

HINTS AND TIPS FOR BETTER QUALITY

A WORTH-WHILE ADDITION TO YOUR SET

Amateur Wireless

and
Radiovision

Every
Thursday 3^d

Vol. XIX. No. 479

Saturday, August 15, 1931

for **HINTS & TIPS**
BETTER QUALITY



**TUNING AND PURITY—PREVENTING OVERLOADING—FITTING
VOLUME AND TONE CONTROLS—HIGH-TENSION AND QUALITY—
DETECTOR DISTORTION—LOUD-SPEAKERS AND DISTORTION**

THE BEST WILL ALWAYS STAND OUT



Just as one great man will dominate a crowd, so does a PERTRIX Dry Battery stand out from all others—in performance and in length of life.

And the PERTRIX Accumulator, built as it is, on more than forty years' experience in the manufacture of storage batteries, is a worthy companion to its 'Dry relation.'

All 'good' dealers sell PERTRIX.

PERTRIX SUPER LIFE DRY BATTERIES & ACCUMULATORS

Made by
BRITANNIA BATTERIES, LIMITED
at Redditch, who also make:

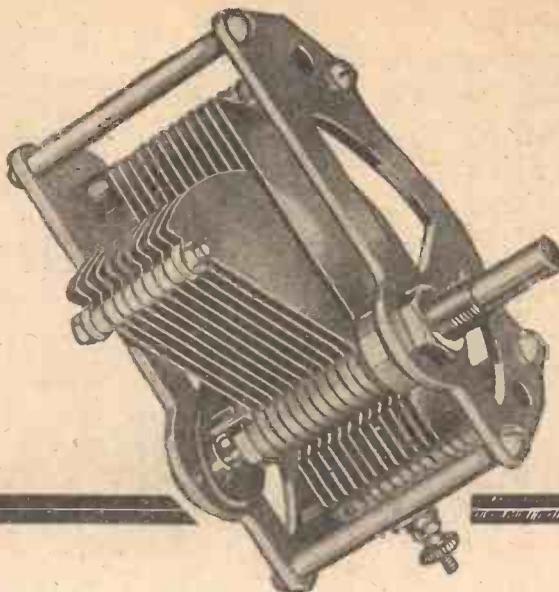
- Batteries for Central Stations
- Batteries for Country House Lighting
- Emergency and Stand-by Lighting Batteries for Theatres, Cinemas, Hospitals, etc.
- Batteries for the Starting and Lighting, and Lighting and Ignition of Motor Cars, Motor Cycles, Buses and Coaches
- Batteries for Electric Vehicles, Trucks, Locomotives, Ships and Yachts
- The only Nickel-Iron Batteries on sale in Britain that are entirely made in this Country.

YOU WILL HEAR IT BETTER WITH PERTRIX

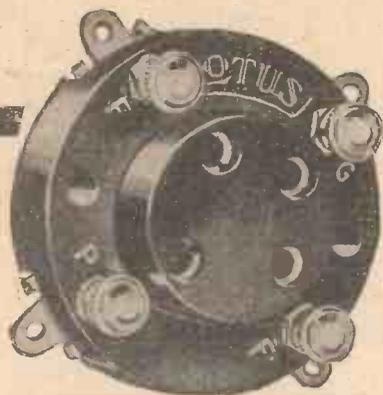
Advt. of Pertrix Ltd., Britannia House, 233, Shaftesbury Av., London, W.C.2. Telephone: Temple Bar 7971 (5 lines) Works: Redditch (L.P.203)

To Ensure Speedy Delivery, Mention "A.W." to Advertisers

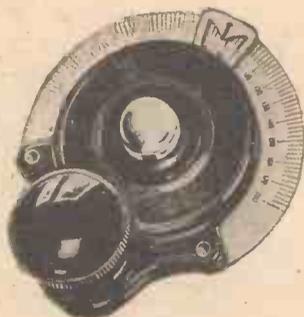
DONT EXPERIMENT -USE LOTUS COMPONENTS



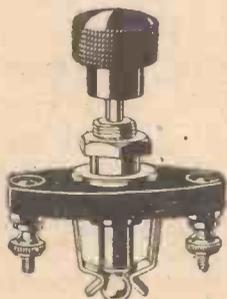
The LOTUS Variable Condenser. Brass vanes and endplates. Ballbearings. .0005 5/9, .00035 5/7, .0003 5/6, .00025 5/3, .00015 5/4.



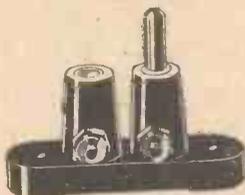
The LOTUS Miniature Anti-Microphonic Valve Holder. One piece phosphor bronze springs and sockets. With or without Terminals 1/- each.



The LOTUS Slow Motion Dial Ratio 7-1. Satin Aluminium Dial marked 0-180. Guaranteed free from backlash. 4/9 each.



The LOTUS Battery Switch. A highly finished component for reliable and efficient switching 1/6 each.



The LOTUS Single coil Block. With Terminals 8d. each.



The LOTUS L.F. Transformer. A small but highly efficient instrument having remarkable characteristics at all audio frequencies. In two ratios 3-1 and 5-1, 12/6 each.

THESE COMPONENTS ARE SPECIFIED FOR THE "UNIVERSAL SHORT WAVE 3"

described in this number

Progressive excellence of design and performance has built an enviable reputation for LOTUS Components. That is why all the leading radio designers specify LOTUS. They know from actual experience that these Components are reliable and will ensure the efficiency they themselves have achieved.

When you build the "Universal Short Wave 3" be sure to ask for 2 LOTUS Variable Condensers, 2 LOTUS Slow-Motion Dials, 1 LOTUS Battery Switch, 2 LOTUS Valve Holders, 1 LOTUS Single Coil Holder, and 1 LOTUS L.F. Transformer.

YOU CAN RELY ON



Ask your dealer or write direct to the makers
for an illustrated list

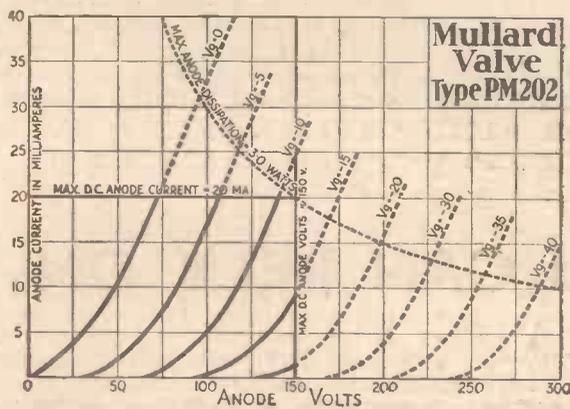
LOTUS RADIO, LTD., Mill Lane, LIVERPOOL

Mention of "Amateur Wireless" to Advertisers will Ensure Prompt Attention

Mullards, always ahead . . . produce a great new type



P.M.202



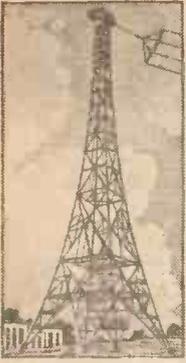
Do you know that you can now use a true super-power valve in your portable? You can — it's the Mullard P.M.202—a new valve which consumes only 0.2 amp. low tension—no more than an ordinary power valve.

PRICE 13/6

Mullard
THE · MASTER · VALVE

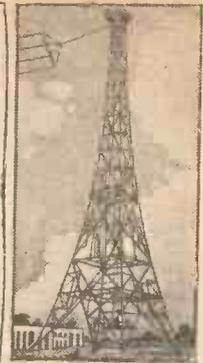
Advt. of The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2

You Will Help Yourself and Help Us by Mentioning "A.W." to Advertisers



Amateur Wireless

and
Radiovision



EDITOR:
BERNARD E. JONES.

TECHNICAL EDITOR:
J.K. REYNER, B.Sc., A.M.I.E.E.

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

RESEARCH CONSULTANT:
W. JAMES.

ASSISTANT EDITOR:
H. CORBISHLEY.

NEWS · & · GOSSIP · OF THE · WEEK

PURITY!

IS there any listener who can honestly sit back and say: "My reproduction is perfect"? The experts may be able to do so, but the average man will want to turn to pages 198-200 of this issue and read the helpful advice on getting better reproduction. The hints apply to any type of set.

NOT A. J. ALAN!

MANY listeners have asked us whether Robert Hartman, who recently talked on "Carping and Crabbing," is another name for A. J. Alan. There is certainly a striking similarity in the intonations and mannerisms of these two popular broadcasters. Actually, Robert Hartman, who is an old Etonian, was "discovered" by Lionel Fielden, of the B.B.C.'s talks department. Many bets have been laid on the probability that Hartman is Alan—but he is not!

HANDS OFF B.B.C.'s MONEY

IF the recommendations of the Committee on National Expenditure, whose report was recently published, are carried out, the B.B.C. looks like losing a huge slice of its present revenue. The Committee discloses B.B.C. financial secrets of interest to all listeners. It is disclosed that the B.B.C. is going to purchase Broadcasting House, that is, the site and building, for £650,000. That it will spend £200,000 on equipment and furnishing. That it has purchased the adjoining site for £50,000.

WHO GAVE AWAY SECRETS?

THIS information was not supplied to the Committee by the B.B.C. Who did supply it? It looks as though the Civil Service has had a hand in the matter. At any rate, the B.B.C. cannot feel very pleased about the way its secrets have been broadcast in the report.

REVISED REVENUE

IF the recommendations go through, the B.B.C. will be paid 80 per cent. on the first million licences, 60 per cent. on the second million, 40 per cent. on the third million and all in excess of 3 millions, 20 per cent. This is stated to yield a licence

revenue of just over £900,000, assuming 4,000,000 licences for the present year. The Exchequer stands to gain about half a million pounds for the year.

A QUEER NOTION

SINCE less than 20 per cent. of the total licence money would go to broadcasting, it is important to gain an insight into the attitude taken by the committee. It seems to regard the licence money as a tax, whereas we are sure listeners regard it as payment for programmes. The fact that much of the licence revenue is at present going to technical improvements and not to actual programmes may account to some extent for the committee's attitude.

FROM "STUDIO" TO "CONTROL"



The hundreds of cables linking Broadcasting House's studios with the control room are carried in this conduit

MINORITY REPORT

THERE is, fortunately, a minority report about the recommendations mentioned above. In this report it is stated that possibly the acquisition of new premises out of revenue was an unwise move, but that if the successful operation of a state enterprise like broadcasting is taken as an excuse for appropriating more of its revenue than was originally intended, there can be no general success for this type of state service.

NOT A REAL BROADCAST!

WE hear that a big Paris newspaper now furnishes the public with a telephonic information service through which any subscriber can for three minutes hear the latest news. On the occasion of the Davis Cup Final, however, there was such a heavy demand by Parisians desiring to know how the matches were progressing that all the lines on the same exchange became muddled—with the result that, for a good half-hour, one of the largest areas in the centre of the city found itself compelled to listen in to the announcements of the results!

MORE VAUDEVILLE

FOLLOWING on our plea last week for more vaudeville, listeners who appreciate "light" turns should note that Jack and Claude Hulbert return to the microphone in a combined turn on August 26 (Regional) and 28 (National). This is a strong vaudeville programme, for it includes also Tommy Handley and Sandy Rowan. Ann Penn will bring another batch of her impersonations to the microphone on August 29, in a vaudeville programme which also re-introduces Stainless Stephen to listeners after a considerable absence from Savoy Hill. *That's* the sort of stuff we want!

NEWCASTLE'S TROUBLES

AS the B.B.C. anticipated, the synchronisation of the Newcastle station's wavelength with that of North Regional on 479 metres has introduced a mush area around the Hartlepoons and Teeside. Several Northern newspapers are creating an uproar about "wave wobbles" caused

by the synchronisation experiment. It is only an experiment and we think the agitation is a little premature. The only constructive suggestion we have seen is that Newcastle should be synchronised with the wavelength of the Midland or London Regional stations.

PROGRAMME PROBLEMS

IF Newcastle were synchronised with Midland or London Regional stations, the mush area would certainly be removed from the Hartlepoons to some point outside the service areas of the two stations involved. From a technical point of view the suggestion therefore has merit. But would Newcastle listeners like the Midland or London Regional programme? After all, these listeners come within the Northern Region. Maybe Newcastle will go back to 288.5 metres and so become a National programme outlet once again.

DIRT-TRACK AGAIN

PAST O.B.'s from the dirt-tracks have proved popular. A third is to be given. On August 14 a running commentary

the amplifying equipment at the disposal of stand holders. We can think of no one more capable of providing good quality reproduction than the B.B.C. Let us hope the innumerable loud-speakers will do justice to the "juice" supplied to them. The B.B.C.'s exhibit is not yet settled. One idea is that the exhibit should show the relationship between the population of this country and the areas covered by the B.B.C. service.

RADIO WEEKS

AT Exhibition time there will be the Bristol Radio Week. We hear that there is also to be a Cardiff Radio Week, from October 24 to November 1. These Radio Weeks are organised to popularise radio by the broadcast of special programmes made up of local talent.

TRANSATLANTIC RELAYS

AT present the interchange of programmes between this country and the U.S.A. is most successfully done through the Rugby 'phone service. In the not too distant future there will be another

is concerned. Many more Welsh programmes may be expected in the future from our one and only long-wave station.

MORE FAT-STOCK PRICES

UP to the present, a list of market prices for the information of farmers in Northern Ireland has been broadcast from Belfast once a week. In view of the value of this bulletin it has been decided to make it a daily feature and, starting on August 31, it will be broadcast at 5.55 p.m. each day, Saturdays and Sundays excluded. Farmers please note: other listeners will tune to a different station!

WHY NOT A MUSEUM?

SO far we haven't heard that there will be a radio museum in Broadcasting House. But there should be. It would add to the national interest of the building. It is proposed to establish at Prague a radio museum, and the authorities are now collecting documents and other matter relating to the development of engineering and the constructional work accomplished by radio pioneers. Similar museums have already been founded in Germany at Berlin and at Munich. We have a fine radio section at the Science Museum at South Kensington, but really the B.B.C. might have something of the same kind.

FURTHER NEWCASTLE NEWS

AS we go to press we hear that the serious interference between Newcastle and North Regional in the Hartlepoons area has been considerably reduced owing to greater accuracy in the synchronisation of the two stations to the wavelength of 479 metres. The B.B.C. admits that, during the first two or three days, results were less satisfactory than was hoped. It now asks for listeners' co-operation. If the experiment is a success Newcastle listeners will have a choice of two programmes, but if it is a failure, and Newcastle goes back to 288.5 metres, listeners in that district will have only the National programme.

RODNO RADIO

THE first Bulgar transmitter has been opened in Sofia, says a Philips correspondent. The station is installed in a bank building, has a power of 1 kilowatt, a wavelength of 319 metres, and uses the call "Rodno Radio."

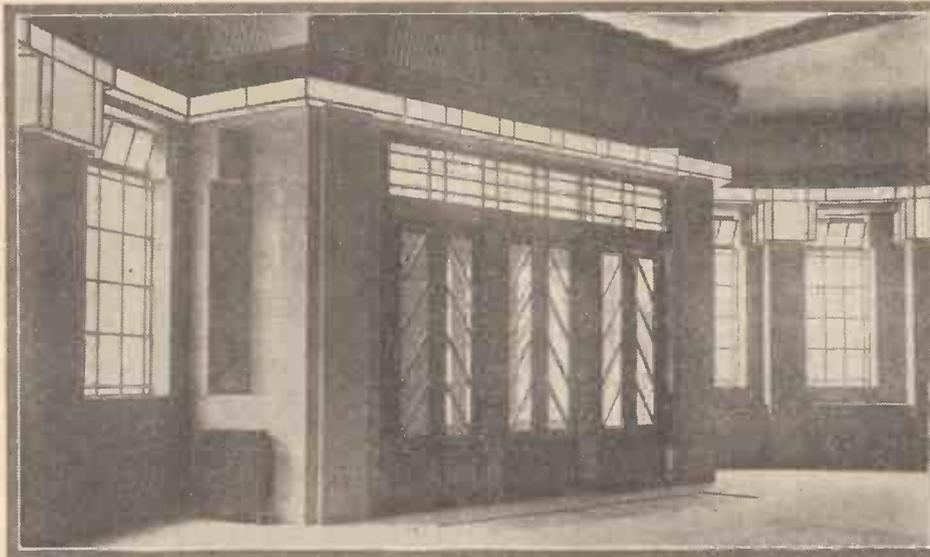
"BACH" AGAIN

BACH lovers (and nobody else) will be pleased to hear that the Bach cantatas will be reinstated in the Sunday programmes on September 6, after a ten weeks' rest. The first cantata to be given will be No. 17, with Percy Pitt as conductor; it will be relayed from All Saints' Church, Margaret Street.

"LIVING DANGEROUSLY"

HOLT MARVELL and S. P. B. Mais have some job ahead of them! Starting on Monday, August 31, they are to discuss, every Monday and Thursday for three weeks, the above topic. It is no secret that they hope to be helped out by people who have "lived dangerously" and are willing to say how in front of the microphone.

AN IMPOSING ENTRANCE



The entrance hall of Broadcasting House is now almost complete, and some idea of the dignified effect created by the stone and metal work, and the hidden lighting, is conveyed by this photograph

on the official speedway test match between England and Australia will be given by Mr. J. S. Hoskins from the Wembley Stadium and will be relayed in the National programme.

STILL MORE STATIONS

PLANS have now been approved for extending the Hungarian Broadcasting organisation. A large transmitter having a power of 150 kilowatts will be erected at Lakihegy. At the same time relay transmitters are being erected at Nyiregy-Hazal (5 kilowatts) and at Miskolo, Magyar-Ovar and Pecs, where the relay station will have a power of only 1/2 to 1 kilowatt.

B.B.C.'s EXHIBIT

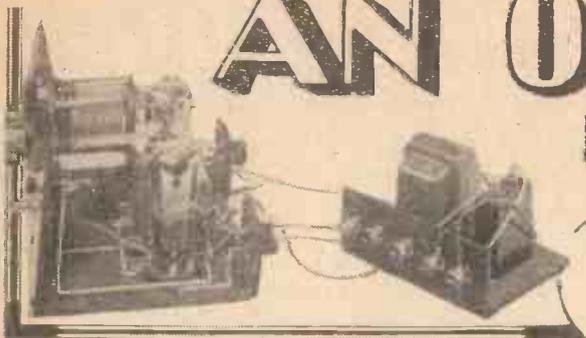
WHEN the Olympia Radio Exhibition takes place from September 18 to 26, the B.B.C. will again be responsible for

connecting link, for we hear that at the present time a transatlantic telephone cable is being manufactured. This cable will be quite suitable for relaying speeches between the two countries, although music will be out of the question.

FOR WELSH BROADCASTING

MAJOR EDGAR JONES, a headmaster and member of the Board of Celtic Studies, has been appointed to advise on Welsh matters connected with broadcasting. He is apparently doing a good deal to appease Welsh sentiment and to bring together the different groups interested in the development of broadcasting in Wales. The Nationalists demand a separate Welsh broadcasting service. The House of Commons group has at heart the interests of North Wales. The B.B.C. has definitely given in to the Welshman so far as Daventry

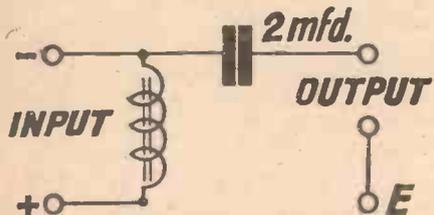
AN OUTPUT UNIT IS A WORTH-WHILE ADDITION



There are many reasons why you should fit an output unit to your speaker and here are constructional details of a simple unit, costing a few shillings, which will make a big improvement in tone

THE advantages of using an output unit should be obvious to anybody who is out to get really good tone. Not only is it possible by suitably adjusting the output unit to change the tone which may be useful on occasions, but the speaker is, of course, insulated from the high-tension current and this may be a great advantage if, for instance, your set works from the mains.

There are, of course, several forms of



The circuit of the output unit

and a fixed condenser serve the same purpose. The choke is connected across the speaker terminals and passes the steady high-tension current, but offers a high impedance to speech-frequency currents. These are by-passed through a large fixed condenser to the loud-speaker. Altering the tapping on the choke has exactly the same effect as altering the tapping on an output transformer.

This, of course, is a very straightforward arrangement and has the merit of low cost because neither a tapped output choke nor a fixed condenser are very expensive components and even if one makes a thorough job of the output arrangement by mounting the condenser and choke on a baseboard and fitting a terminal strip, the cost is well under £1.

To anybody who wants really good tone and who wishes to protect the speaker—not only to make it safe to handle if the mains are used for high tension, but also to protect its magnetic system from the steady D.C. current—this will be considered very good value.

In the unit illustrated by the photographs, which represents probably the best way of arranging the parts, a tapped output choke is used which has an inductance of 20 henries at 10 milliamperes. It is pro-

vided with an earthing terminal which under certain circumstances may be very useful. There are only five wires in the unit and it should not take more than half an hour to drill the terminals and make the connections.

You will see that the two input terminals are connected across the three tapping terminals of the choke. For most purposes it is advisable to leave the centre terminal free and to use the two outside terminals. The fixed condenser is joined to one of these tapping terminals (the one connected to loud-speaker negative and not to high-tension positive on the set) and the other side of the condenser is connected to one output terminal. The other output terminal and the earth terminal on the unit are wired together.

Now for working. The speaker is first disconnected from the set and the input terminals of the unit are connected in place of the speaker. It is important to wire it up the right way round. The input positive terminal on the unit must be connected to the loud-speaker positive

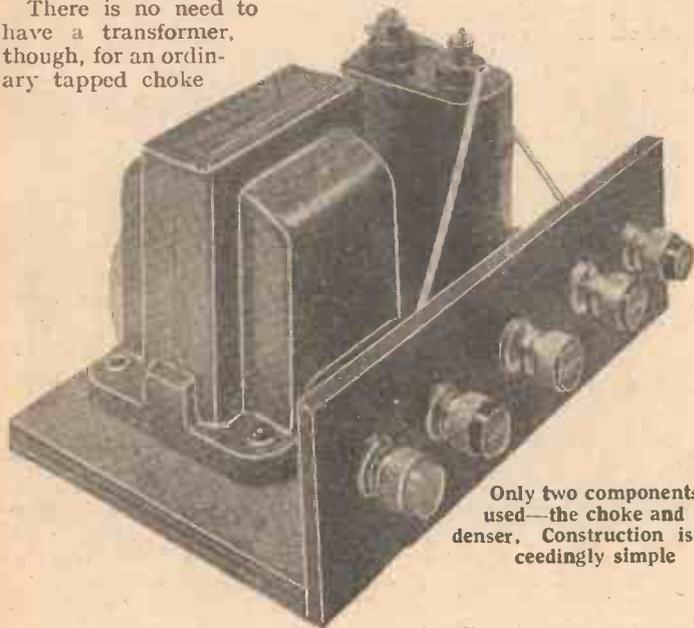
(Continued at foot of next page)

output unit and it is not wise to make a haphazard choice.

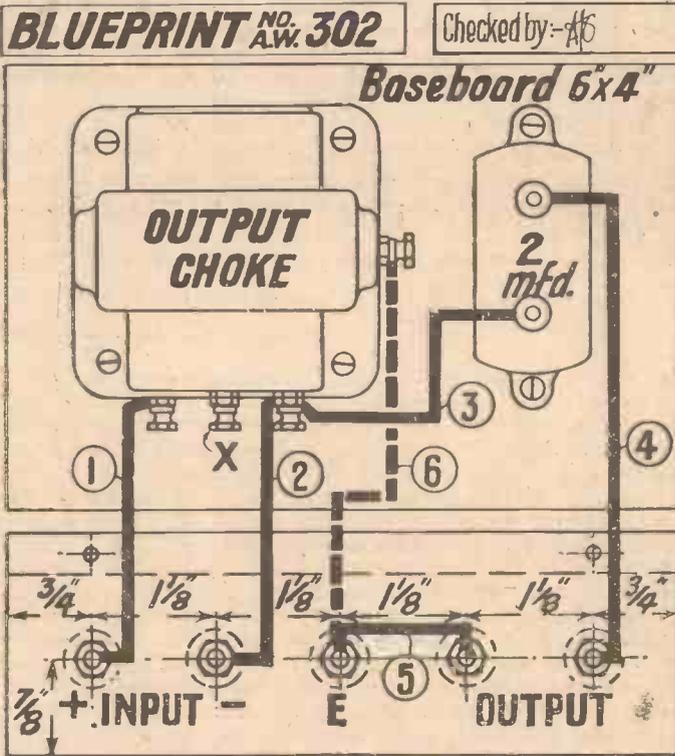
One can have, for instance, a tapped speaker transformer, the primary winding of which is connected across the loud-speaker terminals of the set and the secondary of which is connected to the speaker.

One winding, generally the secondary, is tapped, so that one can try various transformer ratios, each one giving a slightly different tone from the others, because this alters the ratio of the anode circuit and loud-speaker impedance.

There is no need to have a transformer, though, for an ordinary tapped choke



Only two components are used—the choke and condenser. Construction is exceedingly simple



Ebonite 6x2"

The layout and wiring diagram of which a full-size blueprint is available, price 9d.

THE NEW SET

By LESLIE T. BARNARD

Now listen, Molly. I paid a lot of money for this radio. It's a darned fine set, but it's simple to work. I'll just show you how to get the stations, so you can have it on when I'm away, see?

Notice all these knobs here, Molly? Well, don't take any notice of 'em, they're only to be used by people like myself who want to get more out of the set. All you've got to do—see here—is to pull out this knob—so—and—well, that's funny. That fellow at the shop told me you only had to pull out the knob and—

Now just a minute, Molly; don't fluster me. Oh, yes, you pull out this knob—that switches on the high tension or something—you wouldn't understand that, of course, and then twist the dial to whatever station you want. Simple, isn't it? A fool could work it.

Let's say you wanted to get the Midland Regional, Molly. You put the dial here—

so—no, here—dammit, that's peculiar. I could have sworn—don't keep grinning like that. For Midland Regional, I repeat, you set the dial so—no—yes, I know, it's atmospheric—just here, see—oh, well, you won't want Midland Regional, anyway, I'll show you how to get the National programme.

Watch closely, Molly. You pull the knob out—yes, I know it's out now—and twist the dial so, see. Got it first time. Simple, isn't it? Gorgeous music. You see how I did it, Molly, just twisted the knob to that number—eh? What? A German station. Don't be ridiculous, girl. As if I don't know—dashed if I don't think you're right. What the devil's wrong with the set?

Let's cut that awful music off. Dammit, the set's gone dead. Stone cold. Heck, what the—eh? What did you say, Molly? I pushed the knob in accidentally with my

hand? Don't be absurd. It's impossible—hrrm, funny, me doing a thing like that.

Now listen to me, Molly. What's the good of my showing you how to work this set if you won't take notice? You put the dial reading so—no, I know I'm not getting the National. I'm getting Jack Payne on the London Regional—oh, shut up, woman, I can't help it shrieking, can I? What the devil is wrong with the set? It went all right in the shop.

Molly. Don't go near that set. Molly! If I can't manage it I know you can't. Oh, girl, you're doing it all wrong—all wrong. Come away. Eh? That the London Regional. More likely Kamchatka or Timbuctoo. You make me laugh, Molly. Now listen for the announcer in Hungarian or Sanskrit—hum, you're quite right, Molly. It is the London Regional.

Well, as I was saying, Molly, now I've shown you how to get the stations, you'll have to be very careful. This set cost a lot of money. But simple. Nobody but a fool couldn't work it—hrrm—hum.

Yes, that was a snappy dance number.

AROUND THE SHORT-WAVE DIAL

By MANDER BARNETT

At the moment of writing, station W2XAD has almost vanished, only a faint carrier being audible at times. W2XAF is better, but is still faint and is subject to interference from a morse station, which heterodynes the American's carrier during most of its transmissions. Rome I2RO is good, but is not up to its usual strength. The new French "colonial" station at Pontoise, Paris, has been heard transmitting on two wavelengths simultaneously, namely, on 25.20 and 25.63 metres. The call of this station is FYA and he is easy to find because he appears to be transmitting on either one or both of these wavelengths at most hours of the night and the Rome I2RO station is about midway on

the dial between the two wavelengths. W8XK also transmits on 25.24 metres, so that it is not hard to find this small cluster of stations.

Zeesen continues to come in fairly well and the quality of his modulation has improved somewhat lately. Radio Rabat, Morocco, on 32.26 metres, is a good signal and comes in at full volume as a rule. By the way, if you want to hear your own name come floating over the ether, send this station a report of reception and they are likely to repeat extracts from it during their programmes on certain nights. A new station which can be heard at times is ZLW, at Wellington, New Zealand. The writer heard him a few nights ago talking

to London. His wavelength is 27.3 metres.

How many amateurs ever listen for the American "hams," using 'phone? You do not need any knowledge of Morse to do this and one can get quite a thrill to realise that the station one is listening to is owned by an amateur and not a commercial broadcasting concern. WICZ, for instance, who gives his location at Cape Cod, Massachusetts, has been heard by the writer just lately, with quite as much volume on the 20-metre band as the powerful W2XAD can sometimes put up.

RW59, the station at Moscow on 50 metres, continues to roar in but he has a very noisy background, and the carrier is not very steady.

It is welcome news that G5SW is going to increase its power to 50 watts in the immediate future, and also that it will continue radiating until 4 a.m., G.M.T.

"AN OUTPUT UNIT"

(Continued from preceding page)

terminal and the input negative terminal to the loud-speaker negative terminal on the set. The earth terminal on the unit is connected to low-tension or high-tension negative on the set and the two output terminals of the unit are connected to the speaker. The tapings on the choke may be varied until the best tone is obtained.

There is a big advantage in this unit if loud-speaker extension wires are used. The output unit should be wired up close to the set and the loud-speaker extensions made from the output terminals.

If the extensions are not too long you need only have one wire. This extension should be connected to the output terminal which is wired up to the fixed condenser of the unit and not to the terminal which is earthed. This extension is, of course, connected to one terminal of the speaker and the other speaker terminal is taken to any convenient earthed point. The return circuit is made via the earth lead of the set and this possibility of doing away with

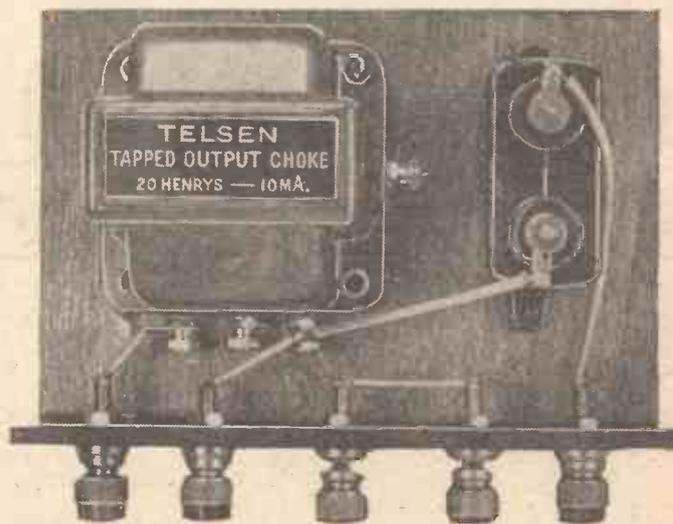
one loud-speaker extension wire may be very useful on occasions.

The earth terminal of the choke may be connected to earth or high-tension or low-tension negative if the output unit has to be placed very close to the set and there is the possibility of interference.

Another point is that this choke output unit can be used for tone correction when there is a pentode in the power stage of your set.

For working with a pentode it is necessary just to make a slight alteration in the connections. The lead marked 3 on the blueprint should be disconnected from

its present terminal on the tapped choke and connected to the centre terminal marked X.



This plan view of the unit shows clearly its construction

HOW THE B.B.C. ENCOURAGES LOCAL TALENT

KENNETH ULLYETT here gives details of the new Provincial studios which are being opened to provide Regional stations with more programme matter from local Regional centres.

WHEN the Regional scheme was first started, and after listeners all over the country had had a taste of National and Regional programmes, people in certain districts began to fear that the programmes from the bigger distributing centres, Savoy Hill, Manchester, and Edinburgh, would leave no room for local talent from the studios of the relay stations.

As though to add support to this belief, changes had to be made at the relay stations and they were "commoned" on the National common wavelength of 288.5 metres. This meant that they all had to give the same programme, and the only feasible way of doing this was to link them up with the National centres.

More Local Studios

Now there is a move in the opposite direction. The relay stations must still operate on the common wavelength, but the Programme Department is being pressed to make more use of local talent and the only way in which to do this is to open studios in the area concerned.

These studios will not be connected to the relay stations, but will have a land-line link with the big Regional transmitters.

Slaithwaite gets its Regional programme from the Manchester Broadcasting House, but for some considerable time it has been felt that this does not adequately cover the needs of Northern listeners. At the beginning of this month, the B.B.C. took over a local studio in Leeds, and when this has

been completely fitted out it will play a big part in providing the programmes in the North.

The Glasgow studio—previously the main studio for the Glasgow station—is being maintained despite the opening of the Broadcasting House in Edinburgh where there are three fine studios. This Glasgow studio is often handy for Glasgow artistes who could not conveniently get to Edinburgh.

Down at Plymouth, a regular feature is maintained from the local studio there in the shape of a Children's Hour. There is, strange as it may seem, a great deal of interest in the Children's Hour as a local item, and at present undoubtedly there would be strong objection to alteration of Plymouth's local "hour" in favour of a Children's Hour by land-line from London. The studio facilities at Plymouth are handy for talks—Bernard Shaw has spoken from there—and for items of local interest. Plymouth's Navy Week was recently featured at the B.B.C. studio there and this item was included in the Western Regional programme.

At Bristol there is a talks studio which has a particular advantage because it often saves Western Regional artistes crossing the Severn in order to go to Cardiff. The Bristol studio centre has a control room, a



A glimpse into the Plymouth local studio during the special Children's Hour which is given from here—the only local studio centre to maintain a feature of this kind

Board Room, and headquarters for the Education Officer of the West Regional, and the studio is connected by land-line link with the transmitter.

When the Western Regional transmitter is built, the Bristol studio will assume a much greater importance in the provision of local programme material.

Also there are plans on the *tapis* for the acquisition of a small talks studio somewhere in North Wales. The site has not yet been settled and it is not probable that anything will be done until the construction of the Western Regional transmitter is well in hand, but the Programme Department is confident that there is a great deal of local talent waiting to be tapped in North Wales and that a studio there will be essential.

The Newcastle Example

This matter of making use of local talent has not always been without difficulty. Until Newcastle was synchronised with Slaithwaite, a most extraordinary state of affairs prevailed there. Listeners in Newcastle, before Newcastle was synchronised with the North Regional and when it gave the London National programme, could hear only 5XX and the Newcastle relay. They had no alternative and could hear the National programme on two wave-lengths.

This might not have been of great importance for a while, until new wave-lengths were available, but the galling part of it was that Newcastle was used to provide local talent in the programmes of Slaithwaite, and although this programme material came from Newcastle, Newcastle listeners could not hear it because it was drowned by the London National programme from the Newcastle relay!

Now the introduction of tuning-fork drive has enabled Newcastle listeners to share in the North Regional programmes and when local talent comes from the Newcastle centre, Newcastle listeners will be able to enjoy it.

During the next few months, interest will centre largely on the development at Leeds. (Continued in third column of next page)



The control apparatus at the Plymouth Station which deals with the National relayed items and with the local broadcasts

THE HOW AND WHY OF RADIO—XLIX

BAND-PASS TUNING

Written specially for beginners who want simple and practical explanations of the underlying principles of radio

BAND-PASS tuning will be all the rage during the coming season. Beginners will therefore be glad of a simple explanation of this principle of tuning.

Band-passing is a process of pre-selection. That is to say, the incoming signal is selected from all interfering signals before any valve amplification takes place. To do this two tuning circuits are needed in front of the first valve, which may be the detector or a high-frequency-amplifying valve.

A band-pass tuner is therefore a combination of two tuning circuits, and these are loosely coupled together. The whole essence of band-passing is the differentiation of the wanted signal from unwanted signals before valve amplification. As explained in one of the first articles in this series, tuning is itself a great amplifying process.

valve, tuner. But the inter-position of a valve in this way tends to aggravate the lack of selectivity of the first tuning circuit.

If the two tuning circuits of the above sequence are made sufficiently selective to overcome the broad tuning in the aerial circuit, the overall resonance curve will be "peaked," so that high frequencies will be lost and bad quality produced.

The band-pass sequence of tuner, tuner and amplifier overcomes the poor selectivity of the aerial circuit, and subsequent amplification produces a better ratio of selectivity to sensitivity. Fig. 1 shows an important difference between the resonance curve of the normal circuit and the band-pass circuit.

At A is shown the sort of tuning obtained with a sequence of tuner, valve and tuner, using fairly selective coils. At B is shown

between high-note loss, selectivity and sensitivity. To do this we can use inductive coupling as shown at Fig. 2A, capacity coupling as shown at Fig. 2B, or mixed coupling as shown at Fig. 2C.

The first two methods are losing favour because neither of them provides a constant degree of selectivity over the whole wavelength range. The mixed coupling band-pass tuner, where the coupling is made up of the mutual inductance of the two coils and externally connected condenser, is likely to be very popular.

Another advantage of the mixed coupler is that the loss of signal strength, which is the price of good-quality selectivity, is not so pronounced as with other band-pass couplings. The band width of the resonance curve can be kept fairly constant with the mixed-coupled band-pass tuner, whereas

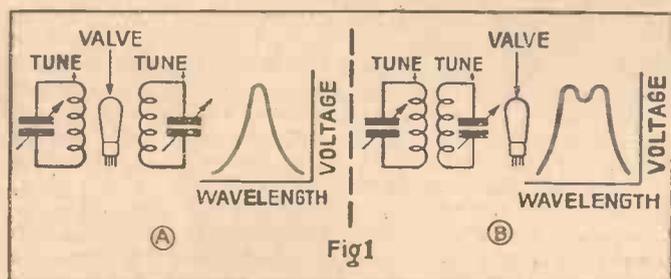


Fig. 1. Here are the differences between the normal resonance curve and that of a band-pass circuit

So when a signal is picked up in the aerial circuit the aerial tuning amplifies this signal, and if the circuit is selective enough it will do this without amplifying any other signals. But if the aerial circuit, or any tuning circuit for that matter, is made too selective, quality of reproduction suffers, because the higher audible frequencies are cut off.

Why are the high notes cut off? The answer is that the received signal is not one frequency but a large number; there is the fundamental frequency, corresponding to the wavelength of the transmission, and there are frequencies on each side of this fundamental, corresponding to the higher frequencies of the audible range and caused by the process of modulation. So if we make the tuning circuit very selective, by a reduction in its resistance, it will, when tuned to the fundamental, cut off the side-band frequencies.

For this reason we cannot, with a single-tuning circuit, gain sufficient pre-selection to lift the wanted signal head and shoulders above the adjacent unwanted signals before valve amplification. In the normal way we have tried to make up for this shortcoming of the aerial tuning circuit by putting in another tuning circuit after the first stage of amplification. Thus a common sequence has been this: tuner,

the tuning obtained with band-passing, that is with a sequence of tuner, tuner and valve. Note that whereas the A tuning shows a sharp peak at the resonant point, the B tuning has a double-hump top to the curve, due to action of two coupled circuits.

As these two tuning curves are supposed to be drawn on the same base, it follows that whereas the dial spread for each station is the same for each circuit, the B circuit covers more of the high frequencies, due to the greater response on each side of the fundamental.

The real advantage of the band-pass tuner is that selective tuning is obtained without a loss of the high notes in the audible range. A signal selected by a band-pass tuner from all others is less likely to be mutilated than with normal sharp tuning arrangements.

The double-hump effect of Fig. 1B is due to the coupling of the two tuning coils. The overall effect is the production of a "flat-topped" resonance curve. There are several ways of coupling together the two coils of a band-pass tuner. It is not convenient to use the mutual inductance of the two coils for coupling as shown at Fig. 1B, which is only a simple illustration of the tuning sequence.

Band-pass tuning is not quite so simple as it looks. We have to compromise

this tends to vary over the wavelength range when plain inductive or capacity coupling is used.

One of the inevitable complications of band-pass tuning is the need for two tuning condensers in the aerial circuit. Two separate condensers can be used, but operation is very much simpler if the two halves of the band-pass tuner are simultaneously tuned by a gang condenser.

HOTSPOT.

"HOW THE B.B.C. ENCOURAGES LOCAL TALENT"

(Continued from preceding page)

It is planned to have a talks studio, a studio large enough to accommodate a fair-sized orchestra, and there will also be a dramatic control panel, so that radioplays can begin.

This new local headquarters is in Woodhouse Lane, Leeds, and was formerly a Friends' Meeting House. Three or four months will be taken in making the necessary alterations and in making the land-line arrangements so that the Leeds studio will be in touch with Slaithwaite or with any other transmitter if necessary.

It seems as though, as the B.B.C.'s scope widens, it is necessary to cut down the number of transmitters, but to increase the number of local studios—which is a thing one could never have forecast.

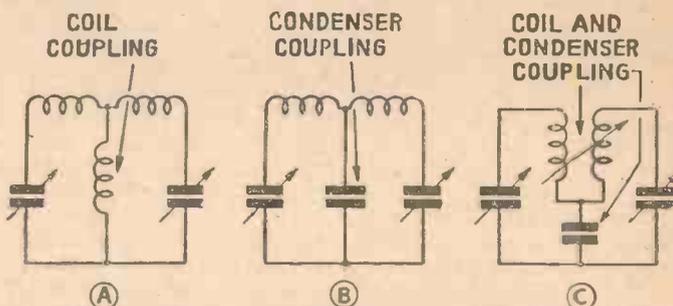


Fig. 2. Three types of coupling for band-pass tuning

Oh Low Waves!

SUMMER RECEPTION

ALL my listener friends seem to be moaning about the general fade-out of their favourite distant stations. It is true that present evening reception, while it is still daylight, yields only a few foreigners, but the consolation is that those few are relatively free from interference. As all the weaker stations have ceased to send us a reflected ray, and their ground rays are quite lost in the intervening distance, the more powerful stations are not now suffering from the horrible heterodyning whistles that invariably accompany them during the winter months.

EARLY-MORNING LISTENING

THOSE who pine for a little really attractive distant-station reception might do worse than get up early in the morning, at which time a surprising number of the foreign stations are "on the air."

At about 7 a.m. the fun begins. My experience shows that there are about five stations always broadcasting during the breakfast period. Try Berlin on the long waves. This station is now a very powerful signal and often sends out some amazingly good quality in the mornings, when he is free from the interference of our Daventry.

Usually the early-morning foreigners send out only gramophone records, but many are well worth hearing. By no means are all the records jazz. In fact, there seems to be a great liking for popular classics and selections from the operas.

If your knowledge of French can be trusted, there are the physical jerk broadcasts from Radio Paris at 7.30 a.m. Personally, I am never quite sure whether the instructor is telling me to lie on my back or jump over the bedrail!

Another interesting early-morning broadcast from Radio Paris, again for those who know some French, is the *revue de presse*. One often hears tit-bits of Continental news through this channel that are either omitted or suppressed from the English newspapers.

FAVOURITE PROGRAMMES

ONE of my favourite stations for breakfast-time music is Hilversum. This sends its programmes through the Huizen transmitter on the long waves. The Hilversum A.V.R.O. organisation certainly selects its gramophone records with great care. This record concert starts at 7.40 a.m., at which time one can hear studio chimes for 8 o'clock in Holland. Follows over an hour's varied selection of music via the gramophone.

Still on the long waves we have Kalundborg, another early-morning broadcaster. The other morning before 7.30 a.m. this station was livening up the ether with "It's a Long Way to Tipperary." Many of the records broadcast by this and other stations are from English companies.

On the medium waves, Langenberg, and

Hilversum doing Huizen programmes, can always be relied upon to supply the early-morning listener with light music. Sometimes the Huizen organisation devotes its time to a religious service, but as a rule it follows other Continental stations in broadcasting selections of gramophone records.

A NOVEL LOUD-SPEAKER TESTER

I CAME across a most interesting and unusual use for gramophone motors the other day. I was showing a friend the new Wates synchronous motor. This form of machine has a large number of pole pieces on the stator, and when alternating current is applied, each pole-piece becomes magnetised in turn. The rotor has a large number of teeth on it which are attracted to the pole-piece on the stator, and follow them round as they become magnetised, in turn. The synchronous motor is not self-starting and has to be given a spin before it will commence rotating. Once it has started, however, it will continue to rotate at a fixed speed, depending only on the frequency of the supply.

I was about to demonstrate the motor to my friend and picked up a length of flex to the other end of which was connected a lamp socket adaptor and connected it to the terminals of the motor. I then inserted the plug in the adaptor and spun the motor round in order to start it. To my surprise, a horrible moaning noise came from the loud-speaker, which was also on the bench. Moreover, the motor did not run but gradually slowed down and at the same time this moaning gradually got lower in pitch.

A WIDE RANGE

I REALISED at once what had happened. I had picked up the end of a wrong piece of flex, and had actually connected the motor to the loud-speaker. When I was spinning it round it was acting as a generator and producing audio-frequency currents which were affecting the loud-speaker. The more rapid the rotation the higher the frequency, so that as the motor slowed down, the pitch of the whine from the loud-speaker gradually got lower and lower.

We made several experiments to see how fast we could spin it, and were able to get up to frequencies of 1,000 cycles per second without much difficulty. The speaker then emitted all frequencies from 1,000 down to about 10 cycles per second in a gradually falling cadence. In fact, the result was just like a falling frequency record which we often use for testing loud-speakers or amplifiers, and I believe in some ways it was even better. At any rate, I am looking into the idea, and anyone who possesses one of these synchronous motors might care to try some experiments for himself.

THE VALUE OF VAUDEVILLE

CRITICS of the B.B.C. seem to be making a "dead set" just now against the vaudeville programme. There are

many listeners I know who prefer it to any other kind of entertainment offered by the B.B.C. But quite apart from personal preferences, I think everyone will agree that it must be a tough job to try and maintain an atmosphere of novelty and freshness in these "variety" turns, week in and week out for years on end, and I don't believe that any of the critics would make a better hand of it themselves in the long run.

The B.B.C. claims that no variety artiste, amateur or professional, is ever refused an audition. Some 2,000 would-be aspirants are tried out annually, of which less than one per cent. reach the standard required. Yet 900 vaudeville artistes, new and old, are booked each year, so that it really boils down to a question of getting value for money, or alternatively of giving sufficient money to attract good value.

PROGRAMME PREFERENCES

SPEAKING of this kind of thing, it is extraordinary what differences of opinion come to the surface, even in the best family circles, on the question of one programme versus another. Of course, it is only to be expected that paterfamilias should like an occasional half-hour with Sir James Jeans when he goes exploring the depths of interstellar space, or with Sir Arthur Eddington when he addresses the microphone on the mysteries of time, space, and matter. These interludes may not always be suffered gladly by the rest of the family, but they are, somehow or other, endured. Dance music can also be a bone of contention where the family, as is often the case, contains some members who enthuse over jazz and others who loathe it.

But broadcast plays are perhaps the most frequent cause of bickering before the loud-speaker. To hear a play at its best the room should be both dark and quiet, and quite free from interruption in the form of casual conversation and domestic chatter. In fact, one has to get back to the hush-hush atmosphere of the old crystal and headphone days, and this isn't always appreciated by the livelier members of the family.

BROADCAST DRAMA

PERSONALLY, I believe there is a bigger future for broadcast plays than most people imagine. Of course, it calls for an entirely different technique from that used on the ordinary stage. For instance, it is quite obvious that the direct relay of a play from a West End theatre never gets across the ether with the same punch as it does across the auditorium. One of the best examples of the new technique, to my mind, was the play broadcast last year under the queer title *The Flowers are not for you to Pick*. Here the author created a striking emotional appeal by methods that would be quite foreign to the legitimate stage.

:: :: *On Your Wavelength!* (continued) :: ::

TRANSFORMER MYSTERIES

FOR a long time I never could really understand why it was that transformer primaries occasionally burnt out. The H.T. current passing through them never came within streets of the safe-load limit of the wire with which they were wound. In fact, if you took a transformer out of its case and put its primary under a much heavier load you couldn't detect the slightest heating-up of the wires. One explanation which used to be given was that the insulating covering of the fine wire was apt to pick up tiny amounts of moisture from the hands of those who were doing the winding when it was made. The moisture in time corroded the wire until a break occurred and an arc was formed which completed the burn-out.

This explanation seemed plausible in the early days, when the wire actually was guided on to the bobbins by the fingers of an operator. But for many years now most transformers have been entirely machine wound. The true explanation struck me one day in rather peculiar circumstances. The set happened to be in one room and the loud-speaker in another some distance away.

SHAKING-LIKE A JELLY

IT was a set designed for big volume with great purity from the local station, and on this occasion the quality was distinctly not up to the mark. Off I went to examine the set. I couldn't see anything wrong with it, but I was amazed to hear a tiny murmuring of sound coming from some part of its "innards." This was traced to one of the low-frequency transformers, which was of the unshrouded type with a plainly visible core. The sound was caused by actual vibrations of the laminations of the core, whose clamping bolts had come loose. When these were tightened up it ceased and the quality from the loud-speaker became normal. The occurrence, though, set one thinking. When you come to work it out, the laminations are in much the same position as the diaphragms of a pair of telephones, and if they are the tiniest bit loose they must vibrate very strongly. Even if they are perfectly tight, the vibrations may still be there, and these will, of course, be communicated to the windings on the core. Vibration sets up fatigue in metals, and this explains how it is that a primary sometimes "goes." It explains also the rarer, but still occasionally met, breakdown of a secondary winding.

A LITTLE DIFFICULT

I WAS very interested to read the other day a letter on the subject of mains supply by an eminent wireless manufacturer. I knew that we had a pretty fair variety of current (A.C. or D.C.) voltage and periodicity, but I hadn't realised that there are towns in which the odd numbers on one side of a street may have A.C., whilst the even numbers opposite may have D.C. You can understand how exceedingly difficult this kind of thing makes it for the manufacturer who receives an order for a

mains set in a town which he does not know—or even occasionally in one which he thinks he does know. The writer mentioned some rather remarkable instances in London alone. In Hammersmith, for example, some people have A.C. at 110 volts and others at 230 volts, and the frequency is 50 cycles for all. In Hampstead some houses have 105 volts and others 210 volts at 50 cycles. In Holborn there are no less than three possibilities—200 volts A.C. at 50 cycles, 100 volts D.C., and 200 volts D.C. In different parts of the country the voltages vary from 50 to 250, whilst the A.C. periodicities may be anything between 25 and 100.

MY POOR ACCUMULATOR

SEVERAL other readers have written in to suggest possible causes for the blowing up of that accumulator cell of mine which suddenly went west for no apparent reason. The latest suggestions from D. G. W. (Fakenham), and D. E. S. (Bolton) are that the gravity of the acid was wrong. These, I am afraid, won't do, for I tested the acid with a good hydrometer when the cell came back from the charging station and found it as nearly correct as it ever is in such cases. When the cell petered out the gravity of the acid was right down. It looks, therefore, as if there must have been an internal short of some kind, though careful examination (this cell was glass-cased) failed to reveal any signs of such a thing. I have written it down as one of those unsolved and unsolvable mysteries which sometimes occur, and I still think that having the cell re-plated was the best solution.

WORTH REMEMBERING

ONE of the good points about glass-cased cells is that you can always have them re-plated when they need it and that it is very well worth while doing so, for the cost is very much less than that of new cells. A re-plated cell, though, is in exactly the same condition as a brand new one. Myself, I am all in favour of glass cases for cells. You don't get that gassing and bubbling which nearly always seems to occur with celluloid cases and is particularly bad if the celluloid is not of the very best quality. Again, the glass case has pitch sealing, which is very easily removed and replaced if you want to get at the innards of the cell in order to remove a deposit of sludge from its bottom or to flatten out "trees" on the plates. Glass never loses its transparency and you can always see your plates when you want to. Celluloid cases grow dim with advancing years. Nor, unless you drop it or something of that kind, will a glass case ever spring a leak. The only drawback I know to glass cases is that they are a good deal heavier than celluloid, but against this you can set the fact that moulded ribs make the use of separators between the cells unnecessary.

GOOD NEWS

FOR years now I have been urging the authorities responsible to open the

Wireless Exhibition at an earlier date. My reason for doing so is simply that most of the boys' and girls' boarding schools are open about September 20. In previous years, therefore, a very large number of potential visitors has been lost to the exhibition since the holidays were over. This year, I am glad to say, the exhibition is to be opened a little before the end of the holidays, and you can bet your boots that during the first few days we shall see a wonderful collection of "young visitors."

GOOD FOR TRADE

THIS should be an excellent thing for business, for the young members of the family are often a great deal more particular about the wireless equipment than is father. If they get him to the exhibition, they will find means of convincing him that it is really quite impossible to carry on with that antediluvian wreck of a set at home and that a new one must be bought at once. I hope that the firms exhibiting will rise to the occasion. What do I mean by that? Well, just this. The youngsters nowadays have a pretty useful technical knowledge of wireless, and there will probably be more ticklish questions asked during the first few days than during all the rest put together.

COMING EVENTS . . .

THE exhibition is still a few weeks away, and most firms have secrets up their sleeves. There will certainly be a good many interesting surprises from what I hear. I predict that loud-speakers will attract as much attention as any other kind of exhibit, and they will be very well worth it. The time was when the moving-coil instrument cost so much that millionaires alone could install it. The moving-coil though, has been steadily simplified, improved, and cheapened, and this year there will be not a few models most reasonably priced. The man whose purse is not over long will be able, at any rate, to buy the "works," and to mount them behind a baffleboard of his own make. Another drawback to the M.C. loud-speaker of yesteryear was that it needed an energising current for its field magnet. The permanent-magnet instrument has now been brought to a state of great perfection and, since it requires no energising current, running costs are exactly the same as with any kind of balanced-armature drive; in other words, nothing at all. I have had a permanent-magnet instrument in use for some months now, and I am delighted with its performances. THERMION.

Czechoslovakian officials are endeavouring to trace a pirate transmitter in that country which on July 20 last transmitted a fake news bulletin including an announcement to the effect that the German Chancellor, Dr. Bruening, was murdered on his departure from the Embassy in Paris. It is presumed that the transmission was made with a view to creating a stock exchange panic.

GETTING THE BEST FROM THE UNIVERSAL SHORT-WAVE 3

This highly-efficient short-wave receiver, constructional details of which were given last week, is fine for the family man who wants occasionally to indulge in short-wave reception. Here are instructions for getting the very best from it



DESPITE warnings that short-wave reception conditions are none too good at the moment, a member of the AMATEUR WIRELESS Technical Staff last week-end spent a highly interesting hour and a half at the dials of the "Universal Short-Wave 3" and brought in many ordinary stations such as 5SW and PCJ at Eindhoven, Moscow, and W2XCD, W2XCR, and W1XAF, of Boston.

These were received quite early in the evening, and as many others could have been received had there been sufficient time.

This rather disproves the notion that during the present "slump" in long-distance reception, no set can bring in the stations. Admittedly, this set with incorrectly chosen valves and operated in a careless fashion would not be a station getter, but then valve selection and choice of battery values is an easy matter and, after five minutes at the dials, one soon gets the knack of the tuning, which in principle is the same as that of any broadcast band set.

As was explained last week, the main purpose of the set is operation by the man who does not want to go to unnecessary expense in the choice of valves and batteries above those already used in his broadcast set.

You will find that the ordinary screen-

grid valve, medium-

Suitable Valves

If you are buying new valves then choose from the following two-volters, or from four- or six-volt equivalents. Screen-grid Marconi S215, Osram S215, Mullard PM12, Mazda 215SG, Eta BY6, Cossor 215SG. Detector: Cossor 210HF, Marconi HL210, Osram HL210, Mazda L210, Mullard PM1HF, Eta BY2023. Power: Osram P215, Marconi LP2/C, Mazda P220, Eta BW1304, Mullard PM2, Cossor 215P.

Voltages depend partly upon the valves used, but the tapplings chosen in the AMATEUR WIRELESS tests of this set will help you to choose the best values for your own set.

The H.T.+1 tapping supplying the screening grid of the H.F. valve was given 80 volts. The H.T.+2 tapping was set just a trifle higher. A normal detector voltage of about 100 did not materially increase the strength of signals and also made reaction a little fiercer.

A full 120 volts was applied to the H.T.+3 tapping which feeds the anodes of the screen-grid and power-valves.

An eliminator was used for supplying the H.T., and this in itself is a good test of the set's stability, for there are many short-wavers which work well enough on batteries, but which fail to oscillate or

which hum or crackle when mains-driven.

Phones were used for tuning-in the very weak stations, but loud-speaker reception was possible when many of these were tuned-in to the maximum point and there is really no necessity to have 'phones for ordinary working.

Quite a short aerial was used—the same aerial, in fact, which works the broadcast-band set; it is a disadvantage to have too long an aerial.

Atlas plug-in coils were used in the holders, and it was found advisable to adhere to the coil makers' ratings of various values for each wavelength range.

Very slow tuning is essential, of course, but this is quite easy with the slow-motion dials fitted to the tuning and reaction condensers. Find the best operating point for the detector valve by moving the arm of the potentiometer a little distance at a time.

For instance, for the first test set it about half-way round the potentiometer winding and then when a distant station has been tuned-in move the arm a trifle towards the positive or negative ends of the winding. This may upset the oscillation point and by adjustment of the potentiometer arm you will find a point at which oscillation is smooth and free from backlash.

Only by getting smooth oscillation can you get really good reception of short-wave stations.

Slight adjustment of the screen-grid voltage on the H.T.+1 tapping will also enable you to get the best from the screen-grid valve.

COMPONENTS FOR THE "UNIVERSAL SHORT-WAVE 3"

Ebonite panel, 14 in. by 7 in. (Becol, Readi-Rad, Trelleborg, Peto-Scott).

Baseboard, 14 in. by 10 in. (Camco, Peto-Scott, Clarion, Pickett).

Two .0002 variable condensers (Utility, I.B., Cyldon, Lotus, Formo, Polar).

Two slow-motion dials (Astra II, Utility, Telsen, Formo, Ormond, Lotus, J.B., Polar).

Filament switch (Readi-Rad, Telsen, Bulgin, Lotus W.B., Junit, Lissen).

Two valve holders (Lotus, Telsen, Benjamin Lissen, W.B., Junit, Formo).

Horizontal mounting valve holder (Junit, W.B., Parex).

Two single-coil holders (Lotus, Lissen, Wearite).

Short-wave high-frequency choke (Wearite HF3).

Standard high-frequency choke (Wearite type HFO, Readi-Rad, R.L., Lewcos).

High-frequency choke (Varley Junior, Telsen, Readi-Rad, Lissen, Wearite, Tunewell, Sovereign).

Two 1-mfd. fixed condensers (T.C.C., Dubilier, Lissen, Telsen, Formo, Ferranti).

2-mfd. fixed condenser (T.C.C., Telsen, Dubilier, Lissen, Formo, Ferranti).

Three .0002-mfd. fixed condensers (Telsen, T.C.C., Dubilier, Lissen, Formo, Graham-Farish).

3-meg. grid leak (Telsen, Lissen, Dubilier, Sovereign, Graham-Farish).

Grid-leak holder (Bulgin, Readi-Rad, Lissen).

400-ohm baseboard mounting potentiometer (Lissen, Wearite, Sovereign).

Low-frequency transformer (Telsen, "Radiogrand," Varley, Ferranti, Lissen, R.I., Burton, Lotus, Lewcos).

Two 10,000-ohm and one 20,000-ohm spaghetti resistances (Readi-Rad, Telsen, Lewcos, Bulgin, Sovereign, Lissen, Tunewell).

3-volt. S.G. bias cell (Siemens).

Two terminal blocks (Sovereign, Junit, Belling-Lee, Lissen).

Four terminals, marked: Aerial, Earth, L.S.+ , L.S.— (Belling-Lee, Eelex, Clix).

Special screen to specification (Readi-Rad, Peto-Scott).

Screen-grid valve anode connector (Belling-Lee).

Connecting wire (Glazite).

Five yards of thin flex (Lewcoflex).

Two spade terminals, marked: L.T.+ , L.T.— (Belling-Lee, Eelex, Clix).

Six wander plugs, marked: H.T.—, H.T.+1, H.T.+2, H.T.+3, G.B.+ , G.B.— (Belling-Lee, Eelex, Clix).

ACCESSORIES

Three short-wave coils: No. 4, No. 6, and No. 9 (Atlas).
120-volt high-tension battery (Palaba, Drydex, Pertrix, Ever-Ready, Lissen, Fuller).

3-volt grid-bias battery (Palaba, Exide, C.A.V., Pertrix, Ever-Ready, Fuller, Drydex).

2-volt accumulator (Exide, C.A.V., Pertrix, Ever-Ready, Fuller, Drydex).

Cabinet, 14 in. by 7 in. by 10 in. baseboard (Camco, Peto-Scott, Clarion, Pickett).

AUTO-TRANSFORMER CONNECTIONS

You can obtain more from your transformers these days if you use the simple parallel-feed circuits which are becoming increasingly popular. In this article our Technical Editor gives some useful information.

IT almost looks as if the old days of heavy-duty transformers were finished with and that our common practice in the future will be the use of quite small instruments wired up on the parallel-feed arrangement.

Fig. 1 shows a simple parallel-feed circuit. Instead of connecting the primary of the transformer in the anode circuit of the valve, the H.T. is supplied through a resistance and the low-frequency currents are shunted through a fixed condenser and then on to the primary winding. The fixed condenser, of course, isolates the steady H.T. voltage and prevents any anode

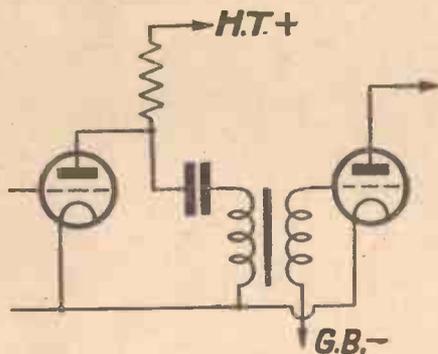


Fig. 1. A simple parallel-feed circuit

current from flowing through the transformer primary. It is well known that the presence of steady current in the transformer winding reduces the efficiency of the iron, so that the inductance is not so high as it would normally be. The older types of transformer overcame this difficulty by putting much more inductance in the core than was necessary and allowing it to be reduced by the anode current to a correct value under working conditions. With the parallel-feed system we do not need to make the inductance of the primary winding any larger than the actual value required, since there is no steady current flowing through the winding, the inductance under working conditions is practically the same.

This is not absolutely true, particularly when we are dealing with large signals, because the alternating current itself may affect the inductance, but we will neglect this factor for the time being and confine our attention to small signals.

Now, with the circuit shown in Fig. 1 the amplification obtained is the same as that with the normal connection, provided that the resistance in the anode circuit is sufficiently large to have no appreciable shunting effect on the primary winding. The performance will, of course, be enhanced because of the absence of steady current through the primary, but for a fair comparison we must consider the Fig. 1 circuit against a normal transformer of a type designed to carry a steady anode current. In this case there is little to choose

between them as far as performance goes.

By a simple re-arrangement of the connections, however, we can obtain an increase in the step-up ratio of the transformer. Fig. 2 shows the arrangement in question. Here the secondary is not connected to the grid-bias battery, but is taken to the top of the primary winding. The bottom end of the primary now goes to grid bias, so placing the correct voltage on the grid of the following valve. By this simple alteration of connections we are able to add 1 to the step-up ratio. If it was previously 3 : 1 it will now be 4 : 1.

It is easy to see the reason for this. In the Fig. 1 circuit we have a certain voltage across the primary winding and we have n times this voltage across the secondary, n being the step-up ratio of the transformer. In the Fig. 2 circuit the voltage applied to the grid of the following valve is not that across the secondary only, but is the voltage across the secondary and the primary combined. Thus we have the primary voltage V + the secondary voltage nV , giving us a step-up ratio of $n+1$, so that without the introduction of any further apparatus we are able to obtain more amplification from the circuit.

The Proper Connections

Clearly, the primary winding must be connected the right way round. It is essential for the voltage on the secondary to be in the same direction as the voltage on the primary at each instant and not in the opposite direction, for in this latter case the primary voltage would not be added to the secondary voltage, but subtracted therefrom. This is simply a matter of ensuring that the connections are correct, and the indications shown on Fig. 2 are usually right for the average transformer. In case of doubt, however, it is an easy matter to find out the correct connection by trial. Connect the grid terminal to the grid as usual. The grid-bias terminals should then be connected to OP and the IP terminal connected to grid bias. Now tune in a station and note the signal strength. Then switch off and connect the IS or GB terminal on the secondary to IP and the

grid bias to OP. Switch on again and note the signal strength from the same station. It will be easy to determine which gives the louder signals and this will be the correct connection. Incidentally, always use a weak station in a test of this sort, as differences in strength are not so easy to notice on a strong signal apart from the danger of limiting action which may arise due to overloading in the detector or other parts of the set.

Many manufacturers of small nickel-iron cored transformers deliberately design them for use in this manner. They will, perhaps, only provide twice as many turns on the secondary as on the primary, the trans-

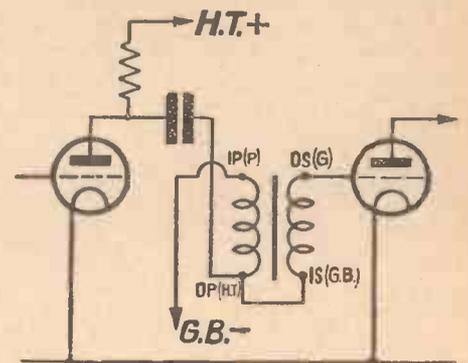


Fig. 2. With this arrangement there is an increase in the step-up ratio

former being intended for use in the manner described so that the effective step-up ratio is 3 : 1. This enables the transformer to be produced more cheaply. At the same time any existing transformer can usually be utilised as an auto-transformer if one employs the parallel-feed arrangement.

The increase in step-up with the auto-transformer system, of course, is only appreciable for small-ratio transformers. If one uses this, for example, on an instrument having a normal ratio of 7 : 1 the increase with auto-transformer connection would only be to 8 : 1, which would give very little increase in the signal strength.

A matter which must not be lost sight of is the possible change in quality which may result from a change over of the connections. In some cases the quality is not seriously affected by the change from one connection to the other, whereas in other cases there is an appreciable difference. I had a case the other day of a small transformer which I subsequently discovered had been specifically designed for auto-transformer working. I set the transformer up and measured its effective step-up ratio at different frequencies, and obtained the curve marked "normal" in Fig. 3. This will be seen to have a rising characteristic which is useful in some cases, but quite unsuitable in others. I then reversed the connections to the primary and obtained

(Continued in third column of page 204)

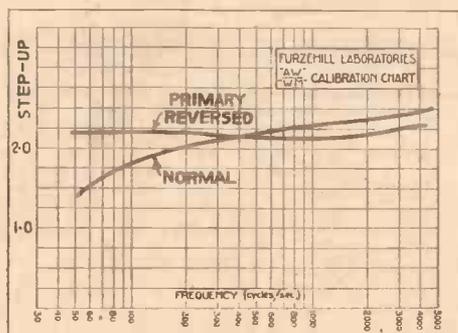


Fig. 3. Curves showing the effect of different connections

A Weekly Programme Criticism—By SYDNEY A. MOSELEY

Without Fear or Favour



BROADCAST COMEDIANS

DANCE BANDS

THE fame of stage comedians would rest on frail foundations if they had to appear before the same audience as often as the B.B.C. comedians, and I can name a few "famous" funny men who have been using the same gags for over twenty years.

Let us deal in a kindly vein with the B.B.C. comedians.

Flotsam and Jetsam did very well. They were at the top of their form, and Flotsam's—or is it Jetsam's—best notes were certainly heard. How on earth they manage to get their topical songs in I cannot imagine. They might pass on the information in many directions. The "Changing of the Guard," which is a bright little thing, and this with another new number, new to me, balance the older tunes that crop up again and again.

I have been listening a great deal to the lighter music, and in one's tired state, as I have been lately, due to pressure of work, I find it most soothing.

Many readers will differ from me, but I do not find the same relaxation in listening to the jolty-jolty rhythm of the dance-bands. So samey. And in this connection I must admit that the greatest interest is shown by my readers in this question of dance bands.

The views about the leaders are so diverse. One reader will think this band rotten and others will describe it as the best dance band in the country. No wonder Savoy Hill is so confused.

I heard *The Wreckers* in instalments, and should very much like to have the opportunity of hearing it again.

Joe Lewis got clean away with his "Old Promenade Concerts Memories." It was news to many listeners that the old Proms were held at Covent Garden and did not originate at the Queen's Hall. It was an artistic idea to begin with that pretty old waltz tune, "See-saw."

Opening a concert of this description with music and then fading out into an announcement is always a good touch, and Joe worked the oracle well this time.

As for his selections of these concerts—well, I don't know. Looking back on my own experiences, I find that some of the songs like "A Fine Old English Gentleman" and "The Drinking Song" very rarely sung at the later Promenade Concerts—say, in the last twenty-five years—whereas the *entr'acte* from *Mignon* and the ballet music from *Sylvia* have been played again and again.

I listened again to the Ruritanian romance, *The King Can Do No Wrong*, with its "Oh yeahs" and decimated English because of the special prominence given by the B.B.C. to Tessa Deane, who took the part of the heroine—the commoner beloved by the Prince of Capponia.

Well, Tessa Deane has an agreeable voice into which she is able to put expression, but now and again I found some difficulty in hearing her words.



An impression of Wilfred Shine
Frequent broadcaster who often appears
with Miss Florence Marks

THE OLD "PROMS"

PROGRAMME TIMES

Quite a delightful change to hear a decent symphony concert. Here was our old German friend, Hermann Scherchen, conducting the Studio Symphony Orchestra with Mendelssohn, Brahms, and Schumann. An hour and a half's musical treat.

What a delightful voice has Marguerite Namara.

Like a dutiful listener, I switched on to London Regional to hear the Elsie Owen String Quartet play Mahler. After a hard attempt, back I switched to the National programme to hear an ordinary light orchestral concert—Verdi, Mozart, Elgar, Mendelssohn.

The studio *claque* claps after each item. Can you beat it?

I confess I don't like Jack Payne's Dance Orchestra murdering "In Old Madrid." Why *do* they do it?

A correspondent in Chesham, Bucks, congratulates me on my "persistent and tireless fight" for better and brighter programmes.

He offers a few comments. Regarding German talks, "If it is essential that we be given German talks (and doubtless there are many people who take a special interest in them) why can't they be given towards the end of the evening programme, when most listeners are thinking about retiring."

He considers military bands are a "wash-out"; but there are thousands of people who like them; in fact, prefer them to a symphony or string orchestra.

My correspondent would like "some more Tom Jones' music from the Grand Hotel, Eastbourne, on weekdays; fewer talks; dance music earlier (not when it is time to go to bed); cut out songs in foreign tongues; Jack Payne's 5.15 p.m. broadcast a couple of hours later. And, above all, cut out the studio clatter."

I don't bother to listen to the news bulletins these days, so heard the overture by Schumann. Blessed are the sweets of alternative programmes.

HINTS & TIPS *for* BETTER QUALITY

In these days of high-power stations and low-price components, there is no excuse for any set user who does not make an attempt to get really pure tone.

Nearly every listener in the country is within the service area of some B.B.C. station, and this means that provided a set is well designed it should give first-rate quality on the local station (and on the alternative if one is available) and on a large number of foreign stations.

Not only is it essential to have the design of the set just right, but it must be operated properly if the tone is to be good. The following hints are prepared for amateurs who want to get the very best out of their sets, in the way of pure tone, both by proper control of the set and by fitting simple "gadgets" to improve the quality.

CAREFUL CONTROL

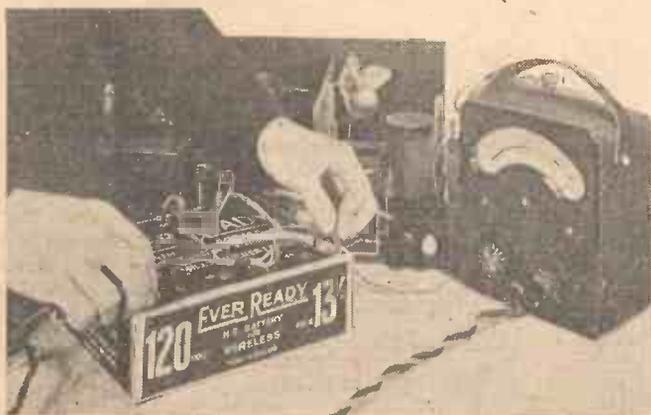
OFTEN a set which is quite capable of giving good purity is found to be giving ghastly distortion because somebody has tuned in the station in a haphazard way.



Take great care when tuning to get exactly on the maximum point. There is bound to be distortion if you are not properly tuned in and the more up-to-date and selective your set the more will it be affected by any out-of-tune adjustment

With modern selective circuits one cannot afford to take chances in this.

When tuning your set, make sure that



The high-tension consumption of the power stage must be watched, because if it is excessive then probably too little grid bias is used and the tone may suffer. Check the voltage on the power-valve anode first and then measure the anode current, altering the grid bias in accordance with the valve manufacturer's recommendations

you are right on the tuning point, for the more selective the circuit, the greater will be the distortion caused if the main circuits are not properly tuned. Occasionally one comes across, say, a highly-selective band-pass type of set which does not give good purity on foreign stations because the user will not tune carefully to the exact maximum point.

AVOID REACTION

It is really surprising what a large number of stations can be had without the use of too much reaction. Try this on your own set. It is quite probable that out of sheer habit in foreign-station listening you are using too much reaction for the reception of local and more powerful stations. Even a small amount of unnecessary reaction tends to cut off the high notes and, in all probability, this reaction effect simply sharpens up on the tuning by an undesired amount and makes the set more difficult to control.

If you have to use a great deal of reaction in order to boost up the signal strength of near-by stations then there is something wrong with the tuning. Look for causes of loss in the coils and see that there are no high-resistance connections in the aerial circuit.

FIT A SLOW-MOTION DIAL

The sharper your set tunes, the more essential it is that you should have fine control of the tuning circuits. A slow-motion dial may not be necessary for reaction, and, of course, if you have a super-het, then a very smooth control of oscillation is provided by the potentiometer; but with the main tuning

circuits a good slow-motion dial is almost a *sine qua non*.

One cannot get to the exact tuning point without reduction gearing on any selective band-pass or super-het arrangement and one is apt to get what is popularly known as sideband distortion, if one is out in the tuning. Make your tuning marks carefully on the dial, or, alternatively, keep an accurate log of the dial readings.

HOW TUNING AFFECTS QUALITY

The most important effect of tuning on quality is noticed when the tuning circuit



An output transformer or a filter choke and condenser must be fitted if a pentode is used in your set, and is an advantage even when an ordinary power valve is used. Here a choke and condenser are being connected up between the set and the speaker

has a very low resistance. Then the tuning is said to be sharp and the high notes in the audible-frequency range are cut off.

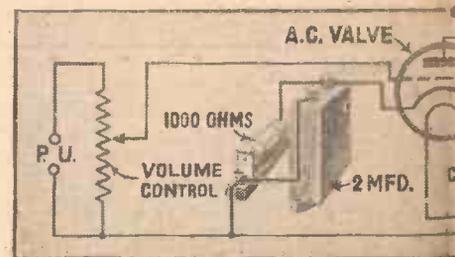


Fig. 1. How an A.C. mains valve is biased by means of the cathode and filament centre

REACTION & TUNING

TUNING & PURE TONE

DETECTOR EFFICIENCY

BAND-PASS TUNING & DISTORTION

LOUD-SPEAKER OUTPUT & QUALITY

SCREEN-GRID DISTORTION

Here are a number of points which must be watched in order to get good tone. The set is the "1931 Ether Searcher" and in the article below hints and tips for all types of sets are given

This is because when we tune in a station of any particular frequency, we tune not merely the fundamental frequency corresponding to the wavelength of the station, but a considerable number of adjacent frequencies caused by the modulation process when speech and music frequencies are impressed upon the carrier wave.

The more sharply a tuning circuit selects any given frequency the more likely are the side-band frequencies to be cut off. The resulting effect upon quality of reproduction is that speech loses its crispness and music tends to be low pitched.

THREE TUNING CIRCUITS

Really the need for selectivity and the need for good quality are conflicting factors in designing a set. If quality of reproduction is the chief aim, and only a limited number of circuits for tuning are employed, the separate tuned circuits must not be made excessively selective. As a matter of fact, good quality combined with good selectivity can be obtained only with several tuning circuits. Each circuit then deals faithfully with the side band, but the overall selectivity is considerable.

Most sets have at least two tuning circuits, but for extreme selectivity without loss of quality, that is, without side-band cutting, the minimum number of tuning circuits is three and it is preferable to use four. The average three-valver with one stage of high-frequency amplification has only two tuned circuits so that good quality with selectivity is not possible.

BAND-PASS FOR GOOD QUALITY

Fortunately a way has been found of

adding to the number of tuning circuits without the need for an extra valve. That way is band-pass tuning. Essentially, the band-pass tuner consists of two loosely-coupled circuits in front of the first valve of the set. The advantage of band-pass tuning is that side-band suppression is avoided and so, in spite of the excellent selectivity, there is no loss of quality.

SUPER-HETS AND QUALITY

When considering the effect of tuning upon the quality of reproduction the super-het type of set is often quite unjustifiably condemned.

No doubt the super-het sets of the old days were guilty of horrible distortion, but that was not the fault of the system of tuning. Valves in those days had to be positively biased to obtain stability. Because of this positive bias, grid current flowed and so introduced distortion.

In such good examples of the super-het as the "Century Super" and "Super 60," only two continuously variable tuning circuits are used and yet quality of reproduction does not suffer in any way from high-note suppression. Why is this? The answer is that there are three intermediate tuning circuits, adjusted to a pre-determined long wavelength. So, altogether, there are five tuning circuits, if we include the oscillator.

Moreover, the intermediate tuning works on the band-pass principle.

AVOID SHARP TUNING

To the man who is normally troubled with selectivity the advice to avoid sharp tuning may sound something of a heresy. The truth is that there are quite a number of sets which give knife-edge tuning even when, say, the pre-set condenser in the aerial lead is slackened off. Knife-edge tuning is very desirable until it is carried to the point when quality suffers. There are some set users who always work with the very smallest amount of capacity in the aerial lead and with the tuning made as selective as possible—often far more selective, in fact, than local conditions justify. This may be a cause of distortion in your set and as there is no point in adjusting the selectivity to be greater than that needed simply to cut out local interfering stations, try using the pre-set condenser.

CONNECTING UP THE SPEAKER

Even a well-arranged power stage, in which a large power valve is fitted and provided with plenty of high tension and sufficient grid bias, can cause distortion if the output arrangements to the speaker are not satisfactory. If the speaker has a high resistance, not only will this cut down the power valve anode voltage if it is connected directly in the anode circuit,

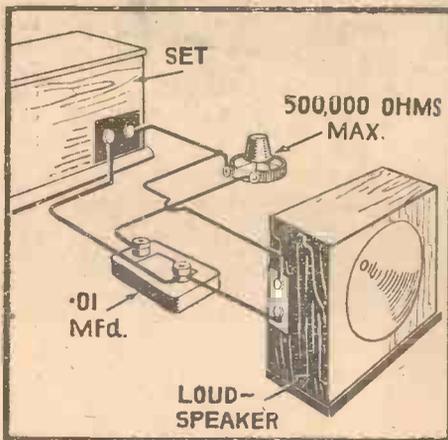
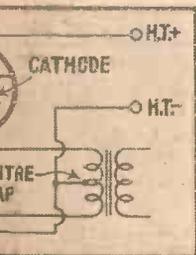


Fig. 3. A simple high-note filter, consisting of a resistance and condenser in series across the speaker



of a resistance between tap



High-tension adjustment has a bearing on quality. Here the intermediate tapings on the battery, for the detector and screening grid, for example, are being adjusted and the readings carefully taken with a high-resistance voltmeter

"HINTS AND TIPS FOR BETTER QUALITY" (Continued from preceding page)

but the introduction of this resistance may, owing to the length of the speaker leads, tend towards low-frequency oscillation.

The proper way to connect a speaker to any set in which quality is of paramount importance is via an output choke or transformer. The cost is limited only to a few shillings for the actual output unit and this is soon repaid by the better performance of the set and the increase in the safety factor.

CHOKE OR TRANSFORMER?

When fitting an output unit one has the choice between a speaker transformer or an



Do not adjust the set so that the selectivity factor is greater than is really necessary for reception conditions at the time. By slacking off the pre-set condenser, for example, one can in many sets make the tuning unnecessarily sharp and this may affect the quality on the high-frequency side

output choke. Each has individual advantages. A tapped output transformer is very handy because one can easily try each tapping in turn until the best natural tone is obtained, when it will be found that the speaker more nearly matches up with the power valve anode impedance. However, it is sometimes cheaper to use a choke with an inductance of 20 or 30 henries and capable of carrying enough current.

EARTHING THE TRANSFORMER

If you have fitted an output transformer (not choke) and find that when long speaker leads are used the tone is not good; then try earthing one of the speaker leads. This, in some instruments, is already provided for, and will be clearly shown on the terminal indications, but the general practice is to have primary and secondary windings well insulated.

CHOKE OUTPUT AND SAFETY

Do not forget that the average choke output unit is so arranged that one wire is connected either to high-tension positive or to low-tension negative. This often is of no importance, but with mains-driven sets it is a point to note, particularly if one intends fitting loud-speaker extensions.

CONTROLLING VOLUME

As no set is complete nowadays without a volume control, you must give a little thought as to the best place in which to fit this. If you have a screen-grid valve stage then a rheostat in the screen-grid valve lead gives a good control of volume, but, of course, this is ineffective for gramophone working and if you have a gramophone pick-up operating through the low-frequency side of the set then a volume control on the low-frequency side will be needed. *Never use the reaction knob as a volume control.*

H.F. VOLUME

A rheostat for cutting down the strength on the H.F. side should be fitted in the negative lead of the screen-grid valve and should *not* be fitted in the filament circuit of the detector. With mains-driven sets no rheostat can be fitted, of course, and for high-frequency volume control one must rely on a pre-set condenser in the aerial lead. With mains-driven sets a volume control on the low-frequency side is essential.

PICK-UPS FOR GOOD QUALITY

One of the chief causes of distortion when using a pick-up can be traced to the excessive voltage output overloading the grid of the first amplifying valve. Of course, pick-ups vary considerably in voltage output. If it is known that this output is on the high side, the first valve of the gramophone amplifier should be negatively biased by at least 1½ volts. A good way to prevent pick-up overloading is to fit a potentiometer volume control between the pick-up and the grid circuit of the first valve.

Although it is easy enough to arrange negative bias on the grid of the first valve when the set is battery operated, this is a little more difficult when the set is operated from the A.C. mains. Quite a simple way of biasing an A.C. detector type of valve is by the automatic method shown by Fig. 1. It will be seen that the cathode connection of the A.C. valve is taken to the centre tapping of the 4-volt filament transformer, through a fixed resistance shunted by a fixed condenser.

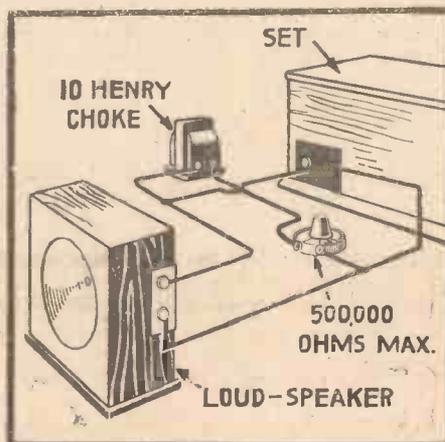


Fig. 4. How low notes can be suppressed by means of a choke and resistance in series across the loud-speaker

This connection makes the grid negative with respect to the cathode, the amount of bias being determined by the voltage that is dropped across the fixed resistance. Ohms Law quickly solves the problem of how much voltage is dropped. Knowing the amount of grid bias wanted Ohms Law can be used to find the value of resistance.

If 3 volts negative grid bias is wanted, we would work as follows: We should first measure the anode current of the valve needing negative bias, for it is the anode current that flows through the fixed resistance. This might be 3 milliamperes.

Ohms Law states that R equals $\frac{E \times 1,000}{I}$

when R is the resistance in ohms, E is the voltage drop and I is the current in milliamperes. So in this example a 1,000 ohms is needed to give 3 volts bias. As a matter of fact, a 1,000-ohm resistance between the cathode and the centre-tap of the filament transformer provides the right amount of grid bias for most input valves. Always shunt this resistance with a 1-microfarad condenser.

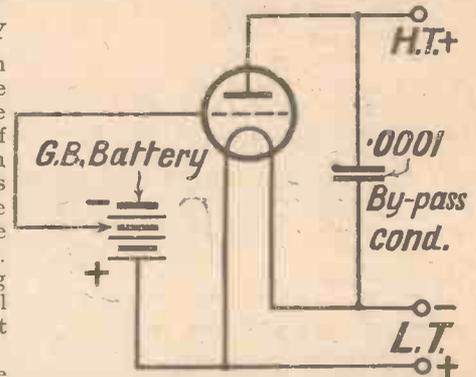


Fig. 2. Connections for anode-bend detection. Note the anode by-pass condenser

ANODE-BEND DETECTION

Although the leaky-grid detector, with either normal or power-grid values of condenser and leak, has now been proved capable of working with very little distortion, some amateurs still prefer to use anode-bend rectification as shown by Fig. 2. One great advantage of anode-bend detection is that grid damping is eliminated, because the grid is negatively biased and no grid current flows through the tuning coil in the grid circuit of the detector.

This reduction in grid damping means better selectivity and often makes just the difference between cutting out a station and having to suffer from its interference. The impedance in the anode circuit of an anode-bend detector must be high, as given by a very good quality transformer or by resistance-capacity coupling.

To work an anode-bend detector with a low-frequency transformer having only a moderate primary impedance is quite easy if one resorts to resistance-feed for the transformer.

HOW TONE AFFECTS QUALITY

Most listeners judge quality of reproduction by classing it as high pitched or low (Continued in third column of page 202)

Build a first-class set with a first-class kit — insist on **READY RADIO**

You can now buy any Ready Radio Kit from your local dealer, but be sure it is a genuine Ready Radio Kit

CENTURY SUPER PORTABLE

1 Ebonite panel, 12 in. by 8 in. by 3/16 in. drilled to specification	£ s. d.
1 Readi-Rad cabinet in polished walnut to specified design	2 5 0
1 J.B. .0005-mfd. junior log slow-motion condensers, 40-1 ratio	1 1 0
2 Set Lewcos super-het coils	2 10 0
1 Sovereign 50,000-ohm potentiometer	4 6
1 Readi-Rad 8 valve base	7 0
1 Telsen 4-pin valve holder	9 0
2 Ferranti C2C condensers	5 8
2 T.C.C. 1-mfd. fixed condensers	2 6
5 Telsen fixed condensers; 2, .001; 2, .002; and 1, .0002-mfd.	10
1 Readi-Rad 1-megohm grid leak	15 000
3 Readi-Rad link resistances; 20,000 and 30,000 ohms	4 0
1 R.I. Parafeed L.F. transformer	8 6
1 Readi-Rad 3-point switch	1 6
1 Readi-Rad fuse and holder	1 3
1 Readi-Rad 3-point terminal strip	6
6 Belling-Lee wander plugs; 4, H.T., and 2, G.B.	1 0
2 Spade terminals	3
1100-yds. reel Lewcos 9/40 frame wire, L.Z. 2140	4 3
150-yds. reel Lewcos 27/43 frame wire, L.Z. 2240	5 6
1 Pkt. Readi-Rad "Jiffilix," wiring	2 6
1 Ormond portable loud-speaker unit and chassis	1 5 0
6 Mullard valves as specified: 2, S.G.; 2, H.F.; 1, L.F.; 1, Power	3 16 0
6 yds. flex, wire, screws, etc.	9
TOTAL (including Cabinet & Valves)	£14:1:0

Kit A (Less Valves and Cabinet)	£8:0:0
or 12 equal monthly instalments of	14/8
Kit B (With Valves less Cabinet)	£11:16:0
or 12 equal monthly instalments of	21/8
Kit C (With Valves and Cabinet)	£14:1:0
or 12 equal monthly instalments of	25/9

CENTURY SUPER PORTABLE

Completely assembled, with valves and cabinet, ready for use and **£17:1:0** aerial tested, Royalties included

Or 12 monthly payments of **31s. 3d.**

CENTURY SUPER PORTABLE CABINET
READY RADIO have produced a cabinet which alone will do justice to the sterling qualities of the Century Super Portable. Built of beautifully polished walnut, it will grace any drawing room, and yet it is exceptionally low in price.
 The frame aerial, which is already built into the cabinet, consists of stranded aerial wire, accurately spaced and wound on rigid ebonite spacers. Cabinet, without frame aerial, **£2:5:0** complete **£3:0:0**

Obtainable from your local dealer

UNIVERSAL SHORT-WAVE THREE

1 Polished ebonite panel, 14 in. by 7 in. by 3/16 in., drilled to specification	£ s. d.
1 Hand-polished oak cabinet with 10-in. baseboard	1 5 0
2 Utility .0002-mfd. variable condensers	13 0
2 Utility S.M. dials	15 0
1 Readi-Rad filament switch	10
2 Telsen 4-pin valve holders	1 0
1 Junit horizontal-mounting valve holder	1 9
2 Readi-Rad single coil holders	1 8
1 Wearite short-wave H.F. choke, type HF3	4 6
1 Readi-Rad "Hilo" H.F. choke	4 6
1 Varley Junior multi-cellular H.F. choke	3 6
2 T.C.C. 1-mfd. fixed condensers	5 8
1 T.C.C. 2-mfd. fixed condenser	3 10
3 Readi-Rad .0002-mfd. fixed condensers	2 6
1 Readi-Rad 3-megohm grid leak and holder	1 4
1 Readi-Rad 400-ohm baseboard-mounting potentiometer	2 9
1 Telsen "Radiogrand" L.F. transformer	8 6
2 Readi-Rad 10,000-ohm spaghetti resistances	2 0
1 Readi-Rad 20,000-ohm spaghetti resistance	1 3
1 Readi-Rad screen to specification	3 6
1 Siemens 9-volt S.G. cell	1 0
2 Junit terminal mounts	1 4
4 Belling-Lee "R" type terminals	1 0
6 Belling-Lee wander plugs	1 0
2 Spade tags	3
1 Belling-Lee anode connector	1 0
3 Atlas short-wave coils, Nos. 4, 6, and 9	8 0
1 packet Jiffilix for wiring	2 6
3 valves to specification, PM12, PM2DX, and PM2A	1 19 0
Flex, wire, screws, etc.	1 1
TOTAL (including Valves and Cabinet)	£8:2:0

Kit A -	£4:18:0
or 12 monthly instalments of	9/-
Kit B -	£6:17:0
or 12 monthly instalments of	12/6
Kit C -	£8:2:0
or 12 monthly instalments of	15/-

TO OVERSEAS CUSTOMERS
 All your goods are very carefully packed for export, and insured, all charges forward.
TO INLAND CUSTOMERS
 Your goods are despatched Post Free and Carriage Paid.

1931 BRITAIN'S FAVOURITE THREE

1 Polished ebonite panel, 14 in. by 7 in. by 3/16 in. drilled to specification	£ s. d.
1 Oak cabinet to specification with 9 in. baseboard	1 0 0
1 Readi-Rad .0005-mfd. variable condenser	4 6
1 Readi-Rad .0001-mfd. reaction condenser	2 6
1 A.E.D. 500,000-ohm potentiometer	8 6
1 Sovereign .0003-mfd. pre-set condenser	1 6
1 Lotus double filament control jack, type J.K.3	2 6
1 Lotus jack plug, type J.P.1	2 0
1 Readi-Rad filament switch	10
1 Tunewell dual-range aerial coil	10 6
1 Brownie slow-motion dial	2 6
3 Telsen 4-pin valve holders	1 6
2 Readi-Rad .0002-mfd. fixed condensers	1 8
1 T.C.C. 2-mfd. fixed condenser	3 10
1 Readi-Rad 3-meg. grid leak	10
1 Readi-Rad "Hilo" H.F. choke	4 6
1 R.I. Parafeed L.F. transformer	8 6
3 Readi-Rad spaghetti type resistances, 10,000, 30,000, 50,000 ohms	4 3
1 Pair Readi-Rad panel brackets	10
2 Junit terminal mounts	1 4
4 Belling-Lee terminals, type R	1 0
6 Belling-Lee wander plugs	1 0
2 Spade tags	3
1 Pair Bulgin G.B. clips	4
1 Pkt. "Jiffilix" for wiring	2 6
3 Mullard valves to specification, PM1HF, PM2DX, PM2 Flex, screws, etc.	1 7 6
TOTAL (including Cabinet & Valves)	£6:0:0

Kit A (Less Valves and Cabinet)	£3:12:6
or 12 monthly instalments of	6/9
Kit B (With Valves less Cabinet)	£5:0:0
or 12 monthly instalments of	9/3
Kit C (With Valves and Cabinet)	£6:0:0
or 12 monthly instalments of	11/-



IMMEDIATE DESPATCH ORDER FORM

To—READY RADIO (R.R.) LTD., 159 Borough High Street, London Bridge, S.E.1.

CASH ORDER. Please despatch to me at once the goods specified for which I enclose payment in full of £ _____ Name _____

C.O.D. ORDER. Please despatch to me at once goods specified for which I will pay the sum of £ _____ Address _____

EASY PAYMENT ORDER. Please despatch my Easy Payment order for the goods specified for which I enclose first deposit of £ _____ Kit required _____

Mention of "Amateur Wireless" to Advertisers will Ensure Prompt Attention

SETS OF DISTINCTION

MC MICHAEL

RADIO GRAMOPHONE

Maker: L. McMICHAEL, LTD.

Price: 48 Guineas



REGULAR readers will remember that in the March 7 issue of AMATEUR WIRELESS I reviewed the McMichael Mains Three. This was shown to be an excellent three-valver for A.C. mains with ingenious controls, the tuning being particularly easy to handle. The circuit comprised a screen-grid high-frequency-amplifying stage, a detector and a transformer-coupled tone-corrected pentode power valve.

Now this efficient three-valve chassis has been incorporated in a radio gramophone cabinet. With an R.K. permanent-magnet moving-coil loud-speaker, a Marconiphone gramophone pick-up and a Garrard induction-type motor, the chassis completes what I have proved to be a first-class radio gramophone.

At present this instrument is available for A.C. mains only, for supply voltages between 200 and 250 or 100 to 115 volts, at 50 or 25 cycles. The running costs are quite low, as the total current drawn from the mains represents a power consumption of only 45 watts. This power is needed for the three-valve chassis and the induction motor. No power is required for the moving-coil loud-speaker, as its magnet is "permanent."

The Controls

On opening the lid of the McMichael radio gramophone, I was at once impressed with the neat way the controls are arranged on the left-hand side. The gramophone pick-up and turntable with automatic stop are easy to get at on the right.

I had better explain the layout of the controls. Of course, the outstanding control is the tuning, consisting of a convenient-sized knob mounted horizontally near the sloping tuning scale. As the knob is rotated a pointer travels horizontally along the scale, which is calibrated in medium and long wavelengths and illuminated when the set is in action. Not far from the tuning control, which is one of the most ingenious on the market, are two subsidiary controls for reaction and radio volume control.

The reaction control is quite orthodox, but in the combined radio-volume control and wave-range switch the makers again show their originality.

The knob of this control has a centre position for gramophone reproduction.

When turned anti-clockwise from this position, the long-wave tuning is switched into circuit and a good control of volume before detection is obtained. Equally good control is available when this switch knob is rotated in a clockwise direction, when the medium waves are switched in.

Apart from a neat push switch for the mains, the knobs for tuning, reaction and combined wave-changing and radio volume controlling complete the layout in the top left-hand section of the cabinet. The makers have made a thorough conversion of the original mains three by including a



A close-up showing the turntable and controls of the McMichael Radio Gramophone

gramophone volume control and an associated tone control.

The two knobs for these controls are mounted on the right-hand side of the cabinet, conveniently near the pick-up connections. When the detector valve is working as the first low-frequency amplifier for gramophone reproduction it is negatively biased and the pick-up voltage applied to its grid was readily controlled by the potentiometer volume control across the pick-up.

The tone control comprises a condenser in series with a variable resistance across the pick-up. Its object is to cut off the very high notes in the audible frequency range. This control is very effective in cutting out needle scratch, particularly when the scratch has a very high frequency. The objectionable hissing noise of high-frequency needle scratch can be readily suppressed.

The combined action of the volume and tone controls enabled me to use the McMichael radio gramophone as a reproducer of all kinds of gramophone records. There is no suspicion of overloading of the pentode output power valve when the volume control is turned to its maximum position.

Wireless Results

On the radio side, this instrument is appreciably more sensitive than the original Mains Three. This is probably due to the fact that a larger power pack is provided. The detector valve works on the anode-bend principle in the radio gramophone, and this circuit modification, taken in conjunction with the fact that choke-fed grid tuning is used to couple the high-frequency valve to the detector, probably accounts for the high degree of selectivity.

Tested with my standard aerial in south-west London, the McMichael radio-gramophone reproduced a creditable number of foreign stations at loud-speaker strength. For use when there is difficulty in erecting an external aerial, a mains-aerial connection is provided. Using the mains as an aerial, the local station and three or four of the more powerful foreigners can be brought in at excellent strength.

SET TESTER.

It should be noted in connection with "Set Tester's" Report last week on the Philips Radioplayer, that the price is £39. 10s., and not £39 as stated.

"HINTS AND TIPS FOR BETTER QUALITY"

(Continued from page 200)

pitched. If top notes are missing quality sounds low pitched, whereas if the low notes are missing quality sounds shrill. Often in sets giving a fairly good balance of high and low notes it is desirable to be able to suppress either high or low notes at will.

Tone can be easily enough controlled with resistances, chokes and fixed condensers. Fig. 3 shows how a top-note filter can be connected across the loud-speaker. This consists of a variable resistance of, say, 500,000 ohms, and a .01-microfarad fixed condenser in series. As the resistance is decreased the effect of the condenser will be increased, that is to say more of the high notes will be by-passed, with the result that the tone will be lowered.

A filter on similar lines of the suppression of low notes is shown by Fig. 4, where, instead of a fixed condenser a low-frequency choke is used in series with the resistance. Used with an average loud-speaker the choke must have an inductance of about 10 henries in order to shunt the unwanted low notes.

OUR LISTENING POST

By JAY COOTE

Now and again when twiddling your condenser dial around the Kalundborg wavelength you may pick up a German transmission; should this happen on a Monday, Wednesday, or Saturday, you will not fail to hear the call: "Hier Radio Wien." This capture on the "long" waves may puzzle you so I volunteer an explanation. Vienna is anxious to possess a long-wave station—almost every other European capital has one—and to this purpose on the days specified the *Ravag* transmits the ordinary programmes simultaneously on 517 and 1,249 metres with a view to ascertaining whether the latter wavelength is a suitable one for a 100-kilowatt plant.

By the way, Trieste is the next station to come on the ether and a search around 247 metres in the later hours of the evening may enable you to log it. So far as is known at present, it will work on that wavelength. Palermo does not yet appear to have settled down permanently, although for the last week or so it is to be found just above Sundsvall.

A further piece of information. If you have not received any signal from Leningrad lately do not put it down to any inefficiency on the part of your receiver; it is merely due to the fact that the station has been off the air for an overhaul. On its re-appearance you may find Leningrad considerably invigorated as I believe the new 100-kilowatt is timed to be launched in the course of the next few days.

Of the two Swiss national transmitters unfortunately I find Sottens of little use to me as there is considerable difficulty in keeping this station clear of Midland Regional, at least,

on an outside aerial. On the other hand Beromuenster is a veritable star turn and provides some of the best programmes put out by the Swiss broadcasting system. The three studios, Basle, Berne, and Zurich, use this high-power station jointly, but all orchestral concerts emanate from Zurich only. According to the city by which the wireless entertainment

ADDING A CONDENSER

In a home-built mains unit, hum may be set up if the smoothing condensers are not large enough. To test



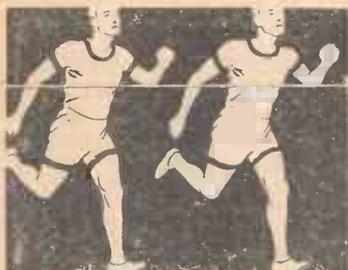
this, try temporarily connecting another condenser, having a value of 2-microfarads or thereabouts, across each smoothing condenser in turn.

is supplied, so the interval signal changes thus clearly indicating, if you have failed to pick up the announcement, the studio from which the programme is broadcast.

Have you heard the tests carried out by the new Paris 85-kilowatt station? The transmitter is being tried out at odd times, but you may drop in for one of these trials at about 4 p.m. or after 11 p.m., when the studio has closed down. Apart from the usual repetition of the alphabet or of the months of the year in the French language you may pick up a short recital of gramophone records. *The Marriage of Figaro* appears to be particularly favoured. The call is not put out regularly and you will not recognise the voice of the announcer. I am also told that Radio Toulouse is now ready for work and has actually been heard at great strength by French listeners. No special times for tests are indicated and it would seem that for the present the broadcasts are more or less kept secret as no indication is given that they are made by the new station.

A correspondent informs me that the 120-kilowatt station erected at Lieblitz (Cesky Brod, Czechoslovakia) to act as high-power transmitter of the Prague programmes is now being put through its paces. To hear these tests you will be compelled to rise early for they are made almost daily at 6 a.m.

For "Century Super" Builders.—Amateurs who are building a "Century Super" will be interested to know that construction is greatly simplified by the use of the Lewcos eight-way coil and valve holder base. This is, too, an economy, for complete with a support for the double condenser and with a Mullard leak and T.C.C. grid condenser it sells at 9s.



ACCURATELY MATCHED!

Perfect Ganging is Guaranteed to all users of the Polar Tub Condensers.

Matched within 1%. Fully screened. Rigidly built. Fitted with minimum trimmers.



Polar Tub Three.

- Polar Tub Three (less drive) 30/-
- Polar Tub Two (less drive) 21/-
- Polar Tub Four (with drive) 50/6
- Polar Drum Drive - - 8/6
- Polar Disc Drive - - 5/-

Obtainable from your Dealer. Catalogue on request.

Polar Tub Condensers used by designers of sets described in the Technical Press.

Polar Tub Two recommended by "VARLEY" for use with their Square Peak Coil.

FOR ALL GANGED CIRCUITS



IN MY WIRELESS DEN

WEEKLY TIPS—
CONSTRUCTIONAL AND THEORETICAL

By W. JAMES.



Shielded Transformers and Mains

THOSE who have experimented with a mains set will agree with me that the usual form of covering for the transformers and chokes does not shield them.

If you place certain of the parts in the wrong positions a hum will be heard because of the interaction of the circuits. A covering round a transformer or choke does not shield the component, unless it happens to be of much thicker material than any that I have used.

Care must be taken with the layout. Place the power transformer as far away from the other parts as possible. Then see that the intervalve transformer is at right angles to the power transformer. That is, see that the covers are at right angles.

You could wire with fairly long leads to the intervalve transformer and then turn it whilst listening.

The only difficulty in this method is that a hum may be introduced into a circuit and then be neutralised by the hum picked up by the intervalve transformer. This must be avoided if possible by going over the circuit carefully and adjusting the position of each part. The valves themselves may pick up noise and hum and so they must be placed away from the power transformer.

H.T. and Grid Bias

Those who use dry batteries for high tension and grid bias are, as they know quite well, using something the voltage of which falls with use.

But the high tension falls much more rapidly than the grid bias. So it usually happens that if the valves are biased correctly when the batteries are new, after a little use the valves may have too much bias for the high tension then available.

You bias the power valve when the high tension is 120 volts for example, and after a few weeks the voltage is down to 100. The bias is then too great.

Most people, I believe, do not bother to adjust the bias from time to time and so it follows that the current taken from the high-tension battery gradually falls off for two reasons. First, because the voltage falls and secondly because the valves gradually become over-biased.

The battery lasts longer when the bias is not altered, it is true, but the quality suffers and also the general performance.

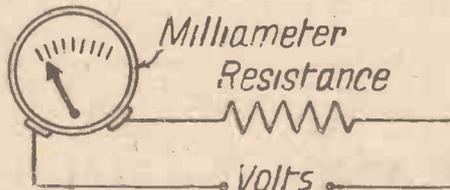
In the case of a set having an anode-bend detector, such as the "Century Super," the high tension applied to this valve must be maintained by tapping further up the battery as it discharges, or

else the bias must be reduced. This will avoid a falling off in the sensitivity, but the power obtained will be reduced as the supply to the last valve falls off with the battery voltage.

Reading Volts

Those of you who have a low-reading milliammeter can fairly easily use this instrument for reading voltages. It is only necessary to add a resistance. You ought first to know the resistance of the instrument itself, but if this is not known the error will usually not be large.

Let us suppose the instrument gives a full-scale reading when it has 5 milliamperes passing through it. Then, if we want to read voltages up to 150 we must



Connections for a series resistance to increase the range of a voltmeter. Mr. James describes this system in the accompanying paragraph

connect in series with it, as shown in the accompanying diagram, a resistance of such a value that when 150 volts are applied across the circuit the current will be 5 milliamperes.

From Ohm's law we know that the resistance must be $150/5$ multiplied by 1,000, that is 30,000 ohms. The resistance value is, of course, the total resistance of the circuit and so the added resistance should be a little less than this.

If we knew the resistance of the instrument we should deduct it from 30,000 ohms and so obtain the value of the resistance to be added.

In practice the error is not large, by ignoring this and so a 30,000-ohm resistance may be used. Get one that is of the correct value, of course, and not one that is merely marked with this value. Knowing that the full scale reading is 150 volts, the other values can be estimated.

Pentodes and Quality

The quality of the reproduction obtained from a set having a pentode valve in its output stage may often be improved by connecting a grid leak across the secondary coil of the transformer connected to its grid circuit.

This grid leak should be of no lower resistance than is necessary. I have found a value of .5 megohm suitable in several instances. With this size joined across the secondary the magnification is not much reduced over the greater part of the range of musical frequencies, but the tendency for the upper notes to be emphasised is reduced.

With a lower value even more uniform characteristics are obtained, and so it is a matter for experiment. Two or three values should be tried, such as .5, .25 and .1 megohm. The resistance should be joined across the secondary terminals of the transformers and not between the grid and filament or cathode.

A resistance should, of course, be connected across the speaker terminals as well, or across the choke or transformer used in the output circuit. This resistance is for the purpose of avoiding excessive voltages across the elements of the pentode should the speaker be disconnected during reception.

"AUTO-TRANSFORMER CONNECTIONS"

(Continued from page 196)

the curve marked "reversed" in Fig. 3. This will be seen to be almost uniform throughout the whole of its length.

It seemed to me to be rather extraordinary that the transformer should work better when the connections on the primary were the exact opposite of those marked on the transformer itself, and on making inquiries I found that the transformer had been designed for auto-transformer connections. This explained the matter, for if you refer back to Fig. 2 you will see that with this latter arrangement the anode is connected to the H.T. terminal, while the plate terminal is connected to the earth side of the circuit, which is the reverse of the connections usually adopted.

Similarly, when using a transformer which has normally been designed to work as a straight transformer, the current will pass through the primary in the reverse direction if it is used as an auto-transformer, and this may possibly affect the characteristics. There are cases where the variation in the response curve is practically negligible, but the matter is one which can easily be checked for oneself and such a procedure may save a disappointment.

"A.W." Solves your Wireless Problems



Get the
valves that
are making
**RADIO
HISTORY**

Ask your Radio Dealer for particulars of the ETA Valve to suit your set. Prices from 7/-.

THE ELECTRICAL TRADING ASSOCIATION, LTD.
ALDWYCH HOUSE, ALDWYCH, LONDON, W.C.2.
Telegrams: Eltradex, Estrand, London. Telephone: Holborn 8139.

Irish and Scottish Agents: W. J. BYRNE, 21, Temple Lane, Dublin.
R. G. JACKSON NISBET, 132, Renfrew Street, Glasgow.

SEND or CALL personal attention always from **PETO-SCOTT**

CENTURY SUPER BATTERY MODEL KIT "A"

Less Valves, Cabinet and Frame Aerial.

£4.17.4

or 12 monthly payments of 8/11
or 12 monthly payments of 15/11

With Frame Aerial £5.17.4
or 12 monthly payments of 10/9

KIT "B"

As above with valves but less Cabinet and Frame
or 12 monthly payments of 15/11

With Frame Aerial £9.12.9
or 12 monthly payments of 17/9

KIT "C"

Complete with Valves, Cabinet and Baseboard,
Panel and Frame Aerial,
or 12 monthly payments of 19/2

FINISHED INSTRUMENT. £13.17.6

Royalties paid. Batteries excluded, deposit
£3.17.6 and 11 monthly payments of £1.

SPECIFIED ACCESSORIES

Century Super Frame Aerial	£1 0 0
Handsome Polished Oak or Mahogany Cabinet with figured Oak panel 12" x 8" ready drilled and 6 ply baseboard 12" x 10"	15 0 0
6 Mullard Valves as specified	£3 10 0

** Fitted with J.B. Tiny Condensers, 5/- extra.*

SHORT WAVES ON YOUR BATTERY SET WITH KELSEY SHORT-WAVE ADAPTOR

Plug the lead of the Kelsey Short-wave Adaptor into the First and only
Detector Valve Socket of your Battery or eliminator
set and the Valve itself into the Adaptor. You are
then instantly ready to tune in short-wave stations
from 16-48 metres from all over the world. Transatlantic
reception on 2 valves is easy with this unit.
Nothing else to buy, sent C.O.D. NO VALVES, BATTERIES OR EXTRAS.

37/6

C.O.D. PARCELS FOR SUPER-HETS.

As specified for the original Century Super-het. Three-way lead and six spacers. Each strand of wire is enamelled and covered overall, which ensures maximum Pay the results. Correct centre tap. The Postman only Frame Aerial complete with wave-change switch and base at	£1	Pay the Postman
Wearite or Lewcos Super-het Coils. Set of 4 coils. As used by the designers and included in Pilot Radio Kits		50/-
Short-wave Kit for Century Super. Complete Kit—Coil, Holder, Neutralising Condenser, Flex, Spare Tags, etc.		Pay the Postman 7/6

DORCHESTER CABINET for A.C. Century Super, in Oak, 35/-; Mahogany, 45/-.

ACCESSORIES FOR BETTER RADIO

ATLAS A.C. ELIMINATOR TYPE A.C.244. 3 Tappings, S.G., Detector and Power. Output 120 volts at 20 m/a. Cash price or C.O.D. £2 19 6 Balance in 11 monthly payments of 5/6	Send 5/6 only
NEW COSSOR EMPIRE MELODY MAKER, MODEL 234 S.G., H.F., det. and power. Employs new Cossor high efficiency metallised S.G. valve. Cash Price or C.O.D. £6 15 0 Balance in 11 monthly payments of 12/6	Send 10/- only
WUFA 60-POLE UNIT, WITH CHASSIS. Cash price or C.O.D. £2 0 0 only Balance in 8 monthly payments of 5/-	Send 5/- only
EPOCH PERMANENT MAGNET MOVING-COIL SPEAKER. Type A.1. Cash price or C.O.D. £3 3 0 only Balance in 11 monthly payments of 5/9	Send 5/9 only
EKCO RADIOCORDER. Complete with Accessories as listed at £5:5:0. Cash or C.O.D. Balance in 11 monthly payments of 9/7.	Send 9/7 only
NEW AMPLION MOVING COIL M.C.C. SPEAKER, with output transformer and Permanent magnet. Complete, Cash price £3:7:6 Balance in 12 monthly payments only of 6/2.	Send 6/2 only
LAMPLUGH OR FARRAND INDUCTOR SPEAKER for perfect reproduction. Unit and Chassis complete, ready mounted. Cash price or C.O.D. £3 10 0 Balance in 11 monthly payments of 6/5	Send 6/5 only
BLUE SPOT SPEAKER UNIT TYPE 66R. 4 pole balanced armature with Major Chassis and Cone (37 cm). Cash Price or C.O.D. £2 10 0 only Balance in 8 monthly payments of 6/-	Send 6/- only
EXIDE 120-volt Type W.H., H.T. ACCUMULATOR, in crates. Cash price £4 13s. only Balance in 11 monthly payments of 8/6	Send 8/6 only
EKCO RADIOCORDER. As described and including microphone. Cash or C.O.D. £7:7:0 Balance in 11 monthly payments of 13/6.	Send 13/6 only

C.O.D. CASH I.P.

PAY THE POSTMAN—it costs no more **WE PAY ALL CHARGES**

Cash with order — Carriage Paid

Strict Privacy Guaranteed, on all Easy Payment Orders

TRADE NOTE Peto-Scott Frame Aerials, Super-heterodyne Equipment, S.W. Adaptors, available to the Trade. Terms upon application.

PETO-SCOTT CO. LTD.

Head Office : 77 CITY ROAD, LONDON, E.C.1 Clerkenwell 9406
62 HIGH HOLBORN, LONDON, W.C.1. Chancery 8266.

MANCHESTER: 33 WHITELOW ROAD, CHORLTON-CUM-HARDY. Phone: Chorlton-cum-Hardy 2028. NEWCASTLE, STAFFS: 7 ALBANY RD. Phone: 67190

Mention of "Amateur Wireless" to Advertisers will Ensure Prompt Attention

WE TEST FOR YOU

A weekly review of
new components



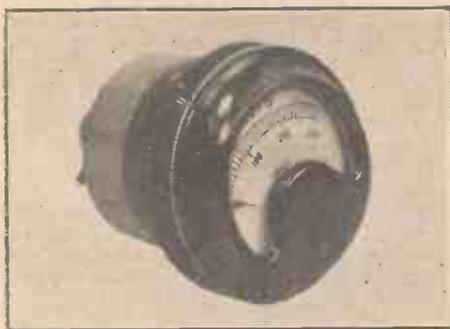
and tests of
apparatus.

Conducted by J. H. REYNER, B.Sc., A.M.I.E.E.

A Handy Voltmeter

AN interesting and unique meter of the midget type which we have tested this week is the 0-300-volts voltmeter, made by the Park Royal Engineering Co., Ltd. This meter, which is of the moving-coil type, is housed in a bakelite casing, the overall diameter of which is only 1 7/8 in.

It is arranged for panel mounting, a single hole 1 1/2 in. in diameter being required,



A handy 0-300 voltmeter

ed, the meter being held in position by a clamping ring which screws on from the rear.

The Park Royal Pivaspring movement suspension is fitted. The special construction of this suspension renders the instrument immune to shock or vibration which would very quickly damage an ordinary type of meter.

The zero adjustment is effected from the front by means of a small and novel knob. This knob is in the form of an inverted and grooved cone, to turn which it is merely necessary to place the point of the finger on the grooves.

On test, the meter was entirely satisfactory, no appreciable error being detected over the whole range up to the full 300 volts. The movement is of the high-resistance type having a resistance of 1,000 ohms per volt. It is thus quite suitable for testing voltages in a radio receiver or in any other case in which a meter with a small current consumption is necessary.

The instrument is very neatly made, the scale, which is marked in black on a white background, is divided into 10 volt divisions. The instrument retails at £1 13s. 9d. and can be recommended.

Igranic Transformer

A REALLY universal transformer is a valuable accessory to the experimenter, and when such a commodity is produced at a reasonable price, the appeal becomes all the greater. Igranic transformers are well known for their reliability

and the latest introduction of this firm will therefore be hailed with appreciation by home constructors.

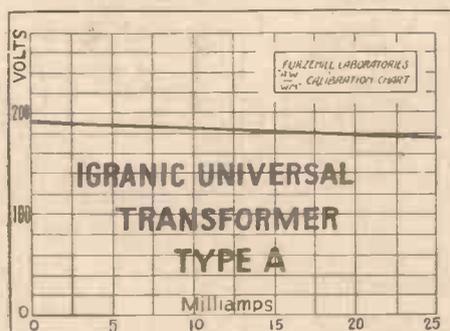
The transformers are wound for an input of 100 to 250 volts, 50 to 100 cycles, and provide a centre-tapped H.T. winding, a 4-volt filament winding, a 4-volt centre-tapped filament winding and an output winding also centre-tapped, capable of giving either 4 or 6 volts as required. Two types of transformer are made, one having a somewhat greater output than the other. Type A gives 180+180 volts, at 25 milliamperes, and the type B 225+225 volts, at 40 milliamperes. The type B transformer is also capable of supplying 5 amperes on the centre-tapped, 4-volt winding, as against 3 amperes on the type A instrument. Both the other L.T. windings supply 1 ampere.

All the connections are brought to a terminal board on the top of the instrument which is very clearly marked, and is quite accessible. It entirely solves the problem of

Trading Co., 109-111 Northwood Street, St. Paul's, Birmingham.

In this range there are cabinet speakers with prices ranging from £2 2s. to £4 4s., and the units which can be obtained separately or with a cast-metal chassis at prices from 16s. 6d. to 28s. 6d. without the chassis, or 27s. 6d. to 35s. with the chassis. Each of the cabinet models have a trade name, the model which we have tested being dedicated Alfio. This speaker, which is of the balanced armature type, is housed in a walnut-faced cabinet of very attractive design which would hardly be out of place in any surroundings. On test the speaker was quite satisfactory. The sensitivity was good and the response fairly uniform from 3,500 cycles to 150 cycles, after which it fell off; but even so, appreciable response was obtained at 64 cycles.

The overall dimensions of the Alfio model are 13 in. by 13 in. by 7 1/2 in., and



The characteristic curve of the Igranic mains transformer

the universal amplifier, which can be carried about and used on any of the various supplies, except the vanishing 25-cycle supply. The curve is shown on the accompanying chart. Altogether this is an excellent job.

Richter Speakers

THE balanced armature moving-iron type of speaker has just lately been somewhat out of the limelight, but even so, the majority of listeners use this type of instrument which, when well designed and properly used is capable of giving very good results. For those who wish to use this class of speaker and are considering the purchase either of a complete cabinet model or a unit for building into an existing cabinet there exists a very complete range of Richter speakers and units which are of Continental manufacture, but marketed in this country by Baedekers



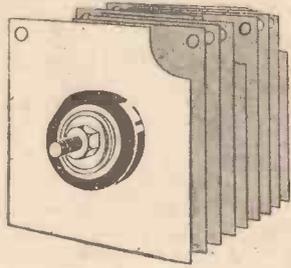
One of the range of Richter speakers

the retail price is 73s. This speaker can be recommended.

Britain's Favourite Three—1931.

In connection with the volume control in this popular three-valver, Messrs. Auto Electric Devices, Ltd., point out that for proper operation of the control they advise that the grid-bias negative lead and the lead marked 35 on the blueprint should be reversed with the lead marked 27. This will make for much more effective control of volume.

In the announcement of Spalton Electrical Stores, Ltd., on page 157 of AMATEUR WIRELESS, No. 478, the price of the Beteco speaker shown was given incorrectly. This is actually the model 47 "Cathedral Speaker" and costs £3 12s. 6d.



Look inside as well as out

When you buy a new receiver, you naturally consider not merely its appearance and external features, but also . . . perhaps more particularly . . . the various units which go into its building. One of the most important of these is the rectifier. Most of the leading receiver-makers incorporate the Westinghouse Metal Rectifier as a standard component, because—unlike its valve and chemical alternatives—it does not burn or wear out; it lasts as long as the set, giving years of trouble-free service. That is why you should

See the set includes a



Metal Rectifier

Also made in a series for amateur constructors, and described in our booklet, "The All Metal Way."

The Westinghouse Brake & Sazby Signal Co., Ltd., York Rd., King's Cross, London, N.1.
Phone: North 2415



The New Transformers

Designed by Mains specialists for use with the Westinghouse H.T.8 Rectifier, these latest Heayberd Models are ideal for All-Mains circuits.

MODEL W.30	MODEL W.31
200 v. at 60 m/A using tapping 175 v.	200 v. at 60 m/A using tapping 175 v.
250 v. at 60 m/A using tapping 200 v.	250 v. at 60 m/A using tapping 200 v.
	L.T. 4 v; 6 amps for A.C. Valves.
Price - 20/-	Price - 25/-

I enclose 3d. stamps for Lists giving full details, with circuit diagrams, of all the Heayberd Transformers.

M
ADDRESS



10, Finsbury St., LONDON, E.C.2

Amateur Wireless HANDBOOKS

each 2/6 net.

Wireless-Controlled Mechanism for Amateurs

The Practical Wireless Data Book

THE BOOK OF THE NEUTRODYNE

by J. H. Reyner, B.Sc. (Hons.), A.M.I.E.E.
Price 1/6 net, or post free for 1/9

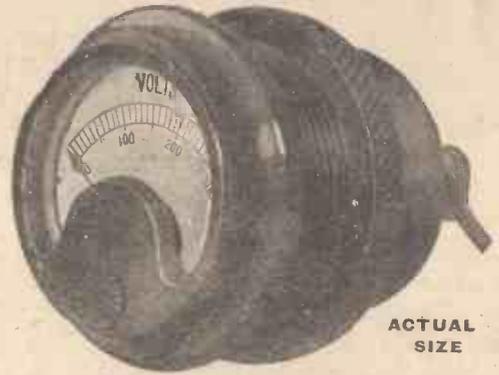


Of all Newsagents and Booksellers, or by post 3d. extra, from Cassell & Co., La Belle Sauvage, E.C.4.



PARK ROYAL "PIVASPRING" INSTRUMENTS

TYPE
M.C.
1 1/2 F.



ONE HOLE FIXING

ACTUAL SIZE

(Patent applied for) Regd. Design No. 759295

THIS is the smallest British instrument made and is recommended by "A.W." (see current report). Fitted with MOVING COIL movement, high grade jewels and sprung pivots, cobalt steel magnet, in best quality bakelite case.

VOLTMETERS 1,000 OHMS PER VOLT
150v ... 32/3 250v ... 33/-
300v ... 33/9

AMMETERS AND MILLI-AMMETERS 30/-

Send for List

PARK ROYAL ENGINEERING CO., LTD.

CUMBERLAND AVENUE, LONDON, N.W.10

Telephones: Willesden 2223, 2224 and 4715.

Telegrams: Isobar, Phone, London

PLAYER'S

Plain or tipped with cork of pure natural growth



10 for 6^p
20 for 11¹/₂^p
50 for 2/5 100 for 4/8

"It's the Tobacco that Counts"

NCC 323



The "Room-to-room 2"

SIR,—Congratulations to AMATEUR WIRELESS for the "Room-to-room 2"; it just fitted nicely in an old cabinet I had by me. The results are simply wonderful; the family are quite taken by its compactness. Wishing AMATEUR WIRELESS every success.
L. J. (Liverpool).

Using the Speaker Out-of-doors

SIR,—A number of my friends enjoy their radio in the garden and I have attempted to do likewise by running long leads from the receiver to a speaker arranged in the garden. The arrangement, however, has proved to be unsatisfactory. What is the trouble?

E. L. (London, E.).

The long leads between the receiver and the loud-speaker give rise to a considerable drop in voltage between the H.T. and the anode of the last valve in your set. This accounts for most of your trouble and can be remedied by introducing a choke-filter output circuit in your set between the output of the last valve and the extension leads to the speaker. We would suggest you make up a unit for attachment to your set inside the house as described this week.—Ed.

"Britain's Favourite Three"

SIR,—I feel I must write and congratulate you on your new 1931 set, "Britain's Favourite Three." I have used your "Favourite Two" since 1929 and have not come across anything better. My friends say so, too. It is such a simple little set to build and its results are wonderful, but you go many steps farther with your new set.
W. F. G. (Isleworth).

Appreciation

SIR,—I have been a reader and admirer of your valuable paper almost since its inception and I can assure you I am grateful for the assistance I have derived from the information gleaned from it. It certainly is in my estimation the best for wireless news.

I have also noted in your columns the generous treatment some of your readers have received at the hands of advertisers. I myself have had dealings with various advertisers in your paper and can certainly verify the courtesy with which they deal with their customers.

One case I think stands out in particular. I had reason to write to Messrs. Arthur Preen & Co. with regard to a Formo trans-

former I had which I considered not quite satisfactory.

By return of post I got a reply, expressing their sorrow and offering (without any question) to replace this transformer on payment of carriage only.

This action, I think, speaks greatly of the courtesy and generosity with which these people treat their customers.

J. T. B. (Newcastle-on-Tyne).

An Alternative Band?

SIR,—In answer to the query *re* Jack Payne's Band, by all means have an alternative band if it is understood that no more time would be given to dance music. I am not uncomplimentary to Jack Payne, but a little friendly competition would surely be beneficial and provide some variety.

Re brass bands. Each year I give a series of gramophone recitals during the winter months at the Free Church Institute here, and I have been surprised at the general enthusiasm always given to first-class brass band records. I have very good audiences of quite musical people and I receive numerous requests for good brass band records—in fact, I think, more requests than there are good records! I quite agree with the remarks *re* Callender's. During the last year or two the improvement in this band has been extraordinary. The Black Dyke Mills and St. Hilda Professional are both O.K.
F. E. E. P. (Bognor).

Directional Aerials

SIR,—It is possible to get a directional effect by using a horizontal aerial, the length of the overhead part of which is greater than three times the length of the down lead; but can a double-directional effect be obtained anyhow?

K. P. (Manchester).

Yes, by using a "T" type aerial. An ordinary horizontal aerial is erected, but the down lead wire is connected to the exact electrical centre of the overhead wire. In this case the length of the two arms should be about three times the length of the down lead wire, but quite good directional effects can be obtained from a "T" type aerial whose arms are only the same length or a little longer than the down lead.—Ed.

Modern Music

SIR,—Mr. Moseley asks what modern music can touch the old musical comedies. I am afraid there would be far

too many to mention. I have seen and heard a great many light operas and musical comedies; only last week I heard a selection of *The Land of Smiles*. Lehars' music requires a first-class orchestra, as anyone who saw and heard *Frederica* at the Palace Theatre will know. Then there is *Rose Marie*, *Lilac Time*, *Wildflower*, *Song of the Sea*, *Desert Song*, *New Moon*, *No, No, Nannette*, *Tell Me More*, *The Rebel Maid*, *Lilac Domino*. I think this is enough to go on with. He also asks about another "dance band." What about another "Wireless Military Band" to give us more popular music?
C. H. (London, N.).

Frame Aerials

SIR,—Using a screen-grid valve set with an outdoor aerial, I find it impossible to separate stations working on the same wavelengths. Will the directional properties of a frame aerial be of any use?

M. L. J. (Birmingham).

A frame aerial will certainly be an asset, as only by using a frame aerial will there be any possibility of receiving such stations' transmissions clear of each other. Pointing the frame aerial in the direction of the station it is desired to receive will enable the operator to tune in the station, provided it is within the normal range.—Ed.

The B.B.C. Dance Band

SIR,—To give an answer to the question, "Should there be another dance band to co-operate with Jack Payne?" I should like to ask: Is it intended that the latter should represent Britain in dance music, or is he expected to express other countries' ideas in this respect?

Of course we all know that Jack plays American and Continental tunes, but in playing other than British stuff he does not come up to the standard required—I am thinking more of American numbers. And it is to this end that I write.

Take the first part of the question, "Should Jack Payne represent Britain and Britain only?" Well, then he must stick to British tunes and play them well, in the British style. Then in this case another band would be required, to play American and Continental stuff. Such bands as Noble Sissle's, Roy Fox's, etc., would be ideal for this.

If, on the other hand, Jack Payne must illustrate all countries, then the standard and quality must fall.—W. J. S. (Walsall).

ELIMINATORS SIMPLY BUILT

RECEIVERS Battery 2; A.C. Mains 2; Screened Grid 3 (A.C., D.C. and battery operated); Screened Grid 4 (A.C. Mains and Battery operated).

H.T. UNITS A range of five eliminator circuits to suit all receivers from a simple 2-valve to a super-het:

FROM

FERRANTI CHARTS

STOP PRESS NEWS!

The Very Latest

additions to the famous Bulgin Quality Range of components will interest the whole Radio World. Make a note to see them at the Radio Show, on Stand 102, Empire Hall, Ground Floor. Among the new fittings shown will be—

Fixed Potentiometer, Double-pole Toggle Switch, Changeover Toggle Switch, Thermostatic Switch, Wire-wound Volume Controls, Volume Controls with Switch, Vibration-proof terminals, Long-contact Valveholders, Twin Enclosed Fuseholder, Combined Plug and Fuseholder, High-test Tubular Condensers, Heavy-duty Grid Leaks, Moving-coil Voltmeters, Moving-coil Milliammeters, D.C. Mains Resistance, D.C. Mains G.B. Potentiometer, Gramophone Needleclips, Drum Diallite, Tapped Anode Resistors, New Range Spot-welded Spaghetts, Super Type Spaghetts, "Quick-wyre" Bakelite Differential Condensers.

Meanwhile send 2d. postage for the famous 60-pp. illustrated Bulgin catalogue and manual—a standard work of reference for all keen constructors.



A. F. BULGIN & CO., LTD.
 ABBEY ROAD, BARKING, ESSEX

(Phone: Grange Wood 3260/7)

Showrooms: 9/10/11 Cursitor St., Chancery Lane, London, E.C.4. Phone: Holborn 1072 and 2072.

FUSES at NEW LOW PRICES



WANDER FUSE

Fuse and Wander Plug combined. Lies flat on battery top—takes no extra space. Use one in the H.T. lead to protect valves and H.T. supply. Fitted without tools. Spare fuse for above 6d.

Holder with 150 m/a fuse 1/6



FLEXIBLE LEAD FUSEHOLDER

Use one where a fuseholder cannot conveniently be placed inside set or unit. Fitted without tools in any flexible lead. Spare fuse for above 6d.

Holder with 1/2 amp. fuse 1/-

BASEBOARD FUSEHOLDER

The best method of mounting fuses inside any set or mains unit. Spare fuse for above 6d.



SPARE FUSES

Belling-Lee Fuses are standardised and interchangeable. 60 and 150 m/a, 1/2, 1 and 2 amps. 6d.

Holder with 1/2 amp. fuse 1/3

BELLING-LEE FOR EVERY RADIO CONNECTION

Advertisement of Belling & Lee Ltd., Queensway Works, Ponders End, Middlesex



ON September 11, the day previous to the running commentary relay, Sir Philip Sassoon will broadcast on "The Schneider Trophy."

With a negro sermon of the old camp-meeting kind as a setting, Paul Robeson will have a novel background for his negro song recital on August 20.

A running commentary on the St. Leger will be relayed from the Doncaster course on the National wavelength on September 9. This will be the fifth year in succession that the B.B.C. has broadcast this.

A programme of excerpts from Gershwin's musical comedies will be given by Reginald King and his Orchestra on September 12. "The Man I Love," the most famous single number that this composer has written, will be included.

On August 17 the Summer Mummies will give an entertainment on their usual lines. This will be their last appearance for some time in the North Regional programmes.

A short play entitled *The Back Way*, by James Lansdale Hodson, will be broadcast from North Regional on August 21.

On August 22, Mr. E. J. Sampson will be at the Leeds studio to give Northern listeners an eye-witness account of the final play in the Scarborough Lawn Tennis Tournament.

"Samson, the Strong Man," is the subject which Mr. E. R. Appleton has dramatised for the West Regional feature, "For the Children," on August 23.

The Sports Talk from Cardiff on August 24 will be given by Mr. Rowe Harding, who will take as his subject "South Wales Rugby." He will then discuss the prospects of Wales and the Welsh Clubs for the 1931-1932 season.

A Welsh programme from Swansea will be relayed to Cardiff on August 24.

On August 22, Roy Fox and his Orchestra from "Monseigneur" take part in a studio vaudeville programme for the first time. Ronald Frankau comes again to the microphone on the same evening.

The sheep dog trials in the Vale of Rydal will be reported to North Regional listeners in a running commentary on August 20.

The Northern artiste who is giving a recital on August 17, is Harry Mortimer, one of the best known clarinettists in the North.

A new "Aunt Maria" sketch will be heard during a dance music programme from Tony's Ballroom, Birmingham, on August 29.

A relay from Yorks Wood Park, Castle Bromwich, the Camping Ground of the Birmingham and District Association of Boy Scouts, will be heard on August 29, when a Camp Fire Concert is broadcast from Midland Regional.

TANNOY PRODUCTS

MAKE YOUR SET COMPLETELY ELECTRIC

for **9/2**

and 11 payments of 8/8
 Cash Price £4 15s.

TYPE G.B.1 Prov. Pat. 1042/31
 150 v. at 15m/a. or
 120 v. at 20m/a.
 Also S.G. and Det.
 Tappings.
H.T. 3 Tappings up to
 12 v.
G.B. Independent of
 H.T.
L.T. 2-, 4- or 6-v
 Trickle Charger
 (Westinghouse Rectifiers)



Write for illustrated list

The ONLY mains unit for portables incorporating independent G.B.

DALTON ST., WEST NORWOOD, S.E.27

TAYLEX

2 DS SPADERS, PINS
 2 DP HOOKS & EYES
 2 DI 2D series, 6 colours.
 2d. each.
 Write for List PDS
 J. J. EASTICK & SONS,
 118, Bunhill Row, London,
 E.C.1 2 DH

TAYLEX WET H.T. BATTERIES
 New Prices: Jars 1/3. Sacs 1/2. Zincs 1 Od. Sample doz. 18 Volts complete with bands and electrolyte 4/1 post 9d. Sample unit 6d. Illus. booklet free. Bargain list free. AMPLIFIERS, 30/-. 3 VALVE ALL-STATION SET £5. A. TAYLOR, 57, Studley Road, Stockwell, LONDON.

CAN YOU



PAINT A HOUSE,
 MEND CHINA,
 ENAMEL A BATH,
 REPAIR HOT
 WATER PIPES?

A copy of "The Handyman, 1,000 Practical Receipts," will explain to you clearly the simplest methods of dealing with these and hundreds of other household problems, 1/9 post free from the Publishers or 1/6 from any newsagent or bookseller.

CASELL & CO., LTD.,
 La Belle Sauvage, London, F.C.4.

Let "AMATEUR WIRELESS" solve your wireless problems

DIXOHMETER

is an OHMETER or Insulation and Voltage Tester for High Resistance Values. It has a moving coil Voltmeter and is a valuable aid to all engaged in electrical work.

For testing at 500 volts and reading from .01 megohm to 50 meg. Terminals for use as a Voltmeter: D.C. 0-250 volts and 0-500 volts. Price £8 10s.

No. 2 has the same features as No. 1 above but in addition the Voltmeter can be used on either D.C. or A.C. Price £9 10s.

THE MULTI-RANGE DIX-ONEMETER

6 TERMINALS.

60 RANGES.

50/- Worth £10.

(Multipliers extra) Latest Model. To 1st. Grade Brit. Eng. Standard. Mirror or Double Scale. Moulded Base. The finest Precision Multi-measuring instrument obtainable. Test Booklet Free.



Send us your enquiries for Microphones and Telephones
ELECTRADIX RADIOS,
218 Upper Thames Street, E.C.4
City O191. Electradix, Cent, London

BROADCAST TELEPHONY

Broadcasting Stations classified by country and in order of wavelengths. For the purpose of better comparison, the power indicated is aerial energy.

Kilo- Metres cycles	Station and Call Sign	Power (Kw.)	Kilo- Metres cycles	Station and Call Sign	Power (Kw.)	Kilo- Metres cycles	Station and Call Sign	Power (Kw.)
GREAT BRITAIN								
25.53	11,751 Chelmsford (G5SW)	16.0	310	950 Marseilles (PTT)	1.5	418	721 Radio Maroc (Rabat)	10.0
242	1,238 Belfast	1.2	328.2	914 Grenoble (PTT)	3.0	1,250	240 Tunis Kasbah	0.6
261.3	1,748 London Nat.	38.0	345.2	869 Strasbourg (PTT)	15.0	NORWAY		
288.5	1,040 Newcastle	1.2	367.2	877 Radio LL (Paris)	0.5	235.5	1,274 Kristiansand	0.025
288.5	1,040 Swansea	0.16	447.1	671 Paris (PTT)	2.0	240.6	1,247 Stavanger	0.025
288.5	1,040 Plymouth	0.16	466	644 Lyons (PTT)	2.3	364	824 Trondelag	1.35
288.5	1,040 Edinburgh	0.4	1,445.7	207.5 Eiffel Tower	15.0	368.1	825 Frederiksstad	0.7
288.5	1,040 Dundee	0.16	1,725	174 Radio Paris	17.0	453.2	662 Forsgrund	0.8
288.5	1,040 Bournemouth	1.2	1,725	174 (testing)	85.0	364.0	822 Bergen	1.35
288.5	1,040 Aberdeen	1.2	GERMANY					
301.5	995 North National	70.0	31.38	9,560 Zeesen	15.0	1,083	277 Oslo	75.0
309.0	968 Cardiff	1.2	217.1	1,382 Königsberg	1.7	POLAND		
356.3	843 London Reg.	70.0	218.5	1,373 Flensburg	0.6	214.2	1,400 Warsaw (2)	1.9
376.4	797 Glasgow	1.2	227.4	1,319 Cologne	1.7	234	1,283 Lodz	2.2
398.9	752 Midland Reg.	38.0	227.4	1,319 Münster	0.6	312.8	959 Cracow	1.5
479.2	626 North Regional	70.0	227.4	1,319 Aachen	0.3	355	896 Poznan	1.9
1,554.4	193 Davenport (Nat.)	35.0	232.2	1,292 Kiel	0.31	366.8	817 Wilno	21.0
*testing on 479.2 m. (626k.)								
AUSTRIA								
218	1,373 Salzburg	0.0	240	1,255 Nürnberg	2.3	381	788 Lvov	21.0
246	1,220 Linz	0.6	245.9	1,220 Cassel	0.3	408	734 Katowice	16.0
283	1,058 Innsbruck	0.6	253.4	1,184 Gleiwitz	5.6	1,411.8	212.5 Warsaw	158.0
352	851 Graz	9.5	259.3	1,157 Leipzig	2.3	PORTUGAL		
453.2	666 Klagenfurt	0.0	269.8	1,112 Bremen	0.2	200.5	1,933 Lisbon (CTIAA)	2.0
517.3	581 Vienna	20.0	270.5	1,085 Heilsberg	75.0	also on 42.0 m.		
also testing on 1,249 m. from 8.0 p.m. (Mon. Wed. Sat.)								
BELGIUM								
206	1,456 Antwerp	0.4	283.6	1,058 Berlin (E)	0.6	394	761 Bucharest	16.0
215.3	1,393 Radio Chatelneau	0.3	318.8	941 Dresden	0.3	RUSSIA		
245.2	1,223 Schaerbeek	0.2	325	923 Breslau	1.7	427	702.5 Kharkov	25.0
338.2	887 Brussels (No. 2)	20.0	360.1	833 Mühlacker	75.0	720	416.6 Moscow (PTT)	20.0
508.5	590 Brussels (No. 1)	20.0	372.3	805 Hamburg	1.7	800	375 Kiev	20.0
BULGARIA								
318.8	941 Sofia (Kodno Radio)	1.0	390	770 Frankfurt	1.7	937.5	320 Kharkov (RV20)	25.0
CZECHO-SLOVAKIA								
263	1,139 Moravska-Ostrava	11.0	419	716 Berlin	1.7	1,000	303 Leningrad	100.0
279.5	1,073 Bratislava	14.0	453.2	662 Danzig	0.6	1,000	283 Tiflis	10.0
294.4	1,028 Kosice	2.5	472.4	635 Langenberg	17.0	1,073	279.0 Kostov Don	4.0
341.7	878 Brunn (Brno)	34.0	532.9	563 Munich	1.7	1,103	272.0 Moscow Popoff	40.0
486.2	617 Prague (Praha)	5.5	559.7	536 Kaiserslautern	1.7	1,260	235 Baku	10.0
486.2	617 Cesky Brod (test)	60.0	566	530 Augsburg	0.3	1,304	230 Moscow (Trades Unions)	165.0
DENMARK								
281.2	1,067 Copenhagen	1.0	569.3	527 Freiburg	0.3	1,481	202.5 Moscow (Kom)	40.0
1,153	269 Kalundborg	10.0	1,020	185 Norddeich	10.0	SPAIN		
ESTONIA								
296.1	1,013 Tallinn	0.7	1,034.9	183.5 Zeesen	75.0	266.6	1,125 Barcelona (EAJ13)	1.0
405.8	644 Tartu	0.5	HOLLAND					
FINLAND								
291.5	1,029 Tampere	1.0	31.28	9,599 Eindhoven (PCJ)	30.0	349	860 Barcelona (EAJ1)	8.0
299.7	1,001 Viipuri	15.0	298.8	1,004 Huizen	8.5	368.1	815 Seville (EAJ5)	1.5
368.1	815 Helsinki	15.0	1,071.4	280 Radio IJzerda (The Hague)	3.0	421	707 Madrid (EAJ7)	2.0
1,706	167 Lahti	54.0	1,875	160 Scheveeningen-Haven	10.0	453.2	662 San Sebastian (EAJ9)	0.6
FRANCE								
220	1,361 Beziers	0.6	550	545 IJlversum	8.5	505.0	593 Valencia (tests)	8.0
232	1,355 Pécamp	5.0	HUNGARY					
237.2	1,265 Nimes	1.0	550	545 Budapest	23.0	SWEDEN		
238.5	1,258 Bordeaux	2.0	ICELAND					
249.6	1,206 Juan-les-Pins	0.5	1,200	250 Reykjavik	16.0	230.3	1,304 Malmö	0.75
255	1,175 Toulouse (PTT)	1.0	IRISH FREE STATE					
265.4	1,130 Lille (PTT)	15.0	224.4	1,337 Cork (OCC)	1.5	257.3	1,166 Hörby	15.0
272	1,103 Rennes	1.2	413	725 Dublin (2RN)	1.5	306.0	977.2 Falun	0.65
285.3	1,051 Montpellier	2.0	ITALY					
287	1,045.5 Radio Lyons	0.5	25.4	3RO Rome (3RO)	9.0	322	932 Göteborg	15.0
294.4	1,018 Limoges (PTT)	0.5	247.7	1,211 Trieste	15.0	436	089 Stockholm	75.0
304	936 Bordeaux (PTT)	11.0	296.4	1,013 Turin (Torino)	8.5	542	554 Svedkoll	15.0
314.3	954.5 Natan-Vitus (Paris)	0.5	312.8	959 Genoa (Genova)	1.5	770	389 Ostersund	0.75
* temporarily closed								
LATVIA						1,229.5	244 Boden	0.75
LITHUANIA						1,352	221.9 Motala	40.0
NORTH AFRICA						SWITZERLAND		
363.4 825.3 Algiers (PTT) ... 13.0						244.7	1,226 Basle	0.65
						247.5	1,214 Berne	0.5
						305.5	743 Sötens	32.0
						459	653 Geromuenster	75.0
						700	395 Bernava	1.5
						TURKEY		
						1,216.2	246.6 Istanbul	5.0
						1,538	195 Ankara	7.0
						YUGOSLAVIA		
						307	977 Zagreb (Agram)	0.7
						430.4	697 Belgrade	3.0
						574.7	523 Ljubljana	2.8

DOES YOUR SWITCH SPINDLE TURN ROUND ?

IF SO, YOUR SET "CRACKLES!"

BY FITTING A "BUSCO" SWITCH

your troubles ended because there is no contact point to turn round, and when you "switch on" you have contact like a power switch.

WHY NOT FIT ONE? They are as cheap as the inferior type but far superior in operation.

From your local dealer, Halford's Cycle Stores, or

BUSBY & CO., LTD. (Patentees)
Dept. A.W., PRICE ST., BIRMINGHAM

DO YOUR OWN SILVER PLATING!

The Wonder Way for Instantly Silver Plating.

Guaranteed Real Silver (Free from Mercury and Chromium) Just rub it on: you will be amazed to see the beautiful silver plating appearing before your eyes.

Wireless Parts, Soundboxes, Tone Arms, Bicycle and Car Fittings, Ash Trays, Gas Stoves, Door Handles, Bathroom Fittings.

Price: 2/6 per bottle, postage 3d. (or 3/- C.O.D.)

SILVEROL MFG. COMPANY
141, New Bond Street, W.1

RADIO-GRAM CABINETS DE LUXE

HUGE REDUCTIONS! Final Clearance

£12-12-0 reduced to £8-8-0 (Cash)
£7-7-0 reduced to £4-15-0 or
£3-3-0 reduced to £2-15-0 (Deferred)

GUARANTEED—Perfect condition and sent on APPROVAL FREE—return at OUR expense if not delighted. Bargains for ONE MONTH only.

Photographs and List FREE!
PICKETT'S Radio-Furniture (A.M.)
Albion Road, Bexleyheath.

LET "A.W." SOLVE YOUR WIRELESS PROBLEMS.

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.

Mr. Compton Mackenzie is taking a keen interest in the broadcasting of his play on Prince Charles Edward Stuart, which is being produced in Scotland in September. Mr. Mackenzie is building up the play on exact fact, obtained from contemporary memoirs and history.

The B.B.C. engineers no longer have much difficulty in transmitting the music of the bagpipes, as was the case a few years ago. So satisfactory have the problems in this regard been overcome, that outside broadcasts of pipe music from Glasgow parks are now being undertaken.

For the Newcomer to Wireless : SHORT-WAVE AMPLIFIERS

I'VE taken up short-wave reception recently, and there's one thing that I would like to ask you about.

What's that?

My set is a two-valver with detector and one note-magnifying stage. I don't want to add another valve, though at present I am not getting quite so much L.F. amplification as I should like. Can you make any suggestions?

First of all, you probably know that the detector itself does a certain amount of amplifying at low frequency. What valve are you using here?

Well, I've tried various kinds, but I find that most medium- and high-impedance valves are very microphonic. What I'm using now is a special detector valve with an impedance of about 6,000 ohms and an amplification factor in the neighbourhood of 15.

You couldn't do better, for these valves give excellent detection and their strong point is that if you get a good one it will hardly pong at all. But doesn't its low impedance suggest anything to you?

I don't quite follow.

Well, I expect you are using an intervalve transformer with a ratio of about 3 to 1.

As a matter of fact, I am for I've always understood that that is about the right step-up for the transformer following the detector valve.

It is so long as fine quality in loud-speaker reproduction is essential, and particularly if a detector valve of 20,000 ohms impedance is used.

Please explain.

You won't get quality unless the impedance of the transformer primary at all audio frequencies is at least equal to that of the detector. The secondary cannot contain more than a certain number of turns, so that the only way of obtaining a high step-up is to reduce the primary turns, which, of course, means making its impedance smaller.

I think I begin to see. I could use a higher ratio transformer, couldn't I?

Certainly you could, because with two valves telephone reception is your object, and there is no point in having a transformer that will bring out the bass when the telephones themselves are incapable of doing so. Since the impedance of your detector valve is low, a comparatively small transformer primary will suffice, and there is no reason why you shouldn't use a step-up ratio

of 7 to 1 or even more than that if you can find a good transformer with a bigger ratio. This will give you an appreciable increase in low-frequency magnification

That's a good idea. Have you any other suggestions to make?

Personally, I use a pentode in my two-valve short-waver and find it excellent for the purpose. You must, though, incorporate either a filter circuit or an output transformer suitable for your own phones.

The pentode must make a big difference.

It does, for you can also employ a high-ratio transformer and you get a magnification of 60 or more from the last valve. The pentode, too, is quite easily fitted with practically no alteration in the wiring of the set. If you don't want to use a pentode you will probably find that a triode of quite high magnification will deal adequately with the signals of telephone strength that your set brings in. There's no need to use a low-impedance output valve with a small magnification factor in a telephone set.

NOTICE

BECOL LOW LOSS EBONITE FORMERS



12 SIZES

LOOK FOR TRADE-MARK BRITISH MADE

Sole Makers—**THE BRITISH EBONITE CO., LTD.**
HANWELL, LONDON, W.7

ARE
RELIABLE
Tested before despatch
PANELS, RODS,
TUBES

IT'S

THE



YOU

ARE

WANTING



The PICK-UP

with the

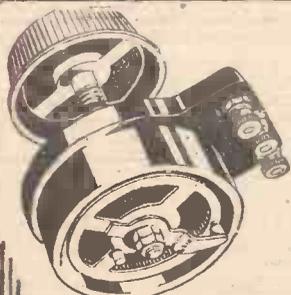
Adjustable Reed.

Combination Pick-up and arm, 32/6
Pick-up only, with side fitting, 21/-

Obtainable from Dealers or write direct.

LIMIT RADIO Ltd., 15 29 Windsor St., Essex Road, N.1.

MODERNISED RADIO



The Sovereign Volume Control has definitely assisted the advance of Radio because it is well made, reliable and moderate in price. The smooth silent action provided by its exclusive "diaphragm" contact is protected in a special dust-and-damp proof housing of solid Bakelite. Complete with domed pointer-knob and 3 terminals. Recent specifications by AMATEUR WIRELESS prove that no set is right up-to-date unless fitted with this component.

SOVEREIGN VOLUME CONTROL

50,000; 100,000;
500,000 ohms; 1 and
2 megohms, each

4/6

SOVEREIGN



SOVEREIGN PRODUCTS LTD., 52/54 Rosbury Av., London, E.C.1.

S.F.B.

IT'S OUT!

Camco's NEW 1931 24-page catalogue. Send the coupon now for your FREE copy.



CARRINGTON MFG. CO. LTD.,
24, Hatton Garden, London, E.C.1
Phone: HOL. 8202. Works: S. Croydon

Name _____

Address _____

PREPAID ADVERTISEMENTS

Advertisements under this head are charged **THREEPENCE PER WORD**, minimum charge **THREE SHILLINGS. DEPOSIT SYSTEM**

As the Publishers cannot accept responsibility for the bona fides of advertisers in this publication, they have introduced a system of deposit which it is recommended should be adopted by readers when dealing with persons with whom they are unacquainted. It is here explained.

Intending purchasers should forward to the Publishers the amount of the purchase money of the article advertised. This will be acknowledged to both the Depositor and the Vendor, whose names and addresses must necessarily be given. The deposit is retained until advice is received of the completion of the purchase, or of the article having been returned to and accepted by the Vendor. In addition to the amount of the Deposit, a Fee of 6d. for sums of £1 and under, and 1s. for amounts in excess of £1, to cover postage, etc., must be remitted at the same time. In cases of persons not resident within the United Kingdom, double fees are charged.

The amount of the Deposit and Fee must be remitted by Postal Order or Registered Letter. (Cheques cannot be accepted), addressed to

"AMATEUR WIRELESS" ADVERTISEMENT DEPARTMENT,
58/61 FETTER LANE, LONDON, E.C.4.

SYKES' POSITIVE MICROPHONE, the only microphone built scientifically correct and entirely devoid of background noise. For Dictaphone, Deaf-Aid, Baby Alarm, Public Speaking, Church and many other uses. Whispers can be heard any distance. Price 7/6 or 3 for 21/-, post paid.—J. & L. Sykes, 55 Knowlsey Street, Bolton.

HIRE A MCMICHAEL PORTABLE SET, 15/- weekly. Sets visited, repaired, overhauled.—Alexander Black, Wireless Consultant, 55 Ebury Street, S.W.1 Sloane 1655.

SET WEARITE "CENTURY SUPER" COILS, unused, 25/.—BM/PXJV, London.

1931 ETHER SEARCHER (battery model), complete with Exide accumulator, valves, also Westinghouse eliminator, in cabinet. Offers.—Box J. F.

A TRICKLE CHARGER FOR 7- The "Tonic" Self-generating Trickle Charger Kit keeps L.T. accumulators up to pitch. Reviewed "Amateur" and "Popular Wireless" magazines. Postage 9d.—Williams, Netherend, Cradley, Birmingham.

BCM/SBROS, London, W.I. make special offer of 33% reduction. Superior quality Table Cabinets, with 10-in. baseboards, to take panels 14, 16, and 18 in. by 7 in., light or dark oak, £1; walnut, £1/2/6. Speaker Cabinets to match. 15 by 15 by 10 in. inside, oak, £1; walnut, £1/2/6. Post and packing paid. Money with order returned if not satisfied within three days. Special Cabinets to order.

ENGINEERS—Are you earning less than £10 per week? If so, you cannot afford to carry on without reading "Engineering Opportunities." This 200-page book is filled with matters of vital importance to you. Among other things, it explains the methods of our unique Appointments Department, gives details of all leading Eng. Exams. (A.M.I.Mech.E., A.M.I.E.E., B.Sc., G.P.O., etc.) and outlines modern courses in Civil, Mechanical, Electrical, Motor, Aero, Radio, Talkie, and all other branches of Engineering. This book will alter your entire outlook and earning power. It is quite free. Send a P.C. for your copy now.—British Institute of Engineering Technology, 109 Shakespeare House, 20-31 Oxford Street, London.

BLUESPOT 41K (new) unboxed, 37/6. C.O.D. or deposit. N. Pickles, 17 Westminster Place, Bradford.

FREDERICK PATERSON, late Burndept Service Engineer; radio sets, apparatus, made, modernised, repaired. Full guarantees. Any set, kit, component, sent C.W.O. or C.O.D.—7 Lisle Street, W.C.2. Phone: Regent 3303.

PHOENIX THREE-VALVE kits complete with cabinet, £1/17/6. Ditto with valves, £2/15/-. Ditto with H.T. and L.T. batteries and speaker, £4/10/6. H.P. terms on kit; 10/5 deposit, 2/7 per week.—Phoenix, 314 High Road, Lee, S.E.13.

AMERICAN RADIO MAGAZINES—"Short Wave Craft," 14/6; "Radio Craft," 12/6 per year.—Subscriptions to A. M., c/o Parr's Advertising, 121 Kingsway, London, W.C.2.

"Amateur Wireless and Radiovision." Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. Post free to any part of the world: 3 months, 4s. 6d.; 6 months, 8s. 9d.; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to "Bernard Jones Publications, Ltd."

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.

Postcard Radio Literature

A Fine Speaker

I AM greatly attracted by the Marconi-phone permanent-magnet moving-coil speaker type 131. It bristles with points of interest on the technical side and, being housed in a cabinet of typical Marconi-phone high-class construction, is a "good looker." The chassis can be had separately if desired, and is known as the model 91. Take my tip and get, through my free Catalogue Service, a folder which describes both models. **326**

Good Speakers and Units

No matter whether you want to buy a complete speaker or make one up yourself from a standard unit and chassis, you should have a little folder just issued by Baedekers Trading Co. In this you will find details of some fine cabinet speakers and three types of unit for home assembly. **327**

Eelex Parts

The new issue of the Eelex Radio Bulletin, primarily of interest to traders, has just come to hand. This is full of interesting information about new parts available, general radio developments, and receiver specifications. **328**

Cheaper Ever Ready Batteries

Reductions have been made in the price of Ever Ready batteries, not only for wireless purposes, but for ordinary electric lamp and pocket lamp lighting. The Popular, Power, Winner, Popular Portable, and High Power H.T. batteries are all subject to this price reduction. You can have, free, a list giving full details. **329**

Know Your Volts!

Really you can't over-estimate the importance of having a good voltmeter. I advise every set user to write for a free copy of a very fine booklet produced by the Park Royal Engineering Co., Ltd., for this describes in a most interesting fashion the high-grade meters available. **330**

A Cheap Portable Set

Outdoor radio enthusiasts who are on the look out for a really cheap but satisfactory portable set should investigate the claims of the "Overseas Screen-grid Four." I have just received from Overseas Receivers, Ltd., a folder which describes this British-made screen-grid four, which incorporates several novel features in its specification. **331**

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.

FULL-SIZE BLUEPRINTS

When ordering, please send Postal Order, NOT STAMPS.

CRYSTAL SET (6d.)

B.B.C. Crystal Set AW281

ONE-VALVE SETS (1s. each)

Regional Ultra-selective One AW278
B.B.C. One AW280
Hartley One WM198

TWO-VALVE SETS (1s. each)

Talisman Two (D, Trans) AW194
No-battery A.C. Mains Two (D, Trans) AW230
No-battery Gramo-radio 2 (D, Trans) AW238
1930 Talisman 2 (D, Trans) AW239
Arrow Two (D, Trans) AW249
Forty-five-shilling Two (D, Trans) AW250
Searcher Short-wave 2 (D, Trans) AW259
Challenge Two (D, Trans) AW261
Everybody's All-in 2 (D, Trans) AW273
Twenty-shilling Two (D, Trans) AW274
B.B.C. Selective Two (D, Trans) AW292
The Room-to-Room 2 (D, Trans) AW298
Gleaner Two (D, Trans) WM201
Merlin Two (A.C. Set) WM213
Five-point Two (D, Trans) WM220
Brookman's A.C. Two (D, Trans) WM225
Aladdin Two (D, Trans) WM231
Ever Tuned Regional Two (D, Trans) WM241

THREE-VALVE SETS (1s. each)

The "A.W." Exhibition 3 AW247
1931 Ether Searcher (SG, D, Trans) AW271
1931 Ether Searcher (A.C. model) AW276
Mains Unit AW277
Ultra-selective Straight Three (SG, D, Trans) AW282
1931 Ether Searcher (D.C. model) AW284
Mains Unit AW285
Square Peak Three (SG, D, Trans) AW293
B.B.C. Selective Three (D, RC, Trans) AW289
1931 Britain's Favourite Three AW299
Universal Short-wave Three (SG, D, Trans) AW301
Brookman's Three (SG, D, Trans) WM161
Inceptordyne (SG, D, Pentode) WM179
Music Marshal (D, 2 Trans) WM190
Concert Three (D, 2 Trans) WM199
Five-point Three (SG, D, Trans) WM212
Falcon Three (A.C. Set) WM217
New Brookman's Three (SG, D, Trans) WM218
Five-point Short-waver (D, RC, Trans) WM223
Baffle-board Three (D, RC, Trans) WM226
Plug-in-coil Three (D, 2 Trans) WM232
Regional Three (SG, D, Trans) WM236
Gramo-radio A.C. Three (SG, D, Trans) WM237
Band-pass Inceptordyne (SG, D, Trans) WM244
Ether Marshal (SG, D, Trans) WM247

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

Regional Band-pass Four (SG, D, RC, Trans) WM211
Five-Point Four (SG, D, RC, Trans) WM216
Regional A.C. Four (SG, D, RC, Trans) WM222
Supertone Four (SG, D, Push-pull) WM227
Brookman's Three-plus-one (SG, D, RC, Trans) WM233

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

James Quality Five (2SG, D, RC, Trans) AW227
1930 Five (2HF, D, RC, Trans) WM171
Overseas Five (JSG, D, Trans) WM191

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

Century Super (Super-het) AW287
A.C. "Century Super" (Super-het) AW295
Mains Unit (1/-) AW295A
Super 60 (Super-het) WM229
A.C. Super 60 Radio Gramophone (Super-het) WM239
A.C. Super 60 (Table Model) WM245
Super 60 (with Wearite base) WM249
Super 60 (with Levocos base) WM251

AMPLIFIERS (1s. each)

"A.W." Gramophone Amplifier AW205
Two-valve Amplifier AW216
Simple Gramophone Amplifier AW257
High Quality Amplifier for A.C. Mains AW275
2-Watt Amplifier for A.C. Mains AW283
A.C. Push-pull Amplifier AW291
Add-on H.F. Screened-grid Unit AW296
Universal Push-pull Amplifier AW300
D.C. Fader WM242

PORTABLE SETS

Continental Portable (SG, D, Trans) AW241 1/-
Companion Portable (2HF, D, RC, Trans) AW279 1/6
Portable "Century Super" (Super-het) AW297 1/6
Pedlar Portable Three (D, 2 Trans) WM197 1/-
Super 60 Portable (Super-het) WM238 1/6
Home and Garden Three (D, RC, Trans) WM246 1/-

MISCELLANEOUS (1s. each)

Handy L.T. and G.B. Unit for A.C. Mains AW254
Our H.T. Unit for A.C. Mains AW262
Gramophone Tone Control AW264
Short-wave Super-het Adaptor AW268
H.T. Unit and Trickle Charger for D.C. Mains AW272
Booster Speaker (6d.) AW286
"A.W." Tone changer (6d.) AW288
"A.W." Selectivity Unit (6d.) AW290
B.B.C. Official Selectivity Unit (6d.) AW294
"W.M." Standard A.C. Unit WM214
"W.M." Standard D.C. Unit WM215
Falcon A.C. Unit WM219
Big H.T. Unit for A.C. Mains WM230
Loud-speaker Tone Control WM234
"W.M." Linen Diaphragm Loud-speaker WM235
Two-Minute Adaptor for Short Waves WM240
Super 60 A.C. Unit WM248

Copies of the "Wireless Magazine" and of "Amateur Wireless" containing descriptions of any of these sets can be obtained at 3s. 6d. and 4s. respectively, post free. Index letters "A.W." refer to "Amateur Wireless" sets and "W.M." to "Wireless Magazine."
Address letters:

Amateur Wireless Blueprints Dept., 58-61 Fetter Lane, London, E.C.4.

Amateur Wireless Available until Saturday
AUGUST 22, 1931

THE BEST SHILLINGSWORTH IN RADIO!

The August issue of the WIRELESS MAGAZINE, now on sale, contains a feast of fine features for holiday reading.

Over one hundred pages packed full of interesting and instructive articles by the best-known writers of the radio world.

There are three sets for you to build, including a simplified edition of the famous SUPER 60.

OTHER INTERESTING FEATURES:

BEHIND THE SCENES AT SAVOY HILL

HOW TO CRITICISE THE PROGRAMMES AND HOW NOT TO! Frank Rogers

THE TRUTH ABOUT CONDENSERS
J. H. Reyner

UNTER DEN LINDEN

A Story by J. Godchaux Abrahams

READERS' TESTS OF W.M. SETS

RADIO MEDLEY

BM/Press

A BIGGER AND BETTER RADIO PARIS

Alan Hunter

LITTLE RADIO PROBLEMS

Solved by Jay Coote

ENJOY THOSE OPERAS!

Whitaker Wilson

For the Home Constructor:

THE ETHER MARSHAL

A band-pass 3-valver

SUPER 60 A.C. UNIT

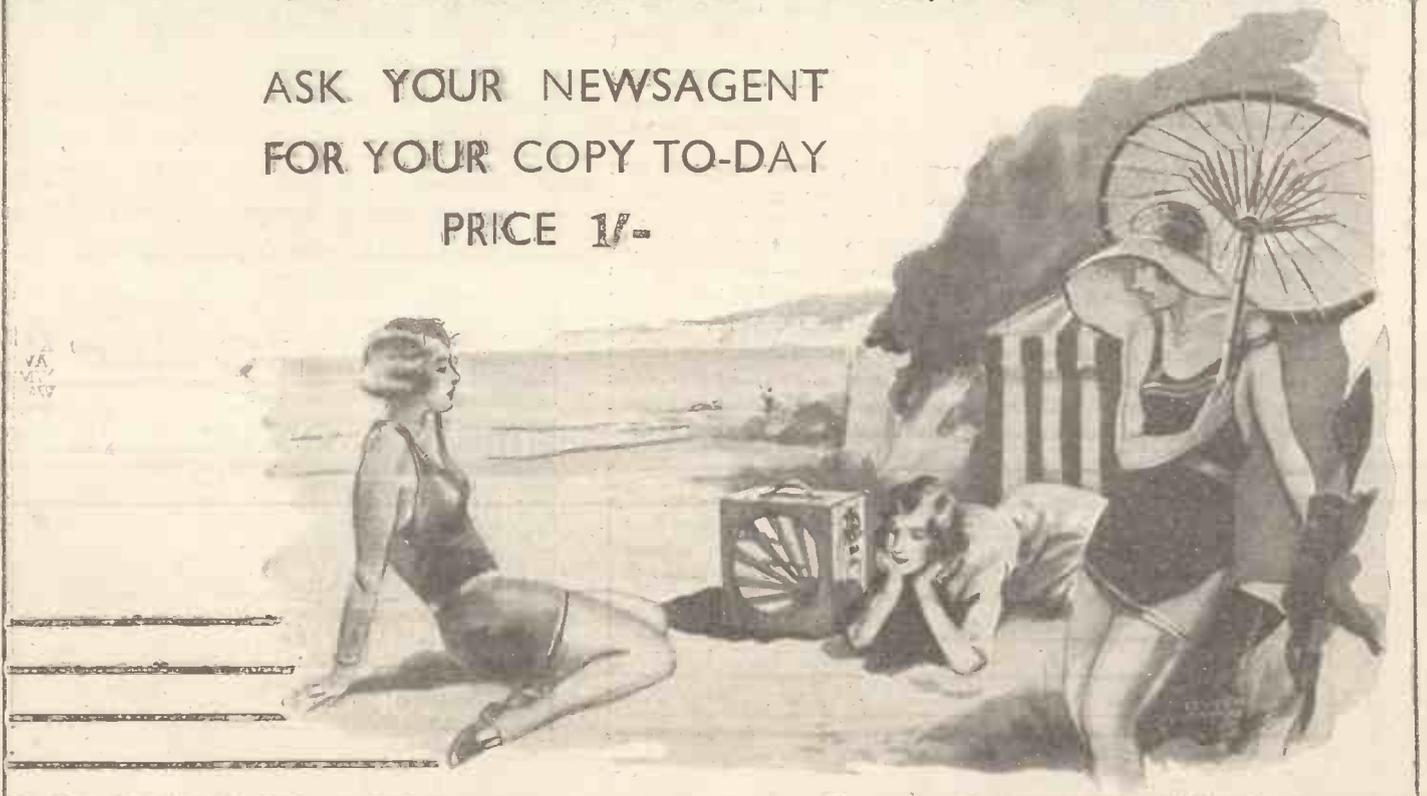
THE HOME AND GARDEN THREE

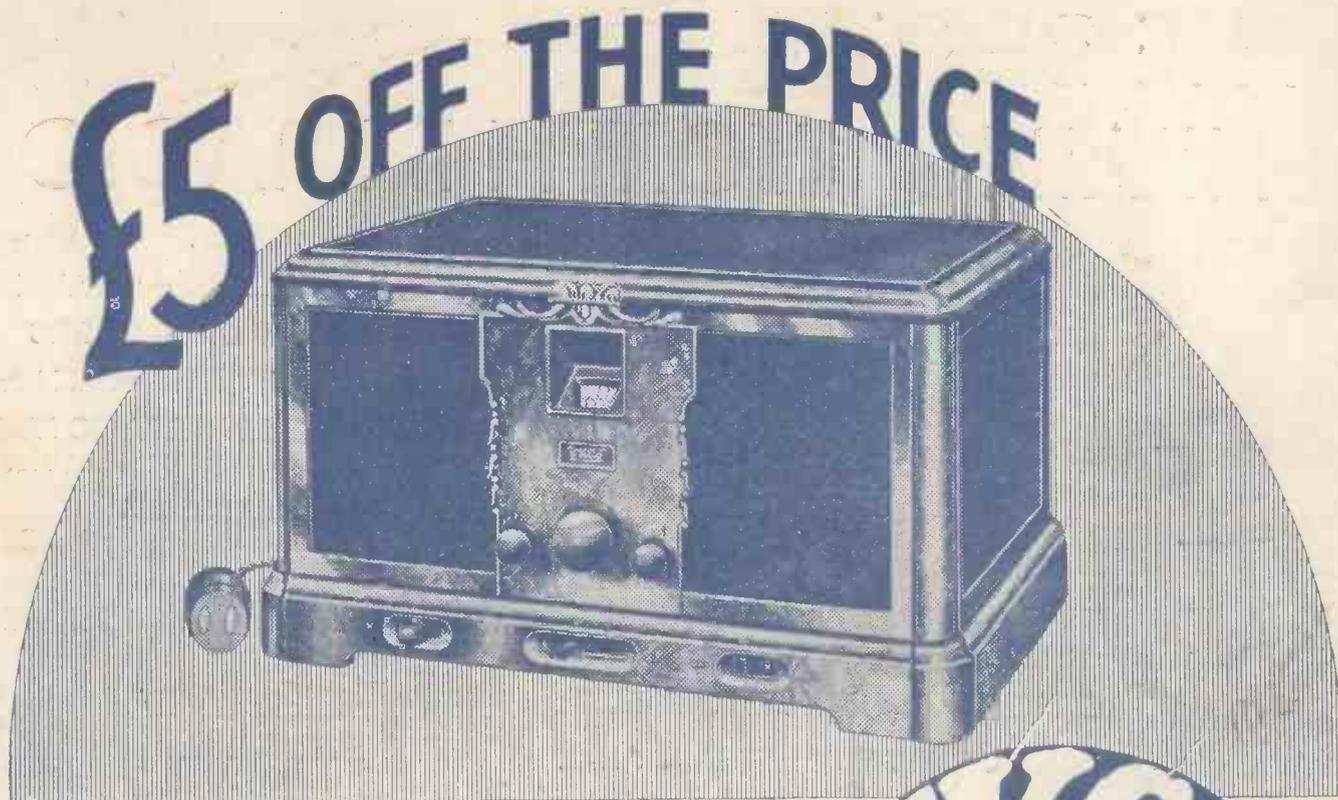
SUPER 60 Operating Hints by W. James

WIRELESS MAGAZINE

ASK YOUR NEWSAGENT
FOR YOUR COPY TO-DAY

PRICE 1/-





The EKCO All-Electric 3-valve Receiver is, without exception, the finest value for money obtainable in modern all-electric radio. Hear its performance at any radio dealer's. Take a radio expert with you and ask his opinion of its construction. Let the radio dealer tell you of its reliability. You cannot fail to be convinced that EKCO represents a supreme achievement.

If you are not prepared to pay cash, you can purchase by easy payments over two years.

EKCO Receivers are all-electric—just plug into the nearest electric light or power socket and switch on, that's all. No batteries—no accumulators—no replacements—no trouble; running costs only a few shillings a year (Westinghouse Valveless Metal Rectification). Easily equal in performance to standard 4- and 5-valve sets. Gives a remarkably wide choice of programmes from home and abroad. Tuning is simplicity itself—one knob control with dial calibrated in wavelengths. Cabinets of figured bakelite in dark jade, dark mahogany and medium oak. A.C. or D.C.

To: E. K. Cole, Ltd., Dept. K.8, EKCO Works, Southend-on-Sea.
 Please send me (a) illustrated literature of EKCO Sets and Speakers. (b) Particulars of how I can electrify my present battery set or portable with an EKCO Unit. (c) Details of easy payments. *(Strike out items not required.)*

Name _____
 Address _____

EKCO
ALL-ELECTRIC
RADIO RECEIVER
3-VALVE—NO.313
Reduced from £22-10-0
NOW ONLY
£17-10-0
OR BY EASY PAYMENTS
SPREAD OVER TWO YEARS
INITIAL PAYMENT OF 52/6
AND 23 MONTHLY INSTALMENTS
OF ONLY 15/3

Woburn

[Handwritten signature]