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Every Wednesday 3d

Vol. XXII. No. 552 Saturday, January 7, 1933

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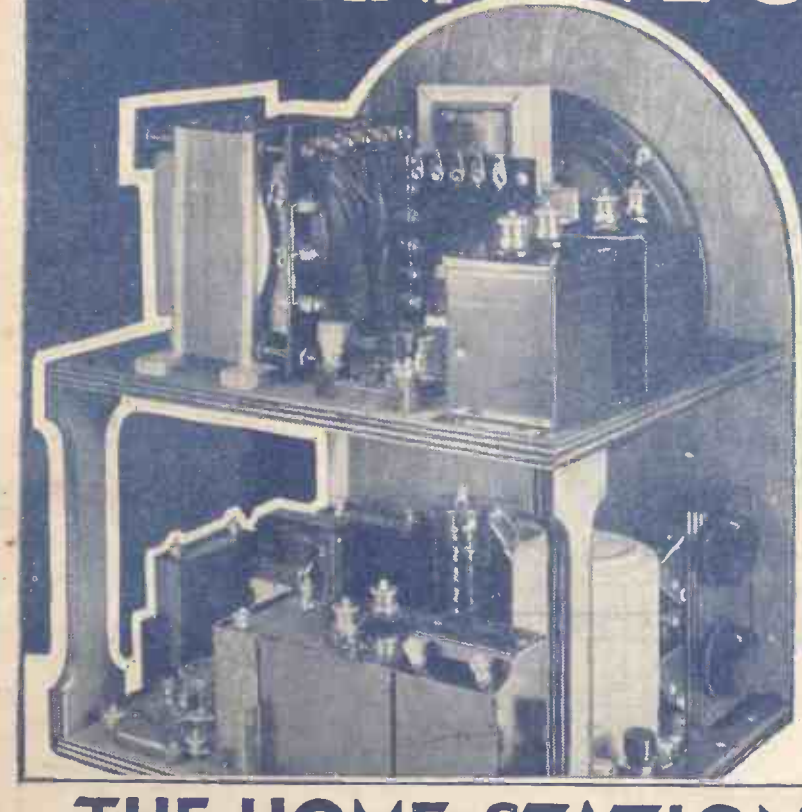

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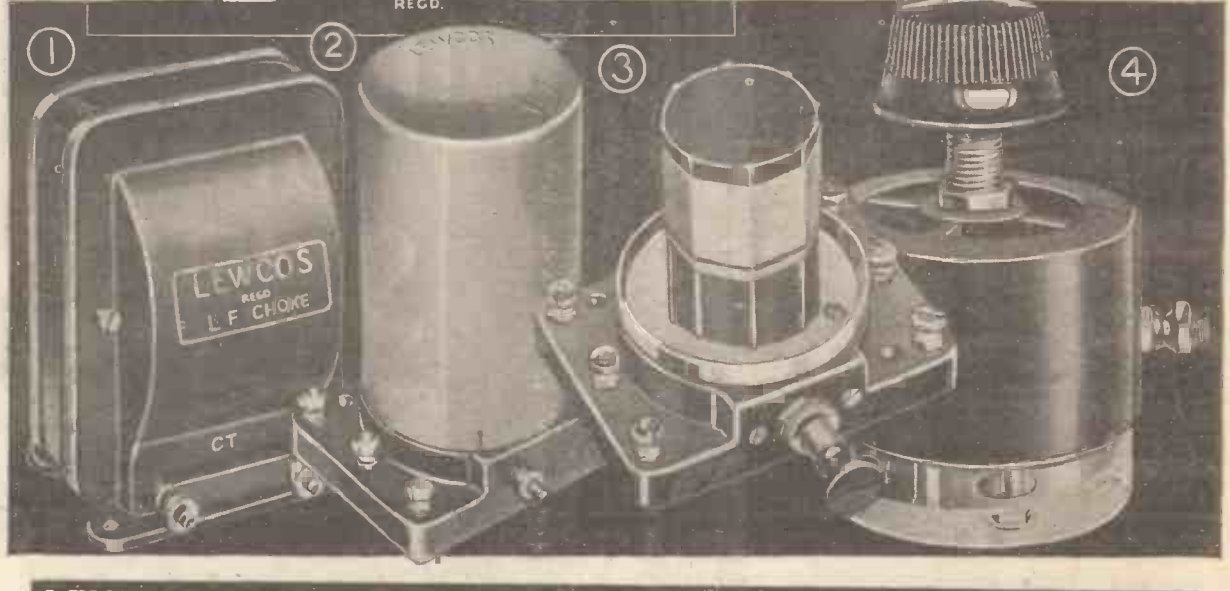

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No. 552. Vol. XXII. JANUARY 7, 1933

Amateur Wireless & Radiovision

BRITAIN'S LEADING RADIO WEEKLY
FOR CONSTRUCTOR, LISTENER & EXPERIMENTER

EDITOR: BERNARD E. JONES. TECHNICAL EDITOR: J. H. REYNER, B.Sc., A.M.I.E.E. RESEARCH CONSULTANT: W. JAMES. ASSISTANT EDITOR: H. CORBISHLEY.

NEWS & GOSSIP OF THE WEEK

ECHOES OF THE EMPIRE BROADCAST

Did You Hear It?

WHEN it is realised that the highly successful Empire broadcast programmes on Christmas Day were technically an unrehearsed effort, some idea of the perfection of the Post Office beam telephony system will be gained. The only failures during the whole tour of the Empire, from the English listener's point of view, were Brisbane and the s.s. Majestic at sea. It may interest readers to know that the messages from Wellington and Melbourne were broadcast by Blattnerphone, having been recorded two or three days before by the beam link, when conditions between the home country and the antipodes were more favourable than on Christmas Day.

THE EMPIRE DELIGHTED WITH THE KING'S SPEECH

ALREADY reports are pouring into the B.B.C. about the reception of the King's Christmas Day message. Canada and Australia both used the beam system for re-broadcasting. In Australia the "A" stations took the Post Office beam and the "B" stations relied on reception from Daventry. Mr. Charlesworth, the new chief of Canadian broadcasting, reports that the King's speech was the best re-broadcast ever done in Canada.

LEAGUE OF NATIONS VERSUS THE EMPIRE

Short-wave Troubles

IT was only to be expected that the starting up of all the Empire stations on short waves should cause a certain amount of dislocation among existing short-wave stations. We hear that already HBL, the League of Nations station at Prangins, which transmits on a wavelength of 31.32 metres, is complaining of severe interference from the B.B.C.'s Australian transmission on 31.32 metres.

OVERLOOKING THE SKIP-DISTANCE EFFECT

ONE of our exuberant lay-press writers has been rating the B.B.C. for its neglect of a golden opportunity to put over a really worth-while broadcast. It was asked why the recent broadcasts by British statesmen from the League of Nations short-wave station were not picked up and relayed. The reason is technical rather than political, we imagine. In this country Prangins, the League station, is not well heard, owing to the skip-distance effect preventing us getting any appreciable reflected ray energy from Switzerland.

The President of Austria before the "mike" at the opening of the Austrian Radio Exhibition to mark the country's tenth anniversary of broadcasting

Also in this Issue—

FEATURES YOU SHOULD NOT MISS

50 Loud-speaker Hints and Tips,
Police Radio on the Road,
Some Helpful Notes on Band-pass Tuning—by W. James.
The "Home-station A.C. Two."

AND SPECIAL EIGHT-PAGE SUPPLEMENT FOR BEGINNERS

WEST AFRICA IS LUCKY

ALTHOUGH many parts of the Empire will have to rely on recorded programmes as their bread and butter wireless fare from the B.B.C., West Africa is lucky because its zone time comes just in our main evening programme time, namely from 8.30 to 10.30 p.m. Already West African listeners have heard three plays including "Mozart" by our Broadcast Critic, whose "Wren" play has also been sold as an Empire record to South Africa by the indefatigable Mr. Malcolm Frost.

"HASSAN" AGAIN

IT was in November, 1926 that the B.B.C. broadcast one of those great poetic plays with which Cecil Lewis's name as producer will be associated in the minds of the older generation of listeners. *Hassan* (for it was one of James Elroy Flecker's masterpieces) attracted wide attention when it was heard on a Sunday afternoon six years ago. There has been no broadcast revival since, but the B.B.C. has now decided to give the play in February. It was always Flecker's wish that *Hassan*, which was completed in the face of death, should be staged. Part 1 of *Hassan* will be broadcast on the National wavelength on February 7, and Part 2 on the Regional wavelength on February 10.

NEXT WEEK: PRACTICAL POINTS ON TUNING FOR ALL SETS

NEWS & GOSSIP OF THE WEEK —*Continued*

THE VERY CIVIL SERVANT

WE are saddened by the story of the Civil Servant who recently broadcast, received his payment, and was then mortified to find that, as a Civil Servant, he was required to pay his hard-earned broadcasting "perk" into the Exchequer. Actually he was out of pocket on the deal to the extent of 2d. for the cheque!

STUDIO APPLAUSE IS NEEDED

SINCE the B.B.C. started its experiment of cutting out all studio applause, many letters and messages have been received asking that the hand-clappers might be allowed in the studios again, as the vaudeville programmes in particular sound very "deadly" without them. This is rather curious when we remember the outcry that used to be raised against the studio claque. Apparently, what listeners do object to is interruptions to the artistes who are broadcasting, but not to a certain amount of applause at the end of each item. The cutting out of the applause was only an experiment for the month of December, and we think listeners will find that the experiment will be counted a failure and that in the New Year the claque will be back again in full cry.

END OF THE REGIONAL NEWS

IN the New Year the Regional News Bulletins will be discontinued. Few listeners, however regionally conscious they may be, will regret this decision. To take the place of these bulletins, periodical reviews of outstanding events of local and regional interest will be broadcast once or twice a week.

THE NATIONAL TOUCH!

Belfast Goes All Spanish!

LISTENERS who tune in to Belfast on January 16 may well imagine that they are listening to a foreign station, for on that evening a programme of Spanish music will be presented, which will be announced and described by a native of the country. The announcer will be Ignacio Gonzalez-Llubera, M.A., D.Litt., professor of Spanish at Queen's University, Belfast, and the soloist will be Leonie Zifado. The orchestra will be conducted by Francisco Gomez, who is personally acquainted with many present-day Spanish composers.

CELEBRATING EMPIRE FESTIVAL DAYS

NOW that the B.B.C. is Empire-minded it proposes to celebrate festival days of Empire as they come round the calendar. A start will be made on January 26, when an Australian Day programme will be specially compiled for transmission to Australia through Daventry on the 25.5 and 31.3 metre wavelengths. Harold Williams, Elisebeth Scotney and other well-known Australian artistes will take part in the programme, which will be introduced by Mr. Bruce, the Australian High Commissioner in London.

B.B.C. VERSUS G.T.C.

VAUDEVILLE officials at Broadcasting House are girding their loins for the coming tussle with General Theatres Corporation over the question of artistes appearing before the microphone when they are under contract with the cinema and music-hall interests. It may surprise many listeners to know that since Gaumont British secured control of Moss Empires, no less than 82 *per cent. of all entertainment talent is now under Gaumont control.* With such a monopoly of talent, Gaumont British, as General Theatres Corporation, must be feeling its way, as evidenced by the recent banning of certain well-known vaudeville artistes who were billed for the microphone.

FIGHT TO A FINISH?

TALK of a fight to a finish between the Gaumont people and the B.B.C. is somewhat premature, since it is known that the head of the G.T.C. concern is very friendly disposed to broadcasting. Should a general ban come into force, the B.B.C. would have no option but to make use of its undoubted powers to get the best artistes it could, by fair means or any other. It might be suggested that the B.B.C. would proceed to buy up artistes almost regardless of the cost, and farm them out, so to speak, to the remaining 20 per cent. interests still in existence outside the G.T.C. octopus. But, as we say, it is far more likely that an amicable arrangement will be reached between the B.B.C. and the G.T.C.

A SIDELIGHT OF THE "TALKIES"
The popular "Mickey Mouse" cartoons are made with wireless-type apparatus to secure synchronization between the cartoons and the sound. (Above) is the cartoonist at work, while (right) are the singers synchronizing with the projected picture

SLOW SPEECH DROPPED

APPARENTLY the experiment of announcing the Empire news bulletins in slow speech has failed to produce the desired result. Although this method of announcing enables each word to be picked up under adverse conditions, the sense of the complete sentence is often lost owing to the appreciable time elapsing between the beginning and the end of the sentence. So now the Empire announcers are speaking just a shade more slowly than for ordinary news bulletins.

DE GROOT, THE ANNOUNCER

HAVE you noticed the announcements of Mr. De Groot, the new London announcer? This English-born announcer with the Dutch name has the distinction of never having been to a public school, so that his accent is entirely devoid of the pecularities that distinguish one public school man from another. Which, for broadcasting purposes, is perhaps no bad thing!

GILBERT AND SULLIVAN AGAIN

A RELAY of Gilbert and Sullivan comic opera will be heard by National listeners on the last day of the season at the Savoy Theatre, namely, January 21. Following an excerpt from the opera which is to be given that evening, listeners may hear some of the farewell speeches from the stage.

VERNON COMES HOME

And then Goes Off Again!

PROBLEMS of the day in foreign countries are to be dealt with by Mr. Vernon Bartlett in a new series of talks which begins in January. Mr. Bartlett, who has been broadcasting from various countries to British listeners, will return home for one brief talk on January 12 and will then explain to listeners his plans for the ensuing series which involves a further foreign tour, in the course of which it is hoped that he will be able to bring to the microphone, some of the men prominent in the political and public life of various countries.

H. G. WELLS' STORY

THE first story by H. G. Wells to be broadcast will be "The Country of the Blind," which is in the National programme for January 9, and the Regional programme for January 10. It will be presented in the form of a drama by E. J. King Bull and the leading male part will be taken by Henry Oscar. Romantic and beautiful in conception, "The Country of the Blind" has what may be termed a dream quality, but carries with it a considerable amount of satire.

MASS-PRODUCED TELEVISION COMING!

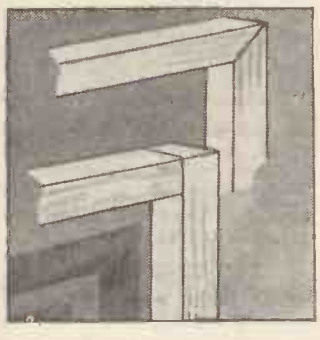
AT last it does look as though the man in the street may be able to judge the progress of television—in the only possible way, by getting hold of the latest type televisor. We now hear that complete televisors will be selling before long for about £50. These will work from the mains and will not need any extras. The great feature will be the use of a large screen.

50 LOUD-SPEAKER HINTS

Practical Ideas for Better Results

SPEAKER FRAMES

YOU will be dissatisfied with your linen speaker if the framework is not firmly built. The sketch shows two ways of making the woodwork joints. The but-on joint is naturally not so strong.



CUTTING OUT HUM

HAVE you tried fitting a large electrolytic condenser across the energising winding of a moving-coil speaker? This often cuts out hum otherwise noticeable owing to A.C. feed.

TIGHTENING THE DIAPHRAGMS

MUCH of the success obtained with a linen speaker depends on the way in which the diaphragms are tightened. It is essential that the strain be taken equally all over the diaphragm, and that the four adjusters are properly tightened. Screw back each adjuster a half a turn at a time. The tightening should be done in stages so that the diaphragm is not burst.

"SAFETY" VALUES

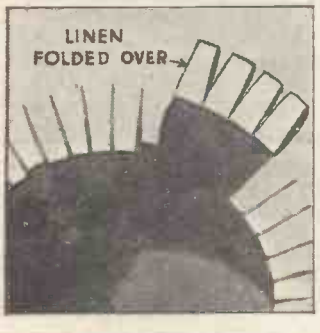
IF an output-filter system is used, the output choke should have an inductance not exceeding 20 henries and should be capable of carrying about 50 per cent. more current than the anode current required by the output valve. The filter circuit condensers should have a working voltage at least equal to the voltage being applied to the anode of the output valve. The use of an output filter or output transformer is likely considerably to impair both the volume and the tone of reproduction unless properly matched to the impedance of the output valve and to the impedance of the speaker.

PACKING SPEAKER BAFFLES

YOU will find it advisable to wear an old pair of gardening gloves when packing slag wool into box baffles. The wool can then be packed in tightly without fear of hurting the hands.

CUTTING OUT WHISTLE

IF reception in your locality is marred by heterodyne whistling, the best plan is to filter out the interference in the speaker circuit. Use an output choke or transformer circuit to prevent the steady D.C. from burning out the winding of the whistle-filter choke. Use a special whistle-filter choke which will cut out at about 4,500 cycles when used in a suitable circuit. Use a .006 condenser on the set side, and a .01 condenser on the speaker's side.



SECURING THE LINEN

TO make a firm job of fixing the linen in a padded baffle, glue the linen to the mounting ring at the front end. The hole in the centre of the linen should be cut as shown in the accompanying sketch, and the ends turned over and glued. The ring can then be screwed down.

WORK IT OUT!

BEFORE it is possible to determine what ratio output transformer is desirable for a given speaker and output valve, it is essential to know the impedance of both the speaker and the valve. The formula, then, for an ordinary *balanced-armature* type speaker, is

$$\text{Ratio} = \sqrt{\frac{\text{Valve Impedance}}{\text{Speaker Impedance}}}$$

WATCH POLARITY

WHERE a speaker is specially designed for use directly in the anode circuit of the output valve, it is important to see that the negative speaker terminal joins the anode of the valve and the positive speaker terminal joins the positive H.T. supply.

MAKING THEM SENSITIVE

MOVING-COIL speakers are sometimes thought to be insensitive, and therefore of little use for battery-driven sets where there is no power to spare. Lack of sensitivity with modern speakers can generally be traced to poor centring (meaning a large and wasteful air gap) and a stiff mounting for the diaphragm and speech coil.

SEPARATING THE WIRES

IN an energised speaker it is essential to keep the two sets of leads carefully spaced. The speech coil wires must not run close to the energising coil wires. It is only too easy for ripple to be induced into the speech coil if the leads run together.

DUAL SPEAKERS

HAVE you tried the dual speaker idea yet? Many manufacturers are supplying small moving-coil speakers in matched pairs generally known as "dual compensated" speakers. They should be wired together, and it is found that much better reproduction is generally obtained than

with the one speaker alone, as a wider frequency band can be carried by the pair of cones. There are various ways of wiring up, but the speech coils are often wired together across the secondary of the one input transformer.

LONG EXTENSIONS

WHEN using your speaker some distance from the actual receiver it is almost essential to employ some kind of output arrangement between the set and the speaker. Whatever output arrangement is used, it should be placed as near to the receiver as possible. The capacity between the wires of a long length of twisted flexible wire is liable to cause a loss of some of the high notes in reproduction. It is therefore a good plan to use separate wires for extension purposes when the speaker is a considerable distance from the set.

VIBRATING CHASSIS

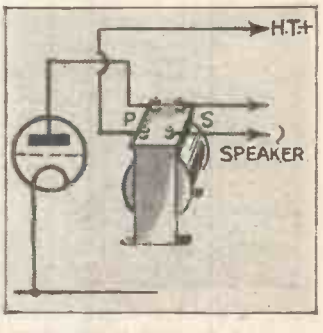
WHEN some speakers are handling a heavy input, there is a tendency for the chassis to vibrate. A buzz is sometimes produced, which is a sure sign that other resonances are being set up which spoil reproduction. Several commercial speakers are obtainable with several sizes of chassis. Choose one which is built up of L or double L section metal, or even made from a casting, rather than from plain strip.

FIT WANDER PLUGS AND SOCKETS

IT is often an advantage to be able to make a quick change of the input transformer connections to a speaker. Most transformers are fitted with terminals, but a more rapid change-over can be effected if small plugs are fitted to the terminal shanks, so that the input leads can have wander-plug ends.

PREVENTING BREAKDOWN

VERY few loud-speakers are designed to carry more than a few milliamperes of energising current, therefore it is advisable never to connect a loud-speaker



directly in the anode circuit of an output valve. An output filter system or speaker transformer should be interposed between the valve anode circuit and the speaker.

TRANSFORMER OUTPUT

THOSE who wish to calculate for themselves the ratio of an output transformer to suit a *moving-coil* speaker in an ordinary output stage may do so by using the following formula.

$$\text{Ratio} = \sqrt{\frac{\text{Valve Impedance} \times 2}{\text{Speaker Impedance}}}$$

(*Continued on page 6*)

"50 LOUD-SPEAKER HINTS"—(Continued from page 5)

COPPERING THE POLES

IF you are renovating an old speaker, remember that many of the new speakers have their pole pieces copper plated to prevent rusting. It is always possible to have the magnets copper-plated at any plating works, and is worth the trouble, as a finer air gap can often be allowed between the coil or armature and the magnet.

CHASSIS POSITION

IN console sets it is necessary to see that the speaker windings cannot upset the working of the receiver. Even with permanent-magnet speakers there is the possibility, if the layout is too cramped, that the mass of metal in the magnet construction may upset the tuning of the set. In "A.W." published designs this point is always watched, and you can be sure that no matter how compact the layout, there will be no interference. But it is a detail worth noting in amateur-designed sets.

RADIOGRAM WHISTLING

DO you find that your radiogram works satisfactorily as a receiver, but whistles when the switch is clicked over to the "gram" position? This is a sign that the pick-up wiring runs too close to the speaker leads. It may also be cured by fitting an output choke or transformer.

PADDING BOX BAFFLES

JUST a point to note when making up a padded baffle of the "Broadcasting House" type. The linen is secured to the baffle at the speaker end by clamping

under a wooden ring. This ring must be screwed down securely and the linen drawn tightly back. A section of a baffle at this point is shown by the sketch, making the detail quite clear.

INSULATING THE UNIT

VIBRATION is sometimes transferred from a heavy speaker unit to the chassis, and thence to the diaphragm. The only way to stop this is to bolt the unit to the chassis with fibre or rubber washers interposed. Insulated washers as sold for electric light fittings can be used, or they can be cut from an old car inner tube.

DIAPHRAGM SIZE

THERE is often discussion as to the frequency range which can be covered by various sizes of speaker diaphragm. It is now agreed by experts that a diaphragm of 12 to 14 in., freely suspended and driven by a light coil movement, can reproduce from 30 cycles to over 8,000.

USING TWO SPEAKERS

IT is always possible to use two speakers together with a fader to connect them together and to the set. Use a 100,000-ohm potentiometer with its windings connected directly across the speaker terminals. Then take a wire from each end of the windings to one terminal of each speaker. Connect the other two speaker terminals together and to the "pot" slider. Adjustment of the potentiometer will then enable you to use either speaker at any desired volume.

USING DRAUGHT EXCLUDER

THERE are many uses for rubber draught excluder tubes in a set, as you have probably found out. It comes in useful, for instance, when tacked on to

the wooden framework of linen speakers, as it makes a resilient mounting for the stretched linen.

CONNECTING MOVING COILS TOGETHER

IF speakers are matched, there is sometimes no need to have separate input transformers for a pair of speakers worked close together. Simply connect the speech coils together, either in parallel or series, according to the maker's recommendation.

OUTPUT VALVES

DO not skimp the values of choke and condenser chosen for an output unit. With the average moving-coil speaker, a 20 henry choke is satisfactory, and a 250-volt test condenser of 2 microfarads (at least) should be used.

"DOPED" LINEN

YOU may find it convenient when making up a linen speaker to use the special "doped" material which does not require the application of any special dope to tighten it. Treated linen is available which only needs damping with water. As the material dries, the threads contract.

FIT A FUSE

IT is a safe plan to fit a fuse in series with the magnet winding of an energised-type speaker. This is of particular importance with speakers which are operated direct from D.C. mains, even if there is a fuse in the receiver itself.

MOVING-COIL CONNECTIONS

THE way in which the connections are made to a moving-coil in a moving-coil speaker can make all the difference to the performance. If the connecting leads to the speech coil are too long or heavy, or if there is any resistance at all to the free movement of the coil, the tone will be

affected. Very fine stranded wire is used in some commercial speakers, but if this is not obtainable when repairing a speaker, use fairly fine wire, taken to two terminals close to the coil.

PENTODE TRANSFORMERS

WHEN considering the ratio of output transformers for use with *pentode* valves, remember that in many cases the valve impedance is often not specified by the manufacturers. An approximation can be obtained by assuming the optimum load of the valve to equal the valve impedance for the purposes of the formula. The approximate load for a small pentode is about 7,000 ohms, and for a large pentode about 10,000 to 14,000 ohms. The formula then is:

$$\text{Ratio} = \sqrt{\frac{\text{Valve impedance} \times 2\frac{1}{2}}{\text{Speaker impedance}}}$$

LINEN DIAPHRAGMS

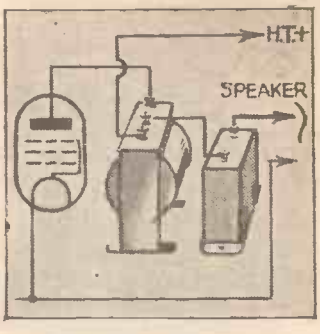
A HOLE should not be cut in the centre of linen speaker diaphragms. Push the cone piece through the linen threads after prising them apart with a needle. If a hole is cut there is a danger of the linen bursting at the apex of the diaphragm.

SCRATCHING NOISES

WHEN scratching noises develop in a moving-coil speaker it may often be traced to the moving-coil touching the magnet poles, especially on loud notes. This does not necessarily imply that the speaker is being overloaded. A simple adjustment of the centring device will stop the scratching noises and enable the speaker to be worked at full volume.

WITH A PENTODE

SPECIAL output-filter chokes are available for use in conjunction with pentode output valves and it is advisable to use such chokes whenever a pentode is



the last valve in the set. In such cases a filter-circuit coupling condenser of as low a capacity as .3 of a microfarad will often prove to be suitable for giving most pleasant reproduction.

FIT IT WITH FELT

TO make a rattle-free joint between a speaker chassis and a cabinet front, fit a ring of felt (cut to the shape of the chassis opening) between the metal and the wood. Draught-excluder felt can be used, and can be glued to the chassis so that it will not come out of place as the speaker is being screwed in position.

A CENTRING DEVICE

IN one system of coil centring, for moving-coil speakers, there is a bolt and lock nut fitted at the centre of the centring piece at the diaphragm apex. If the speaker rattles owing to the coil touching the magnet poles, the coil can be re-centred by undoing the locking nut, tightening or loosening the bolt, and then tightening up the lock nut.

MAGNET SIDE PIECES

IF your moving-coil speaker has metal side pieces fitted to the magnet to keep out dust, see that they do not work loose. On some speakers these side pieces are held in position with small screws, and if these work loose the metal plates will rattle.

BAFFLE SIZE

UNLESS you use a box baffle, it is necessary, with some speakers, to have large flat baffles to prevent low-note leakage. Small 2-ft. baffles cannot prevent leakage on a speaker which can go down to 50 cycles. B.B.C. tests have shown that baffles 5 ft. square are necessary with certain speakers capable of covering a wide frequency range.

(*Continued on page 23*)

POLICE RADIO ON THE ROAD

Our Special Commissioner describes the portable radio gear which provincial police are using to maintain communication between headquarters and "speed cop" cars and motor-cycles

WHILE Scotland Yard is busy testing short-wavers for the Flying Squad cars, and is debating on the advisability of going down on the short waves from the shipping wavelengths previously employed, rapid progress is being made with portable radio at a number of provincial police headquarters.

The provincial police, tired of waiting for the results of the Scotland Yard experiments, have gone ahead with their own portable radio plant for communication between local headquarters and "speed cop" cars and motor-cycles.

In Scotland the police officials have already made use of radio to check car banditry and smash-and-grab raids. The Edinburgh police recently carried out some radio telephony tests with a special four-valve portable set carried in the sidecar of a police motor-cycle, and picking up signals from a transmitter at "H.Q."

Chief Constable Ross, of Edinburgh, himself took part in the trials and the Edinburgh traffic police, headed by Superintendent Berry, were used to carry the portable sets out into the suburban districts on the edge of the police transmitters' range.

In these tests a wavelength of 150 metres is used, but that, of course, will not be the final wavelength, for that will be kept secret.

The transmitter at headquarters is a low-power outfit taking only 3 kilowatts, with an output, of course, of less than this. Metal strut streamlined aerials were fitted to the motor-cycle combinations which toured the City, and were used to check up the field strength at a number of points.

A great deal of secrecy is naturally being maintained about the radio tests by provincial police all over the country, but in a number of cases the transmitters and receivers have been put forward for police use by the well-known Standard Telephones and Cables concern. The transmitter is a small affair mounted in a duralumin frame and using air-cooled valves. A crystal drive can be used if necessary to keep the police radio transmitters exactly on their allotted frequency.

At present the portable sets used in the "speed cop'" cars and cycles are similar to the screened four-valvers supplied for aircraft use.

The tuning is altered to cover the short wavelength used by the police, for the standard range of the aircraft receivers is 600-1,000 metres. These Standard receivers consist of a complete four-valve circuit in an aluminium box measuring only 9¼ in. by 4¼ in. by 4¼ in. The weight of the whole outfit is just under 5 lbs. It has a circuit incorporating two screened-grid high-frequency valves with ganged tuning, and with a transformer-coupled power valve.

This is the transmitter which has been built on the roof of the Brighton Police headquarters for the new pocket radio sets to be carried by the Brighton police. The upper picture shows tests being carried out on the London-Brighton road five miles from Brighton

Current Supply

The batteries are in a separate box and are big enough for about twenty-five hours' continuous working. Certain modifications are made to the aircraft sets to make them more suitable for police use, but the basic design is the same.

The Newcastle police have had a 10-watt transmitter for over a year now, and they find that they get a range of about ten miles with it, in conjunction with portable sets carried on motor-cycles. The transmitter is installed at the head office at Newcastle, and works off the mains. It is operated entirely by relay buttons controlling the rotary convertors, and the officer

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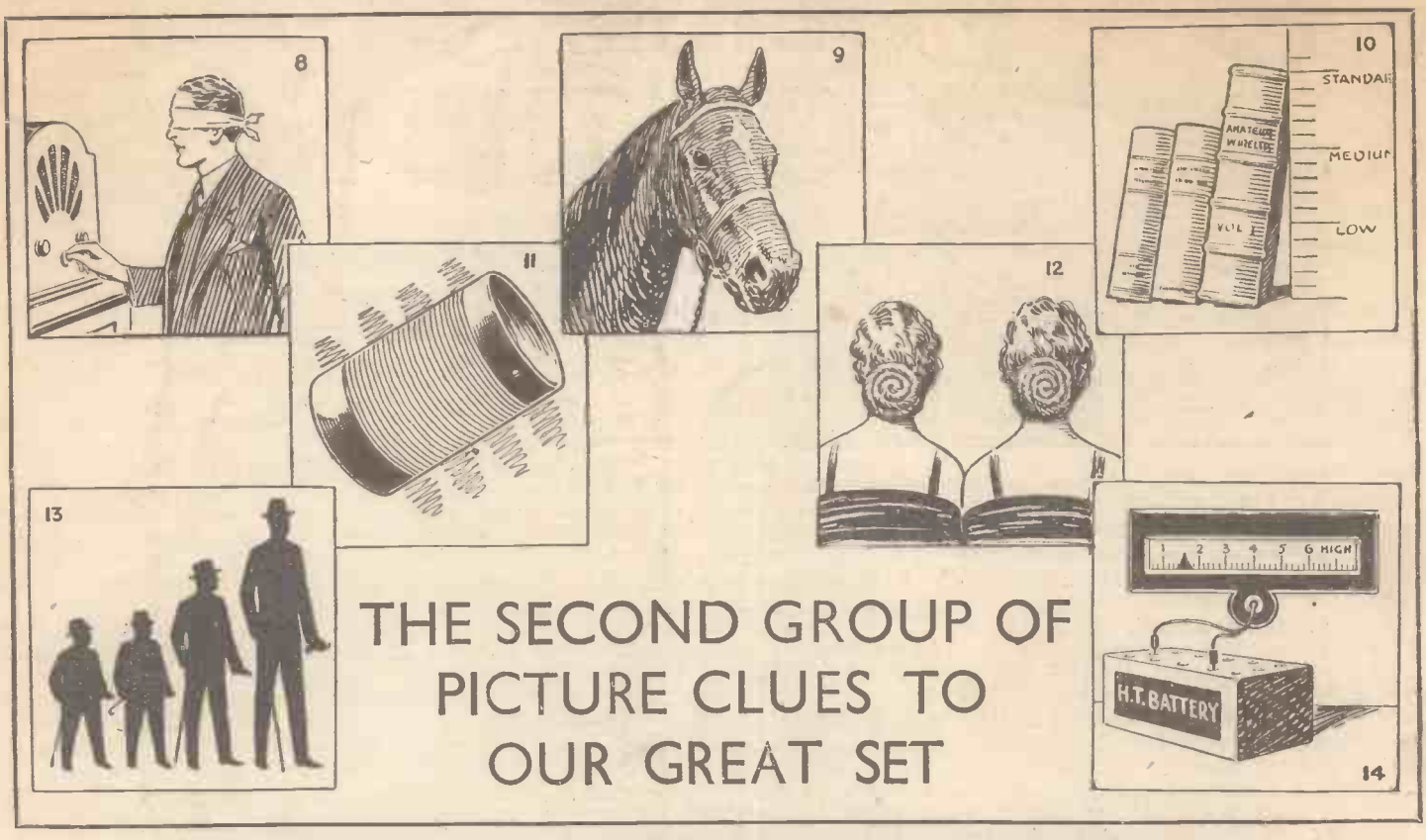
CAN YOU FORECAST THE DESIGN OF OUR NEW RECEIVER?



THE SECOND GROUP OF PICTURE CLUES TO OUR GREAT SET

TWENTY KITS OF COMPONENTS AS PRIZES

HERE are another seven clues (each of them numbered) to **features of the great set** *which, as announced last week, we shall shortly introduce to our readers. In all about twenty clues will be published, and they will provide you with a most interesting time working them out. Each picture conveys in veiled form information about some particular feature of our new set which is of outstanding design.*

Wait for the further picture clues to be given you next week and send all your solutions **on a form to be published in next week's issue.**

We offer a kit of components of our remarkable new receiver, yet to be announced, to each of twenty successful solvers or **competitors who are nearest to the correct solutions.** *In the event of more than twenty competitors being correct, then we shall put all the correct solutions in a heap and an independent person will choose the twenty prize-winners from them.*

The Editor's decision on every point connected with this competition is final, and every competitor by the mere act of competing acquiesces to that rule.

Here is some fun for any evening when there is nothing else to do. Get all your wireless friends round you and hammer out the clues one by one. It is good fun and **the prizes will be kits of components of one of the finest sets which it has ever been our pleasure to introduce to the constructor public.**

A PRIZE COMPETITION FOR EVERYBODY

"POLICE RADIO ON THE ROAD"

(*Continued from preceding page*)

in charge has only to push two relay buttons to start the transmitter—the generators being in a sound-proof cabinet underneath the control panel.

This police outfit is now a permanent affair. It has gone beyond the experimental stage, and it should do much to convince provincial police of the value of radio as a link between "H.Q." and the mobile staff on the roads.

A faked "hold-up" was staged by the Brighton police in tests to demonstrate the utility of radio on police cars. The scene was the London-Brighton road, and the tests were made before Major-General Sir Llewellyn Atcherley (Inspector of Police Forces) and a number of other "big wigs" in the police, including Mr. Charles Griffin, the Chief Constable of Brighton.

Pocket wireless sets were used on this occasion, and they were tested out on the main road first on cars and then by policemen patrolling the roads on foot. A permanent transmitter has now been installed on top of the police headquarters.

Glasgow is just putting the finishing touches to its police radio scheme, and the officials there have chosen a short wavelength for mobile police working. There is, in point of fact, keen rivalry between the forces in Glasgow and Edinburgh, and the Glasgow police have settled on a radio scheme which they think more nearly fits their need than does the Edinburgh arrangement.

Secrecy is maintained regarding the provincial police radio tests, as it is not considered wise that the public should know how rapidly the wireless "net" against criminals is spreading over the country. Radio enthusiasts nevertheless can be certain that wireless is playing a bigger part in mobile police control than the police authorities themselves would admit.

The choir of the Cardiff Musical Society, conducted by Raymond Butterworth, will lead the fourth of the periods of hymn-singing from the Western Region, under the general title "Carolare," on January 15.

Mr. Picton Davies will give a talk on the Lakes of Wales during the Welsh Interlude for West Regional listeners on January 16.

On Your Wavelength!

UNIVERSAL MAINS SETS

THERE are, I believe, great possibilities about full-voltage indirectly-heated valves, and I will suggest in a moment a way in which they could be employed safely, and in conformity with all regulations, for the construction of sets that would work off either A.C. or D.C. mains. Some time ago now I mentioned that I was very far from liking the operation of these valves direct from A.C. mains without any intervening transformer. If you care to examine the regulations of the Institution of Electrical Engineers, you will find that it is most emphatically laid down that an intervening transformer must be used between A.C. mains and any wireless apparatus. These regulations were not drawn up merely for the fun of the thing, and you can be sure that there was good reason behind them. Further, they are adopted by nearly all insurance companies as the basis of their policy conditions.

The great point about these valves is that you can apply to their heaters the full voltage of the mains, and they are just as happy with either A.C. or D.C. A universal set for either type of mains could be made by incorporating a 1 : 1 transformer with metal rectifier in series and arranging a switch to throw these into action in the A.C. position, or to cut them out in the D.C. The smoothing circuits would remain in use in both cases. Such a circuit is all to the good in the D.C. set, for D.C. is often distinctly "marcelled."

SNOWED UNDER!

IN the past I have mentioned, once or twice, instances of the queer little ways that some of our wireless firms have of doing business. I have just lately had an amazing example. It began with an order for certain components sent to the manufacturers thereof early in the autumn. At the end of three weeks they hadn't turned up, so I sent a gentle reminder. A further ten days elapsed; then came a parcel containing all that I had ordered. So far so good, but the incident wasn't closed; in fact, so far as I can see, it never will be. Three weeks later a mysterious parcel arrived which, on being opened, was found to contain half of the components originally ordered. A couple of posts later came a second parcel containing the other half. The second outfit was returned with a note of explanation, but, believe me or believe me not, within a week all the components were back again, accompanied by a rather huffy letter saying that they had been carefully tested out and that no fault could be found with any of them. And now I have just had another big parcel from the same firm. I haven't yet opened it, but I feel quite sure that it contains consignment No. 3. I have a feeling, too, that I shall go on receiving these parcels about once a month until stocks run out.

STRAIGHTENING THINGS OUT

THOUGH France was the world's pioneer country in broadcasting—the Eiffel Tower began transmitting musical programmes shortly after the end of the War—conditions over there have always been chaotic. No Government has been able to obtain legislation to regulate satisfactorily conditions under which either transmitting or listening may be carried out. The result, so far as broadcasting is concerned, is that there are, on the one hand, the official Government stations which do carry out the provisions of the Prague Plan and, on the other hand, the privately owned stations, many of which don't. There is at present no receiving licence fee.

The privately owned stations exist largely upon the revenue from advertising, whilst the Government stations are without visible means of support. A Bill is to be introduced presently before the Chamber of Deputies by the Government which seems to have a good chance of becoming law. Under its provisions the user of a crystal set will pay annually a fee of some seven shillings, whilst the valve man will have to put down about twice as much. This seems quite a fair arrangement, though I am rather surprised to learn that there are sufficient crystal users left for it to be worth while to make special regulations on their behalf. If the Bill becomes law there should be a considerable all-round improvement in French broadcast programmes. One hopes also that the Ministry of Posts and Telegraphs will shortly obtain powers enabling it to sit on the heads of private stations which wander as they list over the medium waveband.

A CURIOUS POINT

SPEAKING of crystal sets brings to mind a rather queer point about the regional scheme. Those who first conceived it intended to make alternative programmes available to users of the simplest receiving apparatus, but actually the scheme has just about extinguished the crystal set in this country. The reason is that the crystal set is inherently unselective. The only known way of increasing its selectivity is to decrease the degree of coupling between aerial and secondary coils and to reduce the number of turns in the secondary across which the crystal itself is connected. Unfortunately, you cannot put back in the crystal set the loss of signal strength which occurs by doing these things. You can to some extent in the valve set by using reaction, but the reacting crystal set is an invention which will never be made, for it falls into the same category as perpetual motion or the feat of lifting oneself into the air by means of one's own bootlaces. You must, then, either have an unselective crystal set, which during the present period of great all-round field strength will probably bring in many stations at once, or increase the selectivity, in which case you will cut down signal strength so greatly that there will probably be no station worth hearing.

PERSONALITIES IN THE WEEK'S PROGRAMME

Getting ready for a new show! Doris and Elsie Waters, the two popular comediennes, are here seen rehearsing for a broadcast "act"

On Your Wavelength! (continued)

CAN'T WE BE ORIGINAL?

IT is amazing how this year nearly all set manufacturers have been smitten with the same inspiration, if inspiration it can be called. What I mean is that if you think of buying an ABC set they show you something shaped rather like a large bracket clock with the loud-speaker in the upper storey and the rest of the apparatus, so to speak, on the ground floor. And whether you ask for an EFG or an OPQ or an XYZ, they go on showing you things rather like bracket clocks with the loud-speaker—well, I needn't tell you where the loud-speaker is. We could, I think, do very well with some more original designs, and, personally, I should rather welcome sets which did not carry their loud-speakers in their insides. Of course, it is all very neat and nice to tuck it away like that, but there is a dreadful risk of cabinet resonances if you cramp the loud-speaker's style by boxing it in a small case already pretty well filled with other bits and pieces. I like to have the loud-speaker outside the set, and I don't think that I am alone in that opinion.

ARE THEY GROWING TOO SMALL?

THERE seems to be a kind of competition amongst manufacturers of moving-coil loud-speakers to see which can produce the smallest. And, believe me, a miniature loud-speaker is not the ideal thing for fine quality reproduction. I look with a certain amount of apprehension upon the flood of midgets that is now with us and hope that manufacturers will return shortly to concentrating upon larger patterns. Some of the good quality midgets are not at all bad performers. I am thinking largely of the very cheap ones, of which there are not a few. The name "moving-coil" is thought by many to be almost synonymous for good reproduction; they believe that *any* moving-coil loud-speaker must be better than *any* balanced-armature instrument. Well, I would certainly much rather have a good balanced-armature speaker than an indifferent or poor one of the moving-coil variety. And if you don't want to spend very much on a loud-speaker you can get a lot more for your money in the balanced-armature line than in the other.

MATCHING COUNTS

WHAT so many people don't realise is that the best loud-speaker in the world can sound perfectly filthy if it doesn't match the impedance of the output valve. If you happen to possess such a thing as a multi-ratio output transformer or can borrow one from a friend, you can very easily satisfy yourself on this point by making an interesting series of experiments with different ratios and different output valves. The hardest of all valves to match up satisfactorily is the pentode, for this generally requires not merely a suitable ratio between the primary and secondary of the output transformer, but also a tone-correcting circuit to get rid of shrillness. Too often one hears a pentode, ill-matched and without tone correction, making a good loud-speaker sound more like a tom-cats' orchestra than anything else. The correcting circuit is a very simple one. It consists simply of a resistance and a condenser in series connected across the input terminals of the transformer. About 40,000 ohms, preferably variable, and a .004 microfarad are the values required. The effect of this device is to mitigate the shrillness of the reproduction due to the pentode's over-emphasis of high notes.

GOING STRONG

THE Daventry Empire station is obtaining wonderfully good reports from all over the Empire, considering that its transmissions are still more or less in the experimental stage. In one or two cases the wavelength used will, I expect, have to be altered, for they don't yet seem quite to have hit the ideal. On the short waves it is surprising what a terrific difference an alteration as small as a metre or two can sometimes make. Some wavelengths are much more atmospheric than others; some travel far better than others at certain periods of the twenty-four hours. As I predicted some time ago, the wavelength used for the Canadian transmissions seems to be on the short side. I said, if you remember, that something well over 50 metres would probably be needed for the best results, and I fancy that the B.B.C. will have to come round to this view. It is more than likely that during the next two years the optimum night wavelength between this country and North America will be much nearer 100 than 50 metres.

FOR SHORT-WAVERS

A short-wave set should never be worked without a series condenser in the aerial lead. One of the ordinary compression-type condensers is not really suitable for this job and a small condenser of the neutralising variety is better. This photograph shows how to connect a neutralising type condenser in the aerial wire to a short-waver. As you move the vanes of this condenser further apart, so you will find it easier to make the short-waver oscillate, even when a long aerial is used

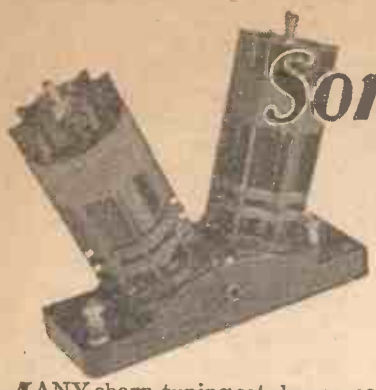
CURIOUS CHANGES

THERE are, I expect, a few old hands amongst readers who remember the twenty-four hours' test carried out a few years ago by PCJJ, of Eindhoven, on 31.5 metres. It was one of the biggest things ever done in experimental broadcasting. The programme began at eight o'clock one evening and went on with no interval of more than a few seconds' duration until eight o'clock on the next. Relays of vocalists, orchestras, entertainers, and announcers were engaged for the job. The purpose of the test was to see how reception upon this wavelength varied at different times in various parts of the world. I cannot claim to have remained glued to the short-wave set the whole time, I switched on PCJJ at intervals during the first night and again during the following day, afternoon and evening. The difference in signal strength was quite extraordinary from hour to hour. At the start of the transmission he was coming in pretty well. He then became less and less loud, and suffered more and more from fading. At bedtime on the first night good reception was not possible. At breakfast time the following morning he was producing "local station" loud-speaker volume from a two-valve set.

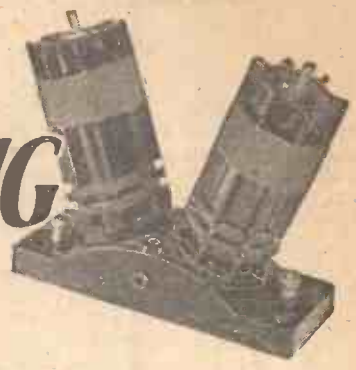
HEARD HIM YET?

I EXPECT that by this time you have heard Athlone, the Irish giant transmitter which replaces the old Dublin apparatus. The original Dublin station was rated at 1.2 kilowatts, but Athlone is the third biggest station in Europe with 80 kilowatts. Unfortunately, the coming of these high-power stations, both in these islands and on the Continent, is not making reception any easier. It is an actual fact that it is far harder to receive, say, a dozen stations of an evening completely free from all interference nowadays than it was three or four years ago. We used to think that as output power went up, increased selectivity in the receiving set would do the trick by enabling us to separate any station from its neighbours. Now we find that the most selective of sets cannot get rid of a particularly horrid type of interference known as sideband splash. If you try to tune in one of a pair of powerful stations operating upon next-door wavelengths, the one that you don't want keeps on splashing and spluttering through. Oh for the old days when no station used more than about 10 kilowatts and you really could run round Europe with a selective set!

THERMION.



Some Notes on BAND-PASS TUNING



W. James makes some instructive comparisons between old and new tuning systems

MANY sharp-tuning sets have a coupled or band-pass filter included in the aerial or valve circuits.

Some sets have two double-circuit filters, and when they are properly made the tuning is quite selective.

Now the need for good selectivity has

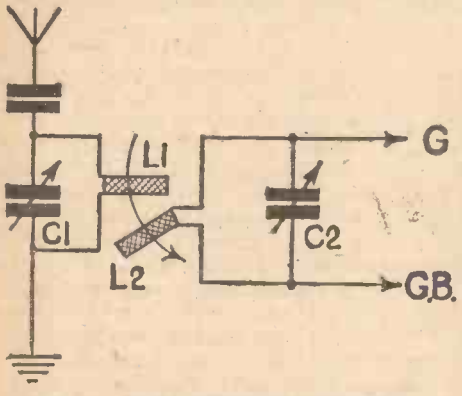


Fig. 1. An old plug-in coil circuit with adjustable coupling

not suddenly appeared. It is true that good tuning is an essential to-day, but if you looked through the pages of old copies of AMATEUR WIRELESS you would find diagrams of selective circuits and articles describing how to obtain sharp tuning.

There is, however, one difference that would be instantly noted. Nowadays we use a two-gang condenser for tuning a two-circuit filter, and this may be ganged

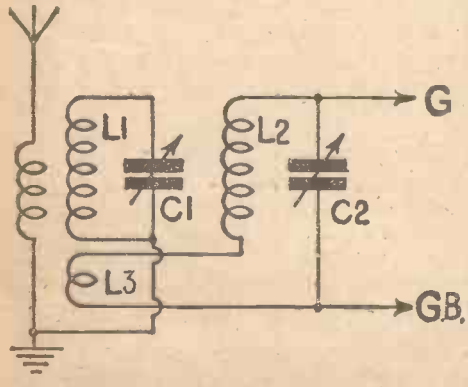


Fig. 2. Another old two-circuit tuning arrangement having adjustable magnetic coupling

with condensers tuning other circuits, whereas years ago separately-controlled tuning condensers were used.

Then again, to-day the coils are usually shielded by being included in metal cans; years ago they were shielded in high-class commercial sets but not very often in amateur sets.

A circuit often used was that of Fig. 1, where the two coils L1 and L2 were of the plug-in type, fitted in a two-coil holder; one of the coils was movable and so its coupling with the fixed coil could be varied by the operator.

There were separate tuning condensers, C1 and C2. The coupling was not wholly magnetic as, owing to the position of the coils, the capacity coupling was far from negligible. But sharp tuning could be obtained, the sharpness increasing as the distance between the coils was increased. Not being screened, the coils themselves might pick up the local station, but still, by adjusting the coupling carefully a local station could easily be cut out.

Selectivity with Plug-in Coils

With a set of plug-in coils various wavelength bands could be covered, and if you happen to have some old coils in good condition (not damp) it would be interesting to try them. I recently tried another old arrangement shown in Fig. 2, and the results were good, as expected.

In this circuit separate tuning condensers C1 and C2 are used, and two coils L1 and L2. Coil L2 has in series with it a coil of a few turns, L3, which is coupled to coil L1. The turns of wire of coil L3 are wound on a small tube fitted at the end of coil L1, and can be moved in order to vary the coupling.

A tuner of this sort can be very selective indeed. But to-day convenience is considered rather important, and dual-range coils are used. They are generally of small bulk, shielded and combined with a switch, but I would not have it thought that so far as aerial tuning goes the present-day circuits are more selective than those used ten years ago or even during the war.

Band-pass Filters

The need for easily-operated and compact tuners has, however, resulted in effective filters of the band-pass type. A fixed coupling is always used; that is, the coupling element is a fixed condenser or coil and sometimes a combination of both.

Now a fixed coupling cannot be the best coupling for a pair of circuits at all frequencies within the band covered. The result is that the couplings are designed to give the best *average* results, and could be improved were it possible to adjust them. It follows that filter circuits having fixed couplings have definite characteristics which must be taken into account when considering a receiver as a whole.

Probably the simplest and most widely used coupling is the capacity type in which a condenser is used, as in Fig. 3. Here the two coils are marked L1 and L2; these are usually shielded. The tuning condensers C1 and C2 are nearly always ganged, and so the whole filter circuit is tuned by adjusting one knob and, when

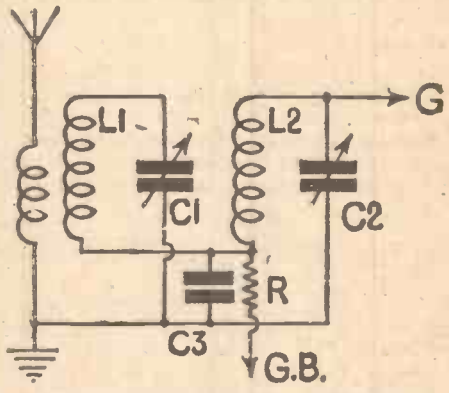


Fig. 3. A simple condenser-coupled filter circuit

the switches of the pair of coils are ganged, the arrangement is very simple.

Condenser C3 is the coupling component. It is joined between both coils and earth, and therefore the circuit of both coils is completed through the condenser. Any voltage variations occurring across the condenser C3 are therefore applied to both tuned circuits. The resistance R plays no part in the coupling of the circuits, but is

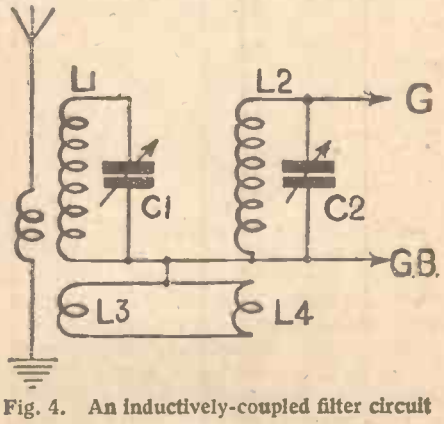


Fig. 4. An inductively-coupled filter circuit

a necessary accessory in order that the grid circuit of the valve joined to the filter shall have a complete direct-current path.

Now the condenser C3 has an impedance which varies with frequency. A non-inductive type is recommended, but it is

(Continued at foot of next page)

DESIGNERS OF FAMOUS "A.W." SETS

(1) J. H. REYNER, B.Sc., A.M.I.E.E.

MR. J. H. REYNER, our popular Technical Editor (usually known as Jimmy) started his electrical career at the age of six, when he puzzled out the manner in which a common flash-lamp worked. Mere theory, however, would not do, so he trotted into the dining-room where the table was laid for lunch, collected all the spoons and forks in sight and constructed an electric circuit with the lamp at one end and the battery at the other. The lamp lit!

He was able to follow his bent in earnest in 1917 when he won a scholarship at the City and Guilds Engineering College. He passed through the course with flying colours, obtaining his A.C.G.I. and B.Sc. (Hons.), the Henrici Medal for Mathematics, and a John Samuel Scholarship which enabled him to spend a further year on research work. He was fortunate here in coming under the influence of Professor Howe, to whom he always pays high tribute for the excellent grounding he obtained.

P.O. Training

After leaving college, Mr. Reyner joined the Post Office Engineering Dept. The Radio Section in those days was small but active, and the experience gained was invaluable. He was concerned with the design of receiving equipment to meet the widely differing conditions encountered at the various stations. The direction-finding service of the Post Office was just being developed and he spent some time on the equipment and calibration of the earlier stations at Niton and Cullercoats.

In 1925, being by this time an Associate Member of the Institution of Electrical Engineers and a Member of the Institute of Radio Engineers, he joined the staff of the Radio Press Laboratories and directed his energies to the design of broadcast equipment for the benefit of the home-constructor. During this period he produced a number of outstanding designs and indeed can be said to have put receiver design on a scientific and calculable basis by the introduction of the now universal screened coils. As a result of this it became practicable to tune a number of circuits together and in 1926 he evolved the famous Solodyne receiver, the first gang-controlled set for the home-constructor.

In 1927 Mr. Reyner decided to carry out receiver research for the Radio Industry in general and founded the Furzehill Laboratories, now the finest independent radio laboratories in the country. At the same time, he retained an active contact with the home-constructor by joining the staff of AMATEUR WIRELESS and *Wireless Magazine* as Technical Editor, and during the past six years it has been his ambition to ensure, in co-operation with the rest of the staff, a standard of technical achievement second to none. There can be little doubt but that he has succeeded.

J. H. Reyner, B.Sc., A.C.G.I., D.I.C., A.M.I.E.E., M.Inst.R.E. The well-known designer of many famous "A.W." receivers

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"SOME NOTES ON BAND-PASS TUNING"

(*Continued from preceding page*)

correct to refer to impedance, as even the best of condensers have a little resistance and inductance. At high frequencies the impedance is less than at the lower frequencies, and the result is that the coupling is weakest at the high-frequency end of the tuning range. Hence, the selectivity of the arrangement varies with the tuning.

Naturally, the selectivity of the coils alone when tuned varies with frequency, but owing to the fact that the coupling is fixed with this type of circuit, it is often very noticeable that the selectivity is greater at the low-wavelength end of the tuning range. At the same time the efficiency of the arrangement falls off at the low-wavelength end of the tuning.

Double-humping

These characteristics are roughly opposite to those of a normal tuning circuit, and so this type of filter usually performs satisfactorily when followed by other stages having plain tuning circuits.

A point worth noting is that if the capacity of the coupling condenser is reduced to broaden the tuning and to increase the efficiency of the low-wavelength end of the tuning range, the chances are that bad double-humped tuning will be obtained at the long-wavelength end. The size of the condenser is chosen to avoid this effect, and the actual capacity needed for the best all-round results depends upon the characteristics of the coils as well as the range of frequencies to be covered.

An inductively-coupled filter has different characteristics. A circuit is shown by Fig. 4, coils L1 and L2 being shielded as a rule, and tuning condensers C1 and C2 ganged. The coupling is effected by the small coils L3 and L4.

This type of circuit is relatively more selective at the long-wavelength end of the tuning range than at the short-wave end. It is not as widely used as the capacity-coupled arrangement, but its characteristics should be considered with those of the rest of the receiver.

A switch can be used, and be ganged with the wave-change switches of the tuning coils, to alter the coupling when going from one wavelength band to another. This is usually done, as a matter of fact, but in the condenser-coupled arrangement a single condenser is generally used for the two wavebands.

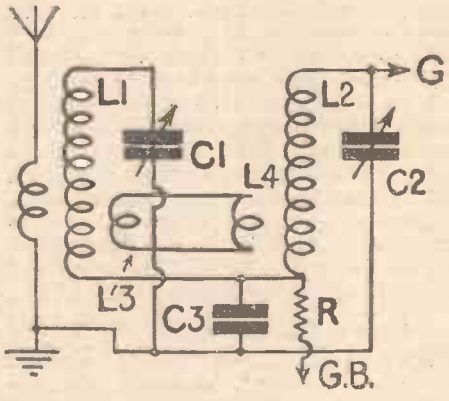


Fig. 5. A mixed filter circuit combining capacitative and inductive coupling

The size of the coupling coils and their positions with regard to the main tuning coils must be fixed in order to provide the best average results over the whole wave-range. If care is not taken, the coupling will be too tight at one end of the tuning range, giving double-hump tuning; if too loose it will result in loss of signal strength.

As might be expected, a combination of capacitative and inductive coupling has advantages, and the wired filter, as shown by Fig. 5, is sometimes used. It is necessary that the coupling coils L3 and L4 be correctly connected or the wrong results will be obtained. The coupling condenser is C3 as before, and R is the resistance of 1,000 ohms through which grid bias is applied to the first valve.

The selectivity of this arrangement is relatively much more nearly constant than that of the capacitative or inductive filters, and it is possible to get a good tuning curve over a large part of the tuning range.

In practice the effective resistance of the circuits may vary owing to the action of the valve connected to the output of the filter. If care is not taken the first stage may practically oscillate, and this is bound to make the selectivity different from when the stage is a long way off the oscillating point. But still, the results in practice are on the whole satisfactory, and filter circuits are nowadays much used.

The first of a new series of talks, entitled "Wales from Without," will be given by Mr. Gareth Jones from the Western Region on January 18, when he will look at Wales from Moscow.

The Annual Inter-University Debate will be held this year at the Powis Hall, University College of North Wales, Bangor, on January 18, and a relay will be taken by the Western Region.

The third talk in the series entitled: "Western Week-end" will be given by Mr. George Childs for the Western Region on January 21.

The second of the "Scrapbooks," compiled by Leslie Baily, is to be opened on January 7. North Regional listeners will hear this programme.

OUR BROADCAST CRITIC ON XMAS BROADCASTING

Joseph Muscant, the director of the Commodore Orchestra

IT was assuredly one of the greatest thrills in the history of broadcasting that the voice of the King should have been heard beyond the seas, and from one end to the other of the British Empire. A simple, kindly message of greeting and goodwill, the King's words came as a fine climax to an hour of wonderment—for a girdle had been cast about the earth. Millions of people must have heard the exchange of greetings in that hour. The Atlantic was spanned as though it were a mere duck-pond; Burma, Malaya, North Borneo, were reached with ease; the Islands of the Pacific; the Antipodes (though late in their night) even visitors to Bethlehem heard Christmas greetings from England. What an age we live in!

◆ ◆ ◆

The Christmas broadcasting, from the entertainment point of view, was poor stuff this year on the whole. Looking at the programmes from the popular standpoint I feel that the loss of a good vaudeville on Boxing Night was a severe loss. Last year (and the year before) "all-star" vaudevilles were broadcast. There is no doubt whatever that a good vaudeville, with the best people "doing their stuff," offers one of the best possible forms of entertainment for a night on which perhaps more people are inclined to listen than on any other in the year. Variety, surely, must be the watchword on such a night?

Instead, the B.B.C. gave us a pantomime. It seemed to me—perhaps I had better confess I started out with misgivings—that the choice was not wise. Ernest Longstaffe's productions have never appealed to me, simply because they do not appear to me to be really funny. I was not a bit surprised when lines such as "between you and me and the workhouse, I mean the gatepost" came over. Of course, Leonard Henry was funny. If, on the other hand, some of "Uncle Leonard's" best lines were Ernest Longstaffe's and not his own, I apologise at once.

At all events, there were *some* good lines. I liked that of the giant (well played and sung by Foster Richardson) where he addressed the hen that laid the golden eggs. After collecting three he told her to sit there and *think out the next egg*.

Yes; there were moments of amusement in this show. On the other hand, I am sure it is a just criticism to suggest that the majority of it was babyish and more suitable for the Children's Hour than for evening broadcasting. It was down again for the Tuesday evening—instead of a vaudeville or some such entertainment.

◆ ◆ ◆

Owing to the production of *Mozart* my listening week has been interrupted, but I have managed to find some items of interest here and there. I cannot say that the St. Hilary Nativity Play was one of them, all the same. There must be something wrong with me over these plays. Everyone tells me how marvellous they are.

◆ ◆ ◆

I noted with satisfaction that the Foundations of Music for the week preceding Christmas were devoted to Mozart's Quintets. Had "Papa" Haydn heard them, he would have agreed that they were amongst the foundations of music; he was a great admirer of all Mozart's chamber music. I could not help thinking that neither Mozart nor Haydn ever heard them played so beautifully as they were this week (Catterall Quartet and Anne Wolfe).

PROGRAMME POINTERS

More than once recently I have been asked how I manage to keep up this weekly criticism "because the programmes are so appalling." That, of course, is a common type of comment and one that hardly merits discussion. I have tried to discover the cause of the discontent—a difficult task. The only conclusion I have arrived at (thus far) is that what I have so often referred to as "routine-work" is responsible for some of the dissatisfaction. People's quartets, quintets, sextets, and the like. The indefinite side of broadcasting. It is, indeed, difficult to see how the long hours can be filled unless these admirable and hard-working musicians are employed, but there may be something in the fact that small orchestras, with their café type of music, are too much in evidence. It is impossible to please everybody (or even "half-everybody"), but it seems to me that certain weekly programmes have contained few—very few—outstanding broadcasts. As broadcasting goes on I am afraid there will be a greater strain still upon the Productions Department. The call will be increasingly for more outstanding productions and less routine-work. Foreign broadcasting is very different in type. Either broadcasting does not enter the life of the nations abroad as it does here, or people over there do not mind café music for five hours at a time. In England there is increasing interest in broadcasting, and with it a cry for more "productions."

I listened for some time to the organ in St. Mark's, North Audley Street. I shall be very glad when the organ at Broadcasting House is finished. These church organs do not reproduce as they should. That in St. Mark's is a failure in my opinion. The player, Master Ivor Keys—what an excellent name for an organist!—chose rather a severe programme. He is, I understand, thirteen. Perhaps when he is, say, three thirteens, he will have learned to make up more attractive programmes.

◆ ◆ ◆

There was some amazingly good singing in the relay of the first act of Weber's *Der Freischutz* from the Municipal Opera House, Berlin. I was particularly struck with Hans Fidesser's voice. He played Max.

◆ ◆ ◆

One of the best operatic voices I have heard recently was that of Eileen Hannevig who sang Isolda's "Liebestod" (*Tristan*) in a manner in which I have not heard it sung before. I was very much impressed. The item preceding this interested me also. It was an overture called "Kentish Downs," by Susan Spain-Dunk.

◆ ◆ ◆

These B.B.C. concerts of contemporary music—the title sounds quite charming—are a snare and a delusion. They have thus far proved to be very much on the hyper-modern side. All the same, I must say I enjoyed the singing of the six Polish Folk-songs (Szymanovsky) by the Wireless Chorus. My heart failed me over those piano pieces of Schönberg. Schönberg makes me hate the piano I have loved since I can remember; he makes me loathe music for hours after I have heard him. Miss Kraus is, I am sure, a charming pianist, but I must ask her forgiveness if I say that even she could not win me to those dreadful piano pieces.

◆ ◆ ◆

It was a good idea to give a relay of *The Yeomen of the Guard* on Christmas Eve. You must have a Gilbert and Sullivan mind to enjoy any of those operas, but as there are thousands of listeners who have the required mind, I imagine the broadcast will bring in a heavy and appreciative post to Broadcasting House.

◆ ◆ ◆

I rather enjoyed listening to Monsieur Nikita Balieff as *compère* to his show called *La Chauve-Souris*. I liked what he called "Gipsy Sonks" very much. M. Balieff reminded me of a Russian lawyer whom I once knew, in that he had plenty of humour and did not mind risking some of it in a language with which he was only partly familiar.

WHITAKER-WILSON.

Alternative Programmes by the Flick of a Switch!

THE HOME-STA

A NO-TROUBLE RECEIVER—NO TU

HERE'S a new set which simply bristles with novelties.

This is its specification. It is a two-valve set, working from alternating-current mains. It is amazingly compact, as you can see from the photographs.

It is entirely self-contained, and although the whole set fits into a cabinet of the usual speaker cabinet size, **it comprises receiver, mains unit and moving-coil speaker.**

The set needs no batteries at all, all the power for high-tension, low-tension and grid bias being derived from the mains. There is pentode output so that, in conjunction with the moving-coil speaker, excellent quality is assured.

A very novel feature of the set is its pre-set tuning. There is a switch on the panel which is clicked one way for one local station, and over the other way for the alternative programme. There is no knob-twiddling to be done! Two small solid-dielectric condensers are pre-set tuned when the set is first built, and it can then be worked by the least technical member of the family.

There is an on-off switch on the panel, and also a reaction control which acts as a control of volume on local stations.

It is also possible to have normal condenser tuning fitted in this set, and next week a straightforward tuning system will be described so that the set can be used if necessary for more than just the local stations.

Owing to the type of tuning coil used, the set is very selective no matter whether it is used with the pre-set or normal tuning. There is an effective detector stage, and the fact that the set is mains-operated means that plenty of "punch" is given by each valve stage.

HOW IT IS BUILT

The photographs show you how straightforward the set is. The receiver unit is on the baseboard, the mains unit above, and the moving-coil is on the front panel. The cabinet fits over the whole set.

Each of these three sections can be seen from the photographs, and from the wiring plan reproduced on page 20. Make a note of the fact that there is a full-size blueprint giving details of the receiver, mains unit and speaker mounting. This can be obtained (price 1s., post free) from the Blueprint Department, AMATEUR WIRELESS, 58-61 Fetter Lane, E.C.4. You will be well advised to work from the full-size print, as it will help you with the small amount of woodwork which has to be done, and with the component mounting and wiring.

PARTS YOU WILL NEED

This set is built with good parts, and although the cost is low, the specification has not been cut down to a price. The table on the next page shows you the parts that have been used in building the original receiver, and the alternatives are components which it is possible to use if the first-mentioned parts are not available.

As the set is compact, you should take care when choosing alternatives to see that the parts will fit in. The baseboard and mains unit board are not too cramped, but in view of the compact design there is naturally no space wasted. Some care in choosing your parts is needed, therefore.

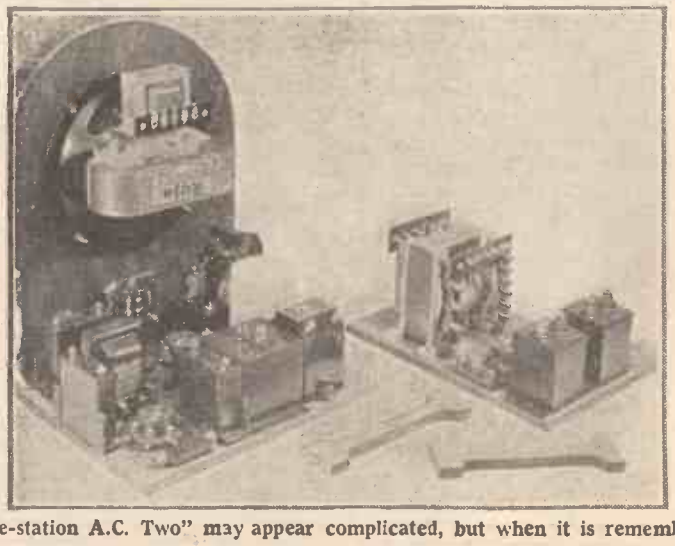
STARTING THE CONSTRUCTION

Various constructional stages are shown by the photographs.

The five photographs below show some of these stages, and much of the other constructional work is explained by the blueprint, in which the various sections of the receiver are shown separate.

The photographs on this page give a good idea of the "Home-Station A.C. Two" in its various constructional stages.

On the left, the cabinet front is seen fixed to the baseboard, and some of the



As a complete receiver the "Home-station A.C. Two" may appear complicated, but when it is remembered that mains apparatus an

Here is an entirely novel two-valve receiver, designed by John B. Crofts, which is entirely self-contained, has pentode output and a moving-coil speaker, and which is fitted with a pre-set tuning device enabling a choice of stations to be obtained at the flick of a switch

ATION A.C. TWO

UNING, NO BATTERY CHARGING

baseboard parts are mounted. For this job, as will be explained later, the blueprint is invaluable as a mounting template.

Before the front was attached to the base, the switches and condenser were mounted on it.

As you can see from this photograph, the dual condensers are already fixed to their supporting bracket on the right of the set, looking from the back.

SIMPLE ASSEMBLY

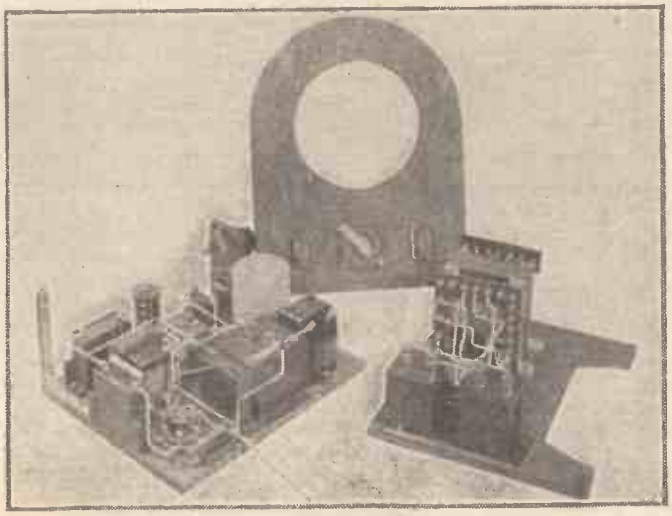
In the next photograph you see that the baseboard mounting is complete, the speaker has been fixed to the set front, and the few components have been screwed down to the sub-baseboard which forms the mains unit.

At this stage no wiring is done.

If you are in doubt about the baseboard layout, the centre photograph on this page will help. Here the main components are screwed down, and everything is ready for the wiring. As you can see, stand-up type condensers and similar parts are used, with the terminals at the top where possible. This makes the wiring very easy.

In the next photograph there is another view of the three main sections—baseboard, set front and mains unit board. Here the set front has been removed temporarily after the component mounting so that some of the wiring can be more easily carried out. This is a tip you may find helpful. By the way, note the U-shape piece cut out of the mains unit board so that it will not foul the speaker when it is screwed to the front.

The mains transformer wiring has been started, as you can see from this view. This may look complicated, but actually it is very simple if you only follow the blueprint, on which all the terminal indications are given.



The extreme right-hand photograph shows the designer examining a complete "Home-Station A.C. Two," all ready to be put into its cabinet after a first test.

You have no need to worry when building this receiver, for in spite of its compactness and neat layout, it is really very simple. There is no metal in its construction, for all the necessary shielding is provided by the components themselves. The woodwork, which is very easy, is the only job which may take a little time. But as plywood is used, and as all the dimensions are given on the blueprint, there is no difficulty about this part of the constructional work.

In fact, when the baseboard, set front and mains unit board have been cut, the set is half built!

THE WOODWORK

You will see that the woodwork is the first job to tackle. The baseboards for the set and mains unit must be cut, together with the wooden front of the set in which there is a large hole for the speaker. This wooden front fixes to the set baseboard by means of brackets to strengthen it, while the mains unit is supported above on wooden feet, allowing just sufficient clearance in which to fit and remove the set's valves.

The various dimensions for the woodwork can be gauged from the blueprint, which you will be well advised to follow as closely as possible.

There is a little drilling to be done on the set front for the reaction condenser and the two switches.

An inset drawing on the blueprint gives the details and dimensions of the special cabinet which encloses the whole set. This can be bought ready-made or it can be made out of plywood and one or two other pieces of wood.

All other woodwork dimensions are given on the blueprint and wiring diagram, and it cannot be too strongly emphasised that you should use good quality plywood of the thickness specified in each case.

It is a great mistake to use too thin wood for the set front or baseboards, or to use wood which is warped.

d speaker are included, it will be appreciated that the construction is quite straightforward as these sectionalised photographs show

A RECEIVER THAT WILL GIVE YOU ALTERNATIVE PROGRAMMES BY THE FLICK OF A SWITCH

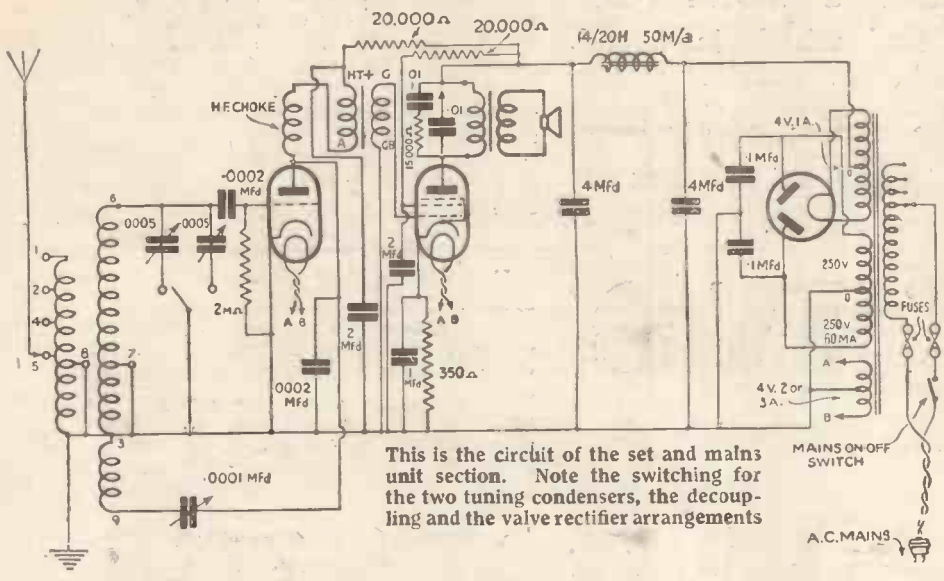
(Continued from preceding page)

MOUNTING THE PARTS

As you can see from the photographs, there is a reaction condenser and a couple of switches to mount on the front of the set. When you have fixed the set front at right angles to the baseboard, using the panel bracket to act as an additional support, mount this condenser and the two switches and then you can carry on with the mounting of the twin tuning condensers on the little bracket at the side.

as shown to clear the speaker. As a valve rectifier type of mains unit is used in this set the construction is very easy. The major components consist only of a power transformer, the valve holder and smoothing condenser.

Plywood legs should be cut to shape as shown, so that when the parts have been mounted on the mains unit baseboard, this can be fixed into position above the receiver section.



This is the circuit of the set and mains unit section. Note the switching for the two tuning condensers, the decoupling and the valve rectifier arrangements

order, you will have no difficulty in getting all leads into position.

Each wire on the blueprint should be ticked off as its actual counterpart is put into position in the set.

This is rather essential with this particular receiver, as we cannot do all the wiring at once. The receiver section must be wired first and then the mains unit. The speaker must be wired up, and finally the mains unit must be mounted above the set and wired to it.

The blueprint shows you that some of the wires are of the rigid variety, while there are also flexes in part of the circuit.

The idea of this is that the rigid wire system is used to connect up the main components on both the mains unit and receiver, while flexes are used between these two sections of the set, so that it is an easy matter to assemble and alter, and there is no difficulty about taking the mains unit out of the set if any adjustment to either section is later needed.

A stout flex lead should be attached to the fuse block on the top of the mains unit baseboard, as this must connect with the nearest lighting or power plug.

Complete the rigid wiring as far as possible, but do not twist the flex leads together until you have done as much as possible of the wiring. Do not get these flex leads muddled. You can stick paper tags on the leads temporarily, while completing the wiring, if you want to avoid any possibility of connecting up the flex leads incorrectly.

THE COMPLETE SET OF PARTS YOU WILL NEED TO BUILD THE "HOME-STATION A.C. TWO"

COILS
1—Colvern, type TD, screened aerial, with reaction.

CHOKES, HIGH-FREQUENCY
1—Peto-Scott (or Lissen, Telsen, Wearite, Varley, Igranic, Ready Radio, Goltone).

CHOKES, LOW-FREQUENCY
1—Varley "Nichoke II" (or Lewcos, Wearite, Bulgin, R.I.).

CONDENSERS, FIXED
2—T.C.C. .0002-mfd., type 34 (or Dubilier, Lissen, Telsen, Graham Farish, Formo, Goltone, Sovereign).
1—T.C.C. .01-mfd. type 34 (or Dubilier, Lissen, Telsen, Graham Farish, Formo, Ormond Sovereign).
1—Dubilier .01-mfd., type 670 (or T.C.C., Formo, Ormond, Graham Farish).
1—Dubilier .2-mfd. centre-tapped, type BE256, 1,000-volt A.C. test (or T.C.C.).
1—Telsen 1-mfd. (500-volt D.C. test) (or Lissen Dubilier, T.C.C., Ferranti)
2—Telsen 2-mfd. (500-volt D.C. test) (or Lissen, Dubilier T.C.C., Ferranti).
2—Dubilier 2-mfd., type LSB (800-volt D.C. test) (or T.C.C., Ferranti, Telsen).
1—Dubilier 4-mfd., type LSB (800-volt D.C. test) (or T.C.C., Ferranti).

CONDENSERS, VARIABLE
2—Lissen .0005-mfd. solid dielectric (or Telsen, Polar, Ormond, Lotus, Graham Farish).
1—Graham Farish .0001-mfd. reaction (or Telsen, Polar, Lotus, Ormond).

FUSE
1—Belling Lee baseboard-mounting twin type (or Bulgin).

HOLDERS, VALVE
2—Telsen five-pin, and one four-pin (or Lissen, Lotus, W.B., Igranic, Benjamin, Bulgin, Ready Radio).

RESISTANCES, FIXED
1—Erie 350-ohm (or Dubilier, Goltone).
1—Erie 15,000-ohm (or Dubilier, Goltone).
2—Erie 20,000-ohm (or Dubilier, Goltone).
1—Erie 2-megohm (or Dubilier, Goltone).

SWITCHES
1—Bulgin single-pole change-over type S81.
1—Bulgin single-pole on-off type S80 (or Claude Lyons, Igranic, Ormond, Utility).

SUNDRIES
1—Two-pin mains plug.
Glazite connecting wire.
2—Telsen terminal blocks.
4 yards thin Lewcoflex.
Single Bulgin panel bracket.
Length of mains flex.

TRANSFORMER, LOW-FREQUENCY
1—Lissen "Hypernik" (or Lewcos, Lotus, Telsen, Slektun, R.I., Igranic, Ferranti).

TRANSFORMER, MAINS
1—Igranic with 250-0-250-volt 60-m/a 4-volt 1-amp. and 4-volt 2- or 3-amp. secondary winding (or Wearite, Varley, Heayberd).

ACCESSORIES

CABINET
1—(Direct Radio), complete with panel, baseboards and supports.

LOUD-SPEAKER
1—Rola, type F5PMP, permanent-magnet with pentode matching transformer.

Now the rest of the baseboard components, valve holders, transformer, tuning coil, condensers and so on, can be screwed down.

Don't guess at the positions, for there is no space wasted in the design.

The speaker can now be mounted. It should be screwed to the front with the transformer uppermost, so that the terminals of the tapped transformer are accessible, and so that the transformer itself will not foul the mains unit.

The next job is to mount the mains unit components on the second baseboard, a part having been cut away in this board

At this stage you will have all the components mounted on the receiver and mains unit baseboard, and the speaker is fixed in position.

THE WIRING

Wiring is the next job to be tackled.

In this case it is easy but demands care. One wrong connection will be sufficient to prevent the set working properly, and may cause trouble in the way of short circuits. However, if you pay due regard to the blueprint, there is no reason why you should make even one wrong connection.

All the leads on the blueprint are numbered. If you follow this numerical

Now when the wiring is finished, the set can be given a brief try-out before putting in the cabinet and pre-setting the tuning.

In next week's issue some helpful hints will be given in connection with the first tests and operation of this novel set, and details will also be given of the way in which a different type of tuning system can be fitted so that the receiver can be used without the two-way switch pre-set device.

Don't forget that you can see the "Home Station A.C. Two" in the Somerset Street windows of Messrs. Selfridge & Co., Ltd., London, W.

NEXT WEEK: THE "HOME-STATION A.C. TWO" WITH NORMAL TUNING

OUR LISTENING POST

By JAY COOTE

UP to the present very little has been said with regard to the mysterious workings of the delegates at the Madrid Convention, and the results of its decisions will only make themselves felt after the next meeting of the U.I.R., which is to take place in June next. Whatever direct gain has been made by broadcasting appears to be limited to a few wavelengths which can be added to the band and which, although rated as an extra allowance, at first sight do not appear to afford sufficient channels for the new transmitters which are either in course of construction or contemplated. On the other hand, a tangible fact is found in the latitude allowed to European countries in respect of power.

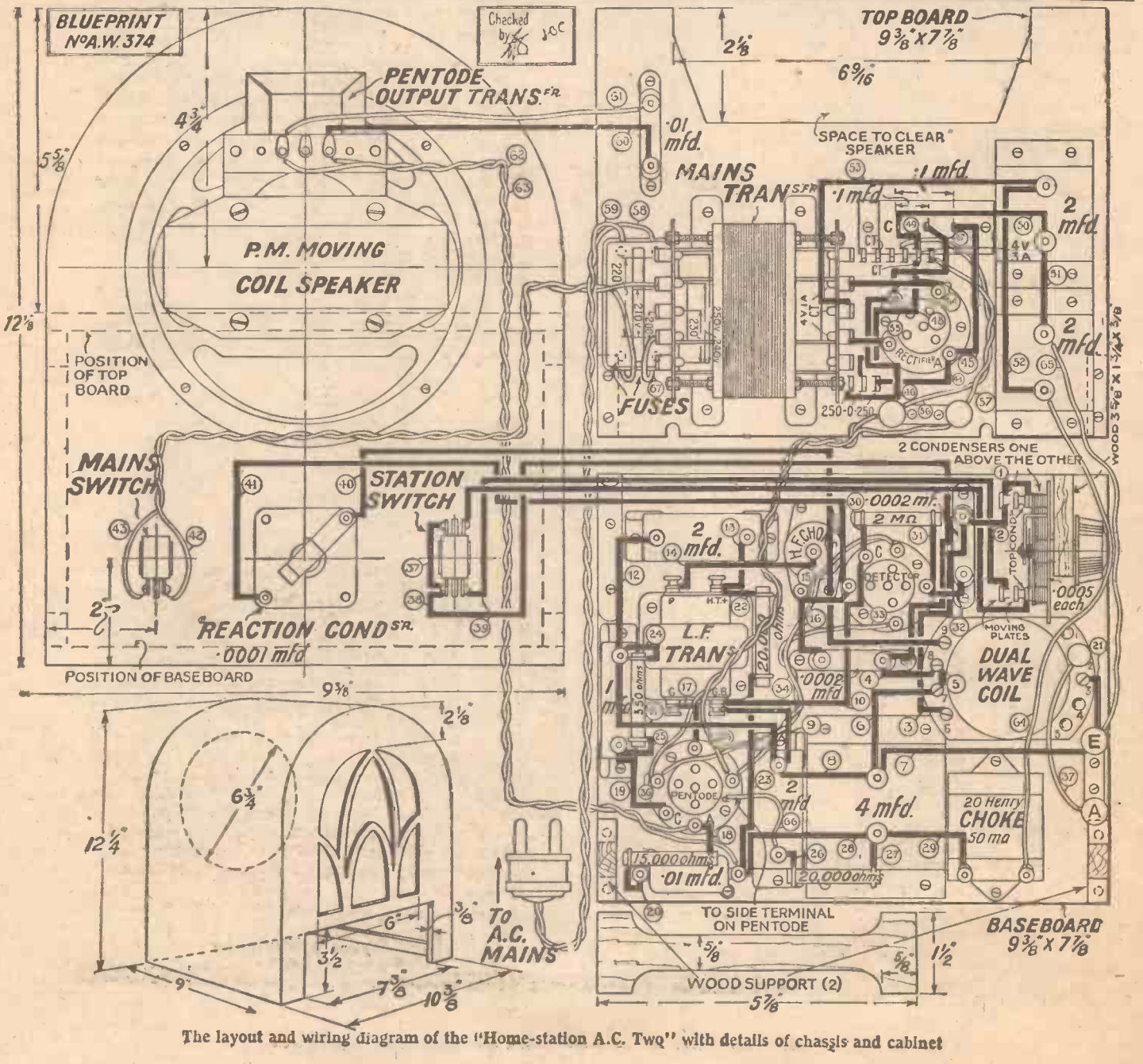
On wavelengths up to 1,000 metres permission is granted to use as much as 100 kilowatts and for stations working on wavelengths above 1,000 metres, 150 kilowatts. Certain exceptions have been made in regard to the higher power allowed to such stations as Prague, Vienna, Budapest, Toulouse, Rennes, and Leipzig, which are in the medium broadcasting band.

The fact that European countries may now transmit with more energy will most certainly influence decisions in regard to new transmitters which they propose to erect and also those which are to replace existing stations. As to the *immediate result* of Madrid, I learn that during 1933, both Brussels No. 1 and No. 2 will be increased to 75 kilowatts! The reason given, in particular with regard to the former transmitter, is that it has to compete in power with Vienna and Florence, which are operating on neighbouring wavelengths!

The coming year will also see bigger stations to replace those at Belgrade, Zagreb, Hamburg, Berlin, Lille, Budapest, and Bucharest, as well as newcomers at Sofia, Lisbon, and elsewhere; so it seems that to fit these into even a new waveplan will prove a pretty hefty problem.

If you have listened recently to the broadcasts from Leningrad and Moscow, you must have noticed how in the course of a few weeks their character has changed, inasmuch as there are fewer talks and much more music in the programmes. In particular, Leningrad gives us now on most weekdays, excellent orchestral concerts with remarkably good singers as soloists. On 835 metres the transmissions are also less subject to morse interference than on the old wavelength. Moscow (T.U.) is equally well worth a visit from time to time. Personally, when I wish to listen to its broadcasts, invariably I tune in on 50 metres, as through this channel they can be better received. You will find it quite clear of the Daventry Empire transmission, although at times—and that for a short period only—you may get a background from the Vatican.

"THE HOME-STATION A.C. TWO"—CONSTRUCTIONAL DETAILS ARE GIVEN ON PAGES 16-18



The layout and wiring diagram of the "Home-station A.C. Two" with details of chassis and cabinet

What Our Readers Think

The Editor does not necessarily agree with the views expressed by readers and does not accept responsibility for the letters published. Letters cannot be published which do not bear the sender's full name and address

Selectivity and the Aerial Tapping

SIR,—A recent edition of AMATEUR WIRELESS contained an important contribution by Mr. J. H. Reyner on the question of selectivity as affected by the aerial tapping, the conclusion being reached as a result of certain experiments, that "where no reaction is applied to the aerial circuit, as is usually the case in a high-frequency stage, tapping down the coil does not make any great improvement in the selectivity."

I submit, however, that this conclusion, although based upon actually measured quantities, is not a sound one upon which to base receiver design—a view obviously held by radio designers, in view of the universal adoption, in commercial receivers, of the practice referred to.

The reasons upon which this submission is based are as follows :—

1. *Removal of parallel aerial capacity.*

This permits of the use of a larger tuning inductance, with a correspondingly increased L/C ratio and therefore superior real selectivity.

2. *Avoidance of overloading.*

Unless a variable-mu valve is employed, the H.F. valve is frequently overloaded when the input is a maximum, i.e., with aerial connected directly to the grid. In such cases tapping down has a twofold effect, both effects having a bearing on the selectivity question :

(*a*) Cross-modulation is reduced or eliminated with a consequent improvement in apparent selectivity.

(*b*) The removal of aerial damping with no loss of volume (as the H.F. valve was being overloaded beforehand) results in an increased real selectivity especially noticeable when receiving high-strength transmitters.

3. *Reaction.*

Mr. Reyner's article showed most strikingly the different results obtained when using a single-valve circuit with and without reaction.

The remainder of his article assumed similarity between his reactionless circuit and that of a practical H.F. amplifier, how such a circuit would be followed by further efficient tuned stage(s), into one of which reaction would probably be introduced; and the aerial stage of such an amplifier is not so reactionless as some supporters of the S.G. valve would have us believe. For support of this statement I refer to the many receivers recently designed which, while technically reactionless, nevertheless oscillate freely when the volume control is at maximum.

Please do not take this to be an attack on the S.G. valve—it is merely a suggestion that a practical aerial stage probably resembles the experimental circuit *with* reaction rather more closely than it resembles the reactionless one.

4. *Ganging.*

A low aerial tapping enables the various parallel capacities to be adjusted with more accuracy than otherwise possible. This does not, strictly speaking, affect selectivity, but does facilitate the design of a selective ganged receiver.

5. *Conclusion.*

Whatever its theoretical deficiencies, the practice of "tapping down the aerial" is a practical and fairly effective means of improving selectivity in receivers incorporating H.F. stages.

May I add, Sir, that this conclusion is not without support. In common, I suspect, with many other amateurs, I have found this practice a most successful one, and invariably resort to its application when Mühlacker & Co. are more than usually troublesome.

J. B. W. (Reading).

The Chimes from Hilversum

SIR,—I was particularly interested in Thermion's paragraph in "A.W." for December 17, regarding "Big Ben." I am surprised to read that he was somewhat mystified at hearing chimes from Hilversum which are almost identical with those of our own "Big Ben." Surely this is not the first time these chimes have been heard by him? I have very often heard the same chimes, in fact every Sunday at 4.20 p.m., and I have always been under the impression that they emanated from either a church or hall in Amsterdam. Perhaps some other listener will clear up this "mystery." F. A. B. (Halstead).

SIR,—I have read with interest Thermion's remarks regarding "Big Ben." I heard this, and like yourself was a bit puzzled at first, but came to the conclusion that it was undoubtedly a gramophone record. I purposely listened in at 11.40 last night and again heard the same chimes, and could hear the mechanism of the clock working quite plainly.

I was also somewhat surprised to hear Hilversum close down with what sounded to me very much like the tune played from Moscow each night; it did not seem to be the usual National Anthem, although I have not heard the latter for some time.

While writing this I am listening to a gramophone concert from Radio Paris, and there is a record on "Big Ben Singing Good-Night," with the chimes from the latter. A. O. (Newcastle-on-Tyne).

The Editor invites letters from readers on all interesting radio subjects. For the most interesting letter published each week a general-purpose valve or other component to the same value will be given.

Morse Interference

SIR,—"D.M." (Glasgow) in his letter to you, complains of morse interference from ships and other stations when listening to Huizen.

This interference comes from GKU (Portishead Radio) exchanging traffic with liners crossing the Atlantic.

It is my experience that these stations are fairly selectively tuned, causing only very little interference and then only with Radio Paris and Huizen.

"D.M."—think yourself lucky you can't hear these nasty old tramps with flatly-tuned spark transmitters spreading from 350 to 1,000 metres, nasty little trawlers covering 170 to 250 metres and the gentleman with an ultra-violet ray from 250 to 400 metres.

Truly were you here, GKU would sound to you, as to me : like a nightingale, and the long waves—just heaven.

D. B. (Sunderland).

The Ideal Set

SIR,—I read with much interest the article on the ideal set in the current issue of AMATEUR WIRELESS.

Ever since it was published I have used the AMATEUR WIRELESS Plug-in Adaptor with my receiver, and regularly listen to the American and Australian short-wave broadcasting stations on the loud-speaker. This combination works exceedingly well, but I do feel it is high time you produced a set which would cover all wavelengths as easily as the present receiver covers medium and long waves.

J. G. F. (Hounslow).

SIR,—I do hope some manufacturer has read your article in to-day's AMATEUR WIRELESS. I have been waiting for over eighteen months for an all-wave receiver of simple design, but none of the so-called all-wave sets that have appeared meet my requirements.

A set with coils to be changed is most unsatisfactory. Let us have one that is as simple to operate as any standard broadcast receiver.

J. A. K. (Bude).

Lilian Keyes, John Rorke, and Brian Gaye will be the vocalists in the fourth Hurdy-Gurdy series of light entertainment for West Regional listeners, which will be given on January 17.

"50 LOUD-SPEAKER HINTS"—(Continued from page 6)

VARYING THE TAPPINGS

NEVER disconnect the speaker or change any of the input transformer tappings, while the set is working. Surge voltages may be set up by the sudden disconnection of the leads which will damage the output valve. This is particularly the case with a pentode.

ESTIMATING IMPEDANCE

EFFECTIVE impedance figures are often given by speaker manufacturers. These are generally only average figures. Most moving-iron speakers can be treated as 4,000 ohms, although inductors are generally regarded as 2,000 ohms. Suitable transformer values can be calculated from these.

CONDENSERING IT

THE old tip of fitting a condenser across the speaker terminals to cut off some of the high notes is a good one, even in these days of "quality" reproduction. Speakers with small cones often give an excess of treble, and even when fitted with a baffle they cannot be made to give even reproduction without accentuating the treble. The trouble is heightened if the output stage of the set is a pentode. A small condenser across the terminals will by-pass the high-note reproduction. The larger the condenser, the greater the cut-off.

VARYING THE CUT-OFF

THE hint that has already been given for cutting off high-note reproduction by shunting a condenser across the speaker terminals, does not permit of tone control unless the condenser value is varied. As it isn't easy to alter the values of large condensers, it is best to use a .01 or .02 condenser in series with a 25,000 ohm variable resistance. Both components are connected in series across the speaker terminals. Variation of the resistance has the same effect as varying the condenser, but is, of course, much more convenient.

MAKING IT COMPACT

A "BROADCASTING HOUSE" type baffle can always be used if there is no room for a flat baffle of sufficient area. It is estimated that a properly made box baffle with an 18-in. square front, and 10 in. deep, has the same effect as a flat baffle 4 ft. square.

REPAIRING THE DIAPHRAGMS

IF a linen diaphragm is accidentally over-tightened during construction, and bursts, it can be patched. It is not necessary to scrap it. Cut a new piece of linen, fit it over the centre, and make a good joint by sewing and covering with the "dope."

SPEAKER EXTENSIONS

IF you have a choke and condenser output circuit, with the speaker connected on the earth side, there is no need to have two wires for a speaker extension to a distant room. Take the "above earth" wire as an extension, and earth the other speaker terminal at the distant point, thus securing a return circuit.

SHIELDING THE WIRING

IF you are troubled with lead interaction in a compact console set, carry out the speaker wiring with thin lead-covered wire. It may also be an advantage to earth the outer covering of the wire.

INSULATING A SPEAKER

MOST speaker chassis are insulated so that there is no connection between the wiring and the metal chassis. A fault may develop, however, and then the high-tension supply may leak through to the metal. This means that the chassis must not touch any of the other metal parts in the set. If possible, try to find the leak. A faulty input transformer (in the case of a moving-coil speaker) may be the cause.

FROM MOVING-IRON TO MOVING COIL

YOU may find, when changing over from a moving-iron type speaker to a moving coil, that the resulting volume is not so great as with the speaker previously used. Most moving-coil speakers nowadays are sensitive, but some types are not so sensitive as the best moving-iron speakers (although having many other advantages) and on battery-driven sets, where there is not much power to spare, the difference may be noticeable. An improvement in the power stage may compensate for the slight loss in sensitivity.

ANCHOR THE CORD

ALWAYS anchor the speaker cord so that it cannot be pulled away either at the set or speaker end. The best plan, in the case of a cabinet speaker, is to tie a knot in the cord behind the speaker back so that the cord cannot be pulled through the hole.

TRANSFORMER RATTLE

VERY small transformers are sometimes fitted to the chassis of moving-coil speakers. Unless these are securely mounted there may be vibration which will be obvious on loud notes. The transformer laminations, for instance, must be firmly bolted down. If the clamping nuts work loose, the laminations will vibrate under the output stage energy, and a buzzing noise will be heard.

SETS OF THE SEASON

SIX-SIXTY CHASSISET TYPE 3-32

THIS is a battery set that definitely competes in performance with the mains-operated type. It supplies a striking answer to those who are always complaining—not without a certain amount of justification—that all the brains of the radio business are put into mains sets. Here is a battery set with more than ordinary attractions, as I hope to show.

In what ways would you say the average battery set on the market compares unfavourably with the mains type? Firstly, in the quality. I rather agree. Well, the Chassiset has a permanent-magnet moving-coil loud-speaker. It is a Celestion model, giving a very pleasing overall tone, with much more bass-note output than you get with the ordinary balanced-armature.

BRIEF SPECIFICATION:

Makers: Six Sixty Radio Co., Ltd.

Price: 10 guineas, without the batteries.

Valve Combination: Screen-grid (218SG), detector (210HL), and pentode output (220Pen), all Six Sixty types.

Power Supply: Self-contained batteries; automatic grid bias.

Type: Table-cabinet set, complete except for aerial and earth. Provision for external speaker. Moving-coil speaker inside cabinet. Pick-up terminals.

Remarks: A remarkably ingenious tuning scale distinguishes this well-designed three-valve band-pass set, which has a general performance above the average for the battery type.

Secondly, there is a feeling that the battery set lacks the "pep" of the main type. To some extent, this is inevitable, since mains valves are more sensitive than battery valves. The designers of this set have got the last ounce out of the three-valve combination. And with a high degree of sensitivity is combined really effective station separation.

An Outstanding Design

The whole set is outstanding in design, and is completely contained within a walnut-finished cabinet except for the aerial and earth. Ample space is left above the chassis for the high- and low-tension batteries, which fit snugly behind the moving-coil loud-speaker.

The combination of the valves is, of course, screen-grid detector and pentode. There are points of distinction about this particular circuit. For one thing, band-pass aerial tuning is employed, with its great advantage of selectivity.

Another outstanding feature of the circuit is the elimination of the grid-bias battery. There are no bias plugs to worry about, because automatic bias is obtained from the high-tension supply.

Quite apart from the convenience of doing away with a battery, this automatic system, which is ideal for self-contained battery-operated sets, has the technical advantage that when the high-tension battery voltage drops with age, the grid bias voltage also drops.

The system is largely self-adjusting, since as the high-tension voltage drops, so does the anode current. As this current is flowing through the bias resistances, the bias voltages developed across them, drop accordingly.

Unique Tuning

The practical interpretation of this advanced three-valve circuit also offers scope for originality. As you can see from the photograph in the heading, a large scale is fitted on the lower part of the front of the cabinet. At first sight I wondered where the pointer was fitted—in fact, I thought it must have fallen off! Then I got the idea—when the set is switched on, the pointer takes the form of a travelling beam of light. The last word in luxury tuning!

As the gang condenser is turned by the central control knob, a metal-carrying arm moves behind the scale. On pressing the knob, contact is made between a bulb carried on this arm and the low-tension supply, thus lighting up just the part of the scale the wavelength marking of which is appropriate to the tuning point.

Actually, there are two bulbs, one for the outer scale of medium wavelengths and the other for the inner scale of long wavelengths. Each scale is liberally marked with stations, in addition to wavelengths and division markings.

The value of the system lies in the fact that you see instantly where you are in the wavelength band, and this without unduly wasting current, because as soon as you have settled down on a station, you just pull the control knob slightly and the light goes out, thus stopping any extra drain on the filament battery.

In this very ingenious manner, the designers have given us a battery set that equals the best mains-operated set in so far as facility of tuning is concerned.

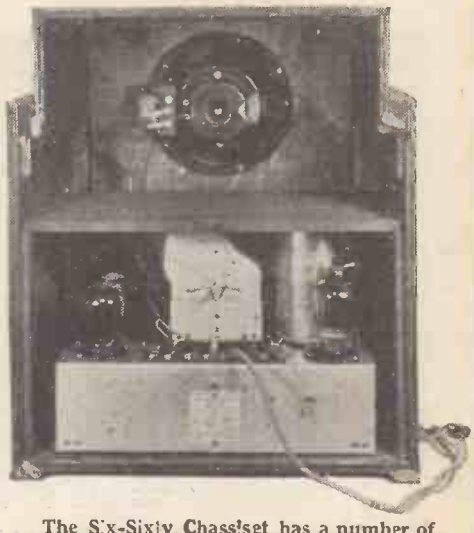
Apart from the tuning knob at the centre there are only two other knobs, the combination switch knob on the left (for medium and long waves, gramophone pick-up and "off") and the volume-cum-reaction control on the right.

Volume is increased by increasing the amplification of the screen-grid valve over the major part of this knob's rotation, and then for the last few degrees, when full amplification is being obtained from the valve, a little reaction is added, thus giving a progressive increase in volume from zero to the very maximum, of which the three valves are capable.

On test, the set worked very well, without the slightest trouble in installation. Neat terminal connections at the back of the chassis are provided for the aerial and earth and with the little trimmer nearby once set to the right aerial load position, away you go logging all the stations round the massive tuning scale.

Excellent Selectivity

The selectivity is what you would expect with a band-pass aerial input. That is to say, stations fall away completely on each side of an appreciable spread, and adjacent high-power foreigners, notably Poste Parisien and Breslau, come in without mutual interference.



The Six-Sixty Chassiset has a number of original features some of which are apparent from this photograph

The quality is quite pleasing even judged on mains-set standards, as there is an appreciable amount of bass-note output. The volume from the pentode should prove enough for most domestic requirements, but it must not be pushed to the limit if the quality is to be retained.

The sensitivity is good, and Budapest at the top of the medium-wave scale came through at exceptionally fine strength. Radio Paris was really good on the long waves, where five stations were heard at enjoyable strength. SET TESTER.

A weekly review of new components and tests of apparatus conducted by J. H. Reyner, B.Sc., A.M.I.E.E.

THE CLIX "MASTER" PLUG

THE Clix "Master" plug, although small, is a clever piece of work. It consists of a single piece of springy phosphor bronze bent double and inserted in a small split metal carrier. Connection is made by pushing a wire through the eye

This sketch shows a section of the Clix "Master" plug, showing how connection is made simply by pushing a wire through the top and screwing on the insulated cover

at the top and screwing home a small insulated cover which effects a perfectly tight yet simple contact.

The other end of the plug, being springy, makes an excellent fit in any ordinary socket. The ends are curved to facilitate easy entry, and we must say that this is one of the nicest plugs we have handled for some time.

Considering it sells at a price of 1½d. only, it is worthy of consideration.

FORMO VERNIER DIAL

WE have tested, this week, one of the Formo vernier dials. The dial is designed to mount on the condenser spindle on the front side of the panel, which saves cutting a large aperture in the panel. The casing of the dial is made of moulded bakelite and is somewhat pear-shaped in design. A small window is provided at the top behind which the scale moves. The actual scale is marked in 100 divisions and is inclined at an angle of 30 degrees, thus making the reading of the dial quite easy. The drive is of the spring-control friction type giving a reduction ratio of approximately 12-1. This drive is quite smooth in action and no back-lash at all was noticeable.

The overall dimensions of the dial are approximately 2¾ in. wide by 3½ in. round.

The dial retails at 2s. 6d. and should prove satisfactory in practice.

BRITISH RADIOPHONE SWITCH

THOSE readers who like midget switches will be interested in the new British Radiophone switch. This is a small, quick-action switch designed for single-hole mounting. The body of the switch is of bakelite on to which the front metal frame is riveted. A small faceplate is provided, indicating the "on" and "off" positions.

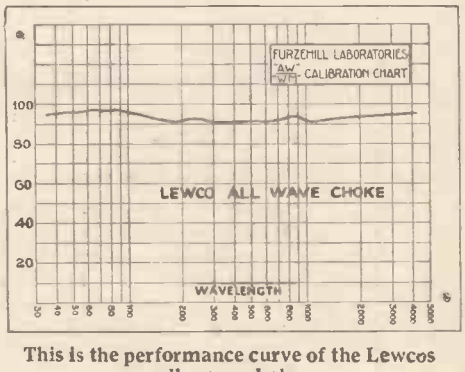
The switch is rated at 750 watts, which means that with the normal 250-volt circuit it will handle a current up to 3 amps. quite safely. We have tested the switch up to this rating and found it in every way suitable.

LEWCOS ALL-WAVE CHOKE

THE new Lewcos all-wave choke is distinctly unconventional in appearance. The choke itself consists of a 1-in. ribbed bakelite former about 2 in. long with a spaced winding of fine gauge enamelled wire distributed over its length. At the end of this is a random-wound coil in a bobbin. The two sections are connected in series and are intended to operate over different frequency bands. The random-wound coil acts as an ordinary H.F. choke, while the spaced solenoid winding operates on the short wavelengths.

The whole choke is assembled inside a standard Lewcos superheterodyne can, the connections being brought out to valve pins arranged to fit a standard socket in the ordinary way.

The performance curve of the choke is shown herewith, and it will be seen that the efficiency is between 90 and 95 per cent. over the whole range. The choking action is very even and there are no subsidiary peaks. We must confess that our experience



This is the performance curve of the Lewcos all-wave choke

in the past has not favoured the use of the two-section chokes of this type, but in this instance there is a definite, though small, improvement in the performance at the very low wavelengths due to the special construction.

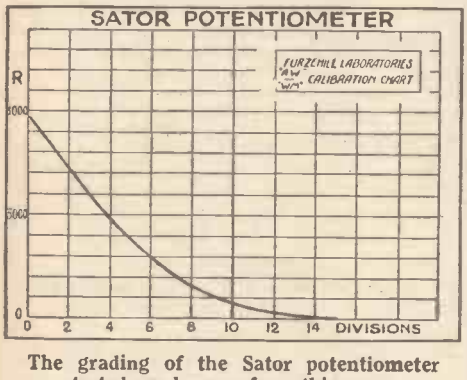
SATOR POTENTIOMETER

WE have received for test a sample of the new Sator Potentiometers. These are made on the well-known principle of a wire-wound track in contact with a resistance element. The rotor rides on the wire which therefore takes all the wear, and as the wire is only the means of making the contact with the resistance track, it can be of quite heavy gauge and therefore robust.

This is the Sator rotary potentiometer tested

The particular sample has the merit of being very flat so that it takes little space behind the panel. It occupies ¾ in. behind the panel and is 1¾ in. in diameter.

The rated resistance was 10,000 ohms, and this is graded in accordance with modern requirements so that when used for volume control the change shall be



The grading of the Sator potentiometer tested can be seen from this curve

gradual at first and progressively rapid afterwards. The actual grading will be seen from the accompanying curve.

Thomas Matthews will broadcast a violin recital on January 7, on the North Regional wavelength.

The Northern Studio Orchestra will play some old-fashioned dances on January 4.

On January 11 Mr. Charles Arning leads off a series of talks to North Regional listeners on "The Business Man Abroad."

The annual relay from the Mammoth Circus at Belle Vue, Manchester, will be be broadcast to the Northern Region on January 13.

Six centuries of village life is the title of a talk which Mr. F. W. Brooks is to give in the Northern Region on January 9. This is the first of a series dealing with the characteristics of the northern countryside in the Middle Ages and life in the medieval village.

OUR QUERY DEPARTMENT

The attention of readers is directed to the rules printed below. Replies are sent by post, only a selection of queries of general interest are printed here.

Variable-mu Volume Control

SIR,—I have a graphite-track type of volume control of 25,000 ohms and, having invested in a variable-mu valve to replace my mains-type S.G. valve, wondered whether I could use this volume control as a variable-bias resistance for the new valve. It is the proper maximum value of resistance as recommended by the manufacturers. I do not know the makers of the volume control but I believe it is of American origin.

T. S. (Sanderstead).

It is not a wise plan to use carbon-track type volume control potentiometers for variable-mu valve bias resistances. Such bias resistances must necessarily carry the combined anode and screening-grid current of the valve in whose cathode circuit they are joined. Wire-wound type potentiometers or resistances are preferable for the duty. Some British-made carbon resistances are specially designed for the job, being rated to carry as much as 15 milliamperes. It is quite safe to use these. Where the maker's name and current rating of the resistance are unknown, it is advisable to be guided by caution rather than by thoughts of economy.

Working the "Wizard" from a Mains Unit

SIR,—Since making up the "Wizard" three-valver I have had extremely satisfactory results. Lately, however, I have invested in a mains H.T. unit and trouble has started. I experience motor-boating, when reaction is brought up to increase signal strength, and the whole set seems inclined to be unstable. Meanwhile, I have reverted to batteries, but I would much rather employ the mains unit as the supply is more constant. Can you suggest what may be causing the trouble and how it may be avoided. W. P. (Kent).

Only two H.T. terminal points are provided on this receiver, one being the screening-grid supply and the other the anode supply to all valves. Apparently, your mains-unit power-output terminal does not supply sufficient current at its maximum voltage terminal to feed the anodes of three valves. We therefore suggest that you alter the wiring of your set so as to apply a separate H.T. voltage to the detector valve. This is best accomplished by disconnecting wire No. 38 from the positive L.S. terminal on the receiver and taking it to another terminal on the receiver to be labelled H.T.—3. The H.T. terminal connections from the receiver to mains unit will then be: Positive 1 to the S.G. terminal, Positive 2 to the maximum positive in the mains unit, and Positive 3 to the intermediate positive terminal on the mains unit.

Metallised Valves and Earthing

SIR,—The increased popularity of metallised valves makes it necessary for modern receivers to be designed with the filament wiring to the valve holders, suitable for earthing the valve coating to negative L.T. I notice that this point is, apparently, often overlooked in some set designs issued by the technical press. In such sets I assume it is necessary to reverse the filament wiring so as to ensure the metallised coating being joined to negative L.T. If my assumption is correct, I should be pleased to have your verification.

R. McA. (Aberdeen).

Literally your assumption is correct but, as one terminal of the low-tension supply is invariably earthed, and as an earth circuit is always maintained whether the metal coating of a valve is joined to positive or negative L.T., it is immaterial, in practice, whether the filament wiring to a valve holder be reversed or not. The most important point to bear in mind is that relating to the wiring of a screen-grid valve holder in which is used a metallised valve. If such a valve projects through a hole in a metal screen, then the metal coating of the valve is likely to come into contact with the earthed metal screen and a direct short-circuit of the L.T. supply may result. With regard to other valves in a receiver, however, the filament terminal wiring of the valve holders is not important.

A BUMPER PARTY

THE manufacturers of Pertrix batteries and accumulators recently entertained no fewer than 730 children of their Redditch employees to a mammoth Christmas party. A fireproof cinematograph cabin was installed in the gaily-decorated works canteen in which the party was held, and after the cinema show, carols, popular tunes and presentations from a giant Christmas tree kept the kiddies happy. After the party broke up, a presentation was made to Mr. R. A. Bachman, Managing Director of Britannia Batteries, Ltd., as an appreciation of his generosity in connection with the party.

WHEN SUBMITTING QUERIES

Please write concisely, giving essential particulars. **A Fee of One Shilling** (postal order), a stamped addressed envelope, and the coupon on the last page must accompany all letters. The following points should be noted.

Not more than two questions should be sent with any one letter.

The designing of apparatus or receivers cannot be undertaken.

Modifications of a straightforward nature can be made to blueprints, but we reserve to ourselves the right to determine the extent of an alteration to come within the scope of a query. Modifications to proprietary receivers and designs published by contemporary journals cannot be undertaken.

Readers' sets and components cannot be tested at this office. Readers desiring specific information upon any problem should not ask for it to be published in a forthcoming issue, as only queries of general interest are published and these only at our discretion. Queries cannot be answered by telephone or personally.

Readers ordering blueprints and requiring technical information in addition, should address a separate letter to the Query Department and conform with the rules.

GET THESE CATALOGUES *FREE*

Here "Observer" reviews the latest booklets and folders issued by well-known manufacturers. If you want copies of any or all of them FREE OF CHARGE, just send a postcard giving the index numbers of the catalogues required (shown at the end of each paragraph) to "Postcard Radio Literature," "AMATEUR WIRELESS," 58/61, Fetter Lane, E.C.4. "Observer" will see that you get all the literature you desire. Please write your name and address in block letters.

The Melotone Kit

I have just received a folder which describes the Melotone speaker kit, a simple kit for making up a type of baffle which enables the best results to be obtained from any speaker capable of reproducing the bass. The complete kit includes all fixing material for treating a cabinet 18 in. by 18 in. by 9 in., while an additional kit can be obtained, complete with the cabinet ready to assemble, if you do not wish to make your own. **917**

Making it a Band-pass

Here's a folder from British Radiophone. The topic, of course, is the popular Radiopak band-pass unit. A distinctly novel idea it is, for a unit like this, added to an ordinary detector and L.F. output arrangement, results in a modern-style band-pass receiver. The folder gives you all the tuning curves, selectivity factors, and so forth. **918**

A Noise Reducer

If you are troubled with induction noises and crackles, why not try the Trix Noise Reducer, which is made to G.P.O. specification and which is suitable for any mains set. Eric J. Lever (Trix), Ltd., have sent me a description of this gadget, which you may find very helpful. **919**

Saving in Space

I am impressed by the Lissen ganged condenser tuning control unit. It consists of two .0005 mfd. variable condensers, wavechange switch for two coils, filament switch, engraved dial and moulded bakelite escutcheon, all in the one compact unit. The saving in space is notable, and the unit is nearly a complete receiver in itself! It is issued with full instructions for wiring it up to dual range coils and to typical H.F. and detector circuits. **920**

The Climax Radio Gramophone

I referred recently to the new Climax radio gramophone, model AC3. This is a small cabinet measuring only 20 in. by 16 in. by ¼ in. and yet housing a balanced band-pass three-circuit electric gramophone equipment and moving-coil speaker. There are A.C. and D.C. versions. Full details are in the Climax sets booklet.

OBSERVER. **921**

BROADCASTING STATIONS

Broadcasting Stations classified in order of wavelengths. For the purpose of better comparison the power indicated is that of the carrier wave.

Metres	Kilocycles	Station and Call Sign	Power (Kw.)
13.97	21,470	Daventry (GSH)	15.0
16.88	17,770	Daventry (GSG)	15.0
19.737	15,200	Zeesen (DJB) ...	8.0
19.82	15,140	Daventry (GSF)	15.0
25.28	11,865	Daventry (GSE)	20.0
25.4	11,810	Rome (2RO) ...	15.0
25.53	11,750	Daventry (GSD)	20.0
31.25	9,598	Lisbon (CTIAA)	2.0
31.3	9,585	Daventry (GSC)	20.0
31.31	9,580	Radio Nations ...	20.0
31.38	9,560	Zeesen (DJA) ...	8.0
31.51	9,520	Skamleback	0.5
31.55	9,510	Daventry (GSB)	20.0
32.26	9,300	Rabat	0.5
40.3	7,464	Radio Nations ...	20.0
43.75	6,865	Vitus/Paris	0.3
46.6	6,438	Moscow	12.0
48.2	6,202	Rome (tests).....	15.0
49.4	6,070	Vienna (UOR2)	2.0
49.59	6,050	Daventry (GSA)	20.0
50.0	6,000	Moscow	20.0
58	5,172	Prague	0.5
206	1,460	Antwerp	0.4
207	1,450	Plymouth(shortly)	0.12
207.3	1,447	Seraing	0.2
209.7	1,430	Magyarovar	3.0
211.3	1,420	Newcastle	1.0
214.3	1,400	Aberdeen	1.0
214.3	1,400	Warsaw (2)	1.9
215.4	1,392.5	Brussels (Conf.)	.025
217.1	1,382	Konigsberg	0.9
218	1,373	Salzburg.....	0.5
219.6	1,364.5	Binche	0.3
219.9	1,364	Beziers	0.5
224.4	1,337	Cork (6CK)	1.2
225	1,332.7	Fecamp	10.0
227.4	1,319	Flensburg	0.5
230.3	1,304	Binche	0.3
230.6	1,301	Malmo	1.2
232.2	1,293	Kiel	0.25
233.4	1,285	Lodz	2.2
236	1,270.9	Kristianssand ...	0.5
236.2	1,270	Bordeaux (S.O.)	2.0
237.8	1,260.9	Nimes	0.6
238.9	1,256	Nurnberg	2.0
240.1	1,249	Stavanger	0.5
242	1,238	Belfast	1.0
242.3	1,238	Liege (Exp.)	0.2
244.1	1,229	Basle	0.5
245.9	1,220	Berne	0.5
245.9	1,220	Cassel.....	0.25
245.9	1,220	Linz	0.5
245.9	1,220	Swansea	0.12
247.7	1,211	Trieste	10.0
249	1,205	Prague (Strasnice)	5.0
249.6	1,200	Juan-les-Pins ...	1.0
250	1,200	Radio Schaerbeek	0.3
250.4	1,198.1	Barcelona (EAJ15)	6.0
253.4	1,184	Gleiwitz.....	5.0
254.9	1,176	Toulouse (PTT)	1.0
256.7	1,168	Horby	10.0
259	1,157	Frankfurt-a-M. ...	17.0
261.6	1,147	London National	50.0
263.8	1,137	Moravska-Ostrava	11.0
265.4	1,130	Lille (PTT).....	1.3
267.1	1,123	Valencia	8.0
267.6	1,120.9	Nyiregyhaza	6.0
267.8	1,120	Bremen	0.3
269.4	1,112	Bari	20.0
270	1,112	Salonica	1.0
271.4	1,105	Rennes	1.3
271.9	1,103	Cointe-Leige.....	0.3
273.7	1,096	Turin (Torino)	7.0
276.5	1,085	Heilsberg	60.0
279.6	1,072.4	Bratislava	14.0
281	1,067	Copenhagen	0.75
282.2	1,063	Lisbon (CTIAA)	2.0
283	1,058	Innsbruck	0.5
283	1,058	Berlin (E)	0.5
283	1,058	Magdeburg	0.5
283	1,058	Stettin	0.5
284.9	1,052.8	Radio Lyons	1.0
286	1,049	Montpellier	0.8
288.5	1,040	Bournemouth ...	1.0
288.5	1,040	Plymouth	0.12
288.5	1,040	Scottish National	50.0
291	1,031	Vilpuri	13.0
293	1,022	Kosice	2.5
293.7	1,021.5	Limoges (PTT)	1.0
296.1	1,013	Hilversum	20.0
298.8	1,004	Tallin	11.0
301.5	995	North National...	50.0
304.9	984	Bordeaux (PTT)	130
307	977	Zagreb (Agram)	0.75
307.5	975.8	Falun	0.5
308.4	972.7	Vitus-Paris.....	1.0
309.9	968	Cardiff	1.0
212.8	959	Cracow	1.5
313.9	955.6	Genoa (Genova)	10.0
315	952.5	Marseilles	1.6
318.8	941	Naples (Napoli)	1.5
318.8	941	Sofia (Rodno Radio)	1.0
319.7	936	Dresden.....	0.25
321.9	932	Goteborg	10.0
325	923	Breslau	60.0
328.2	914	Poste Parisien ...	60.0
331.5	905	Milan	50.0
334.8	897	Poznan	1.9
338.2	887	Brussels (No. 2)	15.0
341.7	878	Brunn (Brno) ...	35.0
345.2	869	Strasbourg (PTT)	11.5
348.2	861.5	Leningrad (RV70)	15.0
348.6	860.5	Barcelona (EAJI)	8.0
351	854.7	Leningrad (RV70)	10.0
352.1	852	Graz	7.0
355.8	843	London Regional	50.0
357.9	838	Tiraspol	10.0
360.5	832	Muhlacker.....	60.0
363.4	825.5	Algiers (PTT) ...	16.0
365.5	820.7	Bergen	1.0
366.3	819	Fredriksstad	0.7
368.1	815	Bolzano	1.0
368.1	815	Helsinki.....	13.2
369	813	Seville (EAJ5) ...	1.5
370.4	810	Radio LL (Paris)	1.0
372.2	806	Hamburg	1.5
376.4	797	Scottish Regional	50.0
330.7	788	Lvov	16.0
385	779	Radio Toulouse	60.0
385	779	Stalino (RV26)...	10.0
388.5	772	Archangel	10.0
389.6	770	Leipzig	75.0
390	770	Archangel	10.0
394	761	Bucharest	12.0
398.9	752	Midland Regional	25.0
403	743	Sottens	25.0
408	734	Katowice	12.0
413.8	725	Athlone.....	60.0
416.4	720.5	Radio Maroc (Rabat)	6.0
419.5	715	Berlin.....	1.5
425.5	705	Madrid (Espan.)	2.0
425.5	705	Madrid (EAJ7)...	3.0
424.3	707	Moscow (RV39)	50.0
429	698	Belgrade	2.8
431	696	Parede (CTIGL)	1.5
435.4	689	Stockholm.....	55.0
441.2	680	Rome (Roma) ...	60.0
447.1	671	Paris (PTT)	7.0
449.7	667	Danzig	0.5
450	666.5	Odessa (RW37)	20.0
435.2	662	Klagenfurt.....	0.5
456.7	657	San Sebastian (EAJ8)	3.0
459.6	652.7	Beromuenster ...	60.0
465.8	644	Lyons (PTT)	1.6
472.4	635	Langenberg	60.0
480	625	North Regional...	50.0
483	621.1	Ivanovo-Vosnesensk	20.0
488.6	614	Prague 120.0	
496	604.8	Trondheim	1.2
500.8	599	Madona	35.0
501.7	598	Florence.....	20.0
508.4	590	Tartu	0.5
509	590	Brussels (No. 1)	15.0
511.8	586	Tartu	0.5
518.6	578.5	Vienna	15.0
525	572	Riga	15.0
532.9	563	Munich	60.0
557.5	537.8	Palermo.....	3.0
542	554	Sundsvall	10.0
550	545	Budapest (1).....	18.5
559.7	536	Kaiserslautern ...	1.5
559.7	536	Augsburg	0.3
559.7	536	Tampere	1.0
563	533	Wilno.....	16.0
566	530	Hanover.....	0.3
571.2	525.1	Grenoble (PTT)	2.0
574.7	522	Ljubljana	5.2
575.2	521.4	Freiburg.....	0.25
675	444	Oufa (RV22).....	10.0
678.7	442	Lausanne	0.6
720	416.6	Moscow (RV2) ...	20.0
748	401	Ostersund	0.6
759.5	395	Geneva	1.25
825	363.6	Sverdlovsk.....	36.0
835.4	359	Leningrad 110.0	
840	357.1	Budapest (2).....	3.0
848.7	353.4	Rostov (RV12) ...	20.0
882	340	Saratov (RV3) ...	20.0
937.5	320	Kharkov (RV4)...	20.0
967.9	310	Alma Ata (RV60)	10.0
1,000	300	Moscow (Old Kom.)	100.0
1,034.5	290	Kiev (RV9) 100.0	
1,071.4	280	Tiflis (RV7) 100.0	
1,071.4	280	Scheveningen-Haven	10.0
1,083	277	Oslo	60.0
1,106	271.2	Minsk (RV10) ...	35.0
1,116	268.5	Moscow (Popoff)	40.0
1,153.8	260	Kalundborg	7.5
1,168	257	Taschkent (RV11)	25.0
1,191	252	Luxemburg	5.0
1,200	250	Istanbul	5.0
1,200	250	Reyjavik.....	16.0
1,229.5	244	Boden.....	0.6
1,250	240	Vienna Exp.....	3.0
1,260.5	238	Bakou	35.0
1,304	230	Moscow (T.U.)...	165.0
1,348	222.5	Motala	30.0
1,380	217.4	Novosibirsk (RV6)	100.0
1,411.8	212.5	Warsaw 120.0	
1,445.7	207.5	Eiffel Tower	13.5
1,481.5	202.5	Moscow (RV1)...500.0	
1,538	195	Ankara	7.0
1,554.4	193	Daventry (Nat.)	30.0
1,600	187.5	Irkutsk (RV14)...	10.0
1,620	185	Norddeich (KVA)	10.0
1,634.9	183.5	Zeesen	60.0
1,675	179	Kharkov.....	25.0
1,725	174	Radio Paris.....	75.0
1,796	167	Lahti	54.0
1,875	160	Huizen	8.5
1,935	155	Kaunas	7.0
2,000	150	Craciunelu	1.0
2,625	119	Konigswusterhausen (press)	20.0
2,650	113	Eiffel Tower	15.0
2,900	103.5	Konigswusterhausen (press)	15.0

THE EARL OF ATHLONE'S presidential address at the twenty-first annual conference of Educational Associations will be relayed on January 4 from University College, London, to London Regional listeners.

A concert by the Leeds Symphony String Orchestra, conducted by Edward Maude, is to be relayed from Leeds on January 14.

At the religious service relayed from Carrs Lane, Birmingham, on January 22, the Rev. Leyton Richards is the preacher.

Dorothy Richards and Herbert Downes support the Studio Orchestra at a Midland Regional concert on January 23.

Captain H. B. T. Wakelam will broadcast to National listeners, on January 21, a running commentary on the England versus Wales International Rugby match, which takes place at Twickenham, and on February 4 Captain Wakelam will describe the Scotland versus Wales match at Swansea.

The London Zigeuner Orchestra will celebrate its first anniversary on January 17 with a London Regional broadcast entitled "A Continental Hour."

Balakirev's tone-poem, "Thamar," and Dvorak's violin concerto in A minor are features of the City of Birmingham Orchestra's concert on January 24.

IN MY WIRELESS DEN

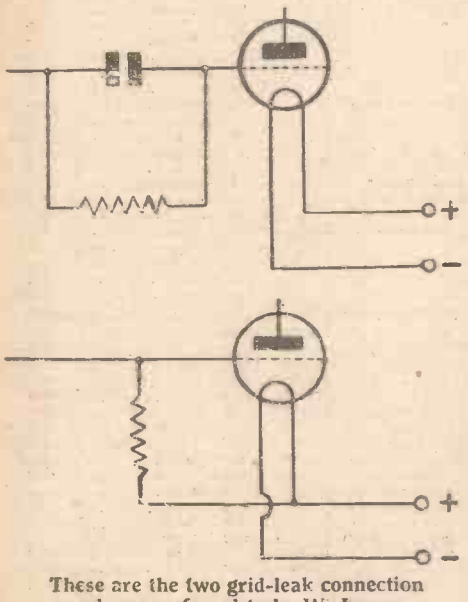
WEEKLY HINTS — CONSTRUCTIONAL & THEORETICAL

BY W. JAMES

WHERE TO TAKE THE LEAK

IN many sets, the grid leak is joined directly between the grid of the detector valve and the low-tension positive side of the filament.

Sometimes the leak is connected across the grid condenser. This connection is not much used, however, because the tuned circuit almost invariably connects to the negative side of the low tension. Most battery valves give the best results as detectors when the grid leak is taken to the positive low tension and this is the chief reason for joining the grid leak between the grid and the positive.



These are the two grid-leak connection schemes referred to by W. James

BIG BAFFLES, PLEASE

TO get the best results from a moving-coil speaker it is essential to use a baffle of adequate size and it must be of suitable material.

Thin plywood is not likely to be satisfactory as it may vibrate too readily. Seven-plywood is good, but at the same time it should be stiffened if used in the form of a large sheet with a hole cut in it for the speaker.

Two feet square is really a minimum size, and the larger the better. When a cabinet is used greater care must be taken or resonances will occur and spoil the results. Have a cut-away style of back. The cabinet must be strongly made and it is advisable to stiffen the sides, or they will vibrate excessively.

It is easy enough to test whether poor quality is due to a cabinet by trying the speaker with a temporary flat baffle of cardboard. To effect a cure, especially when a set is also included in the cabinet, is sometimes rather difficult, but vibration should be reduced as far as possible.

SCREEN-GRID AMPLIFICATION

THE amount of the amplification at high-frequencies which can be obtained from a screen-grid valve depends amongst other factors upon the leakage capacity of the valve.

This leakage capacity, which is measured between the anode and control grid, provides a coupling between the anode and grid circuits. There may be other couplings between the two circuits due to imperfectly shielded parts, but these are always made as small as possible.

Any improvement which can be made in the valve itself is, therefore, welcome, and it is worth noting that the leakage capacity of a screen-grid valve having a metallised bulb is usually much less than in the case of this type of valve, but having a clear bulb.

One make of valve with a clear bulb has a leakage capacity of about .003 micro-microfarads, and the metallised type is exactly half this. In this case, better results would be obtained from the metallised valve, provided, of course, that the circuit stray couplings were themselves very small.

AERIAL COUPLINGS

THERE are various ways of coupling an aerial to the grid circuit of a valve.

Sometimes the coil is tapped and the aerial is taken to the tapping point. In another arrangement the grid coil is coupled to a winding having the aerial joined to it.

Then again, the aerial can be connected through a condenser to the grid end of the coil.

The various methods have their own advantages. They may be of equal effectiveness. Much depends upon the coil itself, for when this is a poor one the method of coupling does not much affect the results.

With a good coil, however, it is most important that the aerial be connected the right way or little may be gained by using the better coil.

It is always of interest to try the various arrangements, and if your set has an aerial coil which is not tuned by a gang condenser it is easy to try a few experiments. You should take a former of ebonite or paxolin and wind a few coils with various sizes of wire. Try the effect of connecting the aerial to a tap on the coil and also to the top of the coil, but through a .0001-microfarad condenser.

The chances are that you will note considerable differences in the selectivity and strength. A coil of fair size, such as one of 2½ in. diameter, will probably prove much better than a small coil if it is not shielded. When shielding is used, however, the smaller coil may be as effective.

"NEW CENTURY SUPER" CONDENSERS

BUILDERS of the "New Century Super" will be interested to know that Messrs. Jackson Brothers (the makers of the J.B. variable condensers specified for this set) ask us to deny the rumour that deliveries of these condensers are being delayed. They can now, as ever, give immediate delivery of the Unitune and Nugang condensers specified.

Talks illustrated with gramophone music have been given from time to time, to the enjoyment and edification of thousands of listeners, judging from the broadcasting post-bag. This has encouraged the B.B.C. to arrange a special series, starting on January 11, under the title of "Strange Music." They will be essentially travel talks, but native music will form a substantial part of each broadcast. J. B. Trend, the great authority on Spain, will open the series with a talk on that country and Richard Hughes will follow with Morocco. Africa and the East will later be included.

Emile Littler, manager of the Repertory Theatre, enjoys his appearances in the Midland Children's Hour. On January 27 he gives a talk about Birthdays.

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General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets. **Contributions** are always welcome, will be promptly considered, and if used will be paid for. **Communications** should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," 58-61 Fetter Lane, London, E.C.4.

FULL-SIZE BLUEPRINTS

When ordering, please send Postal Order, NOT STAMPS.

CRYSTAL SET (6d.)

1931 Crystal Set	AW308

ONE-VALVE SETS (1s. each)

Easy to Build One	AW304
Short-wave One-valver	AW327
B.B.C. One-valver	AW344
Portable Short-wave One	AW354

TWO-VALVE SETS (1s. each)

25/- Two (D, Trans)	AW330
Ten-Station Two (D, Trans)	AW336
Inexpensive A.C.2 (D, Trans)	AW346
Midget Two (D, RC.)	AW348
Mascot Two (D, Trans)	AW353
Ideal Regional 2 (D, Trans)	AW357
Quality 30s. Two (D, Trans)	AW361
Ether Music Two (D, Trans)	AW364
Clarion Voice 2 (SG, D, Pen)	AW371
Music Lover's Two (D, Trans)	WM260
New Economy Two (D, Trans)	WM265
Family Two (D, Trans)	WM278
Economy A.C. Two (D. Trans)	WM286
Screen-grid Two (SG, Trans)	WM289
A Two for 7 Metres (D, Trans)	WM295
New-style Radiogram (D, Trans)	WM299

THREE-VALVE SETS (1s. each)

New Favourite Three (D, RC, Trans)	AW334
Home-Lover's All-electric 3 (SG, D, Trans)	AW335
P.W.H. ("Mascot" D, RC, Trans)	AW337
Home-Lover's Battery 3 (SG, D, Trans)	AW341
£8 Radiogram (SG, D, Trans)	AW343
New Regional Three (D, RC, Trans)	AW349
World-Ranger Short-wave Three (D, RC, Trans)	AW355
Wizard (SG, D, Trans)	AW360
£2 2s. Family Three (D. 2 Trans)	AW368
Five-advantage Three (D, RC, Trans)	WM257
Everybody's A.C. Radiogram (SG, D, Trans)	WM258
Double Band-pass Three (SG, D, Trans)	WM259
Everybody's A.C. Radiogram (with automatic G.B.)	WM262
New Economy Three (SG, D, Trans)	WM263
New Plug-in Coil Three (D, 2 Trans)	WM270
Transportable Three (SG, D, Trans)	WM271
Multi-Mag Three (D, 2 Trans)	WM288
Percy Harris A.C. Radiogram (D, RC, Trans)	WM294
Prosperity Three for Batteries (SG, D, Trans)	WM296
1933 Economy S.G. Three (SG, D, Trans)	WM306
Harris Ethergram (SG, D, Trans)	WM308
A.C. Calibrator (SG, D, Trans)	WM309

FOUR-VALVE SETS (1s. 6d. each)

Four Star 4 (SG, D, RC, Trans)	AW318
Up-to-the-Minute Four (2 SG, D, Trans)	AW356
Your Home Radiogram, (SG, D, RC, Trans)	AW358
65/- Four (SG, D, RC. Trans)	AW370
Ether Rover (SG, D, RC, Trans)	WM266
Quadradyne (2 SG, D, Pen)	WM273
Economy Radiogram (SG, D, RC, Trans)	WM276
A.C. Quadradyne (2 SG, D, Pen)	WM279
Ideal A.C. Home Super (Super-het)	WM290
Gold Coaster (A.C. Short-waver)	WM292
Triple-tune Four (2 SG, D, Trans)	WM293
Calibrator (SG, D, RC, Trans)	WM300
Table Quad (SG, D, RC, Trans)	WM303

FIVE-VALVE SETS (1s. 6d. each)

James Short-wave Super (Super-het)	AW328
Simple Super (Super-het)	AW340

SIX-VALVE SETS (1s. 6d. each)

New Century Super (Super-het) with copy of A.W., 4d., post free	AW363
New A.C. Century Super (A.C. super-het)	AW365
Super 60 (with Wearite base)	WM249
Super 60 (with Lewcos base)	WM251
1932 Super 60 (Super-het)	WM269
1932 A.C. Super 60 (A.C. Super-het)	WM272
Ideal Home Super (Super-het)	WM280
Easytune 60 (Super-het)	WM284

SEVEN-VALVE SETS (1s. 6d. each)

Super Senior (Super-het)	WM256
Seventy-Seven Super (A.C. Super-het)	WM305

PORTABLES (1s. 6d. each)

Hiker's Two (D, Trans) (1/-)	AW345
General-purpose Portable (SG, D, RC, Trans)	AW351
Town and Country Four (SG, D, RC, Trans)	WM282
Everybody's Portable (5-valve super-het)	WM291

AMPLIFIERS (1s. each)

Universal Push-pull Amplifier	AW300
"A.W." Record Player (LF, Push-pull)	AW319
The Battery-operated Amplifier	AW362
A-P-A (Power Amplifier for A.C. Mains)	WM275
A-P-A Radio Unit (SG, D.)	WM281
Economy Gramophone Amplifier	WM277

MISCELLANEOUS (1s. each)

Short-wave Plug-in Adaptor (6d.)	AW326
Short-wave Super-het Adaptor (6d.)	AW329
Ether Searcher Radio-gramophone Motor Board	AW333
"A.W." Short-wave Adaptor	AW339
"Mascot" Mains Unit	AW350
"A.W." Trickle Charger	AW352
Add-on Band-pass Unit	AW359
Short-wave Adaptor for New Century Super	AW367
Super 60 A.C. Unit	WM228
"W.M." Linen Diaphragm Loud-speaker	WM243
Short-wave Director (6d.) (wavemeter)	WM285
Voltage Regulator	WM287
A.C. Mains Unit	WM310

Copies of the "Wireless Magazine" and of "Amateur Wireless" containing descriptions of most of these sets can be obtained at 1s. 3d. and 4d. respectively, post free. Index letters "A.W." refer to "Amateur Wireless" sets and "W.M." to "Wireless Magazine."

Address letters:

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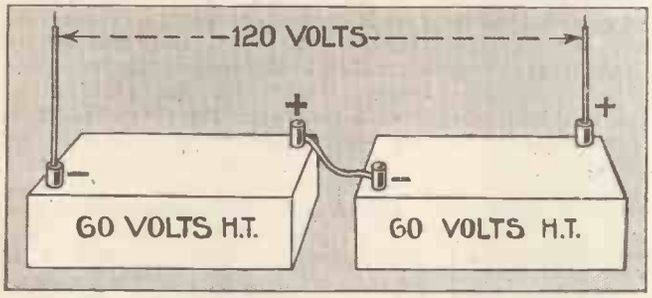
WIRELESS MADE EASY

WIRELESS TIT-BITS FOR BEGINNERS

BATTERIES IN SERIES

VERY often, when a certain voltage is wanted, as for the high-tension supply, you are told to use a battery of that voltage or two smaller batteries



Two high-tension batteries of 60 volts each when connected in series as above give you a total voltage of 120

connected *in series*. Many beginners do not seem to understand what this means.

Let us take a very simple example. You might want a 120-volt high-tension supply for the set and you might only be able to buy two 60-volt batteries. Yet if these are connected in series you will get your 120 volts just as well as with a 120-volt battery.

The point is that when two batteries are joined in series the total voltage obtained is the sum of the voltages of the separate batteries.

To join two batteries in series you must connect the negative terminal at the end of one battery to the positive terminal at the end of the other battery.

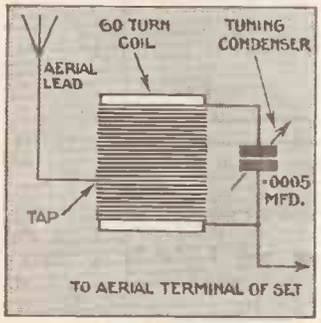
This will leave you with a positive connection at the end of the first battery, which becomes the positive end of the series arrangement, and a negative connection at the end of the other battery, and this becomes the negative connection of the series arrangement.

HOW WAVE TRAPS WORK

DO you know what a wave trap is? Its name gives the clue to its job, which is quite simply to trap waves that you do not want to pass into the set. The local station, for example, is certainly *not* wanted when you are listening to a foreigner.

The idea of the wave trap is to offer a great inducement to the incoming signal to which it is tuned not to pass on into the rest of the tuning circuit. At the same time the well-designed trap will allow stations on wavelengths adjacent to the unwanted station to come through, though often this can be achieved only by some loss of signal strength.

The wave trap is nothing more than a sharply tuned tuning circuit inserted in the aerial lead.



The simplest wavetrap consists of a coil tuned by a condenser with a tapping for the aerial lead as shown above

The more sharply this trap circuit tunes the greater will be the trap's power of discriminating between the station you do not want and all the stations you do want.

In its simplest form the wave trap consists of a solenoid coil of 60 turns, tuned by a .0005-microfarad variable condenser. There are tappings on the coil. The aerial lead is taken to one of them, usually to a point between 5 and 10 turns from the end of the coil connected to the aerial terminal of the set.

ON THE SHORT WAVES

MANY beginners want to know how short-wave reception differs from reception on the normal broadcasting wavebands. The essential difference is in the tuning.

On short waves we are dealing with very high frequencies and this makes it essential to use very small capacity tuning condensers and a range of interchangeable short-wave coils.

The easiest way for the broadcast listener to get down to short waves is by connecting up what is called a plug-in adaptor. A more sensitive unit is the short-wave super-het converter.

Both types of short-wave unit consist of a one-valve detector circuit with special short-wave tuning coils and condensers. The tuning of the broadcast set is not used when either of these units is connected up.

HOW DOES A MAINS VALVE DIFFER?

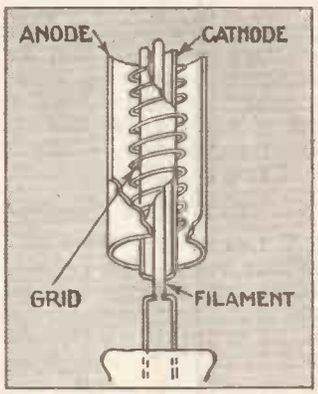
THERE is a great difference in the working of a mains valve when compared with a battery-operated valve. It is quite easy to see why this difference is present and how it works out in practice.

The mains valve has to get its filament heat from the mains, which may be A.C. or D.C. There are irregularities in the mains supply not present in the supply from an accumulator as used for a battery-heated valve.

These little variations would cause the heating of the filament to vary and that in turn would cause the electron emission to vary, so producing a loud hum in the reproduction.

To avoid this we use one electrode for heating and another for the electron emission. The heater filament wire, like the wire in a battery valve, is connected across the power supply, thus causing a current to flow through it.

The current causes the wire to heat up and the heat from this wire is passed on to what is called the *cathode*, which is a separate electrode surrounding the heater wire, but insulated from it.



The heater wire of an A.C. valve is quite separate from the cathode, which is the electrode that emits the electrons

Although the heating of the filament wire varies with the mains variations the indirectly heated cathode does not, as it cannot follow the relatively rapid heat variations that are occurring.

Because the cathode does not vary in its heat the electron emission, which, remember, is coming from the cathode, remains constant, and there is no hum during reception.

THIS WEEK'S SUPPLEMENT ARTICLES

CONNECTING UP TO THE RIGHT TERMINALS — Page Seven
WIRELESS FAULTS YOU CAN TACKLE — Page Eight
PERCY W. HARRIS'S "BUILD AS YOU LEARN" — Pages Two, Three, and Six
ELEMENTARY WIRELESS COURSE FOR BEGINNERS — Pages Four and Five

PERCY W. HARRIS'S "BUILD AS YOU LEARN"

Valuable information is given this week on using several alternative makes of coils in the screen-grid three-valve set, to which Percy W. Harris now adds a pentode output valve

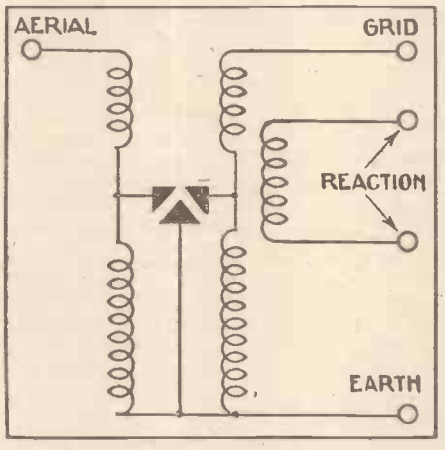
IN last week's lesson we discussed coils at some length, and in particular the form of dual-range coil adopted (because of simplicity) for the present receiver. The design of the receiver is such that almost any standard make of coil can be used, and accordingly I have received a very large number of inquiries from readers who want to know how this or that make of coil can be adopted. Some of the coils are open, some are screened, and some have been designed for special circuits. How are we to know what to do, which one to use, and how to use it?

Two Coils Are Wanted

Let us see what we want in the case of our receiver. We have, you will remember, two separate and distinct coils, the first used for coupling the aerial to the first grid circuit and the second for the dual purpose of allowing the screen-grid valve to be coupled with the detector and permitting reaction to be applied progressively by means of a variable condenser. In each case provision has to be made for both medium and long wavebands.

Last week I talked to you about the effect known as "break-through" and mentioned that nowadays it has been a comparatively simple matter, so far as manufactured coils are concerned, to overcome this defect. While the exact reasons for a break-through in a particular coil are not simple to explain in an elementary article, it will be found, in a large number of coils in which break-through has been avoided, that the aerial winding is separate and distinct from that used for the grid circuit, the two being coupled together electro-magnetically.

A typical coil circuit of this kind is illustrated for the benefit of those who have absorbed sufficient from these articles (and the theoretical ones accompanying them each week in the supplement) to follow the conventional diagrams. In any case, whether you can follow this diagram or not, I should explain that in the type of coil to which I refer there are four distinct windings where no reaction is applied and five where reaction is included.



Circuit of a typical commercial dual-range coil, showing the simple three-point switch method of shorting the aperiodic aerial winding when medium waves are wanted

There are two windings for the medium band and two for the long, and as our switching system calls for the long-wave winding to be short-circuited on the medium band, switching is not so simple as that we have used in our own home-made coils.

Using A Three-point Switch

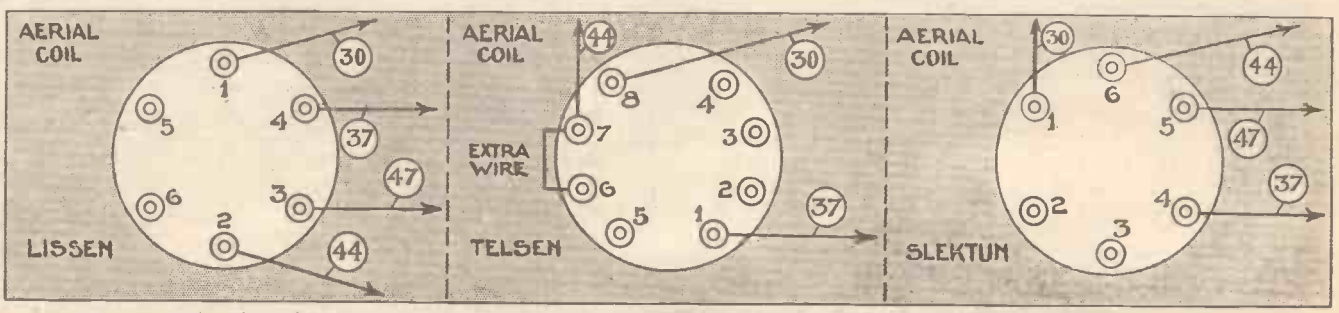
In the coils to which I refer there must be at least a three-point switch; that is to say, one point of the switch connected to earth and two others connected to the ends of the respective long-wave windings. When the switch is in a short-circuit position the two long-wave windings are shunted to earth. For this reason such coils nearly always have a built-in switching system.

So far as reaction is concerned, it is usually possible so to arrange the windings that one reaction coil serves for both medium- and long-wave winding without any switching.

Now, suppose you have one of the numerous excellent commercial coils, either screened or unscreened, and desire to use it for our first instructional receiver. First of all, look for the diagram supplied with the coil. The maker nearly always gives a clear explanatory leaflet telling you which terminals on the coil to connect to which parts of the receiver.

Typical coils are shown by the diagrams. Here the terminals are marked for grid, earth, reaction 1, reaction 2, and aerial. It will now be quite obvious to you, having studied the previous articles, where to connect the grid and earth wires, but you may have some doubts about which way to connect the reaction.

As one reaction terminal of our winding in our set is connected to earth, you must join one of your reaction terminals to the same wire as that which



Alternative makes of aerial-tuning coil are shown above, with their appropriate connections to the other components of the set. Study this diagram with the blueprint layout given last week in the "Wireless Made Easy" Supplement

goes to the earth lead from the coil, the other going to the reaction condenser.

If the maker does not tell you which to connect to which in his data, just try one way or the other. You cannot do any harm, and if you fail to get oscillation with one terminal reaction connected to earth and the other to the condenser, just reverse these connections, joining the one which previously went to earth to the reaction condenser and the one which went to the reaction condenser to earth. One or other of these ways round will give you the correct result.

Tappings For Aerial Coupling

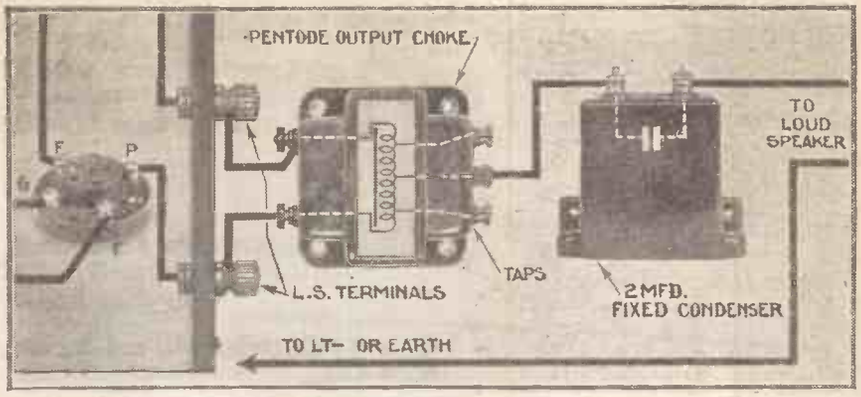
Some coils have several terminals marked, for example, "aerial 1, aerial 2, aerial 3," etc. This enables you to get exactly the same effect as is obtained with the spring clip on the coil designed specially for this receiver, and you will join the lead coming from the compression condenser to which ever of the terminals gives you the best results.

So far the information I have given you applies to the use of commercially-made coils in the first receiver connected to the detector and two low-frequency stages. If now you want to use a pair of coils in the screen-grid, detector and one low-frequency set with which we are dealing at the moment, for the first coil ignore the reaction winding, leaving the reaction terminals blank. In the second coil connect them up as I have just explained to you.

In this case, however, a little more explanation is required. You will remember that the connection from the screen-grid circuit to the second coil comes through the .0001 fixed condenser. Where shall we take this lead? Experiments must be made to find which gives the best result with a particular coil, and you should try first of all taking it direct to the grid terminal ignoring the aerial winding.

Making The Set Stable

If the set is unstabled in this way, try taking it to the aerial tapping giving the strongest coupling—in fact, try the connection from the .0001 condenser to the various tappings just as you would if the lead came from the aerial compression condenser. Probably you will find, particularly if it is a screened coil, that the best results will be obtained when the .0001 condenser is taken straight to the grid terminal.



A pictorial diagram showing how a pentode power valve can be used in the three-valver with the aid of a pentode output choke and a large fixed condenser

So much, then, for the placing of coils. Many commercial coils are now arranged in pairs so that the switching can be "ganged" or joined together by a long rod, and in most cases you will have to use the switches incorporated in the coils. This, however, depends upon particular makes and how they are arranged.

I'm afraid I have taken greater space than I intended for discussing coils, but my correspondence on the matter has been large and I thought it essential to deal in more detail with them this week. Now let us consider another important step forward in receiver design, and that is the introduction of the pentode valve.

In this series of articles I cannot discuss valves in principle or in detail, but as you have probably wondered what this pentode valve is and why so much fuss is made about it, let me say at once that its chief virtue is that its efficiency is very much higher than that of the ordinary power output valve. When judging the efficiency of a valve we must consider how much of the high-tension current supplied to it is really used for producing signals in the loud-speaker and how much is just so much waste.

We can ignore the filament current at the moment. We are, however, vitally concerned with the best use of our high-tension battery out of which the *whole power* for operating the loud-speaker comes. Do not imagine that the input signal supplies the *power* to operate your loud-speaker—this is quite a mistake.

The input signal only serves to *control* the power supplied by the high-tension battery and, so to speak, directs operations. When you point a gun at a rabbit, you operate the trigger with your finger, but it is not the force exerted by your finger which kills the rabbit. It is the stored-up energy in the gunpowder in the cartridge. Similarly, it is not the incoming signal which works the loud-speaker and produces the sound waves. It is the stored-up energy in your high-tension battery or mains unit.

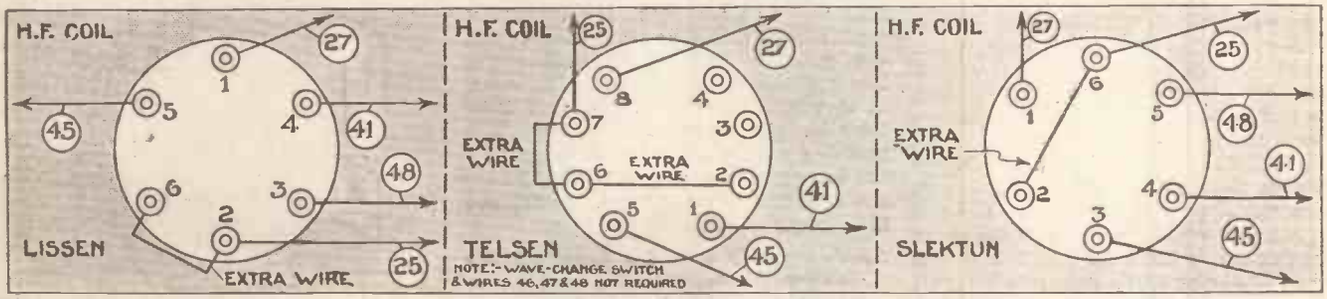
Why The Pentode Is Efficient

Now the ordinary output valve is really very inefficient, some four-fifths of the high-tension supply to the output valve being wasted. In the pentode, however, the efficiency is ever so much higher—two or three times higher in the case of a good pentode, and there is every reason to think the efficiency will be raised still higher when it suits the purpose of the valve manufacturers.

The pentode valve has a filament, a grid and a plate connection just as has the ordinary output valve; there are, however, two more grids, making three in all, one of the inside grids being connected direct to the filament inside the valve and therefore not requiring any external connection, and the remaining one being brought out for joining up to the high-tension battery.

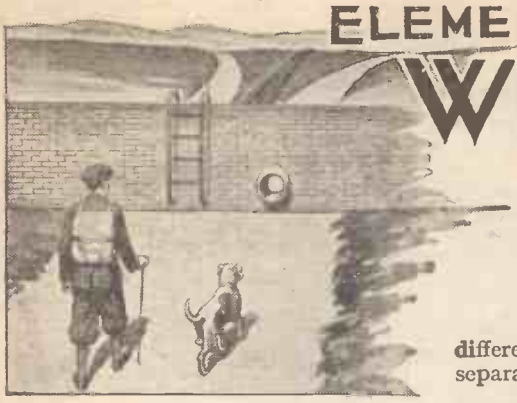
There are two ways of bringing out this last grid, one being to a terminal on the side of the valve, and the other to a central pin, this latter arrangement now becoming standard. If you desire, then, to use a pentode valve in this receiver (I can assure you the efficiency

(*Continued on page Six*)



Alternative makes of high-frequency coil are shown above, with their appropriate connections to the other components in the set. Study this diagram with the layout given last week

ELEMENTARY WIRELESS COURSE FOR BEGINNERS



Here is a simple analogy for detector by-passing. Man and dog approach the wall (modulated wireless waves at detector), and then man goes over the ladder (low-frequency current through the choke), while dog goes through the drain pipe (high-frequency current through the condenser), the two being thus separated

In this week's instalment J. H. REYNER and the "A.W." STAFF explain how high-frequency current is by-passed to earth by means of a choke and a condenser

What is this gadget here?

That is a high-frequency choke as used a great deal in up-to-date wireless sets.

What is it used for?

For choking or stopping high-frequency currents. We sometimes have a circuit which is carrying not only a high-frequency oscillation, but at the same time a low-frequency oscillation or even a steady flow of current.

Don't they get mixed up?

No. It is quite possible for the two types of current to flow through the same circuit. Actually they combine and give us a current which is varying from instant to instant in a very complex manner. We do not need to worry about this because the circuit behaves as if the two currents were entirely separate, and we can therefore calculate the effect of each current individually.

We can even do more than that. We can deliberately separate the two currents by splitting the circuit into two parts, one of which is specially suited to one type of current and the other only suitable for the second sort of current.

For example, suppose we have a man and a dog walking down a road. On the ordinary road or footpath the two can travel together quite easily. The man takes more or less sedate steps, while the dog frisks about his feet.

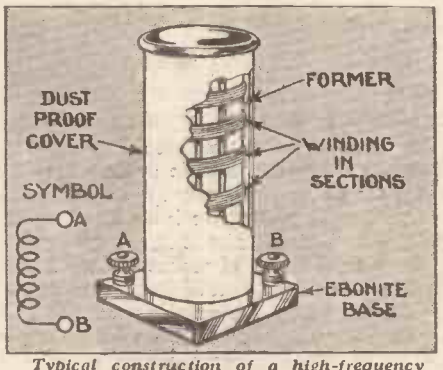
Suddenly the footpath finishes at a wall, over which there is a ladder. The man, of course, is able to climb up the ladder without difficulty, but what about poor Bonzo? We could, with a certain amount of difficulty, help him up the ladder as well, but the process would not be easy.

Fortunately he spies a drainpipe leading through the wall. Now this does not appeal to the man. Even if it did he could not get through it because he is too big, but Bonzo has no difficulty at all and charges through in great style. Alas, the other side of the drainpipe leads on to quite a different path, and master and dog are separated!

Is this touching story meant to represent what happens to high- and low-frequency currents?

Exactly. We often want to separate a current into its high- and low-frequency parts. For instance, in the anode circuit of a detector valve we have both types of current. We apply high-frequency voltages to the grid, and therefore we obtain high-frequency variations of current in the anode circuit. This gives us our high-frequency current.

At the same time, because the valve



Typical construction of a high-frequency choke. The windings are done in a series of slots to keep down the self-capacity of the complete choke

is arranged to act as a detector, the average or mean value of the current is continually changing in accordance with the modulation of the wave at the transmitting station. Therefore we have low-frequency currents existing in the anode circuit at the same time.

I thought the detector turned the high-frequency currents into low-frequency ones?

That is not quite correct. The high-frequency currents which we receive on the aerial have the low-frequency modulations riding on their backs. All the detector does is to enable the low-frequency modulations to dismount, as it were, so that for the first time they have a separate existence. The function of the detector is to extract the low-frequency currents, but it does not automatically get rid of the original high-frequency oscillations.

Surely we only want the low-frequency current?

That is so, and it is here that we use a divided circuit of the type I suggested earlier. We split up the circuit into two parts. One part contains a ladder or in other words a *high-frequency choke*. This is a device which high-frequency oscillations have great difficulty in passing.

Low-frequency currents on the other hand flow through it comparatively easily, just as the man is able to climb the ladder without much trouble. All our low-frequency currents, therefore, flow in this circuit.

It is most important, however, that we should provide a path for the dog, that is to say, the high-frequency current. This point is often overlooked but it is really absolutely essential. Fortunately we are able to do this quite easily with a *by-pass condenser.*

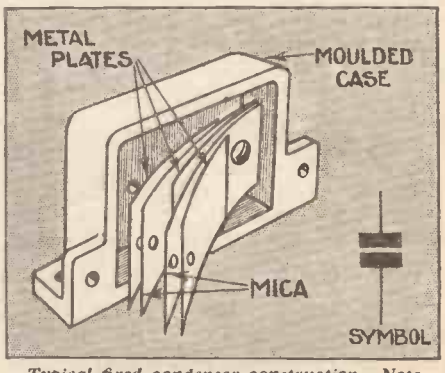
I thought a condenser was used for tuning?

That is only one of its functions. It has other very useful properties, one of them being the property of acting as a very easy path for high-frequency current.

I don't see how a condenser can pass any current. There is no circuit.

Look at it this way. If you apply a voltage across the plates of a condenser the electrons in the dielectric sideslip, and there is a corresponding sway of electrons through the circuit giving a charge on one of the plates. This gives us a momentary current.

If we now reverse the direction of the voltage there is a swing-back of all the electrons, followed by a charge in the opposite direction. So you see that if we have an oscillating voltage applied first in one direction and then in the other, we obtain a motion of the



Typical fixed condenser construction. Note that the two sets of plates are interleaved with pieces of mica, which insulate one set of plates from the other

How High-frequency Current is By-passed

electrons in the circuit backwards and forwards just as if the condenser were not present, or perhaps I should say just as if the condenser were an actual conductor of current like a piece of wire.

Why have the condenser at all?

Because it has some effect, obviously. In the first place it will not allow any continuous flow of current in one direction only. It is a complete barrier to what we call direct current, which is often useful. Secondly, even with an oscillating voltage the actual current depends upon the size of the condenser.

Obviously the larger we make the condenser the more electrons we have in the dielectric capable of being influenced by any voltage applied to the circuit. Therefore we can say that the current through a condenser is directly proportional to the capacity. If we double the capacity we obtain twice as much current for a given voltage.

I see. How fast must the oscillations be before the condenser will act like this?

There is no sudden change. The value of the current depends upon the number of electrons moving past any particular point in a given time, say one second. If the variations in the voltage are relatively slow, the movement of electrons in a given time will only be relatively small and the current will be small in consequence.

As we increase the frequency of the oscillations, although the same electrons are still surging backwards and forwards, they do so many more times a second, giving us an increase in current, and in fact the current through the condenser is directly proportional to the frequency or rapidity of the oscillations.

You mean the same condenser conducts high-frequency currents better than low-frequency ones?

Exactly; and it is here that we obtain the by-passing action. If we use a condenser of about .0002 to .0005 microfarads, it acts as quite an easy path for high-frequency oscillations.

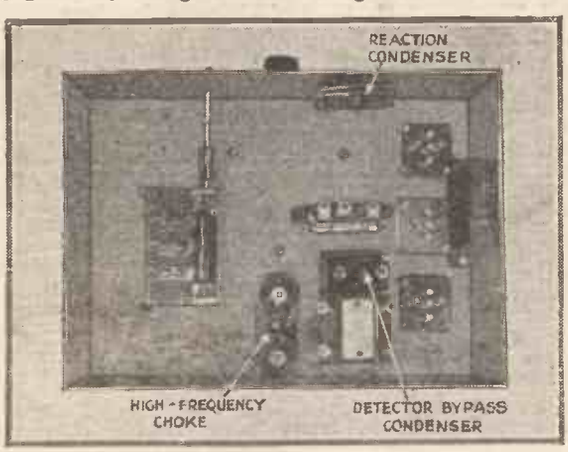
On the other hand, if we are only dealing with speech frequencies which are several thousand times slower, the condenser is nothing like such an easy path and the low-frequency currents prefer to go by other routes if these are available. In this case we have the high-frequency choke circuit, and they prefer to go this way, leaving the high-frequency currents to go through the drain-pipe or by-pass condenser.

You have not told me what the high-frequency choke is.

Simply an inductance coil consisting of a large number of turns of wire on a suitable former. You know that when a current flows through a coil a magnetic field is produced. Now if the current is varying this magnetic field must also vary, and you know from what we said in the discussion on oscillating circuits some time ago that the magnetic field objects strongly to any rapid alteration in its condition.

In other words an inductance coil acts exactly in the opposite manner to a condenser. If the current through the coil is steady then it offers no objection to the passage of current other than that due to the actual resistance of the wire.

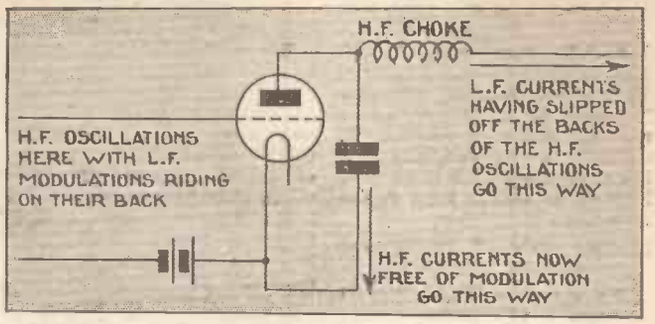
If we vary the current, however, the magnetic field is agitated and induces back e.m.f. to try and stop the current. The more rapid the variations of current the larger are these opposing forces, so that the coil practically refuses to allow high-frequency currents to flow through it at all.



Under-side of three-valve set chassis, showing in particular a high-frequency choke, a detector by-pass condenser and a reaction condenser

Surely it will also have some effect on the low-frequency currents?

Yes. We have to choose the value of the inductance so that it has only a small effect on the low-frequency currents while acting as an almost complete barrier to high-frequency currents. So you see, we have here the two components which act as complete separators. The high-frequency choke acts like the ladder and allows low-frequency currents to pass quite easily, but makes it very difficult for the high-frequency oscillations. The by-pass condenser on the other hand acts like the drain-pipe, providing an easy route for the high-frequency oscillations, but one which the low-frequency currents find altogether too difficult.



Theorectial circuit of a detector valve, showing the high-frequency choke in the anode circuit and the fixed condenser between the anode of the valve and earth

I would emphasize the necessity in a properly designed circuit for providing both these parts. A high-frequency choke without a suitable by-pass condenser cannot do its work properly.

What does a high-frequency choke look like?

It is simply a number of turns of relatively fine wire wound in a suitable former. Usually the former is provided with anything from five to ten slots, and we wind the wire in these slots, first filling up one slot and then going to the next and filling that, and so on.

Why is that done?

Because the coil is rather more efficient if it is wound in this way, just as the long-wave winding of a tuning coil is usually wound in slots.

Is the high-frequency choke always necessary?

No; for example, if we have a low-frequency transformer following a detector, the primary winding will sometimes act as a choke. We must still provide a by-pass condenser however, and in fact this component is of more importance than the choke.

If we use a high-frequency choke in the anode circuit without a by-pass condenser, it will prevent the detector valve from working properly, because the low-frequency currents only arise because of the variation of the high-frequency current.

If we do not provide an easy path for the high-frequency choke the strength will be reduced. It is as if our man refused to go for a walk without his dog!

Next Week!

WHY GRID BIAS IS NEEDED

A specially interesting instalment of the ELEMENTARY WIRELESS COURSE for beginners

WORTH-WHILE FOREIGNERS YOU CAN EASILY LOG

HAVE you ever looked through that AMATEUR WIRELESS feature entitled "Broadcasting Stations" given near the end of the issue? It contains a regularly-amended list of all the foreign stations of Europe, as well as most of the Russians.

Stations That Entertain and Stations That——!

We can broadly distinguish between foreign stations that are of interest merely as additions to the log and foreign stations that offer some chance or real entertainment. The second class of stations contains the only ones worth while.

It will be of interest to beginners to decide the conditions for worth-while foreign station reception. Firstly, we think the most important condition is that the signal strength of the foreigner shall be sufficiently great to enable good loud-speaker strength to be obtained without unduly forcing the set.

Weak Signals are not Worth Worrying About!

This is a very important point. For if the signal is so initially weak that a great deal of amplification is needed to give loud-speaker results, the chances are that the resulting high background level will spoil reception.

The second condition for worth-while reception is that the signal shall not be unduly interfered with either by adjacent stations or by morse messages.

The third condition is that the signal shall not unduly fade. To some extent all foreign stations are apt to fade, but low wavelengths are more susceptible to this trouble than high wavelengths.

For a start you may take it that stations below 300 metres are not worth while from an entertainment point of view, as they fade too greatly. There are one or two exceptions, but the general rule is not debatable.

That rules out quite a large number of stations that figure in amateurs' logs. Let us make the point quite clear that we are talking now of *worth-while* foreigners. Because unless this point is borne in mind many readers may feel inclined to write in to assert that they consistently get many good foreigners below 300 metres!

Try Between 300 and 500 metres!

Another point is that this bar to the below-300-metre stations applies only after dark. During the hours of daylight several shortish wavelength foreigners come through at fair strength and without fading.

We are thus left with a wavelength band at night of 300 to 550 metres. But even that can be cut down a little because very often above 500 metres there is a considerable amount of morse interference. And when atmospherics are bad it is the longer wavelength stations that usually suffer mostly from this incurable type of interference.

Signposts of the Ether

As a guide to the positions of the foreign stations that are worth while, you can hardly do better than to take the powerful B.B.C. regionals as signposts of the ether.

At the lower wavelength limit of our worth-while wavelength band we find North National, on a wavelength of 301 metres. This can easily be located by working up from the bottom of the dial. The first British station of any note is London National, on 261 metres, and a very few degrees above this will be found the Scottish National on 288.5 metres. North National will be the third National from the bottom of the scale.

At the other end you have North Regional on a wavelength of 479 metres. There are three other Regionals in between the limits of North National on 301 metres and North Regional on 479 metres. These are London Regional on 356 metres, Scottish Regional on 376 metres, and Midland Regional on 398 metres.

These home stations will be found fairly equally spaced between North National and North Regional, and will prove valuable points of reference when locating the worth-while foreigners.

Three Powerful Foreigners Together

Starting from the North National point, and working slowly upwards, we come upon three powerful and worth-while foreigners next to one another. If your set is unselective you may have trouble in separating these three, but a modern band-pass type of set should get them quite clearly.

The first station is Breslau, a German giant of 60 kilowatts on a wavelength of 325 metres. Just above is a Frenchman, Poste Parisien, on a wavelength of 328 metres, and a power of 60 kilowatts also. Just above this is Milan, which, on its wavelength of 331 metres, is now also on high power—actually 50 kilowatts.

You will find these three stations without much trouble if you look for them a little more towards London Regional's point than North National's. With luck you should get Brussels No. 2 on 338 metres just before you come upon London Regional.

Can You Get Mühlacker Clearly?

If you live well away from the London Regional station you should then be able to get Mühlacker, the high-power German on 360 metres. Is there anything between London Regional and Scottish Regional? Well, you can try, but we do not think you will have a great deal of luck.

Between Scottish Regional and Midland Regional you ought to get one or two more good stations. Toulouse, a degree or so above Scottish Regional, especially if you catch him on his new 60-kilowatt outfit, now testing, is well worth while. And Leipsig, just below Midland Regional on 389 metres is a wonderful signal. It ought to be—the power is 75 kilowatts.

Now For The Best of the Batch

Between Midland Regional and North Regional you will find what is probably the best batch of foreigners available on the whole of the medium waveband. Just above Midland Regional, for example, is the Swiss station, Sottens, announcing in French, on a wavelength of 403 metres.

A degree or so above you ought now to hear the new Athlone high-power station testing. This new 60-kilowatt Irish Free State station is now testing and announcing in Irish, English and several other languages.

Working down from North Regional you should find Langenberg, a high-power German, on a wavelength of 472 metres. If your set is not very selective you will come upon Beromuenster first after going down from North Regional.

Rome's Lady Announcer

Going down a few more degrees you will certainly find Rome on 441 metres, and just below this Italian with its lady announcer you should be able to get Stockholm on 435 metres. Both the last-named stations are reliable high-power signals.

Above the North Regional "signpost" it is worth while trying for Prague on 488 metres, Brussels No. 1 on 509 metres, Munich on 532 metres, and Budapest on 550 metres. These are strong signals, and when free from interference are worth hearing.

Below the North National "signpost" you might try for Trieste on 247 metres, an Italian that on some evenings is worth hearing.

PERCY W. HARRIS'S "BUILD AS YOU LEARN"

(Continued from page Three)

of it will be still further increased by your so doing), you should change your ordinary four-pin valve holder for a five-pin one.

The four pins will be connected just as at present, and the fifth pin must be taken out to an additional wander plug. This wander plug can be inserted in the high-tension battery, as near as possible to the maximum voltage applied to the output valve, or the lead can be connected straight to the maximum high-tension terminal on the set. Grid bias for this output valve must, of course, be carefully arranged according to that specified by the makers.

Let me say at once that it is a very risky proceeding and likely to injure your pentode if you change the grid bias while the set is switched on. In any case you should not do this even with an ordinary output valve, but it is particularly important not to do so with a pentode.

The set will work quite effectively with no further alteration, but as the pentode valve has a tendency when used in direct connection with the loudspeaker to give an over-accentuation of the high notes, making the set sound rather shrill, it is usual to connect it to the loud-speaker through a special "pentode-choke," which you can buy from a number of makers.

The connections are quite simple, the pentode choke taking the place of the loud-speaker, the loud-speaker itself being connected on one side to earth, and on the other side through a 2-microfarad condenser to the choke tapping provided. You can, if you like, re-arrange the parts on the baseboard so as to allow for the choke and condenser on it, or you can use the choke and condenser on a small board outside or even in the loud-speaker cabinet itself. As we are working out an experimental set, and there are many readers who may be quite satisfied with the receiver using an ordinary output valve, I must leave the choice of means to them.

Next week, in response to a very large number of inquiries, I will show you how, with very simple modification, you can use a variable-mu valve in this receiver.

CONNECTING UP to the RIGHT TERMINALS

A composite terminal strip drawn to show all the terminals usually found on battery sets

CONFRONTED with the array of terminals on the average set, you may be excused for being slightly perplexed as to where all these connections have to be taken. Actually, as we shall show, there is nothing very difficult about the receiver's external connections.

The large diagram shows a row of terminals such as might be fitted to a well-designed three-valve battery-operated set. It will be seen that terminals are fitted for the aerial and the earth, and for a variety of other externals that may not be obvious from their terminal markings.

"L.T." is short for low tension. This is the battery used to heat the filaments of the valves. It has a positive terminal marked in red and a negative terminal marked in black.

Make sure you do not transpose these two connections. No great harm will be done, but you will lose a certain amount of efficiency.

"H.T." is the abbreviation for high tension, the battery used to supply the anodes of the valves with a high positive voltage. Often you will find that a lower voltage is wanted for the first valves in the set than for the power or last valve. This explains why there are so often more than one high-tension positive terminal.

The "H.T." +1 terminal is the lower voltage tapping and if there are several, the highest-numbered positive terminal is taken to the maximum battery tappings.

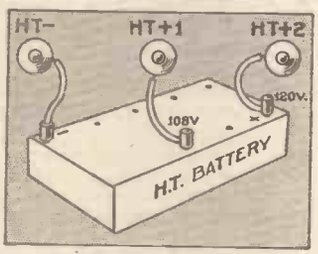
Grid bias is represented on the terminal strip by several "G.B." terminals. There is always one "G.B.+" terminal and always one "G.B.—", but there may, in some sets, be several negatives.

The object of grid bias is to apply a negative voltage to the grids of the amplifying valves (and to the detector if it works on the "anode-bend" system), and it happens that just as the anodes of valves require different positive voltages to work properly, so the grids of these valves require different negative voltages.

"G.B.—1" is usually the lowest bias voltage terminal and "G.B.—2," or some higher number, if there are more than two negative terminals, goes to the maximum negative tapping on the bias battery.

Sometimes, when there are several negative bias tappings, you will find it necessary to plug, say, G.B.—2 into the top of G.B.—1, as perhaps the two valves concerned will want the same grid bias.

Now about those terminals marked "L.S." They are for the connection of the loud-speaker. In these days it does not much matter which way round you connect the speaker, but with certain types it is important to connect the "L.S.+" terminal to the speaker terminal marked positive. Otherwise the magnetism of the unit may be impaired.

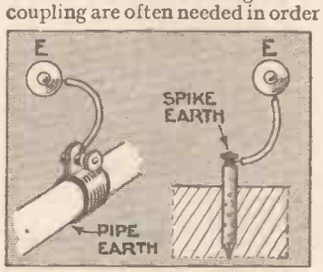


To provide for different voltages on the anodes of the valves, H.T.+1 is taken to a less positive tapping than H.T.+2

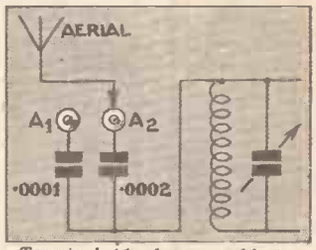
This does not apply to moving coils.

We are now left to consider the connection of the aerial and the earth. Far from being the most straightforward of the set's connections, these two may prove the most difficult to make really satisfactorily.

The aerial is often provided with two or even three alternative connections to the set. The reason is that aerials differ so much in their electrical characteristics that several degrees of coupling are often needed in order to obtain adequate aerial selectivity.

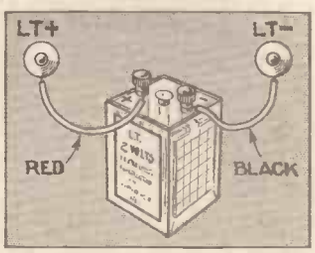


The earth terminal can be connected to either an earth pipe (water main) or to a buried spike or tube



Terminal A1, above, would give more selective tuning than A2 because the coupling would be smaller

There is no standard method of indicating which of two aerial terminals is the more selective. Many sets with two aerial terminals will be found to have terminal "A1" as the normal connection and "A2" as the more selective connection, but only by actual trial can this point be fully proved.



The red terminal is taken to the L.T.+ terminal and the black terminal to the L.T.— terminal

The earth connection can be either a water-pipe or a buried earth, such as a tube or spike. Its proper connection is most important and has a real bearing on the results that can be obtained.

If you consider the terminals in groups, such as "H.T.", "L.T.", and "G.B.", there is little chance of making a mistake. What may happen, though, is that the positive tappings for the high-tension and the negative tappings for the low tension get mixed up. If this happens you may seriously interfere with the working of the set.

The most fatal mistake you can possibly make is to connect the high-tension battery across the "L.T." terminals. If this happens you will blow all the valve filaments.

The way to avoid this calamity is to fit a fuse between the high and low-tension negative terminals, and then the fuse will blow before the current reaches sufficient value to harm the filaments.

So far we have not dealt with the question of pick-up terminals. These are not found on all sets, though more and more listeners are insisting on this additional facility.

The terminals for the connection of a gramophone pick-up are marked "P.U." as a rule, but sometimes they are marked "Gram."

To them you can connect a pick-up, but very often, as explained previously in the supplement, it is necessary to insert a volume control between the pick-up terminals and the pick-up.

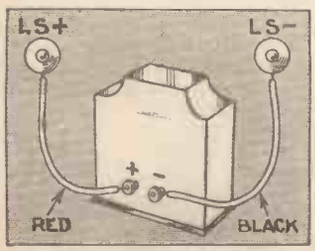
Otherwise what you do is to connect the pick-up directly in the grid circuit of the detector valve, which, although it is biased negatively, will be overloaded by the full voltage from the pick-up.

Sometimes the pick-up will not overload the first valve when connected up in the direct way, but, due to the amplification between the first valve and the power valve, the latter will be overloaded. No matter which valve is overloaded, the quality will be impaired.

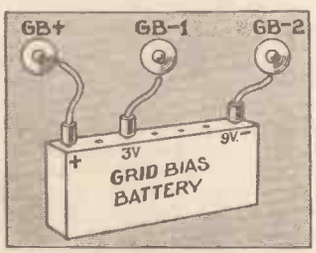
Another point. When connecting a pick-up, or the two leads from the potentiometer volume control, to the pick-up terminals of the set, try reversing the connections to see which way round gives the better results.

In addition to pick-up terminals, some sets now fit terminals for the external connection of a loud-speaker, to be used at the same time as an internally-fitted speaker.

Be careful to connect up to these terminals a speaker of approximately similar characteristics to that in the set or one speaker will give greatly reduced volume.



Connect the positive and negative terminals of the loud-speaker as shown so that positive goes to L.S.+ and negative goes to L.S.—



There are usually two or more grid-bias negative terminals and G.B.—1 is taken to a less negative tapping than G.B.—2

WIRELESS FAULTS YOU CAN TACKLE

CAN a beginner, knowing little or nothing of wireless, tackle a set when it goes wrong? We think he can very often do so, because many of the faults in wireless reception are quite easy to locate and remedy.

Just a little common-sense added to systematic search throughout the vulnerable points we shall mention and there is no reason why nine wrong sets out of ten should not be put right by the beginner.

With every wireless set there are certain parts that will deteriorate, quite naturally, with time. If you imagine that a wireless set can be fitted and forgotten except for the programmes it provides you will be forcibly reminded that it is not an ornamental piece of furniture but a temperamental piece of radio engineering.

When Valves "Go Off"

What gradually "goes off" in a wireless set? For a start, the *valves* do. From the day you put in a new set of valves you must count the hours to the day when you will have to renew those valves *or put up with bad reception*.

These days valves last a long time, but 1,000 hours or one year's listening is about the limit for really efficient valve service. Of course, the valves,

Be sure that the wander plugs of the high-tension and grid-bias batteries are making good contact or crackling noises will almost certainly develop and spoil reception

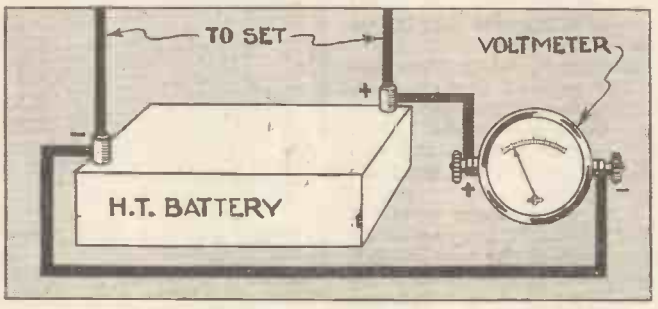
good British products that they are, will go on trying to do their job, but lost emission will be too much for them.

When a valve loses its emission it loses much of its power to work, for emission means the flow of electrons from the filament to the anode, upon which action the valve functions.

So if your set is just generally dull in performance, in contrast to what was once a sparkling efficiency, try the effect of new valves. This may work a miraculous cure.

What else tends to run down as soon as it is installed? The *power supply*, consisting of the high-tension battery, the accumulator, and the grid-bias battery. The most quickly run down is the accumulator, but as this only needs re-charging it is not likely to be an unsuspected cause of poor reception.

What is much more likely is that the high-tension battery rated originally at say 120 volts has through old age dropped to perhaps 90 volts or



To test the voltage of a high-tension battery you must connect up the voltmeter when the battery is actually in use

even lower. This will be more especially likely in sets using what is known as a standard-capacity high-tension, which is the smallest, and mistakenly thought to be the cheapest, size of high-tension battery marketed.

Beg, borrow, or otherwise get hold of a voltmeter, and if you do not know how to use it ask a friend to measure for you the voltage of the battery when the set is working. If the voltage has fallen below 100 volts for a 120-volt battery, or 80 volts for a 108-volt battery the time has come to get a new one.

A Complete Cure

Its installation may easily work a complete cure of many minor faults in reception, such as weakness of signals, bad quality, instability, and general queerness of behaviour.

Don't forget the grid-bias battery, though. That does not last for ever, in fact it runs down in six months usually, so put in a new one fairly frequently or you will increase your high-tension battery current, which is a poor way of economising!

Now we have tried the parts that usually are to blame for a surprisingly large number of faults in wireless sets. Next on the list of frequent causes comes the earth. You may not believe this until you actually come up against a set that is behaving in a perplexing way simply because the earth has gone "high resistance," or has become inefficient in some other way.

Suspect buried earth plates and tubes. In fact, condemn them at sight if they have been down for more than a year. Almost certainly the contact has become oxidised. Dig up and plant afresh, weeding out bad contacts and indifferent earth leads.

Then the aerial—by no means exempt from suspicion when the set develops a fault. In fact, we have come across more than one listener whose complete reception breakdown was due to nothing more than the fact that the aerial lead came adrift from the lead-in tube.

As a rule losses in the aerial are traceable to the insulators, which get very dirty in course of time or to the lead-in tube which often makes a bad contact at the point where the terminal screws down to the lead-in wire.

Leads of all kinds joining the set to accessories can cause faults, especially intermittent faults, such as crackling noises and occasional breaks in the programme.

Loud-speaker leads, which are subject to frequent strain, should be carefully examined for wear. So should the leads to the low-tension battery, for often these leads get covered with acid and partially rot away the insulating covering.

Stopping Those Crackles!

Dirty plugs in batteries cause more crackles than we should care to count. Open split pins in wander plugs for the high-tension and grid-bias. The pins on valve bases should also be sprung open to ensure really good contact.

We have dealt with points that frequently occur and that can be tackled by the beginner without any knowledge of the inside of the set. Of course many other faults do develop, such as breakdowns in components, but here you must carry out experiments that entail a certain amount of technical knowledge.

Substitution is the usual means of telling when a part is faulty. You put in a part you know is good and then if the set works you know the part you have taken out is "dud." It sounds very simple but really takes a lot of time and some practice.

Where Is The Fault?

There is another way the beginner can do something to narrow down, if not to eliminate, the source of faulty reception, and that is to prove whether the fault is in the set or is due to some external cause over which the listener has no control.

Crackling noises may start up, for example, and be due to an electrical machine and not to anything inside the set.

You can prove this by removing the aerial and then the earth from the set. If the noises cease when you do this is is probable that something outside is causing the trouble.

You may tune in your local one night and find that there is an unaccustomed whistle as a background. Many beginners think this means there is something wrong with the set, whereas actually it is caused by some foreign station coming too close in frequency to the local,

Carefully open out the split pins of valve bases to ensure a good contact with the valve-holder sockets. Take care not to damage the connecting wires that run through the pins

thereby setting up an audible heterodyne or interference beat note.

Fading is another so-called fault that is really not due to anything wrong with the set but to atmospheric or rather ether conditions.

If your home station fades when normally you get fade-free reception you may suspect that a nearby listener is absorbing some of the energy you should be receiving.

Look around to see whether there is a much higher aerial, or inquire as to whether a neighbour has bought a new and powerful set.