K. (Gliffden). It is impossible to obtain valves at the price mentioned by you, and you should obtain good standard valves in order to replace the existing ones. Of course, you should ascertain that it is the valves which are causing the trouble and not the receiver wiring. A modern moving-coil speaker is to be preferred to the model mentioned, but it would probably prove cheaper and more satisfactory in the long run to dispose of the set as it stands and get an up-to-date one, or the parts with which to build one of our modern designs.

F. S. L. (Wallington). We regret that the issues in question are now out of print.

A. W. (Oldham). We cannot give full replies to all your queries in this part of the book. No stamped addressed envelope was enclosed and we would remind you that queries should be limited to two per reader. Blueprints cannot be sent C.O.D.

M. R. T. (Edgbaston). A grid winding of eight turns of twenty-two tinned copper wire with spaced turns should be used, and for aerial coupling five turns of twenty-eight cotton-covered should be placed close to the "earthed" end of the grid winding. A reaction winding of six turns of similar wire could be interwound at the lower ends of the grid winding.

A. S. (Pershore). It would appear that either the long-wave windings are faulty or the padding condenser is of incorrect capacity. Try connecting a fixed condenser (say .002 mfd.) in parallel with the padding condenser.

W. A. (Welling). The stabiliser may be obtained from Messrs. Cossor, who will also supply details of connections.

H. W. (Battersea). You cannot expect to get the tone and volume of the original with a simple battery set, and a very powerful and well-designed mains receiver would be necessary with at least 12 watts output.

C. W. (Croydon). We recommend our Television and Short-Wave Handbook which covers all the points raised by you and deals with short-wave conditions and receivers.

J. W. (Sydenham). The largest output would be obtained with the 362 Company's BX2. If you require an ordinary triode the highest rated output is the 362 P.2 rated at 600 milliwatts.

G. B. (Broadstairs). You should follow the text in the article in question, and not the details on the drawing.

M. H. (Kirkdale). Almost any eliminator may be used, but in the event of difficulty it should only be necessary to introduce decoupling components in the H.T. feeds.

THE PREMIER SUPPLY STORES

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All goods guaranteed perfect. Set Manufacturers' Surpluses. Carriage paid over 5/-; under 5/- postage 6d. extra. I.F.S. and Abroad carriage extra. Orders under 5/- cannot be sent C.O.D. New 1936 List Ready Shortly.

VARIABLE CONDENSERS

Utility 0.0005 2-gang bakelite dielectric, semi-shielded condenser. Slow Motion and Uniknob Trimmer, 3/11. Utility 0.0005 3-gang fully screened with Trimmers and Illuminated Disc Drive, 7/6. Polar Star, 3-gang, 0.0005, fully screened with Trimmers, 5/6. Polar 0.0005 with slow motion, 3/11. Lissen 2-gang 0.0005 with Front Trimmer and Disc Drive, 5/11. Bakelite Reaction and Tuning Condensers. 0.0001, 0.00015, 0.0002, 0.0003, 0.0005, 0.00075, 9d. each. Presets, .002 max., 6d. each.

FIXED CONDENSERS

Electrolytics.	Paper Types.
T.C.C.:	Dubilier:
8mf. 650v. (surge) 4/-	4mf. 500v. working 4/-
4mf. 650v. (surge) 4/-	4mf. 800v. working 6/-
15mf. 50v. 1/-	2mf. 750v. working 3/-
15mf. 100v. 1/-	4mf. 1000v. working 10/6
50mf. 12v. 1/-	4mf. 2000v. working 13/-
Dubilier:	Western Electric:
4mf. 500v. 3/-	4mf. 250v. working 2/-
8mf. 500v. 3/-	2mf. 250v. working 1/-
8+4mf. 500v. 4/-	1mf. 250v. working 6d.
50mf. 50v. 1/9	4mf. 350v. 2/6
12mf. 20v. 6d.	2mf. 350v. working 1/6
25mf. 25v. 1/-	

U.S.A.:
4, 8, or 12mf. 530v. peak each 1/9
8+4mf. 500v. peak 2/3
4+4mf. 500v. peak 1/6
8+8mf. 500v. peak 2/6
12+8mf. 500v. peak 2/6
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Wego 1mf. 450v. working 1/-, 2mf. 1/9, 4mf. 3/-, 2mf. 700v. working 2/-, 4mf. 3/6. 1mf. 1650v. working 3/6, 2mf. 5/6.

METERS

British-made Moving Iron Meters. Flush mounting. 2 1/2" diameter. 0-10, 0-20, 0-30, 0-50, 0-100, 0-150, 0-250, 0-500 milliamms; 0-1, 0-3, 0-5 amps. All read A.C. and D.C. 5/9 each. Moving Coil Milliammeters. B.E.S.A., first grade. 0-1 M.A., 2 1/2" diameter, 18/6; 0-1 M.A., 3 1/2" diameter, 22/6. Multipliers for same, any range 1/- each. Westinghouse Rectifiers for same 17/6 each. All Meters flush mounting bakelite cases. Visual Tuning Meters 6 and 12 milliamp types, 5/-; Neon Tuners, 3/- each.

Ferguson All-Wave Sets, 6-valve Superhets 17-2000 metres, 100-250v. A.C./D.C. £7 15 0d. 8-valve Superhet 124-2000 metres, 100-250 A.C. or A.C./D.C. 16 tuned circuits, 7 watts output £12 10s. 0d.

These are full-sized receivers. Not Midgets 111 Send for Illustrated lists of these and other Receiver Bargains.

G.E.C. A.C./D.C. All mains Three, New, complete, sealed cartons. Fully guaranteed (List £7 15s. 0d.) 75/-

DIALS

Clarion Moving Light Slow Motion Dial, with 2" knob. Ideal for Short Waves, 2/-. Utility Disc Drive, complete with 2" knob. Ideal for Short Waves, 2/-. 4" Bakelite Knob-Dials, 6d. New Premier Dual-Ratio Full-Vision Drive, Ratio 10-1 and 150-1. Perfect for Short-Waves 6/6.

WIRE-WOUND RESISTANCES

4 watts, any value up to 50,000 ohms, 1/- each. 8 watts up to 50,000 ohms, 1/6 each. 15 watts up to 50,000 ohms, 2/- each. 25 watts up to 30,000 ohms, 2/6 each. 15- and 25-watt Resistors can be supplied semi-variable at 6d. extra. 1,000 ohms, 150 m.a. semi-variable Resistance, 2/-; 1,000 ohms, 250 m.a. Resistance tapped for any number of 0.18 amp. valves, 3/6. 800 ohms, 350 m.a. tapped resistance, 2/-.

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By best manufacturers. 200, 350, 500, 1,000, 2,500, 5,000, 8,000, 10,000, 15,000, 25,000, 50,000, 100,000, 250,000, 500,000, 1 meg. 2/- each. 5,000, 10,000, 15,000, 100,000, 500,000, 1 meg. with switch, 2/6 each. Dual Potentiometers: 10,000 and 50,000, 5,000 and 50,000; 5,000 and 100,000; 10,000 and 100,000; with switch, 1/6 each.

PREMIER ELIMINATOR KITS

All incorporating Westinghouse Rectifiers, high quality Mains Transformers and Chokes. Generous Smoothing and Decoupling Condensers and Resistances. 120 volts 20 m.a., 20/-; with Trickle Charger, 28/-; 150v. 50 m.a. 4v. 3a., 27/6; with Trickle Charger, 35/-; 150 volts 30 m.a., with 4v. 3-4a. C.T.L.T., 25/-; with Trickle Charger, 32/6. 250 volts 60 m.a. with 4v. 3-5a., C.T.L.T., 30/-; 300 volts 60 m.a., with 4v. 3-5a., C.T.L.T., 37/6. 200 volts 100 m.a., with 4v. 3-5a. C.T.L.T., 42/6.

PREMIER L.T. CHARGER KITS

All incorporate Westinghouse Rectifiers.
2 to 6 volts at 1/2 amp. 14/6
2 to 6 " " at " " 17/6 30 volts at 1 amp. 37/6
2 to 6 " " at 2 " " 27/6 50 " " at 1 " " 50/-
Conversion Units for D.C. Sets on A.C. Mains, 40 watts, 25/-; 80 watts, 35/-.

The following lines 6d. each or 5/- per dozen:—4-, 5- or 7-pin Baseboard or 4-, 5- or 7-pin Chassis Mounting Valve Holders, American Valve Holders, 1 watt resistances, wire end every value; tubular wire end Condensers, 1,500 volt, every value up to 0.5, 3 amp.; 2- or 3-point Switches; Cylind Double Trimmers; 6 vds. Styfolex; 1, 1.5, 2, or 2.5 mm. 1 yd. 7-way Cable, 9ft. resin cored Solder; 6 yds. push-back Connecting Wire; 2in. Knobs. Any type and quantity of Instrument Wire can be supplied from stock. Soldering Irons, 200-250 volts; consumes 0.2 amps, 2/6

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Premier Screened H.F. Choke, 100-2,000 metres, 1/6 each. Premier Screened H.F. Choke, for Short Waves, 10-200 metres, 1/6 each. Premier Short Wave H.F. Choke, 10-200 metres, 9d. Premier Mains H.F. Choke, carry 1 amp., 1/6.

PREMIER SMOOTHING CHOKES

25 M.A., 20 henrys 2/9. 250 M.A., 15 henrys 20/-
40 M.A., 30 henrys 4/- 60 M.A., 80 henrys
60 M.A., 40 henrys 5/6 2,500 ohm for 'Specs' 5/6
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3 Guinea model with stand and transformer, single button type, 19/6. Western Electric type on base, with transformer, 4/6. Home Broadcaster Microphone, low priced two button type with transformer, 7/6. Carlon Microphone with transformer, in handsome Bakelite case, 10/6.

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TEL.: HOLBORN 4631.

15/11 LISSEN SKYSCRAPER 3 CHASSIS. Less Valves, shop soiled. Built and Aerial tested.

25/11 LISSEN SKYSCRAPER 3 CHASSIS. Complete with Valves, shop soiled. Built and Aerial tested.

84/- LISSEN 4 VALVE BAND PASS A.C. MAINS SET. Screen Grid, Detector, Pentode, Valve Rectification, Iron Cored Coils, Band Pass tuned, fitted energised Moving Coil. A super bargain. List £9 15s. Brand new.

70/- LISSEN BAND PASS 3 BATTERY SETS. Complete in handsome Walnut Cabinets, Iron Cored Coils, Band Pass tuned, P.M. Moving Coil Speaker and Valves. Brand new. List £8 10s.

45/- LISSEN 100 STATIONS SET. Complete in Cabinet with Valves and Speaker, Aerial tested, few only.

5/6 TRIAD VALVES. 01-A, 24A, 27, 30, 31, 32, 33, 35, 37, 38, 39, 41, 42, 43, 45, 46, 47, 53, 55, 56, 57, 58, 59, 71A, 75, 78, 80, 0A6, 1C0, 6F7, 2A3, 5Z3, 12A7, 6A7, 6C8, 6D6, 12Z3, 25Z5.

ALL THESE VALVES CARRY A 90-DAY GUARANTEE AND FREE REPLACEMENTS, PROVIDED THAT THE FILAMENT OR HEATER IS INTACT AND THE GLASS IS NOT BROKEN WHEN RETURNED TO US. 5/6.

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2/11 LISSEN INTERMEDIATE FREQUENCY TRANSFORMERS. 120 kc/s. Brand new, boxed. List price, 8/6.

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11/6 350-0-350 volts, 150 ma., 2-0-2 volts, 2.5 amps., 2-0-2 volts, 4 amps., 2-0-2 volts, 2.5 amps. Shrouded.

17/6 500-0-500 volts, 150 ma., 2-0-2 volts, 2.5 amps., 2-0-2 volts, 6 amps., 2-0-2 volts, 2-0-2 volts, 2 amps. Shrouded.

8/11 M.T.B. TRANSFORMERS. 250 volts, 80 ma., 2-0-2 volts, 4 amps.

17/6 DITTO. With H.T.B Metal Rectifier.

ALL THE ABOVE TRANSFORMERS ARE OF FIRST CLASS MANUFACTURE, BRAND NEW AND CARRY MAKERS' GUARANTEE.

2/6 8 mid. and 4 mfd. DRY ELECTROLYTIC CONDENSERS. By well-known manufacturer. 450 volt working, 500 volt Peak. Brand new.

1/6 LISSEN CENTRE TAP OUTPUT CHOKES. Brand new, boxed. List price, 7/6.

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2/6 PEAK 4 mfd. PAPER CONDENSERS. 750 volt test.

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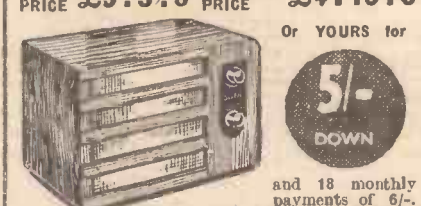
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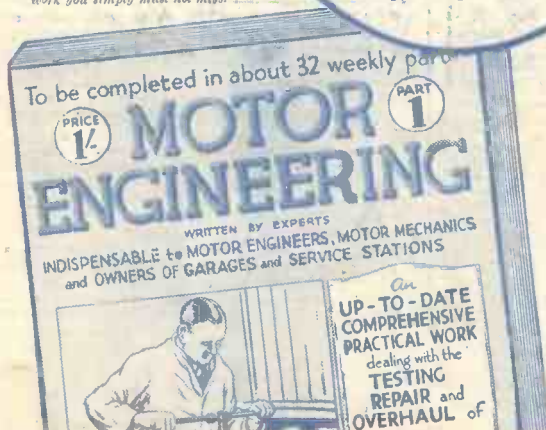
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