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# Amateur Wireless

Every Thursday 3<sup>d</sup>

and Radiovision

Vol. XVIII. No. 454

Saturday, February 21, 1931

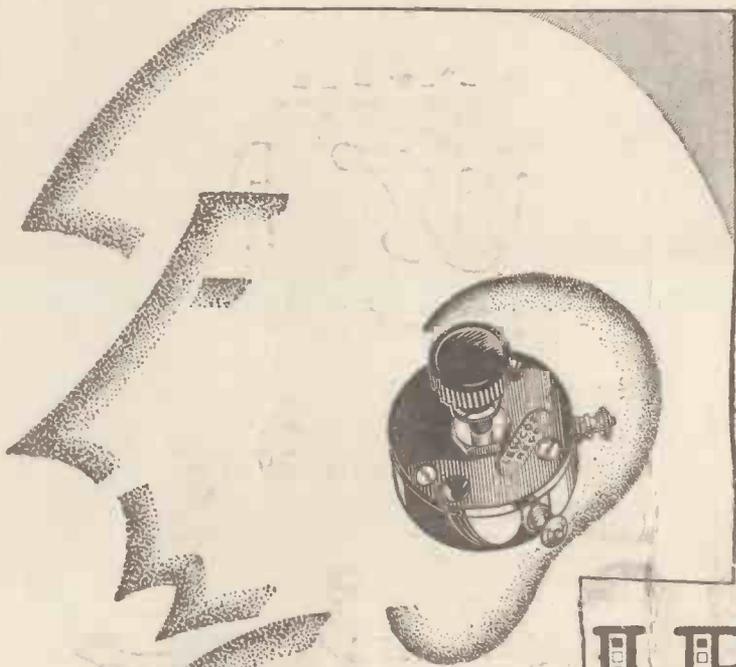
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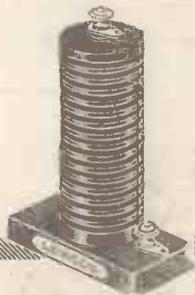
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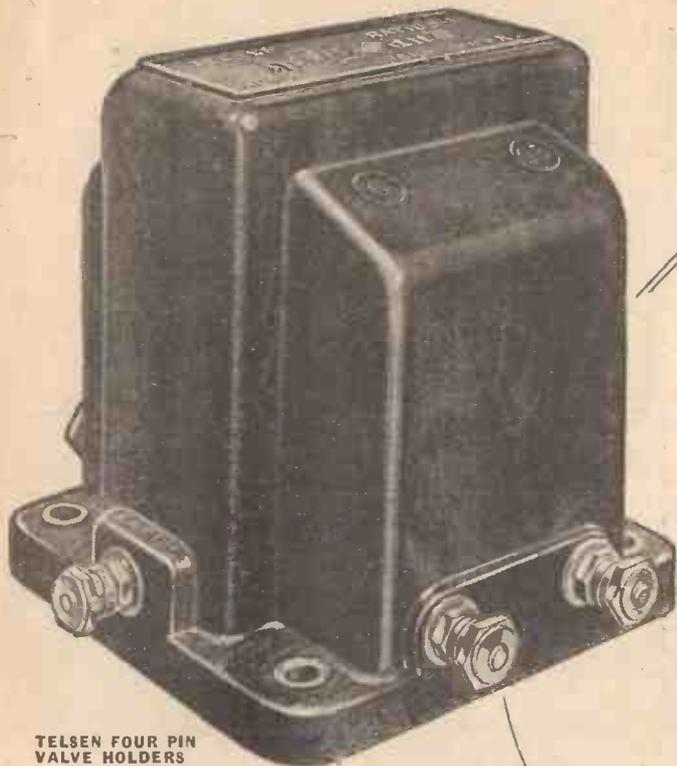
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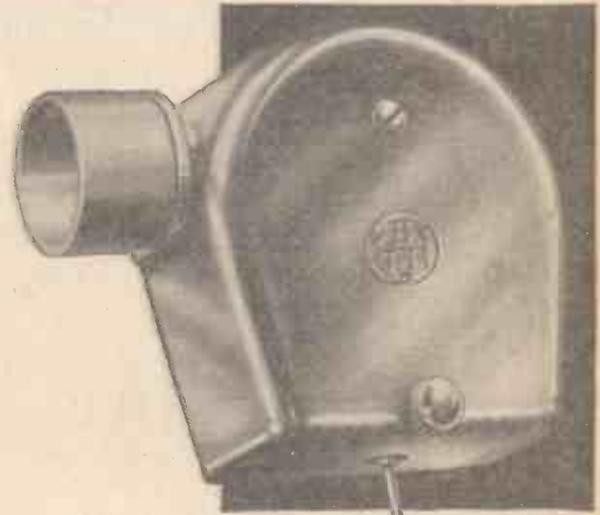
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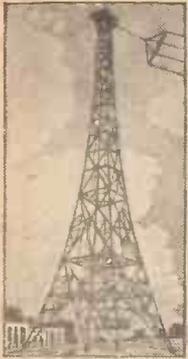


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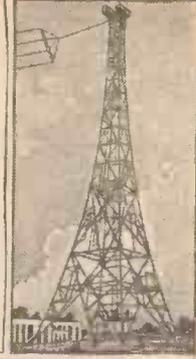
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*Don't Forget to Say That You Saw it in "A.W."*



# Amateur Wireless

and  
Radiovision



EDITOR:  
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THE LEADING RADIO WEEKLY FOR THE  
CONSTRUCTOR, LISTENER & EXPERIMENTER.

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H. CORBISHLEY.

## NEWS · & · GOSSIP · OF THE · WEEK

**THAT STATISTICAL SURVEY**  
A SHORT time ago the Central Council for Broadcast Education suggested that a census or referendum ought to be taken to determine what were the social habits of listeners. The idea was to find out at what time most listeners had their evening meal, what time they preferred talks, and so on. When we recently asked a B.B.C. official what was being done about this idea we drew a blank. And we have more than a suspicion now that the whole scheme will be dropped. This will undoubtedly serve to allay the fears of those listeners who imagined that such a survey would be merely a preliminary to further encroachment of education.

**NORTHERN PIRATES BEWARE**  
WE hear that the Post Office detection van is heading for Liverpool, Leeds, and Bradford, where a big drive against

licence pirates is contemplated. Asked why these districts have been selected, the B.B.C. stated that Manchester, Newcastle, Glasgow, and other big cities having broadcast centres have already received attention, and now it is the turn of the Northern relay towns. The Post Office is evidently waking up to the fact that much revenue is lost through pirate listeners evading the licence fee. Notable increases in licence figures occur wherever the van settles down!

### RADIO AND THE EARTHQUAKE

**A**MATEURS are playing their part in the New Zealand earthquake disaster. As soon as the main shock had subsided, Mr. Mills (ZL-2BE, of Hastings, New Zealand), collected the remains of his transmitter and re-erected it on packing cases out in the open. He is working under very difficult conditions, with fires raging

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all around him. This station provided the only means of communication with Hastings for several days until the land lines were restored. Communication with the stricken area was organised by the New Zealand Amateur Radio Transmitters. Station ZL-2GK, at Wellington, was appointed official station and was operated by two amateurs. In spite of the difficulties under which these stations worked, large quantities of messages were handled.

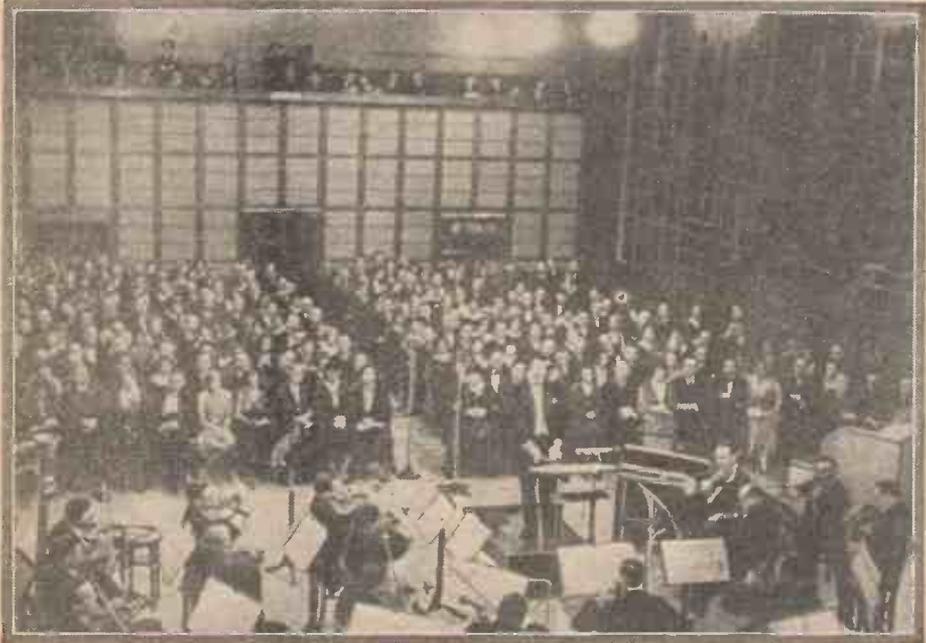
### THE MÜHLACKER TESTS

**A**SUGGESTION has been made by one of our contemporaries that the Mühlacker tests mentioned last week have proved unsuccessful. There can be no basis for this suggestion because at the time of writing the engineers concerned are at Semmering, where among other things, the data gathered from the Tatsfield tests is being discussed by European broadcasting organisations.

### FEWER COMPLAINTS

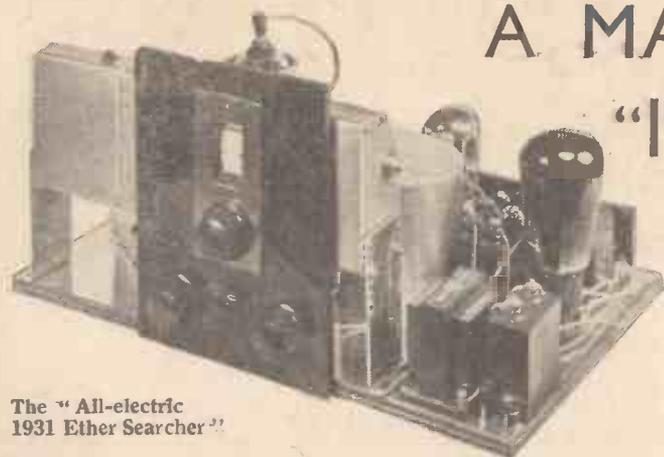
**R**ECORDS at Savoy Hill show that during the last week or so complaints about the interference between Mühlacker and the London Regional have appreciably diminished. At present it is not clear whether this improvement is due to atmospheric conditions or to alterations made at Mühlacker, such as decreasing the modulation and power. Whatever may be the outcome of the Mühlacker trouble, it is  
*(Continued at foot of next page)*

## BERLIN'S "FUNKHAUS" OPENS



A scene in the main studio of Berlin's Broadcasting House on the opening day. This is claimed to be the largest broadcasting headquarters in Europe

NEXT WEEK: THE "ALL-ELECTRIC ETHER SEARCHER"



The "All-electric  
1931 Ether Searcher"

THE "1931 Ether Searcher" is proving a great success, and AMATEUR WIRELESS is being overwhelmed with letters of congratulation and with many amazing reception logs, proving that our claim of "fifty-station reception" is not a myth, but can be actually proved in fact—and it is being proved by the thousands of readers who have made up the new "Ether Searcher." The "1931 Ether Searcher" is

#### THE SET OF THE SEASON

and is the best three-valver that AMATEUR WIRELESS has ever published. Naturally many of the letters which we have received are from

# A MAINS-DRIVEN "1931 ETHER SEARCHER"

"Ether Searcher" owners who work from the mains; and while they are, of course, getting very satisfactory results, we know that there are many readers who would like an all-electric A.C. edition of this successful receiver.

It is not the AMATEUR WIRELESS policy to give readers unnecessary constructional work, so

when the Technical Staff was called upon to produce an all-electric version of the "1931 Ether Searcher," the stipulation was made that it should be just as easy to build as the battery model and that mains users who have already built the battery model shall not have to make any serious alteration or waste components in order to convert it to mains drive.

#### THE A.C. MAINS EDITION

of the "1931 Ether Searcher" has now been produced and has passed all tests with flying colours. So far as volume, selectivity, and sensitivity are concerned, it is on exactly equal footing with the battery model, but it

#### NEEDS NO BATTERIES AT ALL.

High tension, low tension, and grid bias all come from the mains.

How is it done? The mains section of this new "Ether Searcher" is made up as a separate unit. If you already have an A.C. unit giving high tension and provided with a 4-volt filament winding, then this can be used with the new "Ether Searcher," and will fill the bill exactly. For the benefit of those who have no mains apparatus at all, the construction of a suitable unit will be described.

#### MAKE SURE OF NEXT WEEK'S ISSUE

when first details will be given of the new "Searcher." Full details will be given, as was done with the battery model of the "1931 Ether Searcher." The new set is provided with a refinement not fitted to the battery model—a gramophone pick-up switching arrangement is fitted, and this is so connected that automatic grid bias is provided to the first amplifying stage.

All "Ether Searcher" builders should turn to page 308 for full details of our £50 competition.

## NEWS · & · GOSSIP · OF THE · WEEK —Continued

certain that Mühlacker and London Regional have provided a test case for or against the working of high-power stations with a separation of only 9 kilocycles.

#### CHELSEA TOES THE LINE

WHEN the Chelsea Football Club refused to allow a broadcast commentary on the Chelsea-Arsenal cup-tie, it aroused widespread and adverse comment on all sides. The excuse of the club, that it was acting on the advice of the Management Committee of the Football League, was hardly good enough, for the final decision rested with Chelsea. Evidently the club has seen the light, for by the time this is read the Chelsea-Blackburn Rovers match will have been the subject of a full broadcast commentary.

#### A GOOD "O.B."

A PROVISIONAL date has been fixed for a relay of the first half of a concert by the Lothbury Male Voice Choir from a London hotel. This famous choir will broadcast on Thursday, April 16. Male-voice choirs broadcast well, and it is a great pity that we do not have more programmes of this nature. They would be much more popular than the continued and far too frequent North-country brass-band concerts which seem to have filled the National programmes during the past few months. It is good news that the B.B.C. Outside-broadcast Department has not forgotten the Lothbury choir, and that another broadcast is to be made.

#### THE BLIND FUND

ALTHOUGH the Wireless for the Blind Fund has been in existence

more than a year, its resources are still insufficient to provide sets for all necessitous cases, and the homes of thousands of blind persons will remain without wireless until further money is available. The amount still needed for sets alone, apart from any question of maintenance, is estimated at about £15,000. Donations should be sent to the offices of the Fund, 226 Gt. Portland Street, London, W.1.

#### BERLIN'S BROADCASTING HOUSE

IF you have any reception reports of German stations which you think would interest the Reichsrundfunk Gesellschaft officials, then why not send them to the new Berlin Broadcasting House? The correct postal address is Berlin Charlottenburg 9, Masuranalle, Haus des Rundfunks, Reichsrundfunk Gesellschaft. The German officials are, of course, just as anxious as is the B.B.C. to have reception reports of real value. The new Berlin Broadcasting House was opened only a few weeks ago, and a photograph of the opening ceremony in the main studio appears on the preceding page.

#### ITALIAN "PIONEERS"

IN Italy there is a movement known as the "Pioneers of Radio." Several amateur clubs have banded together with the idea of recruiting new listeners. Local authorities in many small towns are being pressed into this amateur listening campaign.

#### THE NEW "PARADES"

THE full cast for the new Ridgeway Parade series, which starts on March 2, has now been selected and is as follows:—Hermione Gingold, Hugh Dempster, Keith

Mason, Irene Vere, Max Turgenoff, Dorothy Dampier, Bertha Wilmott, and Dorothy Hogben and her orchestra. Last and chief of all is Babs Farren, the new "microphone girl" referred to in an interview with Philip Ridgeway published last week.

#### RADIO AND RELIGION

EVERY now and then there comes a pulpit outburst against broadcast services. The Bishop of Durham, Dr. Hensley Henson, preaching last Sunday in the Temple Church, asked whether broadcasting is favourable to religion. "May we," he said, "reckon it among the auxiliaries or the opponents of morality? The practice of listening-in may, in the case of very large numbers of half-hearted Christians, take the place of attendance at public worship, from which a very little consideration will show that it is parted by the whole distance between self-indulgence and duty."

#### "CONTRADICTORY TEACHINGS"

WHAT Dr. Henson really is complaining about is the wide scope covered by religious broadcasts. He said, later: "There is the question of the indirect consequences of broadcasting. Modern democracy affects a complete impartiality between opinions and ordains an equal liberty for them all. I suspect that the mangle-mangle of unrelated and sometimes contradictory teachings which the wireless pours in the public mind is creating in the general mind a temperament of universal scepticism which cannot but be highly unfavourable to the reception of the Christian message."



# A HIGH-QUALITY AMPLIFIER FOR A.C. MAINS

Details of an A.C. mains-operated amplifier suitable for gramophones or small public-address work

By ALAN HUNTER

THIS story really starts with a Christmas present; for if a friend of mine had not received a Ferranti permanent-magnet moving-coil loud-speaker at Christmas time he would not have had to invoke my aid; and I should not have had to help him to build a suitable amplifier to do this loud-speaker justice. But it occurs to me that more than one reader of this paper may also have started at the wrong end of the stick, being in possession of a really good reproducer but lacking a worthy amplifier to bring out its latent possibilities.

Not that I am sure the loud-speaker is the wrong end of the stick, for it is a sad but true fact that this amplifier would be wasted

Any possibility of overloading can be easily avoided by inserting a suitable volume control between the pick-up and the input valve.

The pick-up actually used was a Marconiphone, exceptionally sensitive and having a very fine frequency-response curve. As this pick-up has a high resistance, it is necessary to make the potentiometer volume control of high resistance also, in order to avoid any loading effect, which would cut off the high notes. One can overdo this high-note response in the reproduction to an extent that becomes annoying when the high-pitched hiss of the record surface is reproduced.

value of the condenser after the rectifier must not exceed 4 microfarads; and I have found 6 microfarads quite adequate for the reservoir condenser.

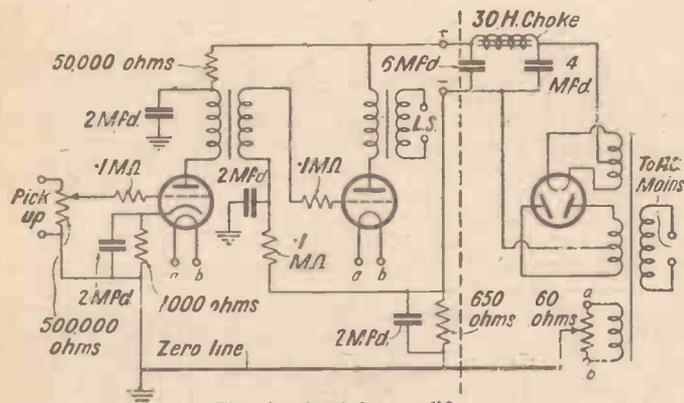
The dotted line in the circuit diagram marks the H.T. supply to the right and the amplifier to the left. Note that there are no voltage-droppers in the supply circuit; the last valve gets the full output of 200 volts but the input valve gets less due to the drop across its anode decoupling resistance.

### All-Electric

Before we leave the power supply note the 4-volt secondary for the filament heating of the input and output amplifying valve. This winding was not tapped, but the equivalent to a centre tap is provided by the "hum-dinger," a potentiometer resistance of 60 ohms connected across the windings. So far we have eliminated the high-tension and low-tension batteries; the grid bias for the input and output valve is also derived from the mains, but in an indirect way.

Look at the first valve, where the cathode is seen to go through a 1,000-ohm resistance to the slider of the filament potentiometer. Shunted by a 2-microfarad condenser, this 1,000-ohm resistance provides a grid bias for the first valve, by virtue of the voltage drop across it, caused by the flow of anode current through it. If the anode current is 3 milliamperes the bias will be 3 volts, or if it is 2 milliamperes the bias will be 2 volts. From Ohm's law it is easy to see that with a 1,000-ohm resistance the grid-bias volts will always

(Continued on next page)



The circuit of the amplifier

on some loud-speakers. Let me reiterate the truism that the low-frequency amplifier is the complement of the loud-speaker. Both should be good, but if either is bad the remaining good part is wasted.

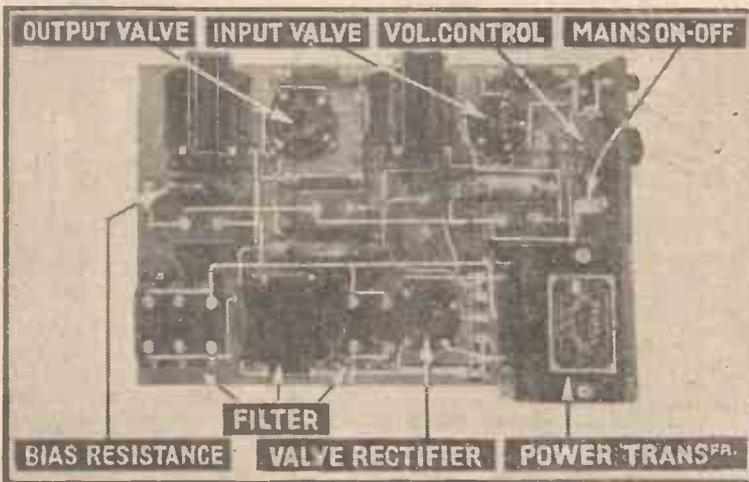
So we started with a "straight-line" loud-speaker, known to give an even response, not merely to the middle register but to the very high and low notes. Problem: to design an amplifier capable of loading this loud-speaker to full capacity but without throwing away the initial advantage of even response offered by the loud-speaker.

In the working backwards process I chose a 10-watt power valve, the PX4, after trying the loud-speaker on several sets with different power stages. This valve takes a peak input of about 60 volts. If we assume a three-to-one ratio transformer and the valve in front of that having an amplification of, say, 15, we arrive at a theoretical need for an input signal of just over one volt to load the output valve. This is only approximate and likely to be modified by the sensitivity of the pick-up.

large secondary winding is connected to the two anodes of the rectifying valve, the centre tap forming the negative high-tension connection. One of the smaller secondaries of the transformer is connected to the filament of the rectifying valve and the centre tap forms the positive high-tension connection.

The necessary smoothing for the rectified current is provided by a 4-microfarad rectifier condenser, a 30-henry choke and a 6-microfarad reservoir condenser. The

The circuit diagram is worth noting since it indicates several points that should be considered when designing a gramophone amplifier to work from the A.C. supply. Firstly, let us dispose of the power supply, since this is perfectly standard. It consists of a Varley power transformer having windings suitable for a U5 rectifying valve, as well as a four-volt winding to heat the filaments of the amplifying valves. The



This plan view indicates the positions of the principal components

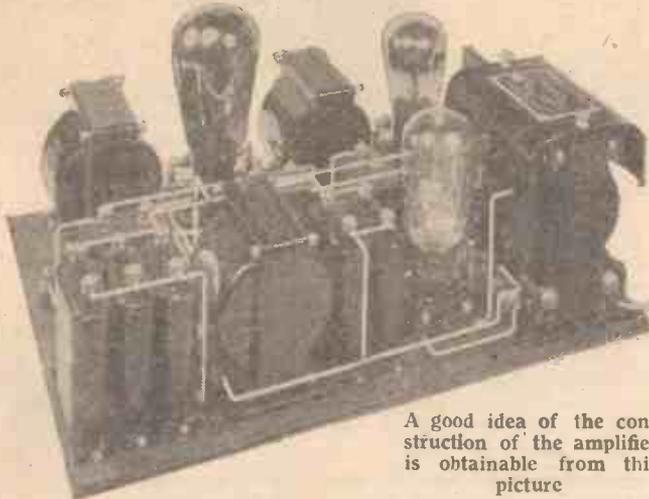
“A HIGH-QUALITY AMPLIFIER” (Continued from preceding page)

be numerically the same as the anode milliamperes.

Note that between the potentiometer volume control and the grid of the input valve is a .1-megohm leak; and one between the secondary of the transformer and the grid of the output valve. These H.F. stoppers are not, in my opinion, a luxury, but materially assist in avoiding distortion. The fact that little or no difference can be detected by short-circuiting them is not sufficient proof that they are superfluous.

**Bias**

As a matter of course, I have de-coupled the anode circuit of the first valve, choosing



A good idea of the construction of the amplifier is obtainable from this picture

the value of the anode resistance so that it drops a certain proportion of the total voltage applied to the input valve. This value is not critical from about 10,000 ohms upwards.

Negative bias for the output is obtained by the “free” method; that is to say, a resistance is connected in series with the high-tension negative lead and the centre tap of the filament winding. The current flowing through this resistance is, of course, the total anode current, so by applying Ohm’s law we can readily drop any desired voltage; and use this drop as bias for the grid of the power valve. With 200 volts on the anode I find the PX<sub>4</sub> passes about 40 milliamperes with 30 volts grid bias. So the drop resistance required is found by applying the formula—

$$R = \frac{E}{I} = \frac{30}{.04} \times 1,000 = 750 \text{ ohms.}$$

As I have used a clip-in type of resistance this value need only be taken as a guide. In the amplifier herewith a value of 650 ohms has been used.

By taking the secondary of the transformer to the end of this resistance remote from the zero line we apply in effect about 30 volts bias to the power valve, whose grid is then 30 volts negative with respect to the filament. The grid de-coupling device, consisting of a .1-megohm leak and a 2-microfarad condenser, may perhaps be regarded as unnecessary, especially as the grid-bias resistances are quite separate. In practice I have found this provision

loud-speaker used. Most makers of moving-coil loud-speakers incorporate a suitable transformer or specify the type to be used for normal super-power valves.

**Construction**

I do not propose to devote much space to the description of the construction of this amplifier because the layout diagram (of which a full-size blueprint is available) very clearly shows how the components are arranged on the baseboard. The small control panel at one end accommodates the pick-up terminals, the mains on-off switch, and the potentiometer volume control.

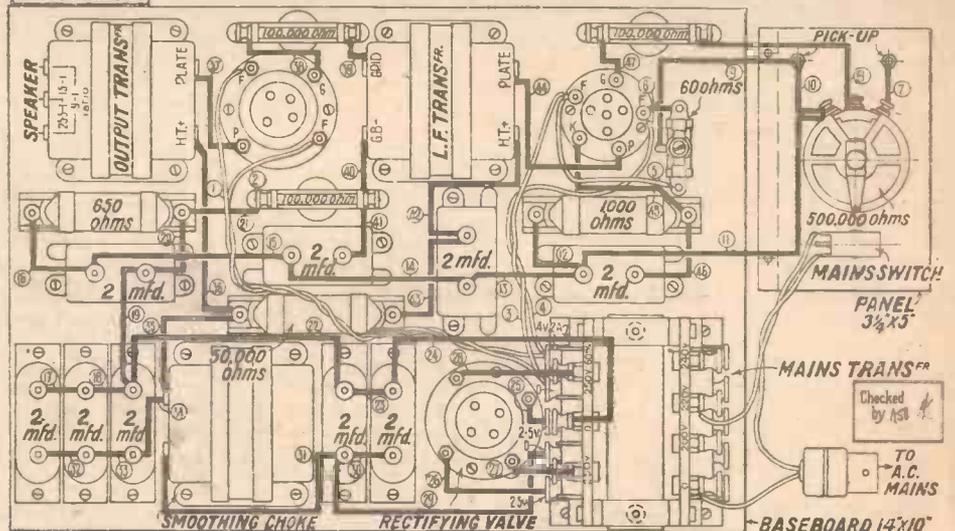
At this end of the baseboard is fitted the power transformer; near by is the valve holder for U<sub>5</sub> rectifier. And following that are the condensers and choke for the filter. The remaining part of the baseboard is taken up with the input valve holder, near the volume control, followed by the intervalve transformer, followed by the power valve holder and output transformer. The various fixed resistances, grid leaks and condensers are fitted in convenient wiring positions. All the resistances are of the clip-in type to allow for individual experiments. Wiring was done with covered Glazite, all joints being soldered.

Those who intend to make up this amplifier would be well advised to send for the is. blueprint, as this avoids all possibility of error in the wiring process.

The amplifier is brought into operation by inserting a U<sub>5</sub> rectifying valve in the appropriate valve-holder near the power transformer, an MH<sub>4</sub> or MHL<sub>4</sub> valve in the holder near the volume control and a PX<sub>4</sub> in the holder between the two amplifier transformers.

The power transformer makes provision

BLUEPRINT N° A.W. 275



The layout and wiring diagram, of which a full-size blueprint is available, price 1,-

helps appreciably in “cleaning up” the tone.

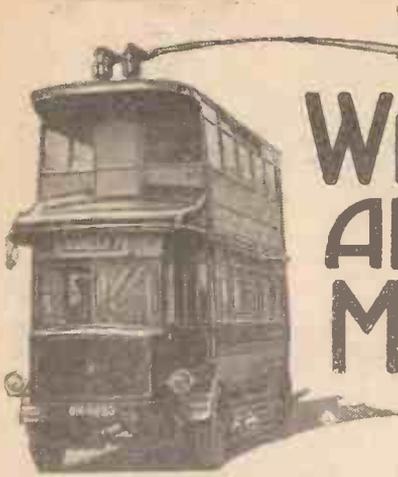
The only part of the circuit not yet mentioned is the transformer between the output valve and the loud-speaker. This is a Ferranti OPM<sub>3</sub>, which admirably matches up the PX<sub>4</sub> to the low resistance of the moving coil. The choice of the output transformer is determined by the type of

for all input voltages between 200 and 250 volts. Care must be taken to connect the flexible leads from the mains switch to appropriate input terminals.

With one of the new induction-type gramophone motors, this A.C. amplifier forms a first-class electric gramophone, capable of reproducing electrically-recorded discs with amazing realism.

**COMPONENTS REQUIRED**

- Baseboard, 14 in. by 10 in. (Camco, Clarion, Pickett).
- Multi-volt power transformer (Varley type EP7).
- Five 2-mfd. fixed condensers, 750 volt D.C. test (Ferranti C.2., Dubilier, T.C.C.).
- Four 2-mfd. fixed condensers, 200 volt D.C. test (T.C.C., Dubilier, Ferranti, Lissen).
- Smoothing choke (Ferranti B1, Varley, Lissen, R.I., Atlas, Wearite).
- Low-frequency transformer (Ferranti AF5, Varley, Parmeko).
- Output transformer (Ferranti OPM<sub>3</sub>; Varley, R.I.).
- Two four-pin valve holders (Wearite, Clix, Telsen, W.B., Lotus, Burton).
- Five-pin valve-holder (Wearite, Clix, Telsen, W.B., Lotus, Burton).
- Three 100,000-ohm resistances with holders (Graham-Farish, Lissen, Ferranti).
- 50,000-ohm wire-wound resistance with holder (Ferranti).
- 1,000-ohm wire-wound resistance with holder (Ferranti).
- 650-ohm wire-wound resistance with holder (Ferranti).
- Ebonite panel, 5 in. by 3½ in. (Becol, Trelleborg).
- 500,000-ohm variable resistance (Rotorohm, R.I., Clarostat, Lissen, Varley, Sovereign).
- Single-pole snap action mains switch (Claude Lyons, Utility, Bulgin).
- Two terminals, marked; Pick-up (Belling-Lee, Clix, Burton, Ealex).
- 60-ohm Hum-dinger (Claude Lyons).
- Connecting wire (Glazite).
- Twin flex for filament and mains connections (Lewcos).



# WHAT THE B.B.C. IS DOING ABOUT MAN-MADE ATMOSPHERICS

*Disclosed by a B.B.C. Official in an interview with the "Amateur Wireless" Special Commissioner*

As every B.B.C. listener has presumably paid ten shillings for the privilege of listening, some redress for electrical interference can surely be sought from either the Post Office or the B.B.C. It is recognised, however, that these bodies do not possess legal powers by which the adoption of remedial measures can be compelled.

## When Complaint is Made

"Just what happens," I asked a B.B.C. engineer, "when a listener writes to you complaining of a crackling background in the reception of your programmes?"

"We send him our Electrical Interference Questionnaire form," I was told. When this has been duly filled in and returned to the B.B.C. it is able to determine fairly accurately whether the difficulty is indeed caused by some external interference or whether some local fault in the set has been responsible for the buzzing, crackling, or sizzling.

The first question asked is whether the set is a valve or crystal set; if a valve set, how many high-frequency and low-frequency stages. Then, does the set work from a battery eliminator? This question helps to localise the fault, for the trouble may be due to a badly fitting power plug or to a run-down high-tension battery.

In question 3 the listener is asked whether the aerial or set has been changed just prior to the interference. Question 4 helps to show whether the interference is widespread or merely local, for one has to say whether neighbours are simultaneously suffering from the same interference, and whether the

proportion of interference to music is the same in the user's set as in the neighbour's.

Question 5, assuming the interference is external, is designed to point to the direction of the trouble, for one is asked whether the address can be given of any local listener who hears the interference at a greater strength. Question 6 quite definitely settles whether the interference is external or due to some fault in the set, for the user is asked to say whether the interference ceases when the aerial or earth or both are removed.

## Searching Enquiry

Answers to question 7 can supply evidence against several possible sources of interference, for the user is asked to say whether, within 400 yards of the installation, any of the following are situated:—Tram-lines or electric bus systems; electric signs of the flashing electric lamp or crimson neon light pattern; manufacturing works or garage employing electrical machinery; hairdresser or medical establishment using X-ray apparatus; a telephone exchange or overhead wires for the transmission of power; refrigerating apparatus or other electrical domestic appliance; accumulator charging station, laboratory or electric research; cinema or power station.

Next the user is asked to state the times when interference is most pronounced. Sometimes there is the possibility of approaching the users of the offending apparatus with a view to altering its hours of operation so that they will not clash with broadcasting hours. Again, certain sus-

pected sources of interference, such as flashing signs, do not normally function in hours of daylight, while others do not work at night, and this may exonerate them from suspicion.

Questions 9 and 10, which complete the B.B.C.'s questionnaire, are framed to reveal the source of the trouble, for the user is asked to say if the interference has suddenly started and for the date when interference was first noticed.

My informant at Savoy Hill stated that if this questionnaire is intelligently filled in (as it usually is) and the case for the complaint of interference appears to be justified, a copy of the filled-in form is sent to the Post Office, who have been extremely helpful in getting down to the many problems involved. The Post Office then sends instructions for a local engineer to call and confirm the diagnosis indicated by the questionnaire form. Remedies for the trouble are then tried.

## Types of Interference

Here I must distinguish between the two main types of interference, (a) tram and trolley buses, (b) all other sources, such as motors and flashing signs. A certain amount of the interference experienced by listeners is undoubtedly due to tram and trolley buses. And since it would obviously be fatuous for an engineer to go to a Corporation and tell them that they were causing annoyance to one or two listeners in carrying out their public service, some concerted plan of action has to be initiated. To this end, and by the courtesy of the

## FLASHING SIGNS—A FREQUENT SOURCE OF MAN-MADE ATMOSPHERICS

This is one of the most difficult types of interference to cure



## A GREAT COMPETITION FOR AMATEUR CONSTRUCTORS

# £50 IN CASH PRIZES

### EVERY "1931 ETHER SEARCHER" BUILDER MUST COMPETE

WE offer Fifty Pounds in cash prizes, as well as a number of consolation awards, in a competition for amateur builders of the "1931 Ether Searcher." The competition is open to every reader who either has built this remarkable three-valver or will be doing so during the next two or three weeks.

We ask all "1931 Ether Searcher" builders to send us an account of how they built the set, how they used it, and how they found its performance. Just a short account—not exceeding 300 words, please.

#### WHAT THE READER IS TO DO

Readers can comment, for example, on the ease or the difficulty with which they built the set; on the time taken to build the set; on their experiences after they had built it; the number of stations actually logged and any particular successes obtained, especially in relation to the conditions of reception in their own district. They should state where they bought the components.

As a guarantee of good faith, we should like every reader to get a friend or neighbour to add a few words to the account, saying that he has seen the "1931 Ether Searcher" built by Mr. —, and has every reason to believe that the account is true. Get the friend or neighbour to sign his statement and give his address.

If you can manage to send us a good photograph of yourself with your set, so much the better. A "good" photograph, you will understand, is not a tiny under-exposed "snap" which could not be satisfactorily reproduced.

We reserve the right to publish all, or any, of the entries, wholly or in part.

#### COMPETITION CLOSES MONDAY, MARCH 9

All entries must reach us not later than Monday, March 9. After considering them in detail, we shall choose from among the competitors some such number as

twenty or thirty who will be specially invited to submit their actual sets for a brief period. We shall send each of the selected competitors special packing instructions and addressed labels, and we shall pay for both packing and carriage.

Further, we shall give each of these selected competitors an undertaking not to retain his set for more than six days. The Editor, with his Technical and Constructional Staff, will examine each set and award points for workmanship and general appearance, and will then test each set and award points for performance. The Editor will act as Chairman of the Judges, and his decision will be final.

#### CELEBRATING SUCCESS

We have arranged this competition, firstly, to prove our own great faith in the "1931 Ether Searcher" and to celebrate

the tremendous success that it has won, and, secondly, to give the amateur constructor the pleasure of competing with his fellows for a number of cash prizes each thoroughly worth having.

We want an entry from every reader

who has made the "1931 Ether Searcher" or who intends to make it during the next fortnight or so. All you need do is to send us the short account asked for. We repeat, all accounts must reach us by Monday, March 9.

Any set sent us, except at our own special invitation, will not be considered. Competitors must wait to hear from us before sending their sets. Their job is to post us their 300-word account in good time. The next step is ours.

In making our selection of readers whose sets are to be sent us for examination and test, we shall be guided by our special experience and by ordinary common sense, and readers must rely on our good faith in this and in all other matters relating to the competition.

We pledge ourselves to award the full prize money.

THE EDITOR.

#### FIFTEEN CASH PRIZES, TOTALLING £50, WILL BE AWARDED

1st Prize—  
Cheque for Twenty Pounds  
2nd Prize—  
Cheque for Ten Pounds  
3rd Prize—  
Cheque for Five Pounds  
4th Prize—  
Cheque for Three Pounds  
5th Prize—  
Cheque for Two Pounds

There will be Ten other Prizes, each of a cheque for One Pound.

In addition, we shall award a number of small "commemorative" prizes.

ground noise built up considerably as any car passed the receiver. It became evident that a collective effect of all the cars then in service, or at any rate on that section of the system, was being heard. The two test cars were therefore run alone in the early hours of the morning.

The use of a stopper circuit, tuned to 1,900 metres, inserted in the down lead from the plate collector to the car controller, was found to reduce the interference by about 20 per cent. The transposition of the traction and compressor motor series coils from the low potential side of the motors, so that they became in effect chokes between the motors and overhead conductor wires, reduced the interference to about 45 per cent. of its original volume.

#### What the Lists Have Shown

The report concludes that collector clicks can be somewhat reduced where plate collectors are used; that the greater proportion of tramway interference is not caused by the collector system; that the transposition of the field coil of the motors, so that it is used as a choke, is a practical means of reducing interference with broadcasting; and that a wholesale transposition, in conjunction with the use of the plate system of collecting, will render a great improvement as far as interference from tramway system is concerned.

#### Other Causes of Interference

So much for the tramways interference; nearly all the other prevalent causes can be traced to some form of sparking at motor commutators or switches. This source of trouble can be eliminated by shunting the commutator with condensers, and earthing the centre point; quite an inexpensive process. It is admittedly difficult to cut out the high-frequency radiations caused by neon signs and such apparatus as X-ray machines; but in this country such apparatus is not used as extensively as abroad.

It is highly probable that the B.B.C. will issue a pamphlet in the future, containing the information on this subject which is now available. The pamphlet will tell listeners of the various types of electrical machinery which, in certain circumstances, can cause interference to broadcast reception—and the steps which can be taken to reduce that interference to a minimum. Information will also be contained in this pamphlet to help listeners ascertain whether their own receiving equipment is faultless before suspicion descends on some other, possibly blameless, piece of electrical machinery.

Fortunately, on all sides a general spirit of co-operation has prevailed, engineers of the Post Office and B.B.C. working in the most harmonious way with the Corporation or individuals concerned. There is reason to hope that in a very few years the major sources of electrical interference will have been tracked down and eliminated at their source.

#### BROADCASTING HOUSE

PROGRESS continues to be rapid in the completion of Broadcasting House, the B.B.C.'s new headquarters at Portland Place. We hear that the question of the decorations for the studios and attendant suites in the central control tower is now under review. Simplicity is to be the keynote of the decorations in this ultra-modern building.

#### "WHAT THE B.B.C. IS DOING ABOUT MAN-MADE STATIC"

(Continued from preceding page)

tramway officials concerned, extensive experiments have been going on, at Blackpool and Birmingham in particular. In a report recently issued by the radio section of the General Post Office some details of the work accomplished are disclosed.

#### Is there a Remedy?

It is admitted that complaints of interference with broadcast reception, caused by tramway systems, have been received in the past from many districts. No general remedy had been found. It was known that a plate type of overhead collector was in use on the Continent (where a B.B.C. engineer had been sent to investigate it)

and that its introduction into this country was imminent.

Tests made about a year ago at Blackpool proved that the plate collector considerably reduced the clicks heard on a portable set situated 10 yards from the tram route. But, as had already been noted at Birmingham, the greater part of the interference was not due to the clicks caused by the collectors passing under suspension bars, but to a more generally distributed source.

Tests made by B.B.C. and G.P.O. engineers at Blackpool, using a test car and a standard car, both fitted with plate-type collectors, showed that interference was present even when no cars were in sight. The background of interference noted during the working hours of the tramway service gradually decreased as the trams returned to the depot at night. The back-

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# A STRAIGHT LINE

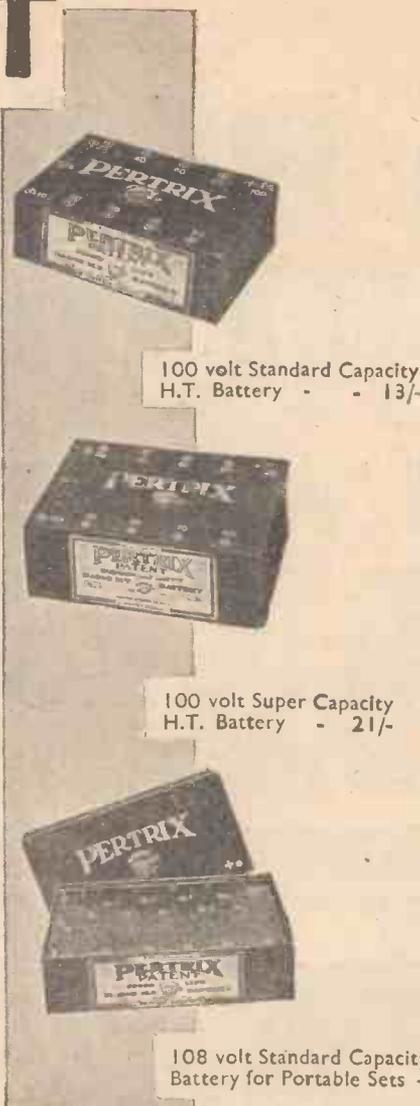
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# Oh Your Wavelength!

## MORNING AFTER THE NIGHT BEFORE?

FINDING myself wide awake at half-past six the other morning, I thought that it might be a good idea to come down to the wireless set to see whether any of the more westerly U.S.A. stations were still at work. You probably know that there are four time zones in the States; Eastern Standard time is five hours behind ours; then come Central Time, six hours; Mountain Time, seven hours; and Pacific Time, eight hours behind. Sometimes, therefore, you can catch stations like KGO, in California, working merrily away just before it is daylight over here.

### A SURPRISE

WELL, having glanced at the calibration chart, I whirled the condensers to a likely setting and switched on. A positive bellow of music immediately came through. "Ho, ho," thinks I, "I'll come back to this chap in a few minutes. Meantime I'll have a run round to see if anything else is going. Sure enough, real loud-speaker stuff was coming in all over the dials, and, having discovered this, I went back to station number one for identification purposes. I hadn't long to wait before a voice announced: "*Hier Hamburg.*" Then I compared the settings that I had jotted down with my tables for European stations. They were all German transmissions. I cannot decide whether they were still continuing the programme of the night before or whether they had reached the morning after. Unless my memory deceives me, 6.30 a.m. in this country is 5.30 a.m. in Germany. It does seem to be a pretty early hour for trios, orchestral pieces, and things. The German stations seem to be putting in almost as late hours, too, as some of the Spaniards. On several occasions I have found them still working at 2 a.m. or even later.

### LWOW MAKES HIS BOW

THOSE who are sticklers for pedantry in the matter of place-names write Lwow with a funny little accent thing over the "o"; though why, in heaven's name, they should do so I do not know, for it cannot convey anything to anybody who does not know Polish. I can tell you, though, that he calls himself something very like "Lvoo," for I heard him give out his own name several times the other night when the new transmitter was making its bow to the world. It is quite possible that you won't find Lwow in your atlas unless it happens to be particularly up to date, but you will find Lemburg, the old name, which has the advantage of being easily pronounceable by anybody. The station works on a wavelength of 381 metres; so that he is just between Manchester and Toulouse. I have found him coming in quite strongly on most occasions, and, if you haven't already heard him, now is the time to add him to your bag of foreigners.

He is anxious, by the way, to have reports about his reception in foreign countries. The address is Polskie Radio, Lwow, Poland.

### MISLEADING PLACE-NAMES

IT is, I think, a great pity that there is a movement on foot amongst the high-brows to discard the good old English names for foreign towns in favour of their native equivalents. If the native equivalent gives any impression of the pronunciation when it is printed, matters are not so bad; but, as a rule, it does not unless one happens to know something of the language. What, for example, is the point of printing Goeteborg instead of the English Gothenburg? No Englishman could realise when seeing it in print that the name was pronounced something like "Yerteborry" in Swedish. And there are heaps of other names, such as Brno and Kattowice, whose pronunciation is not suggested by any attempt to write them as their own inhabitants would. There is another point, too. Unless you possess a very modern atlas you will not be able to find many of these towns, though you would be able to do so at once if their real English names were used instead.

### STILL GOING STRONG

THE American stations are still pouring in on favourable nights, and so long as you have got a decent H.F. department you can be pretty sure of picking up one or two, even if you don't want to sit up very late. The easiest of all to tune in just now is WTIC on approximately 283 metres. He is usually receivable at good strength as soon as the European group on 283 metres has closed down for the night. The punch with which this station comes in is simply astonishing. On most nights at present I receive him every bit as well as the more powerful European stations.

### A TIP

ONE tip, by the way, about sitting up for America. Do not bother about it if you find that there are any atmospherics earlier in the evening. These are nearly always at their worst in the small hours, and since, as a rule, the set has to be worked in a pretty sensitive condition the big amplification used brings them up to such a level that they completely spoil one's pleasure in listening to speech and music. When WTIC is good you will nearly always find WIOD and WPG coming through well. The stations on wavelengths rather higher up are not, as a rule, at their best until a little later on. This, though, is by no means always the case, for a few nights ago I had superlatively good reception from WJZ long before 1 a.m.

### THE BEST EVER

THOUGH some of us may talk about the good old days of five or six years ago, when Americans could be received on

almost any kind of set, it is a fact that the U.S.A. stations on the medium waves have never before been received so well as they are now. Increased power and improved broadcasting technique enable these transmissions to reach this country with something closely approaching perfection. In the old days it was a rare thing to hear music that had not lost most of its treble, and was not rather difficult to follow. Just now some stations, such as WJZ, KDKA, WGY, WBZ, WTIC, and a host of others, are coming over so well that the quality of both speech and music is in every way as good as that from, say, Rome, Strasbourg, or Heilsberg. For a whole hour some nights ago I listened to a concert from WJZ, not because it came from a distance of 3,000 miles, but because the music was so beautiful.

### A BIG "BAG"

ON another recent occasion stations were coming in so well from across the Herring Pond that I simply could not go to bed. It was, in fact, 5.15 a.m. when I switched off and retired to rest. Part of that time I spent in trying for fresh stations for calibration purposes. One can in this way obtain a particularly good check on one's calibration, for no American station is allowed to deviate even for a few minutes from its allotted wavelength. If it shows any signs of wandering the Federal Ether Police jump on it like a ton of bricks. During that period I picked up just under forty stations. Some, of course, were weak, but a very large number were coming in splendidly.

### SIMMERING AT SEMMERING

SEMMERING, in Austria, is the scene of a kind of interim radio conference which does not appear likely to accomplish very much of real value. Vice-Admiral Carpendale, our delegate to the conference, has announced that no revision of wavelengths or limitation of power or modulation can be brought about before next year's conference meets at Madrid. This seems a pity, for the next twelve months will be a difficult time for European broadcasting. The number of new high-power stations that will come into operation during that time is far greater than most people realise, and there are certain to be troubles of various kinds. What a pity it is that conferences and things can never work with an eye to the future, but must always wait until things have happened before they can do anything about them. Anyhow, one can be pretty sure that there will be plenty of business on the table when the Madrid conference assembles.

### THE HEAVISIDE LAYER

CONDITIONS in the upper regions of the atmosphere are getting complicated. It is no longer a question of one reflecting layer, but two, the upper being more highly ionised than the lower. According

## On Your Wavelength! (continued)

to Professor Appleton, the nearer layer is the one which reflects the long waves used in long-distance transmissions, whilst the upper one comes into action on the shorter wavelengths. He has recently carried out a series of experiments with the object of measuring the state of ionisation of the long-wave layer. It seems that in the neighbourhood of London there is a daily variation which reaches a maximum about noon, then gradually falls off to a minimum value during the night. The effect of the sun on the layer is shown by a sharp increase in ionisation, which occurs shortly after sunrise, followed by a gradual rise to the noon-day maximum.

### INTERFERENCE-PREVENTERS

I WONDER whether this kind of investigation will in time lead to the discovery of a really effective method of cutting-out atmospheric disturbances. It is one of the oldest problems in wireless reception and, so far as I am aware, it has never been solved. Of course, in this country we are not bothered with ordinary static to any considerable extent; though it is an absolute bugbear in tropical countries, especially in summer. The point I have more particularly in mind is that the effect of "natural" static on a broadcast receiver is very similar to the effect of the "unnatural" static caused by electric trams, trains, and the like, which is becoming a distinct problem. The remedy for one kind of interference would most likely prove to be a cure for the other, and would certainly be received with open arms by a wide circle of long-suffering listeners.

### THE RADIOSTAT AGAIN

I SEE that the Stenode principle is being employed in another novel and interesting direction, namely, that of multiplexing or sending several distinct signals simultaneously over the same wire. For instance, high-speed morse, speech, and the signals used in picture transmission can now be superposed on the same wire and separated out at the receiving end without overlap. The installation and upkeep of long-distance trunk lines is an expensive matter these days, and any method of making one line serve the purpose of three is bound to effect a tremendous saving in cost.

### A COMMON TONGUE

SOONER or later, I imagine that the combined effect of broadcasting and the talkies must make itself felt in the movement towards some kind of universal language. Both are forms of recreation which have a universal appeal, and both stand to gain enormously by the adoption of a common mode of speech. Until recently the advantages of learning any of the so-called universal languages, such as Esperanto, were too academic to carry much weight with the ordinary man. He naturally felt that the return was hardly worth the labour involved. But there are many listeners at the present time who would think it well worth while to tackle one new language if they were assured that

it would occasionally bring them into direct touch with the political thought and national drama of all the more important European countries. Much the same argument applies to the talkies, though perhaps in a lesser degree.

### BROADCASTISH?

IN mediaeval times Latin was the common language of every university in Europe, and the desire for knowledge a sufficient incentive to make every student learn it. Once so equipped, he could move about from country to country and feel equally at home in each centre of learning. Nowadays to do the same thing it would be necessary to learn, perhaps, a score of different languages. But it is no longer a question of travelling abroad. One can make contact with half a dozen different countries in a single evening simply by listening-in at one's own fireside. The tragedy is that most of us cannot make full use of this privilege, apart from the musical items. Some day the problem will be tackled seriously, and we shall have a new

NEXT WEEK:  
"THE ALL-ELECTRIC  
ETHER SEARCHER"

language taught in the schools, possibly based on a mixture of French, German, and English. It might be called Broadcastish, though I hope they will find it a better name.

### BAND-PASS FILTERS

I WAS talking to a fellow the other day on the subject of band-pass filters. He said that he had never been able to get them to gang properly and thought that they were not satisfactory. I said that, from my experience, there was no difficulty, provided one used reasonably accurate coils and a decent ganged condenser, and I asked him what components he was using. He told me, and I was somewhat surprised to find that he was using the same components as I did myself.

Obviously, there was some difference between his conditions and mine, and I went into the matter more deeply. He

### DID YOU KNOW THIS?

Mains-driven sets should always have an output choke or transformer. Transformer manufacturers produce anode transformers, the primary of which is connected in place of the speaker terminals in the anode of the power valve, the secondary is connected to the speaker. Generally the primary is wound to have an inductance of 40 to 50 henries with fairly low ohmic resistance.

When the new transmitter near Böhmisches Brod is ready, Prague will have two broadcasting stations. These will be the existing 5-kilowatt station and the new transmitter, which will have a power of from 60 to 120 kilowatts.

To solder wires to grid leaks is, as a rule, to ask for trouble. The least amount of heat applied to some types alters the value.

drew me a circuit, and I then saw what his difficulty was. He employed a form of circuit in which the anode of one valve is tapped on to the next grid directly, and in order to isolate the high-tension from the grid, the bottom end of the coil is connected to earth through a condenser. Thus the tuning circuit includes not only the coil and tuning condenser, but this fixed condenser as well. Consequently, it is necessary to see that the fixed condensers in the circuit are also matched, as well as the coils and tuning condenser, if correct ganging is to be obtained; and the fact that this was not so introduced the difficulties to which my friend was referring. This is probably a factor which has caused trouble in one or two circuits, and the experimenter should be on the look out for any peculiarity of this nature.

### A NEW IDEA

HAMBURG is experimenting just now with an entirely novel method of transmitting piano music. Every wireless man knows that the piano is by far the most difficult of all instruments from the radio point of view. Often a set which gives a good account of itself as regards almost everything else will be hopelessly bad in its reproduction of a piano solo. One reason for this is to be found in the wide spread of the strings of the instrument, which makes it very difficult to find a position for the microphone that will suit them all. The new system which the German authorities are trying out does not make use of a microphone at all. The vibrations of the strings themselves are converted direct into electrical impulses. So far the tests have shown a certain amount of promise. Whether they will ultimately prove that the microphone can be superseded for the transmission of piano music still remains to be seen. Meantime, you may catch Hamburg experimenting outside normal broadcasting hours with piano music, and if you do so you will have an interesting time.

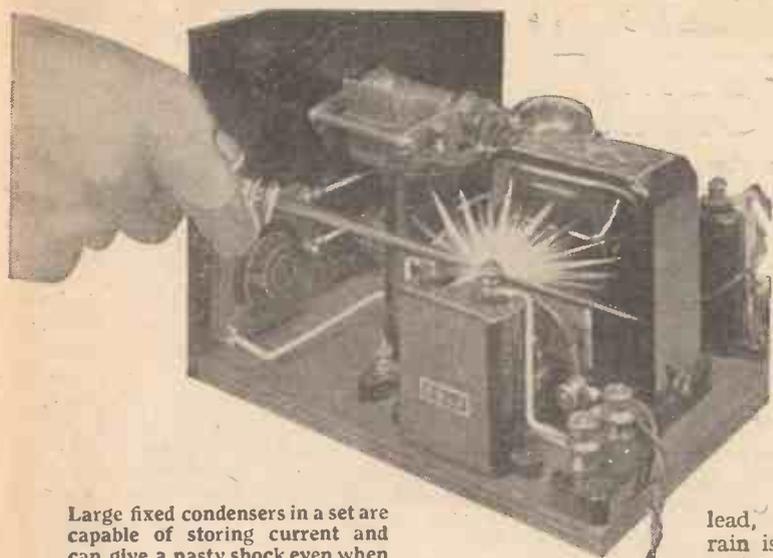
### THANK GOODNESS!

I HAD reason recently to be thankful that I make a practice of using fuses in the H.T. leads of all my sets, for otherwise I should probably have done a good deal of damage by means of an accidental short-circuit of the kind that may come anyone's way. I was fiddling about, engaged in trying various values of resistances at a particular point. The resistances used were of the small tubular clip-in type, and one of these slipped out of my fingers as I was inserting it. It fell to the bottom of the aluminium case and brought up with one metal end in contact with both earth and H.T. +150. There was a pretty useful bright blue spark, but a fuse bulb instantly blew, and all was well. But for that fuse I should probably have done a heap of damage and have given a brand new H.T. accumulator a nasty kick in the neck. As it was, no harm was done, except that a bulb costing a few pence had to be replaced.

THERMION.

# AVOIDING SHOCKS AND SHORT-CIRCUITS

*Beginners are sometimes worried by the possibility of getting shocks from a set, particularly if it works from the mains. Here is some practical advice by* **KENNETH ULLYETT**



Large fixed condensers in a set are capable of storing current and can give a nasty shock even when the mains supply is switched off

lead, find that when rain is falling on the aerial, small sparks jump across the condenser insulation.

### Static Charges

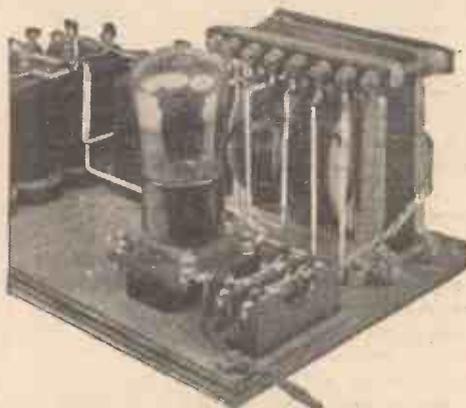
These sparks are the result of the charging up of the aerial from the static potential of the raindrops. This potential builds up slowly until the value is so great that the current jumps the small air gap of the aerial condenser. If a "safety valve" is not provided, the insulation of the whole of the tuning side of the set may be damaged. It is believed that these static discharges are often the cause of cracked aerial insulators and broken lead-in tubes.

The trouble is hardly ever likely to occur with indoor aerials and certainly not with frame aerials, but possessors of outdoor wires should make a point of fitting a safety spark gap, or, better still, an aerial-earth switch, as close to the lead-in as possible. This may not be an efficient protection against big lightning discharges, but it certainly will prevent the set from being harmed by static discharges.

The other "risks" in a set are much more definitely under control; in fact with a carefully constructed set, there should be no possibility of shocks or short-circuits. If the set works from batteries, then all

sorts of trouble can be obviated by the provision of a safety fuse. A fuse of this description should preferably be of the screw-in bulb type, for it gives a visual indication when it "blows" and fuses of this variety are cheaper to buy and fit easily in standard screw type bulb sockets.

The best place for a fuse in a battery set



Never work a mains unit which has not a separate fuse in each mains lead. Here is a suitable fuse block for the mains output

is in the negative high-tension connection. A similar fuse may be fitted in a mains-driven set and it is also advisable to provide a fuse on the mains input side. These can be of a different type, and it is necessary to have one fuse in each mains lead so that no matter which wire is above earth, the receiver is adequately protected.

Both with battery and mains-driven sets there is the possibility of getting shocks if the working of the anode circuits is not properly realised. In the average set, there are at least two condensers which have the full mains voltage across them.

If these have a value exceeding 1 mfd. then they will be found capable—if the insulation is good—of holding an appreciable amount of electricity for perhaps several minutes. Thus, if the mains supply is switched off and no other circuit is provided, there is the danger that, if the hands are placed inside the cabinet, a shock may be felt if the condenser terminals are touched.

This is often experienced with mains  
(Continued at foot of next page)

"IS there any danger attached to the working of a set? Is it possible to get shocks; is there any danger from lightning and is it quite safe to work from the electric light?"

These are the sort of questions that every

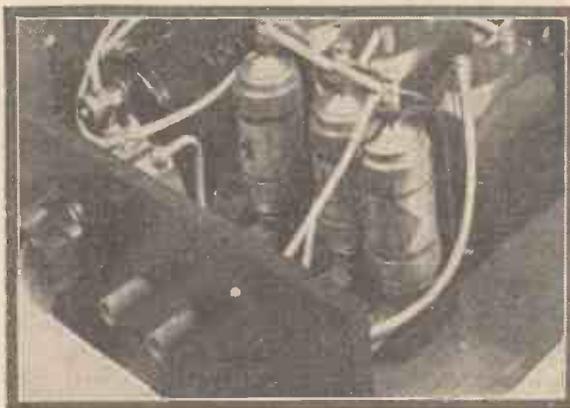


It is a wise plan to have an earth condenser when the mains supply is used. This shows how the condenser is connected in the earth lead to the set

set owner has to ask himself when the aerial is overhauled and one tentatively wonders whether there is any danger of lightning (the lightning danger is not confined only to summer time), or when a mains eliminator is installed and there is some doubt as to whether there is any possibility of shocks or short-circuits.

Despite the millions of outdoor aerials which there are in England alone, it is only infrequently one ever hears of a genuine case of an outdoor wire being struck by lightning, and then generally because that particular aerial was not earthed at the time and because there was no other adjacent metal. Direct "hits" by lightning are possible only during fierce summer lightning storms.

There is an atmospheric danger which exists all the year round, however, and it is quite likely to be serious during heavy rains. Rain is frequently charged with electricity, and many users of sets, having an air dielectric pre-set condenser in the aerial



Insulated connectors are better than terminals and spade tags for a mains unit, for if a lead pulls off its connecting point there is no danger of a short-circuit

## THE HOW AND WHY OF RADIO

# XXIV—MAINS WORKING—FILTERS

*If you are a beginner in wireless, now is your chance to gain a clear conception of its theory and practice. In this series of articles, specially prepared for the beginner, no previous knowledge of wireless is assumed. It is intended to deal with every aspect of the subject and the whole series will endow the beginner with sufficient knowledge to enable him to derive the greatest possible interest from the fascinating hobby of wireless*

WHEN A.C. is converted to D.C. by means of the rectifier, which can be either a valve or a metal rectifier, the result is a series of one-way pulses of current. To work a wireless set we need a smooth continuous source of current, so before the rectified A.C. can be used it must be filtered.

The picture shows the essentials of a filter. Across the unsmoothed D.C. is shunted a fixed condenser, having a capacity of several microfarads. This condenser is known as the rectifier condenser, as distinct from the reservoir condenser.

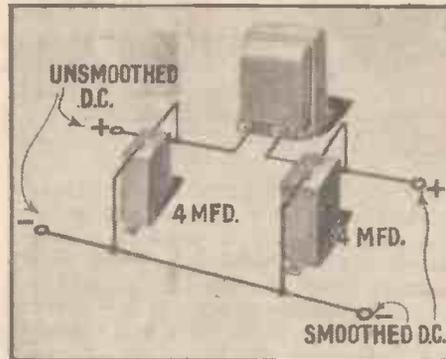
In series with these two condensers is a low-frequency choke, shown in the positive lead between the rectifier and reservoir condensers.

In brief, the action of the filter formed by these condensers and the choke is to oppose any change in the value of the current and voltage. As we have seen, the rectified current, although quite distinct from the unrectified current in that it has a one-way direction, is still changing in value.

If we visualise the A.C. as the waves of a sea, the backward and forward motion of the tide corresponds to the change of direction of the current. If we compare the rectified current to a tide-less but unevenly-flowing river, where the water is all going in one direction, sometimes at a rush and sometimes at a trickle, we are led easily enough to picture the filter as sluice-gates. The constant calm depth beyond the sluice compares with the even source of current after the filter.

To get back to electricity, always more difficult to visualise than hydraulics, we can assimilate two simple facts; one relates to choke coils and the other to condensers.

When current flowing through a choke, which is really an inductance coil, changes in value, the effect of inductance tends to prevent that change. Suppose the current is slowly increasing in value; the inductive effect is to store part of that increase as a magnetic field around the choke. When the



The essentials of a filter are condensers and choke as shown pictorially above

current falls in value the choke tends to prevent that fall; for as the magnetic field collapses the energy so stored up is returned to buoy up the drooping current. The choke tends to oppose changes in the value of current flow; it does not matter whether this change is a rise or a fall.

Now about condensers, these have the property of capacity; in a sense they store electricity, although the phrase is not an accurate indication of what happens. When current flows through a condenser, that condenser becomes a reservoir for voltage, so that when the source of current is stopped the condenser tends to maintain the flow, because a difference of potential

has been created across the plates of the condenser. So condensers store voltage, which is potential energy, ready to assist the flow of current when the source of that current fails.

Taken together, it is easy to see how chokes and condensers help to maintain an even flow of current; the chokes oppose changes and the condensers come to the rescue when those changes do occur.

The first condenser receives the pulsating D.C. from the rectifier. Due to the reservoir action of this condenser the current that flows through the choke is not so markedly pulsating. Then the choke does its work of opposing current change, passing on a still more regular current to the second condenser, which is the final reservoir from which current is drawn by the set.

This condenser must be large enough to store potential capable of supplying the maximum current demanded by the set. A value of four microfarads is usually considered a safe maximum for the condenser connected to the rectifier. The reservoir condenser should be not less than four microfarads, but need not be more than six or eight microfarads with a full-wave rectifier.

In a normal mains unit the choke in between these condensers should have an inductance value of at least 30 henries! As the effective inductance of the choke decreases as the current flowing through it is increased, we specify the inductance value required to pass a given current. Due to the resistance of the choke winding, some voltage is lost across it when current is flowing through the filter. One can easily lose 30 volts between the input and output of the filter.

HOTSPOT.

Next Week : Voltage Regulators

### “ AVOIDING SHOCKS AND SHORT-CIRCUITS ”

(Continued from preceding page)

units, the condensers of which generally have a very large capacity and hold sufficient electricity to give quite a bright spark if directly short-circuited within a few minutes after switching off the power. No harm will be done to the condensers by this short-circuiting, but the shock experienced may be considerable.

This trouble can be minimised by making sure of cutting off the high-tension supply before the filaments are switched off. Most of the condensers will then have an opportunity of discharging through the filament anode paths in the valves. It does not follow that all the condensers will be discharged in this way, and if you want to carry out any adjustment to the set in perfect safety, you should first—having switched off the high and low tension—short-circuit

each condenser in turn with a length of flex.

With home-made mains apparatus, there is a chance that a wrong connection on the earth side will cause a short-circuit. An incorrect connection in the unit itself is easy to trace, but it is not always so easy to trace the external mains wiring. This potential danger is greater with direct-current supplies than with alternating-

#### DO YOU KNOW THAT—

the effect of S.G. voltage on output is often quite marked when going over from short-wave to long-wave reception? It is always advisable, for instance, to try the effect of varying the S.G. plug on the H.T. battery when changing over.

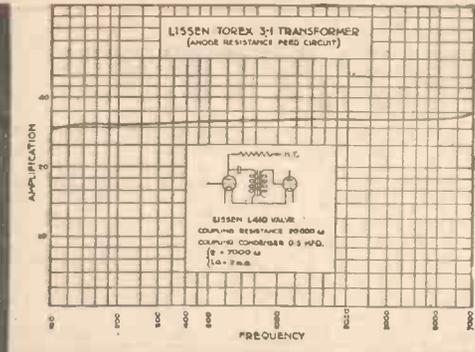
for good quality at big volume one needs at least 200 volts high-tension supply? Or if that is impossible one must turn to push-pull amplification, by means of which one can obtain volume and quality with a supply of 120 volts.

current mains. Some direct-current wiring systems have the negative wire connected to earth and some have the positive wire connected to earth.

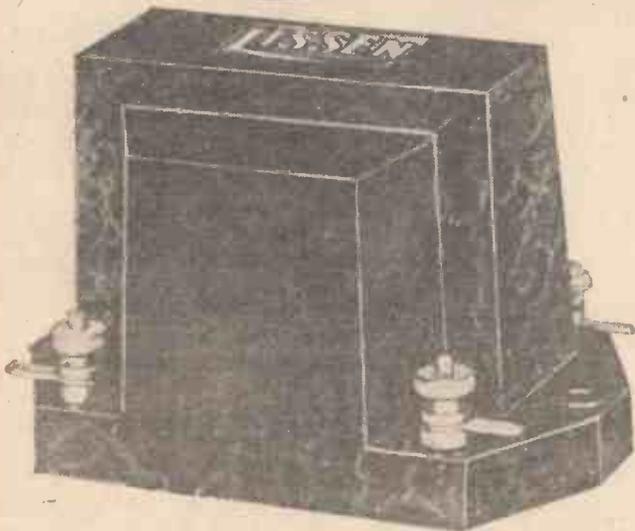
To prevent any trouble cropping up through this cause, you must never make a direct earth connection if you are working with a D.C. high-tension unit. In very many cases, in fact, you will not find an earth essential, although it may sometimes assist smoothing and the elimination of mains hum. If you do use an earth wire, then it should not be taken direct to the earth terminal, but a fixed condenser, with an insulation standing up to twice the mains voltage, should be interposed. This condenser can have any value above .1 mfd. or so, its sole purpose being to provide an easy path for the aerial currents and to insulate the mains side of the set from earth.

If these little points are watched, then there need never be any fear of radio “risks.”

# A MIGHTY good TRANSFORMER WITH A CURVE!



for **5/6**



THIS new Lissen Torex Transformer enables you to make a big cut in the cost of building amplifiers. It is a high-grade silicon-steel core transformer, with remarkably even amplification over the whole band of audible frequencies (see curve). It is a neat, compact component; moulded bakelite case which is hermetically sealed and completely insulates the windings. Proof against shorting, leakage or moisture.

### WHERE TO USE IT

Use this Lissen Torex Transformer for the first L.F. stage of any amplifier. Use it where big amplification is desired at small cost. Use it for all temporary "hook-ups"—you can change it from set to set because it is a "general purpose" transformer.

Particularly fine results are obtainable when this transformer is used in an anode resistance feed circuit.

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# GREATEST RADIO SENSATION

## 3-VALVE SET OBTAINS OVER 60 STATIONS ON LOUD-SPEAKER WITH INDOOR AERIAL

This is the new Northampton Plating Co. Super Selective 3-Valve Loud Speaker set, which is now offered to the public. After months of careful research a circuit has been designed superior in selectivity to a screen-grid set, and yet remarkably simple. It can be used, not only for cutting out the local station, but for other disturbances, such as Morse. It is the simplest, cheapest, and most selective in the world. No soldering required or coil changing. Experts have declared it absolutely unique. Over fifty stations have been obtained on loud-speaker with aerial 20 feet high using cheap valves, including Cardiff, Paris, Madrid, Manchester, Stuttgart, Toulouse, Hamburg, Glasgow, Frankfurt, Rome, Langenberg, Berlin, Brussels, Hilversum, Kalundborg, Königswusterhausen, Radio Paris. These were obtained 3 miles from Daventry while 5GB was working. Thousands of novices with no knowledge of wireless have built the old Northampton Plating Co. Super 2 and 3 in all parts of the world, and have been astounded by the results even with cheap components but the new Super Selective 3 makes other sets old fashioned and marks the greatest improvement in valve sets for years. Orders have poured in from all parts of the world, including America, Turkey, Gold Coast, and Nigeria. In order to give everyone the opportunity of testing out the new circuit, two 6d. Blueprints, one for new Super Selective 2 and one for Super Selective 3 Valve, will be supplied for 3d. each.

### NEW SUPER 4-VALVE PORTABLE SEPARATES TWO BROOKMANS PARK STATIONS UNDER THE AERIALS

This is the latest model circuit by the Northampton Plating Co. offered to the public for the first time. It has been specially designed to satisfy the requirements of the new regional stations. Owing to its wonderful selectivity, it requires no wavetrap and obtains under favourable conditions a large number of Continental stations at loud-speaker strength, including Toulouse, Hilversum, Eiffel Tower, Königswusterhausen, and Radio Paris. At less than half the price of a high-class portable set, it is acknowledged under severe technical tests to be far superior. In order to show what marvellous results can be obtained the set was placed between two aerials at the entrance to Brookmans Park, and the two programmes were easily separated. The set was also taken on a 1,000-mile motor tour over England and Wales. On the south coast and east coast many stations were easily obtained on loud-speaker at good strength. Even in Wales, where reception is difficult, excellent results were also obtained. In order that everyone may be able to construct this unique portable set, a full-size shilling Blueprint, with details and instructions, can be obtained from Northampton Plating Co. for 6d. Letters must be fully stamped. NAME AND ADDRESS IN BLOCK LETTERS.

TRADE SERVICE AGENTS WANTED.

### READ THESE TESTIMONIALS

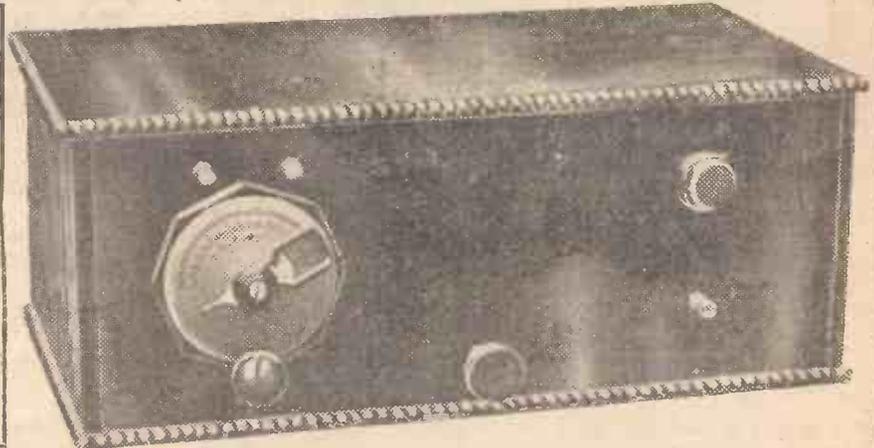
It may, perhaps, interest you to know that I had my three-valve set converted to your circuit some months ago, and I have logged over sixty stations on the loud speaker.

When I tell you that I only have an indoor aerial and the gas bracket for an earth you will understand this is a remarkable achievement, particularly as I am situated practically on the top of the tram wires and electric railway a couple of hundred yards away. I am certainly troubled with noises as the trams come up the street, but this, I presume, is only to be expected.—C. R. A., Birkenhead, 5.1.31.

Thanking you for goods of such excellent value received so quickly and well packed. I have made your 2-valve set and am quite astonished at the result.

Working at 42 volts for the highest in most cases I have received well over 30 stations. Each of these with the greatest quality. I am using a poor little indoor aerial slung too near the wall and ceiling. Wishing you greatest success.—N. M., Herne Hill.—1.1.31.

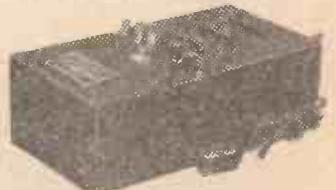
I have examined the above testimonials, and am satisfied that these are genuine communications.—Advertisement Manager, Daily Newspaper.



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**SPECIAL OFFER:** 7 days' approval to test. This unit value £7 will be sent to any address on payment of £4 5 0 cash, or C.O.D., with the guarantee that if it is not superior to other units on the market and not giving complete satisfaction the money will be instantly refunded if returned undamaged. It is most silent in operation. Trade inquiries invited. STATE MAINS VOLTAGE AND CYCLES and VOLTAGE OF ACCUMULATOR.

Easy payments arranged.



### NORTHAMPTON PLATING CO. SUPER A.C. ELIMINATOR

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to be most silent in operation, giving over 20 milliamperes and suitable for 2-, 3-, and 4-valve sets. Test it for yourself. Trade inquiries invited. State mains voltage and cycles. Easy payments arranged.



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5/- Ebonite for same, 12 by 8	3/6	7/6 H.F. Choke	3/11	7/6 Aluminium Panel, 18 by 7	3/11	2/- Accumulator Carr.	11d.
5/11 Transformer	3/6	3/6 H.F. Choke	1/11	17/6 Dual Coil for M.M3	12/6	4/6 Neutralising Condenser	2/11
4/6 .0005 Variable Condenser	2/11	2/6 Daventry 5GB Coil	1/3	Triotron Dull Emitter Valve	4/11	5/- Reaction Condenser	2/6
2/- .002 Condenser	10d.	10/6 G-volt Amplion Valve	3/11	5/- Cycle Tyre	2/6	5/- Diff. Reaction	2/11
1/6 .0003	10d.	12/6 Cone Unit	6/11	2/6 Cycle Tube	1/3	2/- Loud-speaker Cord	11d.
1/- Grid Leak, 2 meg.	10d.	12/6 Cone Speaker Cabinets	7/11	6/6 Double-reading Voltmeter	3/11	2/- 'Phone Cord	11d.
1/- Anti-Mic. Valve Holder	9d.	2/- 12 in. Cone Speaker Frets	11d.	Triotron Super Power Valve	6/6	6/- S.L.F. Condenser	3/11
2/3 Rheostat	9d.	3/- 15 in. Cone Speaker Frets	1/11	17/6 Screen Grid Valve	9/11	17/6 Electric Iron, Weight, 5 lb.	7/11
2/- Indoor Aerial	9d.	7/6 Old Cossor Type Coils	3/11	15/- Titan Coil	9/11	£4 A.C. 20 millamps	59/-
5/- Earth Tube	1/6	15/- Old Cossor Type Cabinets, 21 by 7	7/11	9/- 60-volt H.T. Battery	3/11	30/- Cone Speaker	9/11
10/- Guaranteed Phones	4/11	21 by 7	7/11	12/6 100-volt H.T. Battery	6/11	25/- Electric Heater	9/11
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New Cycles, Guaranteed, 59/11; with 3-speed, 79/11; with Dunlop Tyres, 10/- extra. Parts supplied for all sets at Reduced Prices. Send now to avoid disappointment. Cash with order or C.O.D. Special terms to those making sets. All goods guaranteed and exchanged if not satisfactory. Inquire for anything you want. Trade supplied. Send for our wonderful Bargain Price List, A.W.

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# W. JAMES ON HOW TO USE A PENTODE



The pentode valve actually provides the output of a super-power valve of the three-electrode class with less input. It must, however, be worked under suitable conditions which are detailed in this helpful article.

A PENTODE valve has five electrodes. It has three grids, as well as the filament and anode.

One of the grids is connected inside the valve to the filament, with the result that we are concerned with the connections to only two of the grids and the anode.

In battery-type valves the filament con-

order to provide a large output from a small input. Even the smallest pentodes provide 350 to 400 milliwatts output when fully loaded, with 150 volts of high-tension and a grid bias of about  $-7.5$  volts. This output is also obtained from an ordinary power valve such as the Osram P240, but in order to get this a grid bias of  $-24$  for

When overloaded, relatively great voltages are set up across the electrodes of a pentode. This is a frequent cause of breakdown.

The smaller pentodes may usually be given an anode voltage of 150 and an auxiliary grid voltage of about 120. When batteries are used the voltages are easily adjusted, but when the supply is from a mains unit a little care must be taken.

As a rule it is essential to feed the auxiliary grid through a filter circuit consisting of a resistance and condenser. The circuit is indicated in Fig. 2, where  $R$  is the resistance included in the supply to the auxiliary grid and  $C$  is the condenser. When the voltage of the grid must not exceed a certain amount it is convenient to drop the excess voltage in the resistance, which, by the way, can be of the flexible wire-wound type.

The current taken by the auxiliary grid circuit varies widely with the different makes and may be 3 or 4 milliamperes. This point may be settled by looking up the information provided by the maker. Even when the valve is designed to have an auxiliary grid voltage of about that of the anode it is advisable to filter feed the grid supply and when the resistance is of only a few thousands of ohms, the condenser can be of 4 microfarads.

The output available depends largely upon the auxiliary grid voltage. It should always, therefore, be as high as possible.

(Continued on page 334)

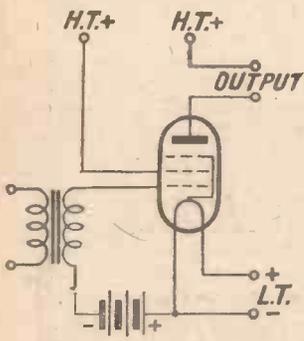


Fig. 1. Arrangement of pentode electrodes.

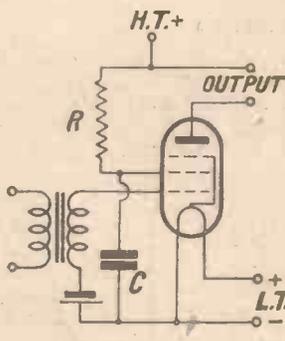


Fig. 2. Showing the filter-circuit feed to the auxiliary grid.

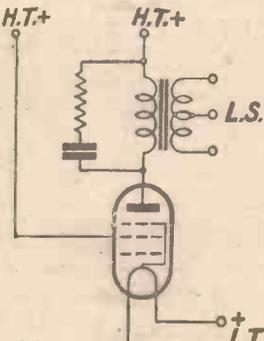


Fig. 3. Transformer output circuit.

control grid and anode are taken to the normal contact pins in the base of the valve. The other grid is connected in many types to a terminal fitted to the side of the base, and in a few later types to the centre pin of a five-pin base.

Mains valves, being provided with the usual heater and cathode contacts as well as the control grid and anode contacts, making five in all, have the auxiliary grid terminal on the side of the base.

In Fig. 1 is shown the arrangement of the electrodes. The control grid is nearest the filament and is the one taken to the grid pin of the base. It is joined to the usual grid circuit, consisting of the secondary winding of a transformer and the grid bias in the figure.

The next grid, which is the auxiliary grid, is the one taken to the terminal on the base as a rule, and is connected to the high-tension circuit.

Next to the anode is the third grid and it is taken to the filament inside the valve.

In this valve we have something with characteristics quite different from other types. The manufacturers produced it in

150 volts of high tension must be applied.

The pentode can be used in any part of a low-frequency circuit or for detection, if desired, provided overloading will not continually occur. If we had a two-stage low-frequency amplifier, there would be a good chance of the pentode being grossly overloaded, unless a volume control was fitted and carefully used.

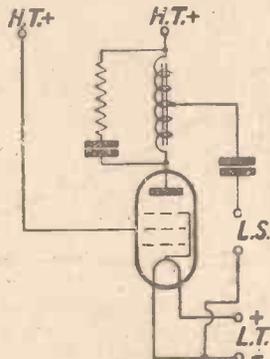


Fig. 4. Tapped-choke output circuit.

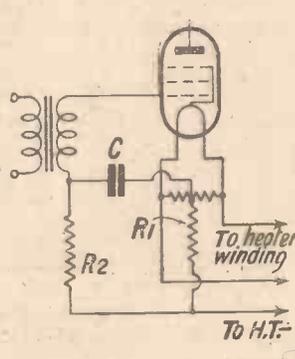


Fig. 5. How bias is obtained with a directly-heated valve.

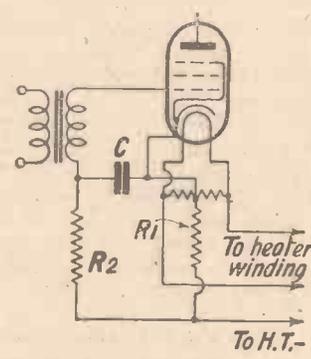


Fig. 6. Showing how bias is obtained with an indirectly-heated valve.

# HOW AN OUTPUT TRANSFORMER HELPS QUALITY

By J. H. REYNER,  
B.Sc., A.M.I.E.E.

IT is generally accepted that the use of an output transformer or choke-output circuit is desirable. Most people are aware of the general arguments in favour of such devices. In the first place the steady current in the anode circuit of the output valve does not flow through the loud-speaker. In these days when we use 10 to 15 milliamps in the output valve even with a quite small set, this is an important point. Apart from the question of the protection of the speaker windings, there is the question of isolating the loud-speaker from the high voltages in the set.

There is, however, another important aspect of the question and that is the effect on the quality of reproduction. One is liable to assume that since the quality depends principally on the internal construction of the amplifier, the manner in which the output valve is connected to the loud-speaker has little to do with it. It is, of course, a well-known fact that in order to obtain freedom from distortion on strong passages the loud-speaker must be correctly matched to the valve, but it is not always appreciated that this correct matching not only minimises overloading but has a distinct effect upon the quality.

### Loud-speaker Impedance

There are perhaps two factors which influence the average user in making up his mind regarding an output transformer. The first of these is the relatively high price of such commodities. The second is the lack of suitable information regarding the impedance of one's loud-speaker. Moreover, the impedance of the ordinary moving-iron type of instrument (i.e. the customary cone or horn speaker) is not constant, but varies almost directly with the frequency, a typical example being shown in Fig. 1. Consequently the impedance will depend entirely upon the frequency at which we make the calculation, and there seems to be little definite information as to the best frequency for the purpose.

I propose to discuss the question in this article and to show that a value round about 400 cycles is the most suitable for average use. A few representative impedances of well-known speakers are given here. It must always be remembered, however, that matching can often be carried out by ear to quite a satisfactory extent, various possible ratios being tried until one is obtained which gives the best quality.

It will be of interest, however, to review the effect of the output transformer on the quality. A short time ago ("A.W." No. 452) I summarised the theory of power output very briefly and developed an expression for determining the output from any given valve. It was shown there that the output depended upon the ratio of the speaker impedance to the valve resistance. It is quite easy to show that the maximum power output occurs when the speaker impedance equals the valve resistance, and this is a condition of affairs which gives us

the maximum power output for a given small input. The proportion of power output obtainable if the loud-speaker impedance is different from this optimum value can be read off at a glance by referring to Fig. 2, which is a very handy curve when making loud-speaker calculations. This curve shows the variation in output in terms of the ratio between the external (speaker) impedance and the internal resistance of the valve. It will be seen that the output is a maximum when this figure

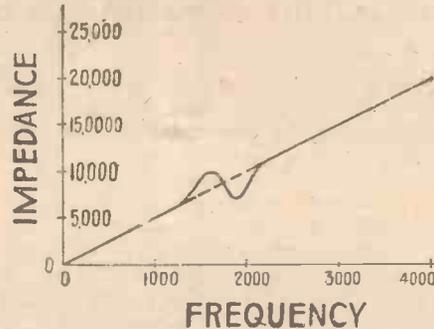


Fig. 1. Typical impedance curve for a cone speaker

is 1, i.e. when the internal and external impedances are equal, and it falls off on either side.

In practice we do not want to use our valve in the condition which gives the

Approximate impedance at 400 cycles of well-known speaker units:—

Make	Impedance (ohms)
Blue-Spot 66K ...	5,000
Grawor balanced armature ...	3,000
Hegra ...	4,000
Lissen ...	4,000
Ormond... ..	5,000
Wates Star ...	1,000
Watmel ...	12,000

maximum output for a given input. We are more concerned with working the valve with the maximum input which it will

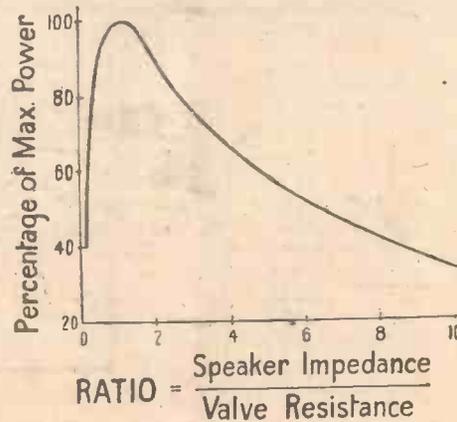


Fig. 2. A useful curve when making loud-speaker calculations

stand before grid current flows. If we load the valve up fully in this manner we find that we cannot make the loud-speaker impedance equal to the valve impedance because distortion occurs, and we have to make the ratio between 2 and 3 in ordinary practice, if we are to avoid more than a reasonably small proportion (about 5 per cent.) of distortion. Reference to the curve above will show that this causes the signal strength to drop to between 75 and 90 per cent. of the maximum possible output, and this is a point which should always be borne in mind.

### Matching Speaker and Valve

Let us try to match up the speaker of which the impedance is given in Fig. 1 and let us assume that we are using this loud-speaker with a valve of 2,500 ohms impedance. At 1,000 cycles the impedance is 5,000 ohms, which is twice that of the valve, and we shall be correctly matched, the power output being .88 of the maximum. At 4,000 cycles the speaker impedance will have become 20,000 ohms, so that the ratio of external to internal impedance is now .8. Reference to the curve given shows that the power output is now .39, i.e. distinctly less than half what it was before.

If we now go in the other direction and consider a frequency of 100 cycles we find by making a similar calculation that the power output is .56, so that we have a falling off in the power supplied to the loud-speaker at both ends of the scale. Now it happens that the moving-iron loud-speaker will reproduce the higher frequencies better than the low and, therefore, does not mind a certain falling off in power at the upper frequencies. In order to get a well-balanced result, however, we certainly cannot afford any falling off in the low frequencies, and an arrangement such as we have just discussed would probably accentuate the middle register, giving us, possibly, pleasant speech, but an unnatural balance of tone on music.

The remedy is to match one's loud-speaker rather lower down, and as already stated, 400 cycles is a good frequency to choose for the purpose. Reference to Fig. 1 shows that the impedance at 400 cycles is 2,000 ohms. In order to match this to the valve we should have to use a step-down transformer of 1.6—1 so that the effective loud-speaker impedance would be—

$$2,000 \times 1.6^2 = 5,100 \text{ ohms,}$$

which is what we require.

At 100 cycles the ratio of effective external impedance to internal impedance would then be .5, and we should obtain the same output as at 400 cycles, i.e. .88. Above 400 cycles there would be a gradual falling off, until at 4,000 cycles we should obtain an output of .18. With many loud-speakers this would just give a pleasant balance.

It is clear, therefore, that apart from any question of overloading the use of the correct matching does make a distinct difference to the tonal quality.

A Weekly Programme Criticism—By SYDNEY A. MOSELEY.

# Without Fear or Favour



A GOOD PRODUCTION

PROGRAMME BALANCE

THE LAUDER BROADCAST

BOXING BROADCAST



A DISTINCT success was the production of *Dr. Abernethy—His Book*. The joint authors, Alicia Ramsay and Randolph Kordova, had done their work well. So did the producer, Howard Rose. The rugged and rather rude rejoinders of the doctor somehow go down, although if a doctor spoke to me like that I would send him to blazes and damn my health.

The only criticism is that the doctor seemed to be too ready to be rude, and appeared to be wholly pre-occupied in this manner; whereas, of course, he must have been paying some attention to the ill, imaginary or real, of his patients. However, altogether one of the best little things for a long time.

The best way to listen is to catch 'flu and remain in bed. In this way, however, I missed going to my Wednesday symphony concert. But, such are the wonders of wireless (which I can never get over), I had my portable by my pillow, and closing my eyes, imagined I was there. There is no doubt that these symphony concerts are unqualified successes.

Those of you who have got strong views about the claque will be interested, intrigued, or annoyed by the news that Scotland is to have a studio audience! Recently I notice that the claques have been permitted to applaud each song, so that we shall have to deal with this question very seriously soon.

In regard to Sunday programmes, I can only say, in reply to letters, that I have the matter in hand and hope to report favourably before very long.

Did you like Harry Lauder? I was privileged to go to the studio, and found a rather serious individual in a last-minute rehearsal with the orchestra. There is no doubt that the Lauder transmissions are very popular, although they cost, I am told, some £300 each.

Sir Arthur Quiller-Couch has no equal in the writing of English, but so far as broadcasting is concerned he is a long way

behind. His speech at the Dicken's dinner was by no means clear, which is rather regrettable, for a personality of his sort is worth putting over.

The description of the International Rigger Match was very well done. One was able to follow the match very closely. The commentators, Captain Wakelam and his colleague, deserve applause. Captain Wakelam's delivery is rather different from Mr. Allinson's, but each serves his purpose well.

Those who are clamouring for highbrow music as against those who like the lighter stuff can surely find common ground in a programme made up of the following items: The Gershom Parkington Quintet playing Tchaikowsky, Rimsky-Korsakov, Schubert, and Mendelssohn; Frederick Lake (tenor) singing "O Vision Entrancing," and Constant Wentworth (soprano), "Down in the Forest." Then there was a pianoforte recital by John Hunt, who played Bach and Chopin; *Dr. Abernethy* (a comedy of 1815), and, finally, the Wireless Military Band, with John Collinson (tenor).

Can anybody improve on such a programme?

I heard part of *Bumpkin Pie*. Each to his dish. Not bad, perhaps, for a hungry mortal; but, nevertheless, not for all digestions.

The rarity of boxing broadcasts was, no doubt, partly responsible for the unqualified success of the recent broadcast. The unexpected delay while waiting for the boxing gloves was a piece of unrehearsed realism. The commentator was inclined to talk on the same note for the first few rounds, but gradually warmed to his theme, and his constant expectation that Kirby would be knocked out made the broadcast amusing as well as exciting. A good transmission.

When I first mentioned Number 10 studio on this page there were only four or five privileged listeners. Now it is a miniature concert-hall. During the Stravinsky broadcast it was almost impossible to find a seat. I must say that seeing the composer at close quarters has rather reconciled me to his extraordinary compositions. Indeed, it was a jolly evening, pulsating with excitement.



The Marchese Marconi (left) is standing by the transmitter panel of the new Vatican station. The opening of this station was relayed by the B.B.C. last week

**I**F you intend making up this extremely low-priced and efficient two-valver, then you should keep on hand your copy of last week's issue, for in this were given both constructional details and a free full-size layout and wiring plan.

The idea of this set is that it shall be built down to a price but that the results and the general quality of reproduction shall not be in any way impaired. Furthermore, despite the price limit, something very novel in the way of a tuning arrangement has been incorporated.

This is in the nature of a pre-set tuning device and the result of it is that once the set has been built and initially tuned it is then only necessary to push or pull a switch on the panel in order to receive the local, Regional, or National programme at will. This is a feature not to be found in very many more costly sets and the advantage of it for home use is obvious.

It should be explained that although the main tuning is pre-set so that the National-Regional control is effected by means of the switch on the panel, the two actual tuning controls for these wavelengths are pre-set condensers on the baseboard and these may be individually adjusted to bring in any two stations within the wide range of



The back of the "20/- Two"

the receiver and, of course, they may be also adjusted so that other stations apart from the two stand-bys can be brought in.

**Selectivity**

The extremely low price of the "20/- Two" is achieved partly by the use of a simple home-made coil which is very selective in working and yet can be made up by any amateur in ten minutes or so. Selectivity is obtained by tapping down the aerial on the coil so that it embraces only a small portion of the winding.

This prevents aerial damping and you will not be troubled by interference except perhaps if a very large aerial is used and the

set is occasionally used for distant station getting in the neighbourhood of a high-power local station. This possibility will not often arise and for ordinary broadcast use the selectivity is of a high order and is entirely satisfactory.

On reference to last week's issue you will see that there the construction of the coil is described and that the first part of the constructional work was referred to in detail—points such as the drilling of the wooden panel and assembly, etc.

**Wiring**

Now we come to wiring. The main part of the wiring up of the parts on the panel and baseboard should be done with stiff insulated wire, such as Glazite, although if the reader prefers it he may use bare wire enclosed in lengths of insulated sleeving. Generally speaking, it will be found more convenient to make soldered connections, but it is, of course, possible to wire up on the point-to-point system, the ends of the wires then being merely clamped underneath the terminal nuts. For the battery connections and for a few leads in the set rubber-covered flex is used.

The coil is connected to the aerial and earth terminals and to the pre-set and reaction condensers by means of lengths of rubber-covered flex soldered to the ends of the windings and the tapping leads.

This is better than taking the frail wire of which the coil is wound to the actual terminal points, although, if it is desired to eliminate any unnecessary soldering work then the actual wires may be so connected to the terminal points, and they should be enclosed in lengths of insulated sleeving



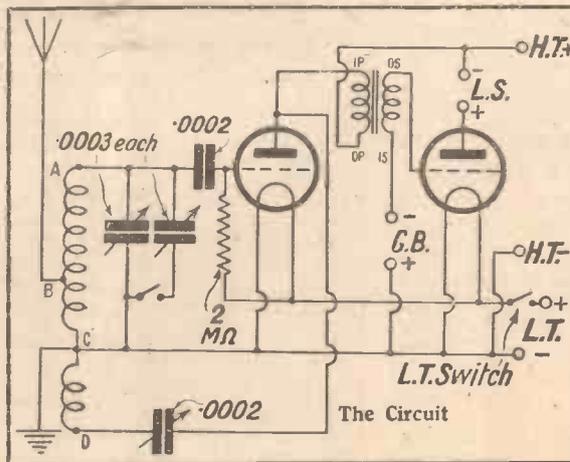
**Completing the Wiring :: V Earth :: Setting the Pre-set**

to prevent them from being broken and from short-circuiting to other metal parts.

You will find in use that it is very convenient to have long lengths of flex for the battery connections in place of the ordinary terminals—in a simple set of this description. There are actually six battery leads, these being for H.T.—, H.T.+, G.B.—, G.B.+, L.T.—, and L.T.+. Terminals are provided for the aerial, earth and loud-speaker output connections. It is not convenient to have flex connections for these points, on the one hand, because of the stray capacity which would be set up by the long trailing flexible leads, and on the other hand, for the necessity of ensuring correctness of polarity for the loud-speaker output wires.

**Battery Leads**

The flex leads for the batteries may, when they have been soldered in place, be twisted together for neatness and the leads should be kept in three separate pairs, that is, high tension, low tension, and grid



**COMPONENTS NEEDED**

- Low-frequency transformer (L.S. "Torex," Telsen, Varley, Premier Ferranti, R.I.).
- Two valve holders (Clix, Telsen, Lotunit, Benjamin).
- One .0002-mfd. pre-set condenser (Lewcos, Formo, Polar, Sovereign).
- .0002-mfd. fixed condenser (Telsen, Lissen, T.C.C., Dubilier).
- 2-megohm grid-leak (Telsen, Lissen, Dubilier).
- Two pre-set condensers (Sovereign, Lewcos, Formo, Polar).
- Two on-off switches (Readi-Rad, Pet Scott, Bulgin, Lissen, Junit, Benjamin).

# MORE ABOUT THE 20/- TWO

## Valves and Batteries :: Aerial and Tuning :: Increasing the Selectivity

bias. Before twisting, however, put red wander plugs or spade tags on all the positive leads and black connectors on the negative leads. Two spade tags make the most convenient form of connection for the low-tension wires whilst wander plugs are most convenient for the H.T. and grid bias leads which make contact, of course, with the sockets on the respective batteries.

The low-frequency transformer is shown on the layout with its terminals marked with two indications for each connection point; that is, H.T. and O.P., P. and I.P., I.S. and G.B.—, and O.S. and G. This will be found a great help if, for any reason, a different make of transformer than that shown is used. Some transformers are marked with the wiring connections, P., O.P., I.S., and O.S., while others have indications showing to which points the terminals should be connected; that is, H.T., plate, G.B.—, and grid. The method of marking adopted in the print should prevent any confusion in this respect.

### ED FOR THE "20/- TWO"

Four terminals, marked: A, E, L.S.—, L.S.+ (Belling-Lee).

Four wander plugs, marked: H.T.—, H.T.—, G.B.—, G.B.— (Belling-Lee Midget).

Two spade terminals, marked: L.T.—, L.T.— (Clix).

Two ebonite terminal strips, 2 in. by 2 in. (Becol, Trelleborg).

Paxolin former, 2 in. diameter by 3 in. (Wearite).

One ounce of 22 d.s.c. (Lewcos).

Baseboard, 9 in. by 7 in. (Camco, Pickett, Clarion, Peto-Scott, Ealex).

Wooden panel, 9 in. by 6 in.

Take care to get the grid condenser and leak connections right. The leak is held at one end by means of a clip connected to one terminal of the grid condenser, while at the other it is supported by a clip insulated from the condenser terminal. The combined end is connected to the grid terminal of the detector valve holder, while the free end is connected to one of the filament sockets.

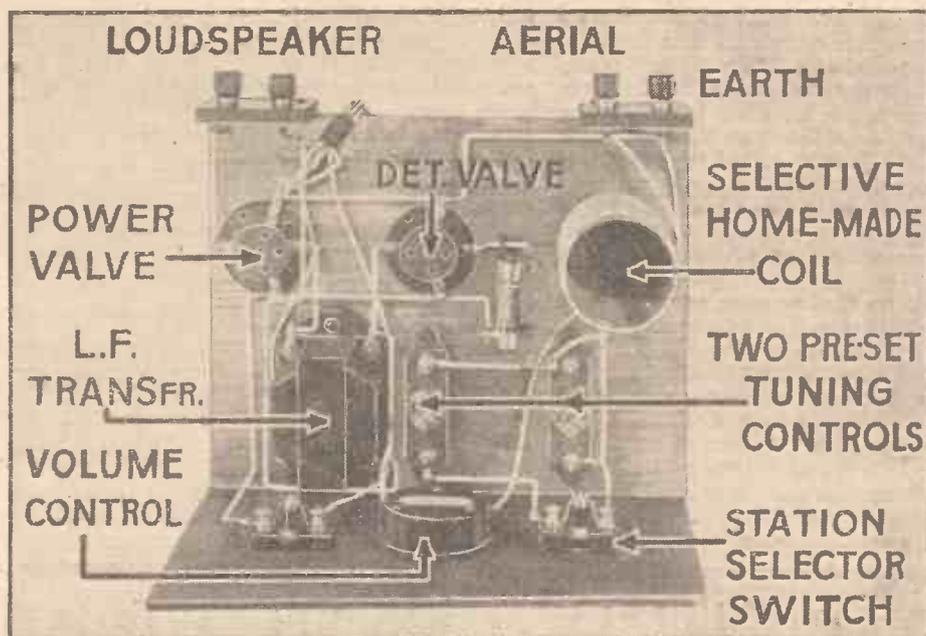
It is imperative to repeat the advice so often given, make up this set exactly according to the full-size layout and do not experiment with different parts having different electrical values nor attempt to alter the scheme of connections

Nothing very elaborate is called for in the way of high tension, and a medium-capacity battery of 100 or 120 volts is suitable. By the use of a large power valve it is possible to deal adequately with quite a large output of sound, as may be required if the set is worked close to a local station. If a large power valve is used then obviously its high-tension demands must be catered for and a battery or eliminator capable of standing up to a discharge of 20 milliamperes or more may be needed.

With most valves the high-tension current consumption of the "20/- Two" will be in the neighbourhood of 8-10 milliamperes. Naturally, the resulting performance depends to a large extent upon the valves used and readers may be interested to know that during the bench tests of the "20/- Two," entirely satisfactory results were obtained with Fotos valves in the detector and power stages.

Some good two-volt detectors suitable are the following: Fotos BC18, Mullard PM2DX, Cossor 210 Det, Marconi and Osram L210, and Mazda L210.

We have obtained good results with the following 2-volt power valves: Fotos BD9, Cossor 215P, Marconi LP2, Osram LP2,



This picture will make the explanation of the operation of the set easy to follow

or the layout, then will success be assured.

### Checking

In order to make quite sure that the set is wired up correctly and that you will not burn out the valves through any accidental short-circuit of the high-tension supply, it is a wise plan to check over all the connections in conjunction with the wiring plan. This is quite easy because each of the leads is numbered on the plan, starting from No. 1, the earth lead from the earth terminal, and it is necessary only to check each lead in turn and to check off its counterpart in the set.

Mullard PM2A, and Mazda P220.

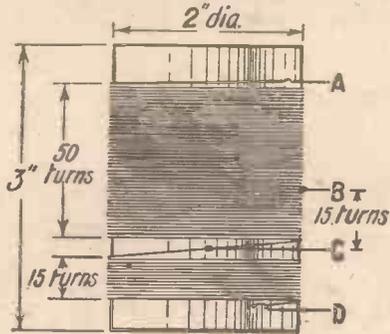
These do not consume an excessive amount of high-tension current and at the same time will be found very suitable for average working of the "20/- Two" and with quite large loud-speakers not having too low an impedance.

The initial tuning of the "20/- Two" requires to be carried out very carefully if the best results are to be obtained. When the batteries have been connected (the full value of high-tension being used, and  $4\frac{1}{2}$ - $7\frac{1}{2}$  volts grid bias), pull out the low-tension switch and push in the station switch.

MORE ABOUT THE "20/- TWO" (Continued from preceding page)

Make sure that the set oscillates gently and without reaction plop (this should be quite satisfactory provided one of the recommended detectors and sufficient high-tension are used), and then tune in the lower-wave station of the two locals on the left-hand pre-set condenser, viewing the set from the back. The station switch must be set so that it does not make contact.

Judiciously increase the reaction to the



No.22 d.s.c. wire

The coil can very easily be made at home, all the necessary details being given by this drawing oscillation point in order to sharpen up tuning and make quite sure that this local station is tuned in to the very best point. Then pull out the station switch and tune in the higher wave local station with the second pre-set condenser on the baseboard.

Provided this tuning has been accurately done you will find that there is no interference between the two stations and that by merely pulling or pushing the switch either one station or the other can be brought in at will.

There is no need to have anything very elaborate in the way of an aerial or earth, but it is advisable to point out that a good short direct earth lead makes all the difference to signal strength and, if an eliminator is used, often reduces the possibility of hum. An outdoor aerial is advisable for obvious reasons for a set such as this which does not incorporate a stage of high-frequency amplification. Nevertheless, in genuine service areas of local

stations it is surprising what can be done with a really efficient indoor aerial.

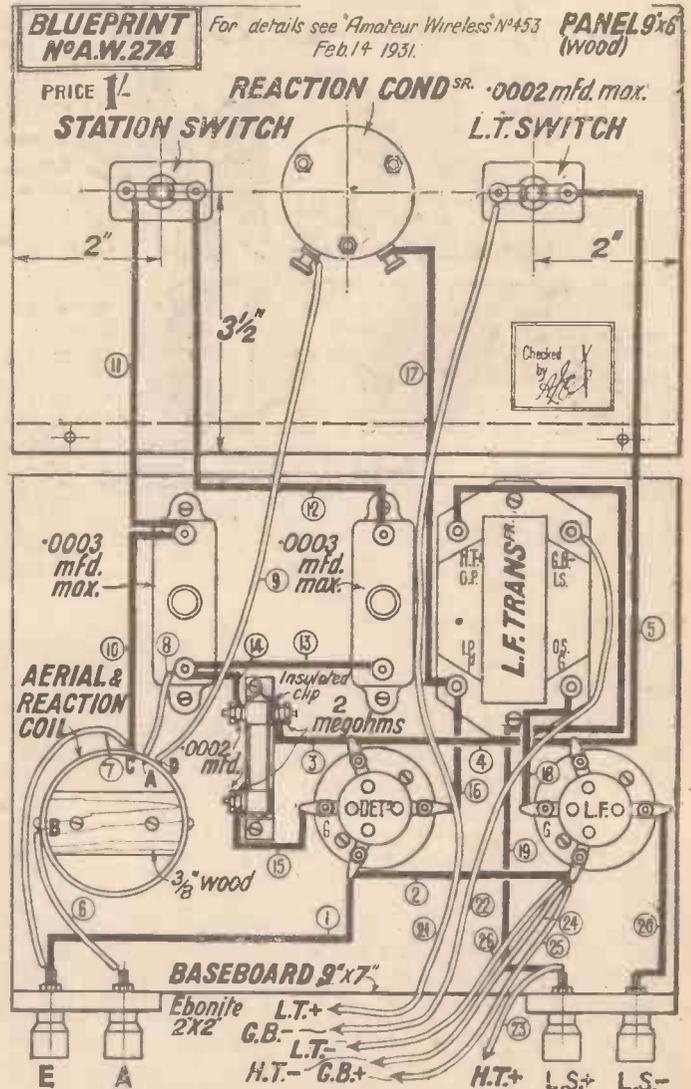
If a long outdoor aerial is used and trouble is experienced in getting an entirely silent background free from interference of the other local station, then you might try the experiment of putting a .0003 maximum pre-set condenser in series with the aerial terminal and the aerial itself. As this condenser is slackened off, so decreasing its value, the tuning of the set will be sharpened. At the same time it may be necessary to readjust the pre-set tuning condensers on the baseboard.

This exceptional method of obtaining added selectivity will only be necessary in extreme cases but is referred to here as obviously many users of the "20/- Two" will be working the set right under the shadow of a high-power station.

Constructors who have mislaid their copy of last week's issue containing the full-size layout and wiring plan should note that a small-scale reproduction of it is given here and that a full-size blueprint can be obtained, price 1s. post free, from the Blueprint Department, AMATEUR WIRELESS, 58-61 Fetter Lane, London, E.C.4.

The set may be

seen this week in the Radio Department windows of Messrs. Selfridge & Co., Ltd., Oxford Street, W.1.



The layout and wiring diagram. A full-size print of this, was included in last week's issue. A blueprint, also full-size, can now be supplied, price 1/-.

OUR LISTENING POST—JAY COOTE

A LADY announcer is in charge of the studio at Reykjavik; I have heard the call given out in several languages. The daily broadcasts have been extended since I last wrote about this studio, and on three occasions recently the station closed down at 1 a.m. G.M.T., with twelve strokes of a deep clock gong to indicate the midnight hour. Iceland time is one hour behind G.M.T. On Sundays, at 6.30 p.m., a sacred service and organ recital are broadcast, and on Friday nights you may hear an English lesson apparently supplied by an American (female) teacher.

Kalundborg, immediately below, does not interfere with the Reykjavik transmissions, and the separation between the two stations would seem to be adequate. By the way, although the Danish transmitter does not appear to have adopted a regular interval signal, you will find that a short, sharp toot, as of a foghorn, often precedes an announce-

ment if a pause has occurred in the programme.

Mühlacker, for the present, acts as high-power relay to both Stuttgart and Frankfurt-am-Main, taking the best broadcasts from the entertainments of both studios. The familiar "Hier Frankfurt-am-Main und Cassel" or "Hier Stuttgart und Freiburg-im-Breisgau" are no longer heard, but, fortunately, some indication is given regarding the source of the entertainments. "Hier Suedfunk" points to Stuttgart and "Hier Suedwestfunk" to the Frankfurt group. It is seldom that any other reference is made to cities unless the broadcast is relayed from a more distant centre.

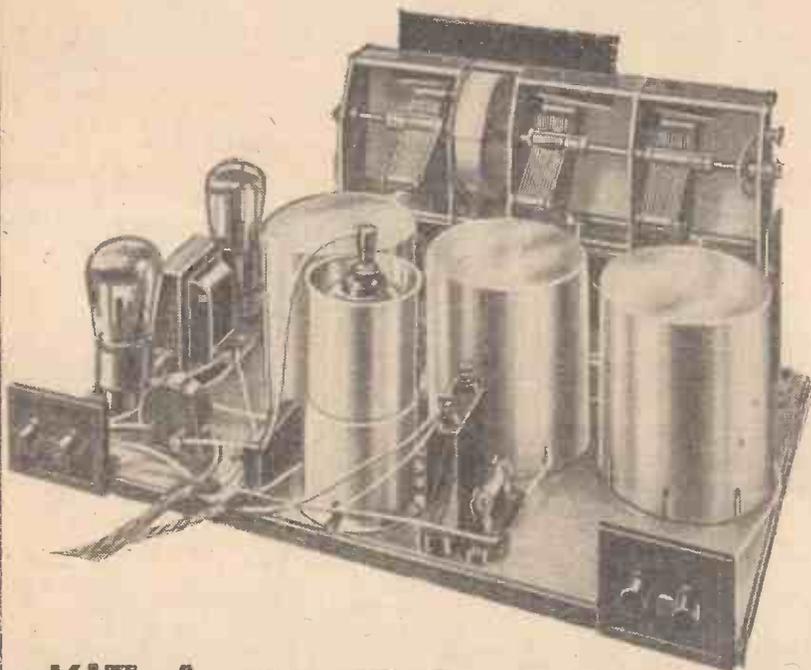
Although Radio Barcelona is always available to me at any time after 6 p.m., I have rarely managed to log Catalana in the same city. By sheer luck I heard it a few nights ago towards 11.30 p.m., and I jotted down the full call put out by this transmitter: "Radio

telefonica (EAJ 13) de la Radio Catalana en Barcelona instalada en el edificio de la Fabrica Industria Espanola de Perlas Imitaciones," thus combining a wireless announcement and an advertisement for Spanish imitation pearls! It was only made at the end of the programme.

Possibly between Prague and Milan you may have discovered a relay of Oslo; it is not mere fancy, but a reality, for Nidaros (formerly Trondhjem) has moved up from a common wave to the position previously occupied by the Oslo transmitter, namely 493 metres. In that corner of the waveband the signals are very clear.

It is also surprising to find at what great strength the Warsaw programme can be received through Lvov on 381 metres. If you have not yet logged this station, set your condensers for Radio Toulouse and work carefully downwards. It will also prove an excellent jumping-off spot.

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1 Farrand Inductor-type Loud-speaker Unit	3	10	0
1 Fuller 9-volt Grid Bias Battery	1	6	
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1 Fuller 9-volt Grid Bias Battery	1	6	
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WEEKLY TIPS—  
CONSTRUCTIONAL AND THEORETICAL

By W. JAMES.



## A Wrong Idea

THESE still lingers in the minds of some amateurs the idea that if you plug into your set a valve having a greater magnification factor than the one previously used the signal strength is bound to increase.

As a matter of fact, the strength may remain about the same as formerly, it may increase, or it may well decrease. It is necessary to consider the impedance of the valves, as well as their magnification factors. Of two valves, having equal impedances and one having a greater magnification factor than the other, it is possible to say that a difference in the strength of distant stations will be noticed.

The reason is that the amplification of the set is greater with the better valve in circuit. But even this must not be carried too far, for supposing the valves we are discussing are of the screen-grid type, it is possible that by using the valve with the greater magnification factor the set is made unstable.

In low-frequency circuits, however, we can predict pretty closely what will happen when valves having known characteristics are used.

In high-frequency circuits it is not possible to say what will happen, as the characteristics of the coils and the circuit generally are important factors. Some screen-grid valves are better shielded than others, with the result that pure amplification effects are masked by various reactions.

## Mains Power Valves

Valves designed for the power stage of a mains receiver may be divided into two classes, those having a directly-heated filament and those with an indirectly-heated cathode.

As regards hum and noise, experience shows there is little to choose between the two classes properly used. The directly-heated valves have stout filaments and are so constructed that, in my experience, no troubles through hum or noise are met with.

Power valves having indirectly-heated cathodes are naturally also free from hum, so there is nothing to choose between the two classes in this respect.

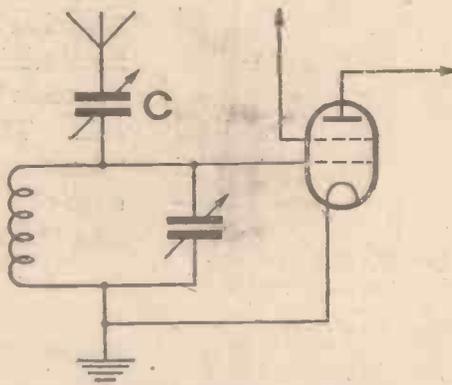
When we come to examine the characteristics of the different valves, however, we find that the indirectly-heated class of valves usually have a more curved anode current grid-bias characteristic. The result is that although the amplification factors and impedances of valves of the two classes may be identical, the possible power outputs are not necessarily equal.

In fact, with the directly-heated classes of valves the possible outputs may well be the greater owing to the better characteristics.

## When Aiding a Pre-set

The fact that the tuning appears to be more selective when a condenser is included in the aerial circuit as at c, in the accompanying circuit, is well known.

It is also known that if the condenser is made of too small a capacity the signal strength falls to less than the normal value. This condenser does, in fact, affect three things: selectivity, signal strength, and the wavelength range of the aerial circuit. We reduce the damping effect of the aerial when a condenser is connected in series



This is the pre-set condenser C in the aerial lead, referred to in the accompanying paragraph

with it. As the capacity of the condenser is reduced, so the damping effect is lowered and the tuning becomes sharper.

At the same time the signal strength is affected. It may increase a little, but will certainly be reduced as the capacity is made very small.

Thus the apparent selectivity is further improved by the reduced input to the first valve. The tuning range is, on the whole, extended by the use of a condenser in the aerial circuit. Lower wavelengths may be tuned to.

As an example, the minimum wavelength to which a set could be tuned was 250 metres, but by adding a condenser to the aerial circuit the set tuned down to 210 metres. The maximum wavelength is not greatly affected, so from the point of view of tuning range there is a gain.

A pre-set condenser having the maximum capacity of .003 microfarad is recommended, and is certainly to be preferred to a fixed condenser.

## A Difficult Detector Job

The detector valve of a set, when you consider that it has to deal with both high and low-frequency currents, has a difficult job to perform.

We apply to the grid circuit, through a grid condenser and leak, as a rule, the modulated high-frequency signals either as collected by the aerial circuit or in a magnified form.

Then we have in the anode circuit a low-frequency transformer or other coupling for passing on the low-frequency signal to the next valve. Also in the anode circuit we have a reaction coil and condenser, or when reaction is not used, a condenser only. This circuit carries high-frequency currents. If we vary any of the parts we affect performance probably in several ways. Thus, the quality may be affected, the smoothness of reaction, and the strength of the signals. The design of a detector stage is therefore one full of difficulties.

It is so easy to obtain one desirable effect at the expense of another. We often have to decide which feature to improve at the expense of another, as, for example, smoothness of reaction and range-getting properties against quality. The careful experimenter can do much in this direction and spend considerable time in adjusting values.

## Cutting Out Backgrounds

Background noises are a great nuisance. They mask the weaker signals and spoil the enjoyment of otherwise acceptable programmes. How, then, can we reduce these noises?

First, parts such as grid leaks and the grid battery should be examined. A grid leak may well be the cause of an amount of trouble. Some are definitely not constant and therefore noises are produced.

A faulty grid battery will also on occasion cause poor reception. Sometimes a bad valve will cause endless trouble until it is used in a different position or replaced. Valves should, indeed, be suspected. A screen-grid valve may well be troublesome and all that you can do is to try other valves in the set.

You might possibly arrive at a combination in a powerful set which results in the magnification being lower than normal. This is not meeting the problem fairly, however. Having looked to the various parts, you should go over the circuit itself.

In the second place, therefore, examine the circuit and try to find whether feedback is causing the trouble.

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# WE TEST FOR YOU

A weekly review of new components



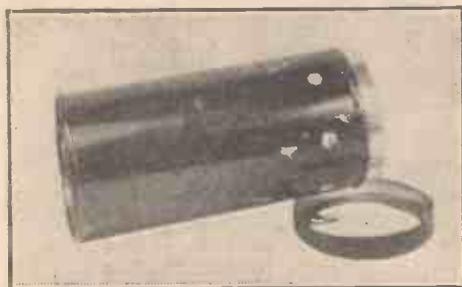
and tests of apparatus.

Conducted by our Technical Editor: J. H. REYNER, B.Sc., A.M.I.E.E.

## A Useful Valve Screen

IT is becoming increasingly common to place a cap over the screen-grid valves in a set. The reason is that the silvering inside the screen-grid valves of to-day sometimes gives a small stray coupling between anode and grid, tending to instability. This may be overcome to a large extent if a metal cap is placed over the valve, and connected to earth. Needless to say, this cap should be removable, and adequate care should be taken to see that the anode of the valve does not touch the metal, as otherwise a short circuit of the H.T. battery will result.

We have received from the Loud-speaker Co., Ltd., of 2 Palmer Street, Westminster, a sample of one of the screens for this purpose. There is a small base which can be screwed to the baseboard underneath the valve holder and is of sufficiently large diameter to clear the terminals without difficulty. Over the top of this fits the remainder of the screen,



A useful valve screen, made by the Loud-speaker Co.

which is some 5 in. high, giving adequate clearance for all the modern screen-grid valves. In the centre of the top is a small bushed hole through which a lead may be taken to the anode of the valve.

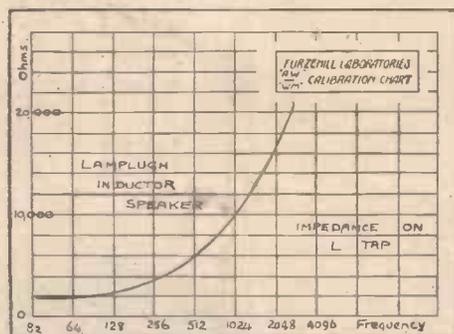
The screen itself sells at 2s. 3d., and is a useful accessory.

## New Lamplugh Speaker

THE essence of the moving-coil speaker is the freedom of the diaphragm, which is capable of considerable movement. In order to radiate a satisfactory quantity of energy at the lower frequencies the diaphragm must be capable of moving  $\frac{1}{8}$  in. to  $\frac{1}{4}$  in., and perhaps even more. The moving-coil speaker permits this, whereas the standard type of reed-driven cone does not.

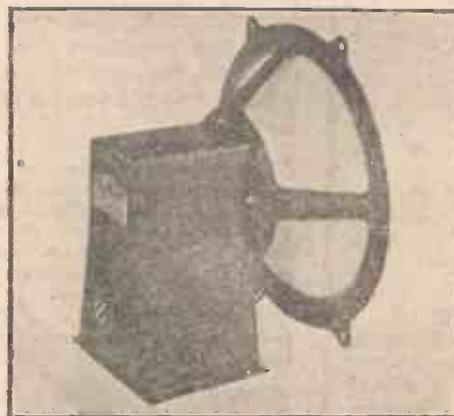
The inductor speaker is a development introduced a short time ago whereby a moving-iron system is still permitted to

have some freedom of motion, and although this does not approach that of the moving-coil system it is a distinct advance over the customary form of reed-driven cone. It was with considerable interest, therefore, that we tested the Lamplugh speaker of this type which was submitted for test.



Characteristic curve of the new Lamplugh inductor speaker

We found that the greater freedom of motion of the diaphragm undoubtedly allowed the radiation of bass notes to an unusual extent. The quality, in our opinion, was not equal to that of a moving coil, but it was a good imitation. The speaker, of course, is much lighter than the moving-coil type since there is no heavy magnetic circuit, and the permanent magnet system is used so that it can be driven from an ordinary set without any extra provision, although it is desirable to isolate the direct current from the speaker



This is the new Lamplugh Inductor-dynamic speaker

by using a choke output or transformer. There are two sets of terminals provided on the instrument, one marked high and the other marked low, having resistances of

1,300 and 650 ohms respectively. Both windings are centre-tapped to allow the push-pull working.

As a matter of interest we measured the impedance of this loud-speaker and the curve reproduced with this report shows that the impedance is well maintained at the lower frequencies. The curve is, indeed, appreciably more constant than the average reed-driven cone, but rises somewhat rapidly in the upper frequencies. Altogether, those readers who require moving-coil reproduction without the expense and inconvenience would do well to consider this form of instrument. For the best results it should be used with a baffle just the same as a moving-coil speaker.

## Byldurone Cabinet Improvements

WE reviewed in these columns a short time ago the Byldurone Cabinet, marketed by Messrs. Easticks. We hear that these cabinets have been so popular that numerous improvements have been found possible. The hinges are now made as part of the corner pieces, which is of material assistance in building the cabinet. Again, bolts and nuts have been provided instead of screws for the assembly, while finally, a very thin wood veneer can be obtained, applied by means of a suitable adhesive, as a result of which the cabinet may be made to have the appearance of any one of a number of woods. This veneer is actually a very thin shaving of wood with a paper backing. When the cabinet is covered with this it should make quite a handsome job.

**"20/- Two" Condensers.**—It should be noted that in the Sovereign announcement, on page 288 of last week's issue, in connection with the "20/- Two," two .0002 compression condensers are mentioned. This should, of course, read 0003, and these Sovereign condensers are used in the actual receiver described.

The Hallé concert, which will be heard by listeners to the Manchester and Leeds programme on February 26, is of an instrumental nature. Cassado is the soloist in Dvorak's Violoncello Concerto. Brahms' First Symphony will occupy the second half of the programme.

The midday concert from Leeds on February 26 is interesting because the three artistes are all quite young. Norman George, the violinist, is only thirteen; William Woods, the pianist, is sixteen; and Harold Jackson is seventeen.

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 but it had to be perfect first!



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Don't Forget to Say That You Saw it in "A.W."

## SETS OF DISTINCTION



# The METROPOLIS PORTABLE SUPER-HET

Makers: Economic Electric, Ltd. Price: 24 Guineas.

At the moment every amateur seems to be talking about the super-het. For that reason alone I should be justified in writing of the Metropolis portable, because it incorporates the super-het principle, using five modern valves to produce a really extraordinary performance. A lengthy test has convinced me that the Metropolis is one of the most interesting portables on the market.

The Metropolis is portable in the true sense of that mis-applied word. The dimensions of the leather-covered wooden case are 13 in. by 12 in. by 8 in. The handle is easy to grip and does not cramp the hand during the transport of the set. The total weight of the Metropolis, with the batteries, is only 22½ lbs.

### Good Quality

The problem of obtaining good quality from a self-contained battery-operated set can only be solved by compromise. For good quality at considerable volume a 100-volt standard-capacity high-tension battery is inadequate, however good the circuit arrangement may be. But for moderate volume it is quite possible to arrange matters so that the quality is not merely tolerable, but definitely pleasing.

The makers of the Metropolis quite rightly state that some portables on the market achieve good quality only by the constant renewal of the high-tension battery. Since a standard-capacity battery is fitted to the Metropolis one can expect only moderate volume with good quality, although at some sacrifice of quality the volume can be considerably increased. During tests I found that sufficient volume to fill my room was readily obtained short of the point where distortion due to overloading started. The makers give a total anode-current consumption of 7½ milliamperes. This was borne out by my tests. The standard battery is not therefore over-run, and should give several months' service if the set is used for normal reception.

Many points about the Metropolis will appeal to the non-technical listener. For example, on opening the lid, which contains the loud-speaker and frame aerial, the user sees a very simple control panel mounted on the main section of the case, with instructions and calibrations near by. A hinged bakelite lid opens to show the battery compartment; one of the neatest I

have seen in portable-set construction. The accumulator terminals are fitted with copper strips, which automatically make contact with the accumulator connections when the accumulator is lowered into its compartment.

The high-tension battery supplied with the set includes a 9-volt section for grid bias. There are five plugs inserted at various points on this battery unit. Here again, the instructions are at hand, indicating the correct voltage tappings for the different plugs.

To operate this portable the sequence is easy. First of all the set is turned so that the plane of the loud-speaker is in line with the station wanted. The set is switched on by means of a neat little on-off switch mounted at the centre of the control panel. Next, the black knob at the corner of the loud-speaker fret is pushed in or pulled out for long or medium waves respectively. Then the right and left hand tuning dials are set to the numbers shown on the calibration chart. For example, on the long waves Berlin comes in at 73 and 71 on the left and right-hand dials. On the medium waves Rome is heard at 72 and 76.

### Volume Control

Volume is controllable within quite wide limits, by means of the knob mounted between the two tuning dials. This is really a sensitivity control and had to be set at its minimum when receiving the strong local stations. As the circuit is a super-heterodyne I expected very good selectivity. Nor was I disappointed, for I was able to get Zeesen on the long waves quite clear of Radio Paris and Daventry. On the medium waves the set gave really exceptional results, cutting out the local stations within two degrees.

### Extensive Range

The performance of the Metropolis certainly justifies the super-heterodyne principle. As two screened-grid valves, two three-electrode valves, and a pentode

valve are used, this five-valve combination is equivalent to a seven- or eight-valve super-heterodyne using ordinary three-electrode valves throughout. I had an interesting evening bringing in most of the stations allocated wavelengths under the Prague Plan. I should say there are very few stations outside the range of this portable. And the reception of these innumerable stations is within the scope of the non-technical operator.

SET TESTER.

Accessibility is a feature of the Metropolis Portable

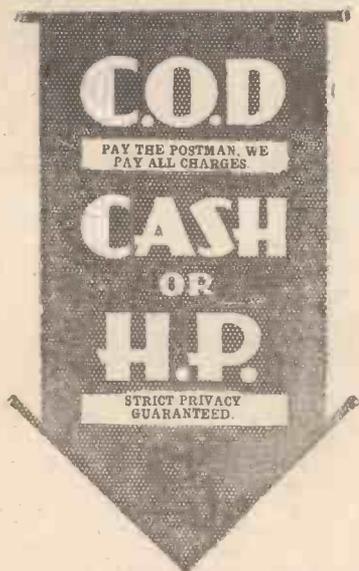


### AT THE QUEEN'S HALL

DR. ADRIAN BOULT, who conducted the B.B.C. concert on February 11, is a conductor with very deep feeling for certain music, but he is not a first-rate Beethoven conductor. The Fourth Concerto (Backhaus was the soloist) was not played *really* well. There was, however, a really good rendering of Holst's *Planets*; the legendary significance of each planet was deftly combined to make a composite picture of the human mind. The music is remarkable enough.

L. R. J.

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**Model "A"** Handsome Figured Oak, Hand Polished Cabinet. Overall sizes, 22 in. wide, 17 in. deep, 40 in. high. Waters Star Pick-up and Tonearm. Swiss Single Spring Motor, 10 in. Turntable and Volume Control, Silk Gauzed Fret.

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**"1931 Ether Searcher"**

**SIR,**—Will the "Ether Searcher" enable me to cut out interference from the London stations' transmissions and get other more distant stations?

J. B. (Mill Hill).

The "1931 Ether Searcher" has been tested on an outdoor aerial in North London at a distance of five miles from the Brookmans Park stations, and it was not only possible to get the two London stations' programmes clear of each other, but it was also possible to receive at least ten other stations on the speaker whilst the London stations were working. From this test it would appear reasonable to expect something in the way of other stations in the above locality when the London stations are working. We do not recommend an outdoor aerial in your case, although one might be permissible. Thirty to forty feet of wire indoors should be sufficient as an aerial in your case. —Ed.

**Those Amateur Stations**

**SIR,**—I read with interest the article in a recent issue of AMATEUR WIRELESS entitled, "The World's Best Amateur

Station." I think it does not really give a full description.

It would be rather interesting to know what power is used, also what percentage of gear 5BY makes himself, how much he buys, and how much he gets provided from other sources.

It is the easiest thing in the world to imitate a broadcast station if your power and equipment is similar to professionally-made apparatus. Personally, I think there is more credit due to some of our 10-watt stations, whose financial resources are very limited, than a station whose installation is more professional than amateur, and if 5BY states truthfully the power he uses during his QSO's, nobody would be surprised at the contacts he makes.

This letter is not written in any antagonistic spirit. G5HK.

**Gramo Switch**

**SIR,**—I want to use a switch for gramophone change-over as in the "Searcher," as I do not like the simple arrangement described in last week's issue.

P. H. (Manchester).

The connections for a suitable switching arrangement are as follows. Use a single-pole, double-throw switch and break wire No. 23. Connect the grid terminal of the detector valve to the arm of the switch. Connect one side contact of this switch to that terminal of the grid condenser from which wire No. 23 has been disconnected. Now go over to the other contact of the switch and connect a wire from it to one terminal of the pick-up. The other terminal of the pick-up should be attached to a wander plug, which should be plugged into the grid-bias battery at about 1½ volts negative. A separate switch should be used to break the L.T. supply to the S.G. valve, and this switch can conveniently be introduced in wire No. 1 simply by breaking the wire and taking each part to the terminals of the switch. This is, of course, not absolutely essential. —Ed.

**"Two Queries"**

**SIR,**—In reply to BM/BB5J, his first query is easy. Check the voltage of your batteries and leave them out when they do show signs of being tired. Like your correspondent, I have had lengthy service out of several of mine.

(Continued on next page)

# GRAMOPHONE RECORDS OF ALL YOUR RADIO FAVOURITES MADE IN YOUR OWN HOME!

The simplest and finest method of Home Recording obtainable  
**THE KINGSTON HOME RECORDER**

**Read these Press Opinions:**

The *Wireless Magazine*, Feb., said:

"Easy to use. Mr. Kingston made a number of records for me in his laboratory and I was also able to make some myself at home without any difficulty. . . It takes less than five minutes to get the device working."

"Mr. Kingston made a number of records of broadcast items picked up on a McMichael portable working at ordinary strength."

"By means of the cutter pick-up, it is a simple matter to make records of any broadcast item."

The *Wireless World*, Jan. 23th, said:

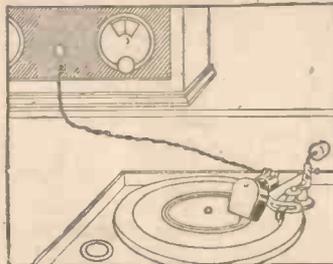
"With the Kingston Recorder the aim has been to produce an outfit suitable for use with the ordinary gramophone fitted possibly with but a meagre type of gramophone motor. That this has been achieved is revealed by the public demonstrations which are being given."

"A very interesting evening can be spent making records by speaking or singing into the small trumpet. It is thought, however, that the principal application of home recording is that of using the electrical recorder connected to the output terminals of the wireless set. It is surprising what good results can be obtained from broadcast transmissions. The outfit is reasonable in price."

The Kingston Home Recorder is obtainable from all good class dealers.

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**THE BROADCAST MODEL**  
For recording broadcast items as well as one's own voice.

**You could have Recorded**  
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From the NATIONAL programme (Feb. 14):  
A STAR item from the LONDON PALLADIUM, Commentary on CHELSEA v. BLACKBURN ROVERS, or the ENGLAND v. IRELAND International Rugby match. DANCE MUSIC by JACK PAYNE'S B.B.C. Band.

From the LONDON REGIONAL (Feb. 14):  
Excerpts from "IL TROVATORE," by the Covent Garden Opera Company. REGINALD FOORT at the ORGAN of the Regal Cinema, Marble Arch, London. A VIOLONCELLO Recital by that Broadcast favourite, W. H. SQUIRE.

From the MIDLAND REGIONAL (Feb. 14):  
SELECTIONS by the BIRMINGHAM MILITARY BAND. LIGHT MUSIC by the Studio Orchestra.

A Request Programme of ORGAN MUSIC by REGINALD NEW. SAXOPHONE SOLOS by NORMAN NEWMAN.

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**KINGSTON**  
**HOME RECORDER**  
*"The Ear of the World"*

**"READERS' IDEAS AND QUESTIONS"**

(Continued from preceding page)

His second query is not quite so simple, as he does not give us many particulars of his equipment, but there are (amongst doubtless others) two possibilities which occur to me: (1) The capabilities of his loud-speaker are limited. (2) His loud-speaker impedance is suited very well by a power valve of say, 4,000-5,000 hms. When he changes over to a super-power valve of 1,600-2,000 ohms, the impedance relations are very different and any advantage which might accrue from the use of a super-power valve are offset by the upsetting of the output impedance conditions.

I know the idea isn't popular, but it is, nevertheless, a fact that, although a collection of components will function, in order to obtain a first-class result a wireless set must be regarded as a scientific instrument, from the aerial right through.

G. M. P. (Tunbridge Wells).

**A Rearrangement**

SIR,—I intend to build the "1931 Ether Searcher" into a gramophone cabinet which allows a panel height of 6 in. only, but a panel length of some 20 in. I want to know whether it will be quite satisfactory to arrange the aerial series condenser and reaction condenser on each side of the ganged condensers on the panel and not beneath the ganged condensers.

W. P. B. (W.C.1).

This rearrangement will be quite in order, but it will be advisable to put the aerial series condenser nearest to the first coil in the set, while the reaction condenser should be placed at the other end of the panel nearest to the detector valve holder. The position of the L.T. switch is immaterial and can be placed beneath the ganged condensers or to the right of them, when facing the panel.—Ed.

**New Transformer**

SIR,—I am making up the "Ether Searcher" and have a Ferranti A.F.5 transformer which I want to use. I am uncertain about it being suitable, owing to there being a small-capacity fixed condenser connected internally across the primary winding of the transformer. L. K. (Bristol).

This transformer can be used with advantage, but it will be advisable to introduce an H.F. choke in series between the anode terminal of the detector valve and the input primary terminal of the transformer. To do this, wire No. 21 should be broken and the H.F. choke inserted between these two points. Suitable H.F. chokes are Lewcos, British General, Wearite, R.I., Lissen, Telsen, and so on.—Ed.

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Contributions are always welcome, will be promptly considered, and if used will be paid for.

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**H**OLT MARVELL is helping to give the Boat Race commentary this year. It is the first time he has ever seen the race; so his boat commentary will at least be fresh. Last year the commentary was given by the well-known sportsmen J. C. Squire and Oliver Nickalls. The launch *Magician* will again be used.

Brother acting as producer to brother is the unusual situation marked by the broadcasting on Sunday afternoon, February 22, of *The Tempest*. The actors from Harcourt Williams' "Old Vic" production who are taking part are Leslie French, Ralph Richardson, George Howe, and John Gielgud. Val Gielgud, the productions director of the B.B.C., will produce the broadcast version in conjunction with E. A. Harding.

Harry Tate will make his first appearance for many years in a studio on February 28, when he is to broadcast in the vaudeville programme for National listeners. He has been heard only twice previously on the wireless.

On February 27 a new Requiem Mass by

Baron Frederic d'Erlanger is to be performed for the first time by the B.B.C. Symphony Orchestra, conducted by Dr. Adrian Boult. This will be broadcast in the National programme.

An hour's sketch by Mabel Constanduros will introduce to National listeners on March 14 a new phase of Buggins' history. Its title is "Mrs. Buggins Obliges."

There are sixty-seven licences already issued per 1,000 of the population of Liverpool.

An Organ Sonata in D minor by Gustav Merkel is the main feature of an organ and violin recital to be relayed from Albert Hall, Nottingham, to Midland listeners on March 1.

Dame Ethel Smyth's new work, "The Prison," will be broadcast on February 24 on the Regional wavelength.

Dulcima Glasby, whose name has been associated for several years with broadcast adaptations of dramatic works and who wrote the thriller, *Obsession*, for the micro-

phone, is turning her mind to a lighter kind of fare. On March 4 her first comedy sketch will be heard in the National vaudeville programme. It is entitled "A Treat."

A "snappy" little play entitled *Mademoiselle*, by Elizabeth Illingworth, is to be broadcast from Birmingham for Midland Regional listeners on March 5.

Songs written by the entertainer himself will be heard from Midland Regional on March 2, when Ernest Elliott gives an entertainment during a concert by the Birmingham Police Band.

The outstanding event of the programmes for the first week in March from Midland Regional is a performance of Elgar's "Dream of Gerontius," given by the Worcester Festival Choral Society and relayed from Worcester Cathedral.

Albert Coates is to conduct the City of Birmingham Orchestra when it broadcasts a concert from the Town Hall on March 5. The main work of the programme will be Tchaikovsky's Symphony No. 4 in F minor.

Stanley Houghton's well-known play, *The Younger Generation*, is to be broadcast on February 25, at 7.45 p.m., for listeners to the North Regional programme.

Listeners who heard the concert recently relayed from Ilkley will be pleased to hear that the Bradford City Police Vocal Union are to make another appearance on February 27 in the programme for the Northern Region.



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Inductance 175/80  
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Milliamps

PRICE 25/-

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# ECONOMY IN MAINS WORKING

Details of the new Regentone mains units available

**N**OWADAYS there is no necessity to incur any great expense in working your set from the mains. Regentone have just produced some fine new mains units, the prices of which really set a new standard.

Three new portable models have been produced. Users of direct current mains will be interested in a new D.C. combined unit (No. 2) which costs only £2 12s. 6d. This gives a most generous output; for example, if connected to 220-volt mains, the output is 20 milliamperes at 130 volts. There are three fixed H.T. tappings, that is 60-70 volts, screen grid and power. It embodies an accumulator charging arrangement giving ½ to 1 ampere, according to the size of bulb used in the special socket provided. By this method while the lamp is being used to light a room, the accumulator connected to the unit is being charged. Certainly this D.C. unit is excellent value for the money.

There is a model available for A.C. mains users. It has the same output arrangements and gives the same generous supply

of high tension. This model, known as the type W1D, costs £3 7s. 6d.

The third new Regentone model is the W5A. This unit costs £4 15s., and gives high tension of 120 volts at 20 milliamperes and incorporates a low-tension trickle charger.

They are all enclosed in neat metal cases and are provided with stout flex connections and high-tension connector sockets on an insulated strip.

Readers should note that the A.C. model was fully described on page 292 of last week's issue of "A.W." Particulars of the other models can be obtained from Regentone, Ltd., 21 Bartlett's Buildings, London, E.C.4.



Two of the new Regentone units. (Above) the type W1D for A.C. mains, and (right) the D.C. combined model

## "HOW TO USE A PENTODE"

(Continued from page 317)

As the grid voltage is reduced the anode current falls off and with it the amount of power that the valve will give.

Owing to the relatively high impedance of pentode valves the current flowing in the anode circuit as the result of a signal applied to the grid is not greatly affected by the load as usually connected.

It therefore follows that the higher frequencies tend to be much stronger in the anode circuit of a pentode than a three-electrode valve, other things being equal.

Moving-coil loud-speakers generally have a more uniform impedance than other types, so that pentodes seem very suitable for working into moving-coil instruments. The response curves of all loud-speakers vary widely over the frequency range, however, and usually some connection is necessary. A filter to reduce the impedance of the loud-speaker circuit at the higher frequencies is often used to improve the tone. It takes the form of a resistance and condenser in series and may be connected across the loud-speaker itself.

This seems a stupid thing to do in sets specially designed to have a pentode output. The logical place for the correcting circuit is at the beginning of the low-frequency part of the circuit, for then the pentode is

relieved of the excessively strong voltages of the higher frequencies.

As with three-electrode valves, the pentode must have joined to it a load of suitable impedance for the maximum output to be obtained. The load best suited to a pentode averages from 8,000 to 11,000 ohms. With three-electrode valves the best load is usually about twice the impedance of the valve.

With a moving-coil loud-speaker, having a low-resistance coil, for example, a transformer is necessary. This may be connected as in Fig. 3, while the tapped choke referred to may be arranged as in Fig. 4. In both circuits the filter for reducing the strength of the higher notes is shown. A choke or transformer having several tapping points is an advantage as the tone and general output may then be adjusted.

Grid bias is usually obtained from a battery, but a resistance may often be included in one of the circuits for the purpose of providing this.

In mains sets this method of biasing is nearly always used. The actual arrangement depends upon the type of valve and the rest of the circuit. With a directly-heated valve, a centre-tapped resistance may be used across the filament as shown in Fig. 5. Resistance R1 provides the

(Continued on page 336)



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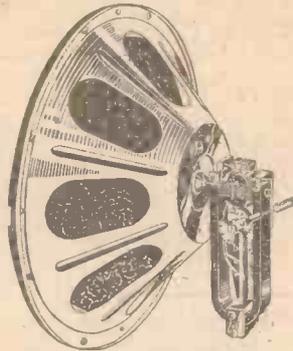
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**"HOW TO USE A PENTODE"**

(Continued from page 334)

voltage drop for the grid circuit, a grid leak R2 and condenser c filtering the circuit.

In the case of an indirectly-heated valve the circuit of Fig. 6 may be used, the parts marked corresponding with those of Fig. 5.

A pentode is usually employed directly after the detector for the reason that a detector, having only a weak input, is able fully to load it.

A pentode makes a fairly good power detector. The loud-speaker can be connected directly to it, but the anode current is considerable, perhaps 30 or 40 milli-amperes, according to the type. To deal with this current a fairly good choke or transformer is needed, but fair loud-speaker results may be obtained.

You may find that hum is more difficult to remove in a mains set having a pentode instead of an ordinary three-electrode power valve. This is partly because of the greater sensitivity of the pentode and may be partly due to the heavier total current which flows.

There are the two currents, to the auxiliary grid and the anode. The total may well exceed that of the usual power valve and the smoothing of the mains unit may not be sufficient at the higher current output. The directly-heated pentode may usually be worked in an A.C. set without difficulty.

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 YOU may remember that the above title was owned by an attractive booklet recently produced by Philips Lamps, Ltd. There was such a demand for this that the first issue went out of print almost immediately. A new edition has just been published and copies can be obtained free through my Catalogue Service. You should make a point of writing for this. **185**

**Moving Coils Explained**

If you want to have a really technical and sound idea of the working of moving-coil speakers and the best way to use them, then write to Messrs. Star Engineering (makers of the well-known Webson moving-coil speakers) for a booklet which has been issued describing the working of moving-coils. **186**

**Exide H.T. Batteries**

I see that when referring, in paragraph 177 in a recent issue, to Exide products, I inadvertently also mentioned a publication of another concern. All readers who wrote for the Exide literature, however, have had their requests properly forwarded. **187**

**A "DX" Portable**

"DX," as you probably know, is the radio term for long-distance and the new Amplion suitcase portable is certainly a long-distance instrument. It has two screen-grid stages and a pentode valve in the output stage. A cabinet model portable embodying the same circuit is also available, and particulars of both are given in a folder just sent me by Graham Amplion. **OBSERVER 188**

**GET THESE CATALOGUES FREE**

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

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242	1,238	Belfast	1.2	815	052.5	Natan-Vitus (Paris)	0.5	418	721	Radio Marco (Rabat)	10.0
261.3	1,148	London Nat.	68.0	828.2	014	Grenoble (PTT)	3.0	1,250	240	Tunis Kasbah	0.0
288.5	1,040	Newcastle	1.2	329.5	010.3	Poste Parisien	1.2	<b>NORWAY</b>			
288.5	1,040	Swansea	0.10	345.2	869	Strasbourg (PTT)	12.0	235.5	1,275	Kristiansand	0.5
288.5	1,040	Stoke-on-Trent	0.10	370	810.5	Radio LL (Paris)	0.5	240.6	1,247	Stavanger	0.5
288.5	1,040	Sheffield	0.16	833	779	Radio Toulouse	15.0	884	824	Bergen	1.0
288.5	1,040	Plymouth	0.16	447	671	Paris (PTT)	2.0	368.1	813	Fredrikstad	0.7
288.5	1,040	Liverpool	0.16	466	644	Lyons (PTT)	2.3	453.2	662	Porsgrund	1.5
288.5	1,040	Hull	0.16	1,445.7	207.5	Eifel Tower	15.0	494.2	607	Nidaros	1.2
288.5	1,040	Edinburgh	0.4	1,725	174	Radio Paris	17.0	584.7	513.2	Hamar	0.8
288.5	1,040	Dundee	0.4	<b>GERMANY</b>							
288.5	1,040	Bournemouth	1.2	81.38	9,560	Zeesen	15.0	1,071	280	Oslo	75.0
288.5	1,040	Bradford	0.10	216.3	1,387	Königsberg	1.7	<b>POLAND</b>			
301	995	Aberdeen	1.2	219	1,369.7	Flensburg	0.8	214.2	1,400	Warsaw (2)	1.9
309.9	668	Cardiff	1.2	227	1,319	Cologne	1.7	234	1,283	Lodz	2.3
356.3	842	London Reg.	45.0	227	1,319	Münster	0.6	244	1,229	Cracow	1.5
376.4	797	Manchester	1.2	227	1,319	Aachen	0.3	312.8	959	Wilno	0.8
398.9	752	Glasgow	1.2	232.2	1,292	Kiel	0.31	335.1	887.1	Poznan	1.3
479.2	626	Midland Reg.	38.0	239	1,256	Nürnberg	2.3	351	788	Lvov	2.2
1,554.4	193	Daventry (Nat.)	35.0	246.4	1,277.2	Cassel	0.8	403	734	Katowice	16.0
<b>AUSTRIA</b>											
218.5	1,373	Salzburg	0.8	253.4	1,184	Gleiwitz	5.6	1,411	812.5	Warsaw	14.0
246	1,220	Linz	0.8	259.3	1,157	Leipzig	2.3	<b>PORTUGAL</b>			
284.7	1,059	Innsbruck	0.8	269.8	1,112	Bremen	0.8	240	1,250	Oporto	0.25
351.7	853	Graz	0.8	276.5	1,085	Heilsberg	75.0	<b>ROMANIA</b>			
453	666	Klagenfurt	0.5	283.0	1,058	Magdeburg	0.6	283.0	1,053	Lisbon (CTIAA)	0.23
517	581	Vienna	20.0	283.6	1,058	Berlin (E)	0.6	394	761	Bucharest	16.0
<b>BELGIUM</b>											
206	1,456	Verviers	0.3	288.8	1,058	Stettin	0.6	<b>RUSSIA</b>			
206	1,456	Antwerp	0.4	318.8	941	Dresden	0.3	426	704	Kharkov	4.0
216	1,391	Chatelaineau	0.25	323.7	926.6	Breslau	1.7	720	416.6	Moscow (PTT)	20.0
216	1,391	Radio Conference Brussels	0.2	360	833	Mühlacker	75.0	800	375	Kiev	20.0
244.7	1,226	Ghent	0.25	372	806	Hamburg	1.7	824	304	Sverdlovsk	25.0
249.6	1,209	Schaerbeek	0.5	390	770	Frankfurt	1.7	937.3	320	Kharkov (RV20)	25.0
383.2	887	Velthem (Louvain)	15.0	418	716	Berlin	1.7	1,000	300	Leningrad	40.0
<b>BULGARIA</b>											
509	590	Brussels (No. 1)	15.0	452.1	662	Danzig	0.2	1,065	287.1	Tiflis	15.0
<b>BULGARIA</b>											
819	941	Sofia (Rodno Radio)	1.0	473	633	Langenberg	17.0	1,103	273	Moscow Popoff	40.0
<b>CZECHO-SLOVAKIA</b>											
203	1,139	Moraviska-Ostrava	11.0	538	503	Munich	1.7	1,200	250	Kharkov (RV4)	25.0
279	1,076	Bratislava	14.0	559.7	536	Kaiserslautern	1.0	1,304	230	Moscow (Trades Unions)	165.0
293.6	1,022	Kosice	2.5	569.7	536	Augsburg	0.3	1,380	217.5	Baku	10.0
342	873	Brunn (Brno)	3.0	586	530	Hanover	0.3	1,481	202.5	Moscow (Kom)	20.0
437	617	Prague (Praha)	5.5	570	527	Freiburg	0.35	<b>SPAIN</b>			
<b>DENMARK</b>											
281	1,067	Copenhagen	1.0	1,635	183.5	Zeesen	35.0	251	1,193	Barcelona (EAJ15)	1.0
1,153	860	Kalundborg	10.0	1,635	183.5	Norddeich	10.0	263	1,111	Barcelona (EAJ13)	10.0
<b>ESTONIA</b>											
401	748	Reval (Tallinn)	0.7	31.28	9,599	Eindhoven (PCJ)	30.0	349	860	Barcelona (EAJ11)	8.0
402.1	649	Tartu	0.5	299	1,004	Huizen	8.5	368	813	Seville (EAJ5)	1.5
<b>FINLAND</b>											
221	1,355	Helsinki	15.0	299	1,004	Radio Idzards (The Hague)	0.6	424	707	Madrid (EAJ7)	2.0
281	1,031	Viipuri	15.0	1,071	280	Scheveningen-Haven	5.0	453	662.2	San Sebastian (EAJ8)	0.5
1,796	267	Lahti	54.0	1,875	160	Hilversum	8.5	<b>SWEDEN</b>			
<b>FRANCE</b>											
172.5	1,730	St. Quentin	0.3	550	545	Budapest	23.0	230.8	1,301	Malmö	0.7
222.9	1,346	Pécamp	1.0	<b>HUNGARY</b>							
225	1,337	Strasbourg SGF	1.0	224.5	1,337	Cork (IFS)	1.5	257	1,166	Hörby	15.0
235.1	1,275	Nimes	0.3	413	725	Dublin (2RN)	1.5	302.3	900.8	Falun	0.6
237.2	1,263	Bordeaux	1.0	<b>ICELAND</b>							
240.6	1,247	Béziers	2.0	1,200	250	Reykjavik	16.0	436	689	Stockholm	75.0
249	1,203	Juan-les-Pins	0.5	<b>IRISH FREE STATE</b>							
258	1,171	Toulouse (PTT)	1.0	25.4	and 80	Rome (3RO)	9.0	542	554	Sundsvall	15.0
265	1,130	Lille (PTT)	15.0	296	1,013	Turin (Torino)	8.5	770	389	Ostersund	0.7
272	1,103	Rennes	1.2	313.2	953	Genoa (Genova)	1.5	1,242	247.5	Boden	0.7
285.3	1,051.4	Radio Lyons	0.5	330.5	907.8	Naples (Napoli)	1.7	1,348	222.5	Motala	40.0
286	1,049	Montpellier	2.0	441	689	Roma (Roma)	75.0	<b>SWITZERLAND</b>			
<b>GERMANY</b>											
463	662	Bolzano (IBZ)	0.2	244	1,229	Basle	0.5	403	743	Berne	1.1
501	599	Milan (Milano)	8.5	459	653	Zurich	0.7	680	442	Lausanne	0.6
<b>LATVIA</b>											
525	572	Riga	12.0	760	393	Geneva	1.5	<b>TURKEY</b>			
<b>LITHUANIA</b>											
1,935	155	Kaunas	7.0	1,223	244.3	Istanbul	5.0	1,961	153	Ankara	7.0

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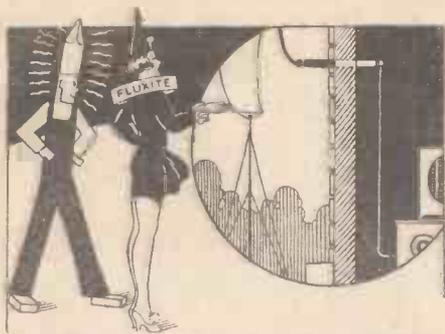
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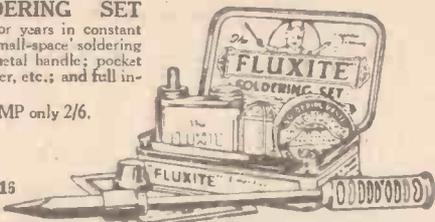
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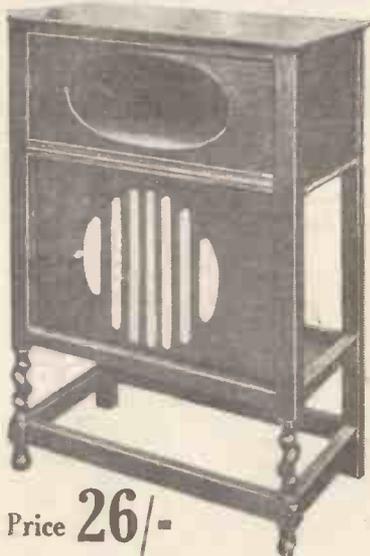
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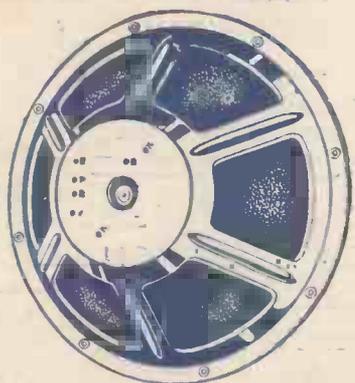
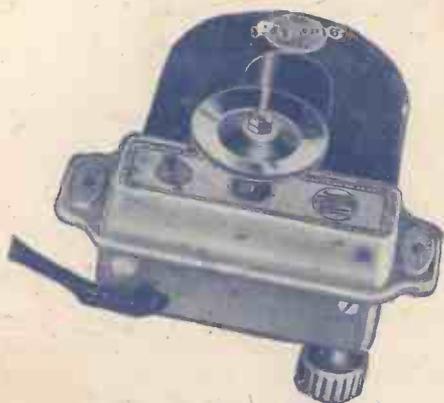
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