BRINGING YOUR SET UP-TO-DATE

HOW TO GET THE SHORT-WAVE STATIONS

Amateur Wireless

and Radiovision

Every Thursday 3d

Vol. XX. No. 499 Saturday, January 2, 1932

EASY WAYS of MODERNISING YOUR SET

PRACTICAL SUGGESTIONS for IMPROVEMENT

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Amateur Wireless & Radiovision

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

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NEWS & GOSSIP OF THE WEEK

YOUR NEW YEAR RESOLUTION

BY the time you buy this issue your New Year resolutions may already be made . . . and broken! If so, let's hope this applies only to ordinary resolutions, and not to wireless ones! There is still time to make new stern endeavours to get better radio reception, and if you turn to pages 16-18, you will see some helpful ideas on modernising your set and generally getting better results.

A DIRECTOR SPEAKS

IT is not often the B.B.C. officials appear before the microphone, and so particular interest attaches to the Scottish Regional Director's forthcoming talk. Mr. David Cleghorn Thomson will deal with the recent development of Scottish literature in his talk on January 6, "A Review of Recent Scots Letters."

£300 FOR RADIO TOULOUSE

ALTHOUGH the B.B.C. wouldn't be able to make much of a programme "splash" with £300 (many vaudeville programmes cost this amount), Radio Toulouse, with its limited programme sources, finds such an influx to its coffers really useful. Officials of the Haute-Garonne have granted £300 to the station authorities, to spend in whatever way they think fit in improving programmes.

ANOTHER "RECORD" PROGRAMME

MANY gramophone companies are utilising Continental stations for gramophone record broadcasts, intended for British listeners. The latest is the Filmophone Flexible Record organisation, which has arranged for British programmes from Radio Normandie (Fécamp) on 246 metres, from 7 to 8 p.m. on Sundays.

JACK AND BRAILLE

MORE work for Jack Payne! He has been appointed Honorary Director of Dance Music to the National Institute for the Blind! For some time past the National Institute has been trying to develop its Braille music production with a view to providing a better service for blind instrumentalists who specialise in dance music. It is on this work that Jack will be engaged.

DORIS ARNOLD BACK

NOW quite recovered from her recent operation for appendicitis, the popular revue pianist, Doris Arnold, is again tapping the keys at Savoy Hill. Her name was recently coupled by an enterprising newspaper with the name of a young London announcer, but according to latest information there are no wedding bells to be rung.

HYLTON v. PAYNE

THERE is a good deal of rivalry between the bands led by Jack Hylton and Jack Payne, a rivalry that must have an added piquancy in view of the latest development —the relaying to America through a B.B.C. studio of Jack Hylton's band as part of a sponsor's programme. We hear from Jack Payne that he was approached over this engagement, but turned it down on account of the B.B.C.'s well-known aversion to advertising in broadcasting. Of course, the fact that the B.B.C. has loaned a studio to Jack Hylton is not really any indication of a change of opinion about sponsored programmes, for, as a B.B.C. official points out, Jack Hylton could quite easily have hired another studio, say from one of the gramophone companies.

WILLING TO HELP

THE spirit of co-operation is strong at the B.B.C. We note with interest that for the preparation of a recorded programme, under the scheme sponsored by Paul England and Malcolm Frost, John Watt of the B.B.C. has directed a play, and John Snagge has done a spot of announcing.

CRYSTAL RANGE

THE B.B.C., true to its early ideals, still thinks about the humble crystal set and proudly informs us that North

BROADCASTING THE EPILOGUE

The eight Wireless Singers in the studio during one of the Epilogues, the musical side of which is conducted by Mr. Stanford Robinson

NEXT WEEK: OUR 500TH NUMBER—MANY SPECIAL FEATURES

NEWS & GOSSIP OF THE WEEK—*Continued*

Regional's signals have been heard on crystal sets as far away as a mountain in North Wales and in Hull. Normally, the B.B.C. adds, the crystal range of North Regional, using a coupled-circuit type of set, is between thirty and thirty-five miles.

MORE STUDIO BROADCASTS

OUTSIDE dance bands do not always compare favourably with Jack Payne's band because they are performing under less ideal acoustic conditions, as in restaurants and dance halls. With this thought in mind the B.B.C. has arranged for several popular broadcast dance bands to give performances in one of the Savoy Hill studios. The first will be Ambrose, to be heard from 8 p.m. until 9 p.m., through National stations, on January 22. Others will follow.

VAUDEVILLE GIVES OUT

AS we ventured to predict, the B.B.C.'s laudable scheme for three different vaudeville shows per week, as put into practice for December, has now broken down owing to lack of talent. In future we shall have to put up with "diagonalised" programmes of vaudeville, that is, repeats from Regional and National stations.

SELECTIVITY—THE FRENCH IDEA

THE French State officials, probably piqued by Radio Paris' new power, have put up the power of the present PTT station, in spite of the fact that a new Poste Parisien is being built and will be ready in eight or nine weeks. General Ferrié has drawn up an elaborate scheme for France, corresponding somewhat with our regional scheme. Unfortunately it doesn't take into account the needs of other European countries, and at the forthcoming Madrid Conference there will undoubtedly be heated words!

A NEW RADIO PLAYWRIGHT

THE B.B.C. is always on the look out for new playwrights. Gilbert Highet, a young Glasgow dramatist, who is now studying at Oxford, has produced as the latest of his most varied achievements a wireless play in verse, *Acts of Faith*. It concerns the old days of witch-finding in Scotland in the seventeenth century. It will be heard on January 8.

WEST REGIONAL PROGRAMMES

ALTHOUGH the foundations for the West Regional station are but started at Washford Cross, the B.B.C. is already working out plans for its programmes. It is proposed to have two, or perhaps three, full-length programmes in Welsh every week from the Regional outlet, and two or three West Country programmes. Apart from such common regional material as tea-time and cinema-organ music, the new station will share its effort between Welsh and West Country interests. Meanwhile, Daventry 5XX is to continue with its interludes of Welsh broadcasting.

VERY ENTERPRISING

THANKS to the initiative of its manager, Mr. Emile Littler, the Birmingham Repertory Theatre can claim the distinction of being the first theatre in the world to fit up a studio specially for broadcast excerpts. One of the dressing rooms, measuring approximately 16 feet square, has been fitted up to correspond in every detail—even to the red light on the outside of the door—with a B.B.C. studio. It is proposed to relay plays from the Repertory Theatre to Midland Regional station.

EMPIRE NEWS

AN agreement has now been reached between the B.B.C. and the News Agencies for a full Empire news service, to be broadcast by the Empire stations when they are completed at Daventry. The service will cover three special bulletins; one at noon, another at 6 p.m., and the third at midnight.

BROADCASTING HOUSE

CONTINUING our serial story about the B.B.C.'s new headquarters at Portland Place, we have recently paid a visit to the offices now in occupation. We find that a number of them are decorated in a striking shade of green and we are informed that this was the choice of the intellectuals responsible for the creation of the B.B.C.'s big programmes.

5SW SERVICE

AS a result of the recent agreement, the B.B.C. tells us, the present short-wave service broadcast from G5SW, the experimental station at Chelmsford, will be greatly augmented in interest by news bulletins, as from January 4, 1932. The exact times of these bulletins have not been fixed, but whatever the times may be, there is no doubt that Empire listeners will greatly welcome the news service. Except for a brief period before the Imperial Conference, G5SW has not broadcast news as part of its programme, as no separate news service agreement had been obtained.

FOOTBALL NONSENSE

THE Federation of Football Supporters' Clubs has recently decided that it would be in the interests of football for the B.B.C. to relay commentaries on football matches, but that in the interests of gate money the B.B.C. should refrain from letting listeners know beforehand which game was to be broadcast. This suggestion is treated at Savoy Hill with amused contempt.

Two views of the newest of Yugoslavia's three broadcasters, Ljubljana, (oval) the station building and (left) the control desk at which the high-tension circuits are regulated. You can hear Ljubljana on 574 metres

WOULD YOU HAVE KNOWN?

IT will interest listeners who dote on the "blah-blah" accent of the B.B.C.'s announcers to know that of the four permanent London announcers, three come from Oxford, but that the Chief Announcer is a Cambridge man. The two executive announcers, as the occasional announcers are known, are Oxford men, so the dark blues have it all the time.

THE POWER UNIT for THE "A.C. BRITAIN'S SUPER"

The Receiver portion of the "A.C. Britain's Super" was described last week. Here are the details of the power unit

By W. JAMES.

THE mains part for the "A.C. Britain's Super" supplies heater current, high tension, and grid bias.

There are four indirectly-heated valves in the set, taking 1 ampere each at 4 volts, and one directly-heated valve. This last is the output pentode.

All are supplied from the one winding on the power transformer, which has a centre tap.

Another winding supplies the heating current for the rectifier, and this also has a centre tap. There is a third winding, supplying 250+250 volts for the high-tension circuits. This winding gives 500 volts across the whole and as it has a centre tap, the voltage of each half is 250.

The last winding is the primary, which is designed for the usual inputs of from 200 to 250 volts, 50 cycles.

The circuit diagram shows two small-capacity high-voltage condensers joined in the high-tension circuit supply to the anodes of the rectifier. These condensers by-pass radio-frequency currents that may be present from the mains wires. They stop high frequency from entering the set from the mains and so the stability is improved and the background is reduced.

After the full-wave rectifier we have the first 4-microfarad smoothing condenser. Then comes the choking coil and a further 4-microfarad condenser. This filter circuit is effective and the result is that the high-tension supply to the set is so smooth that no hum is heard when a moving-coil loud-speaker is joined to the output valve.

Across the output condenser are various resistances. Groups of two in parallel are used in order that the flexible resistances shall carry a current well within their rated values. There are four groups of two, making eight resistances.

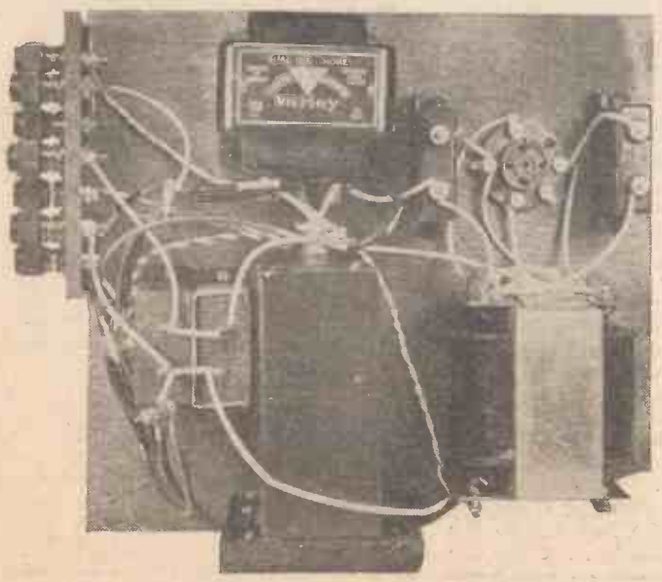
Starting from the positive side we have, first, the supply to the anode circuits of the valves. The supply for the screens comes from the first tapping. Then we have a tap going to the cathodes. Next comes the tap giving the grid bias for the power valve and, finally, from the most negative point is a tap which goes to the volume control potentiometer in the set.

It is, therefore, possible to bias the two variable-mu valves to a greater voltage than the value used for biasing the power valve. A number of terminals are used on the unit for ease of connection and the set is joined to these terminals. The layout is quite easy.

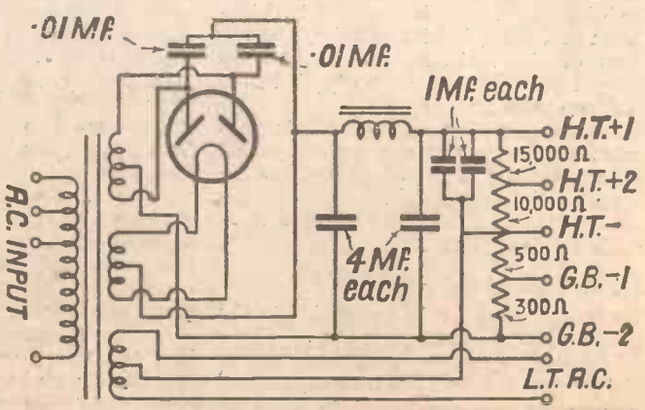
Both 4-microfarad condensers are fitted to a piece of wood, which is screwed to the baseboard, this being arranged merely to save height. The other parts should be fastened to the baseboard in the positions indicated in the layout diagram.

When wiring be careful to note the 4-volt 1-ampere winding for the heating circuit of the rectifier and not to confuse it with the winding that supplies the current for the heaters of the valves in the set.

Use good systoflex, as the voltages in the high-tension circuit are fairly high. Note particularly the values of the resistances used. A small bolt and nut is used to secure the ends of pairs together and the wires from terminals to the junction points are fastened under these nuts. It would be



A plan view of the unit: compare this with the layout on the next page



The circuit of the power unit

"THE POWER UNIT FOR THE 'A.C. BRITAIN'S SUPER'"

(*Continued from preceding page*)

a good idea to wrap a piece of insulating tape over each joint in the resistance circuit in order to avoid the possibility of short circuits.

The unit will give about 250 volts at 50 milliamperes. This is ample for the high-tension and the grid-bias circuits, and the values of the resistances have been so arranged that the valves are supplied with about 200 volts high tension.

In arranging the resistances it was necessary to note that the current passed by the two variable-mu valves varies as the volume control is adjusted. In spite of this it is advisable that the voltages shall remain fairly constant.

Screen Voltage

In particular the voltage applied to the screens must remain at a given voltage for the best results. Some slight change cannot easily be avoided, but the results obtained are well within those considered necessary.

I should, perhaps, point out that the unit will give a high voltage if the set is not connected. It is, therefore, advisable not to switch on the rectifier circuit without having the load on the valves. False readings will be obtained if one circuit is connected and the voltages and currents measured. The set must be connected and then the separate voltages may be measured and if the voltmeter is of the high-resistance type the values indicated will be practically the true working values.

H.T. Connections

There are two high-tension connections from the set, one being for the anodes and the other for the screens of the two multi-mu valves. Then there is the grid bias for the power valve, which is supplied through a 100,000-ohms resistance. This resistance has one end joined to the 2-microfarad condenser in the set placed near the low-frequency transformer.

If the resistance is not long enough, a bolt and nut should be fastened to the end and a wire be joined to it. Cover the joint with insulating tape. There are also the wires connecting the heaters. Use thick wires for this circuit, as the current is fairly heavy.

If the set is to be used with a moving-coil loud-speaker having a transformer of suitable ratio, this is connected to the loud-speaker terminals. But when the loud-speaker is of the moving-iron type, and no transformer is used, a choke condenser filter should be added in the usual way.

These parts can be fitted near the loud-speaker. The quality is very good and there is no hum.

Fitting a Filter

If the higher notes are too strong, a filter consisting of a resistance and a condenser may be joined across the output from the set. Usual values are .005 microfarad and a 20,000-ohms resistance, but as loud-speakers vary so greatly it may well be necessary to use a lower resistance or a bigger condenser in order still further to cut down the high notes.

The set is extremely easy to tune, the quality is good, selectivity is high and a very large number of stations can be received.

COMPONENTS FOR THE "A.C. BRITAIN'S SUPER"

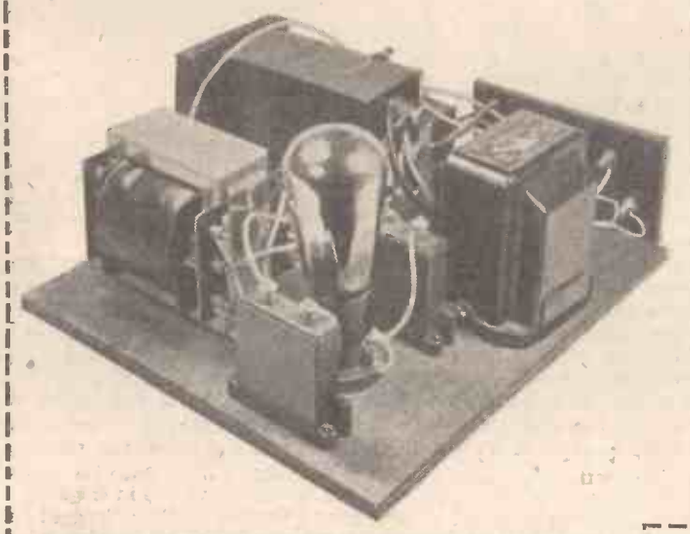
Cabinet (Readi-Rad, Peto-Scott).
Ebonite panel, 18 in. by 7 in. (Danipad, Readi-Rad, Wearite, Peto-Scott, Becol, Permcol).
Baseboard, 21 in. by 10 in. (Camco, Readi-Rad, Peto-Scott).
.0005-mfd. dual-gang condenser and disc drive (J.B., type R.2; Lotus, Utility).
.0005-mfd. condenser and disc drive (J.B., type R.1: Lotus, Utility).
Set of super-het coils, types: one O.T.1, two O.T.2, and one special two-range oscillator for bi-grid valve (Wearite, Lewcos).
Band-pass coil (Lewcos, two-range type B.P.F.).
Eight 5-pin valve holders (Telsen, W.B., Benjamin, Lissen, Igranic, Clix, Bulgin, Wearite, Junit, Lotus, Burton, Graham-Farish).
Three grid-leak holders (Readi-Rad, Telsen, Lissen, Dubilier, Bulgin, Wearite, Graham-Farish).
One .01-mfd. fixed condenser (T.C.C., type S.; Dubilier).
One .0002-mfd., one .0003-mfd., one .001-mfd. fixed condensers (Telsen, T.C.C., Dubilier).
One .002-mfd. fixed condenser (T.C.C.).
Four 1-mfd. fixed condensers, 500-volt D.C. working (T.C.C., Ferranti, Dubilier).
Three 2-mfd. fixed condensers (T.C.C., Dubilier, Ferranti, Telsen, Formo).
Super-het choke (Readi-Rad).
Low-frequency transformer, 7 to 1 (Ferranti).
Two 1-meg. and one .5-meg. grid leaks (Telsen, Dubilier, Lissen, Sovereign, Graham-Farish).
50,000-ohm wire-wound potentiometer (Colvern, Bulgin, Wearite, Watmel).
Five spaghetti resistances, 50,000-ohm, 20,000-ohm, 5,000-ohm, 100,000-ohm, 25,000-ohm (Lewcos, Telsen, Bulgin, Sovereign, Readi-Rad, Lissen, Igranic, Tunewell).
Panel light (Readi-Rad, Bulgin).
Two terminal mounts (Sovereign, Junit).
Four terminals, marked Aerial, Earth, L.S.+, L.S.— (Belling-Lee type B, Bulgin, Eelex, Burton, Igranic).
Connecting wire and sleeving (Lewcos, Jiffilinx, Quickwyre).
Five yards thin flex (Lewcoflex).

MAINS PORTION

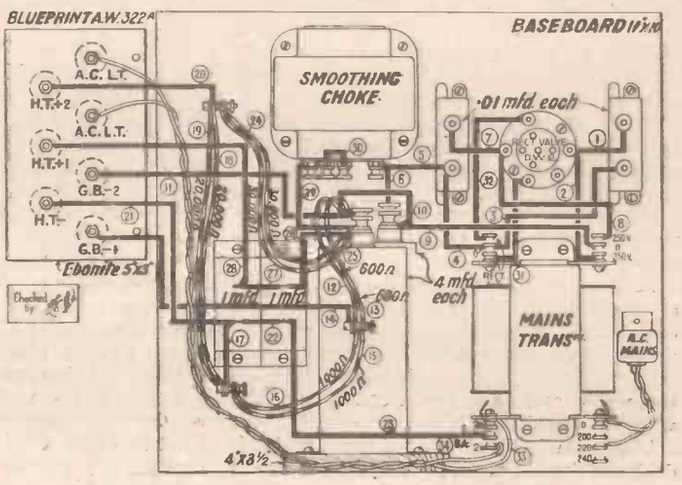
Smoothing choke (Varley dual L.F. choke, Heayberd, Wearite, Regentone, Telsen, R.I., Parmeko, Igranic).
Mains transformer, 4 v. 6 a., 4 v. 1 a., 250-0-250 v. (Junit, Wearite, Parmeko).
Two 4-mfd. fixed condensers, 500-volt D.C. working (T.C.C., Formo, Ferranti, Dubilier, Helsby, Lissen).
Two 1-mfd. fixed condensers, 500-volt D.C. working (T.C.C, Formo, Ferranti, Dubilier, Lissen, Helsby).
Two .01-mfd. condensers, 800-volt D.C. working (T.C.C., Dubilier).
4-pin valve holder (Telsen, Lissen, Benjamin, Igranic, Burton, Clix, W.B., Wearite).
Two 20,000, two 30,000, two 1,000, and two 600 spaghetti resistances (Lewcos, Telsen, Lissen, Sovereign, Igranic).
Baseboards, 10 in. by 11 in. and 3½ in. by 4½ in. (Camco, Peto-Scott, Readi-Rad).
Connecting wire and sleeving (Lewcos, Jiffilinx, Quickwyre).
Strip of ebonite, 5 in. by 3 in. (Permcol, Becol, Peto-Scott).
Terminals: H.T.+1, H.T.+2, H.T.—, G.B.—1, G.B.—2, two L.T. A.C. (Belling-Lee, Eelex, Bulgin, Burton, Igranic).

ACCESSORIES

Five valves: one A.C. bi-grid (Cossor 41MDG), two multi-mu S.G. (Mullard MM4V), one 354V (Mullard), one PM24A (Mullard). Rectifier, DW2 (Mullard).
Speaker (Epoch A.2.).



The simple construction of the power unit is evident from this photograph



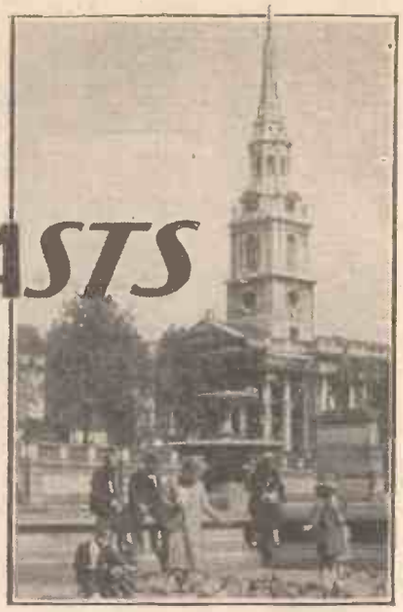
The layout and wiring diagram of the "A.C. Britain's Super" power unit

AT THE B.B.C.

ARRANGING the RELIGIOUS BROADCASTS

An Interview with J. C. STOBART

KENNETH ULLYETT describes the B.B.C. policy in religious broadcasts and appeals



WHEN I met Mr. J. C. Stobart at Savoy Hill last week, he told me something of the B.B.C.'s plans for the future with regard to religious broadcasts, from Broadcasting House and from various cathedrals all over the country.

"I think there are still many listeners who do not realise that we have a regular rota for religious broadcasts," said Mr. Stobart. "On the first Sunday of each month there is a London studio service with some eminent preacher. This is on the National and in London there is generally an alternative on the Regional; other Regionals, too, may have an alternative. On the second Sunday of each month a St. Martin's-in-the-Fields service is always given and there is no alternative. The third Sunday is given over to an outside broadcast, and here, as in the studio service, we try to keep a denominational balance.

"How we do this I will show you later.

"The Regional stations generally have an alternative, preferably from a contrasting denomination. Where there is a fifth Sunday this is given over to a studio service for such bodies as the Salvation Army, Brotherhood Movement, Quakers, and so on. A Regional contrast is provided."

"How far in advance do you make out these programmes?" I asked.

"We work, as a rule, about six months ahead of current programmes," he said. "And we now have the first six months of 1932 settled for our religious broadcasts. For instance, a relay is to be made from Peterborough Cathedral in June. This is a cathedral from which we have never before broadcast.

One of the microphones in Canterbury Cathedral, a broadcast from which will feature in the programmes this Sunday

"This Sunday, the first in the new year, an important broadcast is to be made from Canterbury, there being a special service conducted by the Archbishop of Canterbury for the Day of Prayer for disarmament. On January 17, the Salvation Army will have a special service for their annual appeal, and on January 31 the Bishop of Chichester is conducting a service to be broadcast from Rye. On February 28, all stations will be taking the service from Carlisle, and on Good Friday morning, there is to be a relay from St. George's Chapel, Windsor. Easter morning will probably see a broadcast from Liverpool Cathedral. These are among the 'high spots' of forthcoming religious broadcasts."

I asked about the new religious studio in Broadcasting House and was told that although, at the moment, it is not planned to have an organ in this for acoustic reasons, they do intend trying a small orchestra, possibly a quintet, as an accompaniment to the Wireless Singers. The orchestra will, of course, be subordinate, and the experiment will be tried about half a dozen times a year.

The studio will be used for the daily morning service, which was started in January, 1928, and which has been one of the most popular features in the present programmes. The Rev. Hugh Johnston, who conducts it, has a very great correspondence, almost an embarrassingly great correspondence. Thousands of listeners to these morning services treat him as their confidential advisor. Figures are not available, but on one occasion alone, when Hugh Johnston was temporarily down with influenza, over a thousand letters of sympathy were received. It is rumoured that he is shortly taking a living at Cranleigh, but that may not be too far away for him to continue the B.B.C. morning services, occasionally or on certain fixed days of the week.

Mr. J. C. Stobart at the microphone in Number 5 Studio

The mid-week services on Thursday evening constitute an experiment which is

(*Continued at foot of page* 10)

PERFECT TONE

TELSEN TRANSFORMERS

have achieved fame in the radio world on account of the high standard of their quality and performance. Designed and built on the soundest engineering principles, these robust, full-size transformers will give not only efficient but enduring service.

L.F. TRANSFORMERS

"Ace," Ratios 3-1, 5-1 ...	5/6
"Radiogrand," Ratios 3-1, 5-1	8/6
"Radiogrand," Ratio 7-1 ...	12/6
"Radiogrand," Ratio 1.75-1	12/6

OUTPUT TRANSFORMERS

Multi-Ratio Output Transformer, giving three ratios of 9-1, 15-1, 22.5-1 ...	12/6
Output Transformer, Ratio 1-1	12/6
Pentode Output Transformer	12/6

L.F. CHOKES

L.F. Intervalve Coupling Choke, 40 and 100 henrys	5/-
Heavy Duty Power Grid L.F. Choke, 40 henrys	8/-

OUTPUT CHOKES

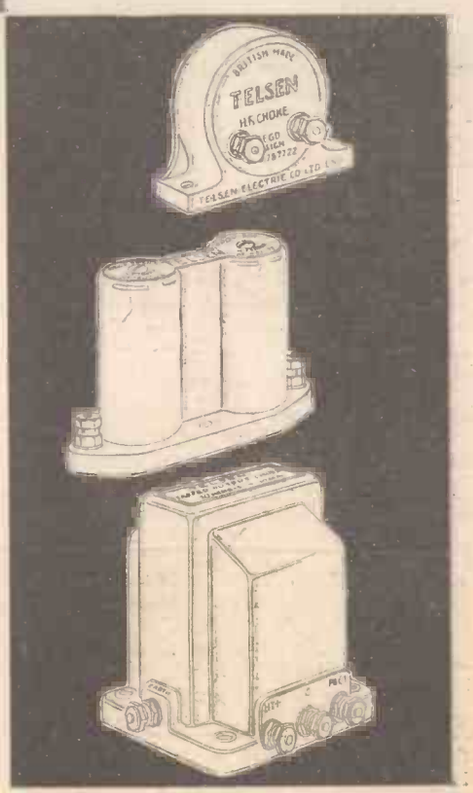
Plain, 20 henrys...	8/-
Tapped, 20 henrys	8/6

BINOCULAR H.F. CHOKES

It is the function of an H.F. Choke to present the highest possible impedance to H.F. currents at all wavelengths. Particularly does this apply to the popular tuned-grid arrangement of screen-grid amplification, where the performance of the whole set is limited by the value of the impedance in the anode circuit of the screened-grid valve. It is equally important that this high efficiency should be maintained over the whole broadcast band. **Price 5/-**

STANDARD H.F. CHOKE

The Telsen Standard H.F. Choke utilises the minimum baseboard space. It is designed to cover the whole broadcast band and has an extremely low self-capacity. The inductance is 150,000 microhenries and the resistance 400 ohms.
It has proved very popular and has been incorporated by set designers in many of the leading circuits: **Price 2/-**



TELSEN

THE SECRET OF PERFECT RADIO RECEPTION

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

TONE BALANCE

TELSEN LOUD-SPEAKER CHASSIS

has been produced to give an excellent performance with perfect tonal qualities. A fully-floating cone is employed of special damp-resisting material, and the shape and texture have been balanced to give a most pleasing, natural mellowness. Holes are provided for the attachment of most Loud-speaker Units.

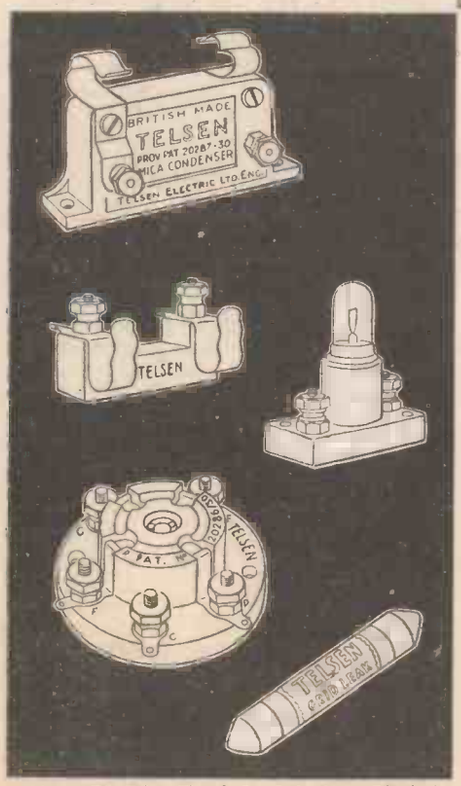
Telsen "Popular" Chassis (Diam. 11") .. Price 5/6

Telsen "Major" Chassis (Diam. 14½") .. .. Price 10/6

FIXED CONDENSERS

(Prov. Pat. No. 20287/30).

Made in capacities from .0001 mfd. to .002 mfd. They can be mounted upright or flat, and the .0003 mfd. fixed condenser is supplied complete with patent grid leak clips to facilitate series or parallel connections. **Price 6d.**



VALVE HOLDERS (Prov. Pat. No. 20280/30). The Telsen four- and five-pin valve holders embody patent metal spring contacts, which are designed to provide the most efficient contact with split and non-split valve legs, and are extended in one piece to form soldering tags. Low capacity and self-locating.

4-Pin ... ... Price 6d.
5-Pin ... ... Price 8d.

GRID LEAKS. Telsen Grid Leaks are absolutely silent and non-microphonic, and practically unbreakable. They cannot be burnt out and are unaffected by atmospheric changes. Telsen Grid Leaks are not wire wound, and therefore there are no capacity effects. Their value is not affected by variation in the applied voltage. Made in values ranging from ¼-5 megohms. **Price 9d.**

GRID LEAK HOLDER. Will hold firmly any standard size or type of Grid Leak. Ample clearance is provided between the terminal screw leads and the baseboard (underneath), preventing any surface leakage upsetting the value of the Grid Leak. The terminals and fixing holes are accessible without removing the Grid Leak. ... ... **Price 6d.**

FUSE HOLDER. This is a neat and inexpensive device which should be incorporated in every set as a precaution against burnt-out valves. The Telsen Fuse Holder firmly grips the standard radio fuse, giving a perfect contact. ... ... **Price 6d.**

TELSEN SCREENS ... ... Price 2/- and 2/6

TELSEN

100% BRITISH RADIO COMPONENTS

Advt. of The Telsen Electric Co., Ltd., Aston, Birmingham.

CVS—120

THE "TALKING" LAMP

One of the Seven Electrical Wonders

WE hear a great deal about photo-electric cells and what they do especially in the reproduction of talking pictures. Here is the other side of the story—the recording lamp which repeats word for word.

Various means have been devised for bottling up the human voice.

Every time a talking picture is made a photographic record has to be taken of the microphone currents, and printed outside of the film to be projected. We are not concerned with the synchronised gramophone, nor, indeed, with the variable "area" method of recording, in which some form of oscillograph or string galvanometer is employed.

The majority of talking pictures to-day are made by the variable *density* method—

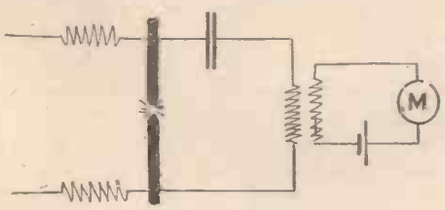


Fig. 1. The circuit arrangements of Duddell's speaking arc

literally by photographing on a moving film the image of a "talking lamp." This lamp is one of the seven wonders of the electrical world, but owing to the fuss made over photo cells it has been largely overlooked by amateurs. It is a lamp which will respond to every frequency change, every change in modulation and amplitude of the human voice, and will at each instant *glow* with a degree of brilliance exactly corresponding to the electrical conditions of the microphone.

Its light is concentrated upon a narrow slit not more than 0.08 in. wide, and images of the illuminated slit are recorded photographically as the film passes continuously behind it at the rate of ninety feet a minute.

On a variable density film the frequency is represented by the number of slit images per foot, the amplitude by the density of those images. Needless to say, the sound is reproduced by running the film between a source of light and a photo cell, the latter generating corresponding currents which are amplified to the loud-speaker.

Early in talking picture history the minds of experimenters went naturally to Duddell's speaking arc, but no arc can be so harnessed as to give a sufficiently steady luminous output. The arrangement is seen in Fig. 1. The microphone M is included in the circuit.

The Aeolight lamp, as developed by Theodore W. Case, is a gaseous discharge tube, which varies in the illumination it gives in strict accordance with the variation in the amplified speech currents.

This type of lamp, the secret of the variable-density "talkies" is a two-element tube, one of the elements being an anode of nickel, the other being a filament of loop shape, coated with barium and strontium; helium or some other "inert" gas, is introduced into the tube at a low pressure. When a polarising voltage is applied to the tube we get an unmodulated exposure of the sound track on the film. When speech or music causes a sufficient voltage to be applied, ionisation occurs, and a glow results which increases with increase in the potential. Superimposed upon the polarising voltage are the speech currents. These modulate the polarising voltage up and down from the centre unmodulated exposure point.

The electric variations received from the power stage cause variations in the brightness of the lamp. The light from the lamp passes through the slit and falls upon the moving film.

The speech recording is done in a separate camera, on a film quite separate from that on which the pictures are being taken—except in the isolated cases of portable equipment. The pictures and sound are printed together on the positive film, though the practice of separate films for picture projection and sound reproduction is being tried out.

The G.E.C. make an admirable recording lamp, in which the glow is produced by a mixture of mercury and an inert gas (or gases). The lamp is seen in section in Fig. 2; the tube T becomes filled with a luminous glow of great photographic intensity, which is placed "end on," and the column of light is focused on the slit of the recording camera.

These lamps operate at about 15 milliamperes, the microphone currents causing fluctuation either side of the 15-milliampere "zero." With the microphone not in use a continuous band of medium density would appear in the developed film; the speech currents break this up into bands (images of the slit) of greater or lesser density.

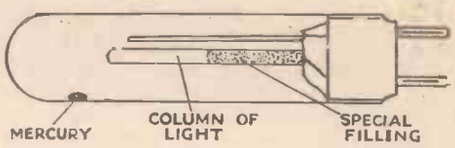


Fig. 2. Diagram showing construction of the "talking" lamp

The study of these recording lamps is one which strictly concerns television, for one of the lines along which television is being developed is the electrical transmission to a number of theatres of *talking* pictures from a master film.

T. THORNE BAKER.

"ARRANGING THE RELIGIOUS BROADCASTS"

(*Continued from page 7*)

still in progress. Mr. Stobart is quite aware that several "dailies" have spoken of the incongruity of following this service with dance-band broadcasts, and they question the advisability of sandwiching a religious feature in between more everyday programme matters. Of course, the dance music does not follow on immediately after the Thursday service. There is a gap. As Mr. Stobart says, there need be no incongruity, because it is up to the listener to choose which item he wants. The mid-week service comes from St. Michael's, Chester Square, of which the Rev. W. H. Elliott, the well-known broadcaster and former canon of St. Paul's, is the vicar. The first broadcast was on October 21 and lasted for about a quarter of an hour.

Mr. Stobart is also in charge of broadcast charitable appeals. He gave me some interesting facts about the B.B.C.'s job as a public almoner. There is an Appeals Advisory Committee to help the B.B.C. The members are all experts in various branches of charitable organisations, hospitals and so on, and when any claim comes forward it is investigated by the member interested in that particular branch.

Broadcast Appeals

The B.B.C. gets about £52,000 a year as the result of broadcast appeals. The amount for individual appeals varies from £50 to about £3,000. A record was set by the late Lord Knutsford when, for one appeal alone, he raised £19,000. Canon Woodward, who conducts some of the Children's Services, is a popular appeals personality. "A. J. Alan" raised about £4,600.

Owing to financial restraint at the moment, it was anticipated that the results to broadcast appeals would fall off, but Mr. Stobart says that there is no serious decline up to the present. For instance, the Wireless for the Blind Fund has now reached the grand total of £37,290.

Of course, there are a number of people who use the B.B.C. as their almoner and they regularly send in lump-sum contributions which are distributed among the fifty or so charities for which appeals are broadcast each year.

The very greatest care is taken to go through the balance sheets of each organisation before an appeal is given. The Advisory Committee works about six months ahead and emergency appeals are dealt with in some special way, such as when recently it was desired to raise funds for the disaster in British Honduras, a special talk was included.

The regular appeals are given after the church service on Sunday because in the early days the complaint was made that listeners to religious services contributed nothing.

Broadcast appeals enable them to "pass the bag round" immediately afterwards at a very opportune moment

On Your Wavelength!

A HAPPY NEW YEAR

ONCE again I have the great pleasure of wishing my readers the best and happiest of New Years. One of the jolly parts about writing "On Your Wavelength" is that one makes so many good friends amongst readers. I must have hundreds of correspondents who, though I have never met them, first wrote to me some years ago, when wireless was still an infant (and given to the howls and yells of infancy), and they have continued to do so at intervals ever since. Others have been added more recently. But one and all like, every now and then, to thrash out one of those interesting wireless arguments that make such an appeal to every enthusiast.

LOOKING FORWARD

EVER since I began to write these notes—and that was in a very early issue of dear old AMATEUR WIRELESS I have made bold in the New Year to borrow Old Moore's mantle for a spell and to cast my gaze forward into the future. And, though I say it myself, I have been a pretty good prophet—much better, anyhow, than those johnnies who give you the certainty for the three-thirty. The only real bad shot that I can think of was three or four years ago, when I was rash enough to prophesy that television would make huge strides in the then near future. Television has had a thornier path than one anticipated, and it has still much work to do with the bowie knife or the *machete*, or whatever it is that people use to hew out thorny paths.

The first thing that I foresee is a boom in short-wave reception as a hobby. The coming of the Empire short-wave station will, of course, stimulate this, but there is something else as well. According to calculations, we should be in for a first-rate short-wave summer. One outstanding virtue of the short waves is that they allow long-distance work to continue during the months which are apt to be dead on the normal broadcast band. We know something about the design of short-wave sets nowadays, and as soon as the wireless public at large realises how simple and how fascinating a business short-wave reception is, there will be something very like a rush to make or to buy receiving apparatus.

THIS YEAR'S SETS

WE have come to a time now when the sets of one year are so good that they don't become out of date directly the next is ushered in. The position of wireless sets is now much the same as motor-cars. If your "bus" is a year or two years, or even three years old it is most certainly not antediluvian. It can, in fact, do pretty well all that the latest model does. The 1932 sets are going to mark a big step forward, but they are not, I think, going to make those already in existence out of date. In many instances it will be possible to bring the 1931 set right up to the minute by making additions and improvements, just as you can modernise a last year's car by adding certain gadgets. Therefore, you need have no fear about buying or building at the present time.

WHAT IMPROVEMENTS?

I SAID a year ago that 1931 would be a super-het year. Please believe me when I say that I had then no inkling of the coming of the "Century Super" or "Britain's Super." These sets simply leaped into popularity and thousands were made up. Many firms of manufacturers, too, introduced super-het designs and found a ready market for them. The super-het has definitely come back, and in 1932 we are going to see it still more popular. The old, old problems of noisiness and poor quality have been solved by the application of modern knowledge to important questions of design. In 1932 we shall see the super-het still further improved by the use of a two-grid valve as combined oscillator and first detector, and of the multi-mu valve as high-frequency and intermediate-frequency amplifier. I won't go into the possibilities of these valves in detail now; suffice to say that they open the way to the solution of two very big super-het problems. Another problem remains—that of second-channel interference. This can be solved by the use of a pre-selector circuit in combination with a number of ganged tuned circuits.

DO YOU KNOW—

THAT you should never alter the grid bias while a set is switched on? Switch off before moving the plug for otherwise, for an appreciable period of time, the power valve will be without grid bias while the plug is being moved. This may cause the anode current to rise to such an extent that the valve may be damaged.

THAT in some output units, consisting of a choke and condenser, there is distortion and loss of volume because the condenser used is not large enough? A 2-mfd. condenser is generally sufficient. If you are in doubt about your own condenser, connect another in parallel.

THAT metal shielding of mains transformers does not always prevent mains hum? Do not put parts too close together in your mains unit.

THAT if you suspect mains hum is being picked up by a transformer in a set it should temporarily be wired up with long leads so that it may be turned round and the position of its core with respect to other parts changed? A position may be found where there is no mains pick-up.

THAT with most modern sets an R.C. valve cannot be used as a detector, for it is too easily overloaded?

THAT in a moving-coil speaker, permanent or energised, rattle may be due to lowering of the magnetic field or to the moving coil chattering against the pole pieces?

"STRAIGHT" SETS

THE multi-mu screen-grid valve is going to play a big part, too, in "straight" receiving sets. This valve has three terrifically strong points. It enables you to eliminate distortion when a powerful near-by station is being received, it sounds the death-knell of cross-modulation troubles, and it provides facilities for first-rate volume control. We are going, I think, to see in straight sets less and less use made of reaction and more and more use made of genuine high-frequency amplification. Take the mains-operated sets. Valves and intervalve couplings have been brought to such a state of perfection that you really cannot employ usefully more than four stages. Two high-frequency amplifiers, a detector, and output stage will, in fact, give you everything that you want in the way of sensitiveness, selectivity, quality, and volume.

With a well-designed set made on these lines you simply cannot use reaction; what you want mainly is a volume control. This doesn't mean that you are limited to four valves. The output stage will probably contain two in push-pull, and in some cases the functions of the present detector valve are likely in the future to be split up between two valves. Both the grid-leak-and-condenser and the anode-bend detector magnify as well as detect. We may find it better in the future to use one valve which is a pure detector and another which takes on the amplifying functions of our present detectors.

BATTERY SETS

IN the past, battery sets have always been just a little behind those operated from the mains. I have given already the chief reasons why this is so; but I don't believe that in the near future the battery four-valver is going to be so much behind the mains four-valver as it has been in the past couple of years. We have now (I told you that it was coming along some time before it appeared), the battery multi-mu valve, and manufacturers are giving us battery tubes with performances that but a year or two ago would have seemed incredible. The battery set is going to catch up to a large extent in 1932, because the mains set has gone just about as far as it can, unless a miracle happens. Designers were, perhaps, a little inclined to devote their energies to the mains set in 1931; they are realising now that for some time to come battery sets must outnumber mains sets in this country

On Your Wavelength! (continued)

and that it behoves them to give the battery man something pretty good.

VALVES

WHAT exactly will be the effect of the 50-per-cent. duty on imported valves it is rather difficult to see at the moment. I don't think it is likely to lead to any increase in the price of the British-made article; in fact, it may lead to a reduction, since the bigger demand will open the way for large-scale mass production. The only wireless people who are likely to object to the duty are those who have invested in American sets, if these sets are of kinds which will work only with valves made in the U.S.A. These unfortunates will find that their replacements will cost them considerably more when the time comes to make renewals.

THE PITY OF IT

ONE reason why the Americans have sold a certain number of sets in this country is that our manufacturers have been so absolutely flooded with orders that in many cases they could not deliver the goods without a certain amount of delay. It is, of course, a pity that our people did not foresee the huge demand that there was going to be this autumn and take steps in time to meet it. One must remember, though, that the trade in wireless sets is to a considerable extent seasonal, reaching its peak in the winter and falling off a good deal in summer time. Makers do not like the idea of taking on big emergency staffs, only to have to turn them off when the demand begins to slacken. In this they are quite right, for it is eminently sound policy to give employment all the year round if possible.

I hope that next year new models will be put into production at much earlier dates. It was here that the trouble arose in 1931. Some makers showed models at Olympia just to see whether the public were likely to want them. The public showed in no unmistakable fashion that it did want them, but, since the factory arrangements had not been completed, full-scale production could not start for some little time. We want, I think, a bolder policy all round.

AMATEUR versus FACTORY SETS

AN American friend of mine, on a recent trip over here, is amazed at the great hold radio has on the home-constructor. He asks why we still *build* sets. Is it, he wants to know, because the factory products do not meet listeners' requirements? I told him I thought radio had enlisted the interest of a very considerable section of the British public that has always loved making things, more for the fun of making than for any material gain.

There is no such phenomenon in America, apparently, as the "handy man" of this country. That is why home-constructors ceased to be a considerable quantity as soon as the radio factories got down to the job of mass-production. According to my friend, no normal American listener would dream of building a set.

Personally, I do not think there is the slightest chance of the home-constructor deserting his hobby for the factory-built set. No, there is too much money invested in the component business to warrant any fears that ready-made sets are ousting the home-constructed sets. And it is still true to say, surely, that with the very rapid development of radio technique the amateur constructor can put himself at least a year ahead of the factory-set designer?

POINTS OF DIFFERENCE

AS one who has a great deal to do with both types of sets, amateur constructed and factory produced, I often notice points about the factory set that might well be taken advantage of by the discriminating amateur. For example, in most of the better class factory sets the control is much simplified by making one knob do several switching jobs.

This is particularly noticeable in mains sets, where the master switch is incorporated in either the volume control or the wavechange switching. I think there is much that might be done by enterprising component makers to simplify control by the production of volume-cum-master switches, or gramo-radio-wavechange switches.

It might be argued that the home constructor is a man who likes to fiddle with as many knobs as possible—that a multiplicity of knobs is part of his fun. But I think the average home-constructor has to think of the other members of the family who will operate the set, and on their account he would welcome combination knobs such as I have described.

METAL CHASSIS CONSTRUCTION

ONE of the most outstanding differences between the amateur- and factory-built sets lies in the use of metal chassis by the latter. A few advanced home-constructor sets, such as the recent "Star" series in AMATEUR WIRELESS, have been presented, but generally speaking the amateur sticks to the same old panel and baseboard. This is all very well in simple two- and three-valve sets with no high-frequency amplification, but for sets with ganged high-frequency stages there is everything to be said for the constructor who takes a leaf out of the manufacturers' book and constructs the set on a metal chassis with sub-chassis wiring.

INGRATITUDE

I NOTICE that in spite of the exceptionally fine weather we have been enjoying recently (touch wood!) nobody has written to the press to say that it is due to "all the wireless waves used for broadcasting." Yet there is quite as much justification for saying a kind word for wireless, in season, as there is for pitching into it when we happen to strike into a bad patch—meteorologically. Just as much or just as little, as you prefer—since there is absolutely no connection between the two in any case. It only goes to show how very one-sided some critics can be.

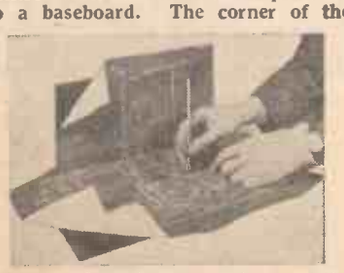
FADING

TALKING of the weather, have you noticed that fading has been pretty bad for the last few weeks? I don't know whether this is really due to climatic conditions, or whether it is a mere coincidence, but there you are. The modern high-powered H.F. valves give such a long reach that many listeners who once did not bother about long-distance reception are now tuning-in to the foreigners regularly every night. Incidentally, they are also learning, perhaps for the first time, what an unholy nuisance "fading" can be. However, there are ways and means of tackling the problem, the most helpful being the use of a variable-mu valve to give automatic volume control. THERMION.

On January 5 Sir Barry Jackson is to give the first of a series of broadcasts on "The Drama."

USING A SCRIBER

A scriber should be used to mark the centres from a full-size blueprint on to a baseboard. The corner of the



print may be cut away as shown at the bottom left-hand corner, so that the sheet can be made to coincide exactly with the board.

BASEBOARD MOUNTING

When the positions of the baseboard parts have been marked off from the

blueprint, the parts can be screwed down. It is advisable to start the holes in the wood with a small bradawl.

Why Band-passing is Best

Just now, when several rival systems of tuning are being discussed by radio engineers, the outstanding advantages of band-pass tuning for good quality selectivity without loss of volume deserve emphasising. This article by our popular contributor, "Hotspot" is the sixteenth in a complete series on "The How and Why of Tuning"

IN the preceding few articles I have discussed the theory of band-passing for aerial-tuning circuits. At this stage in the series, I think it is opportune to consider the claims of band-passing in relation to rival and, to my mind, less effective systems.

To gain a fair picture we must examine critically the different circuits available. Shall we start with the simplest aerial tuning circuit in use? This is shown by Fig. 1. It comprises a single tuned circuit used to the best possible advantage. For one thing, the coil, which may be a solenoid or a plug-in type of inductance, is tapped. The aerial is not connected to the grid end of the coil, but to a point towards the earth end. This reduces the damping effect of the aerial on the tuning circuit as a whole, and thereby increases selectivity.

Another refinement included in the Fig. 1 circuit is a series aerial condenser, which serves still further to reduce the aerial damping, and as this control is variable it follows that selectivity can be varied. There is a limit to the permissible amount of selectivity that can be obtained by this circuit. If the aerial condenser is reduced in capacity too much, the selectivity will be obtained only by a great sacrifice of sensitivity.

That is to say, when made really selective the Fig. 1 circuit defeats its object. For, obviously, there is little point in making the circuit selective if there is nothing but the local to select—and that is what happens. Another snag of making the Fig. 1 circuit very selective, quite apart from loss of volume, relates to the quality. As I have many times mentioned in this series, if a single circuit is made very selective, by reducing its resistance, as by applying considerable reaction, the side bands accompanying the station's carrier wave are reduced in strength, and this means loss of high notes.

Nevertheless, the Fig. 1 circuit is being advocated by responsible engineers as a possible solution of the selectivity problem. It is being suggested that if reaction is fully applied to a very low-loss tuning coil the necessary knife-edge degree of selectivity for modern requirements can be obtained. And that the consequent loss of the side-band frequencies can be made up after detection, by including a filter device designed to accentuate the high notes, thereby restoring the balance of tone.

The future of this system is still problematical, but there is no denying its great attractions—simplicity and cheapness. The difficulty at the moment seems to be twofold; firstly, the reaction systems of the existing type are not suitable, and secondly, the tone-correction device is not really well developed.

Coming back to immediately practicable systems, we can make a passing reference to Fig. 2, which shows the orthodox circuit for selective tuning, namely, two separate tuned circuits coupled together by their mutual inductance. Good selectivity, good quality, and little loss of volume—such are the possibilities of the circuit. Then why is it not used? The answer is very simple. There is no end to the degrees of coupling, and the great interaction between the two circuits causes a lot of confusion when a station is tuned in, owing to the variety of combinations of dial settings that will tune to the station. The Fig. 2 circuit is altogether too unwieldy for ordinary listeners' use.

We pass on to Fig. 3, which is

(*Continued on page 25*)

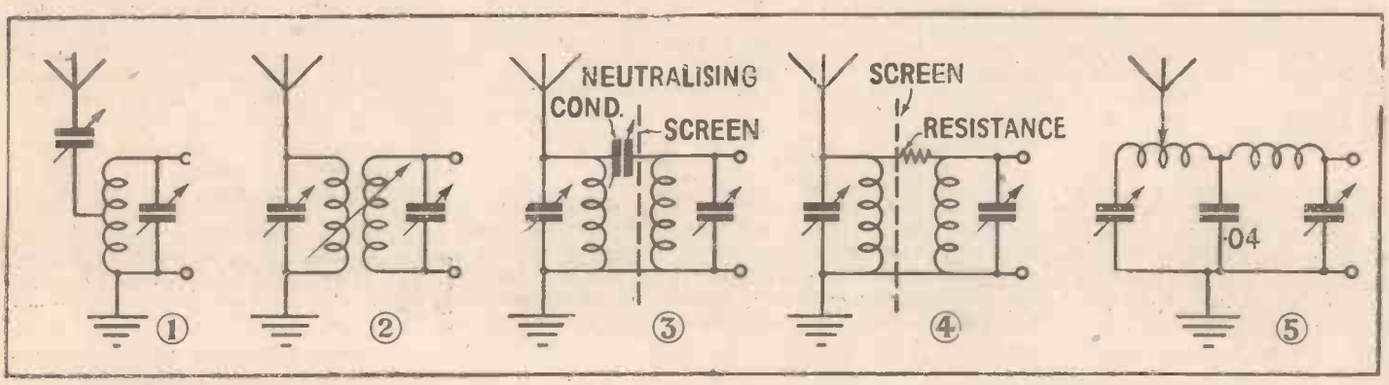


Fig. 1.—Simplest selective single-tuning circuit. Fig. 2.—Old-fashioned loose-coupled circuit, which can be made very selective under the right coupling conditions. Fig. 3.—Capacity-coupled externally-tuned circuit, as advocated by the B.B.C. for unselective sets. Fig. 4.—Two tuned circuits coupled by means of a resistance, giving good selectivity, but with loss of volume and quality. Fig. 5.—Modern band-pass coupling, whereby two tuned circuits are coupled by their mutual inductance and a non-inductive fixed condenser, giving excellent selectivity, without loss of quality and with very little loss of volume

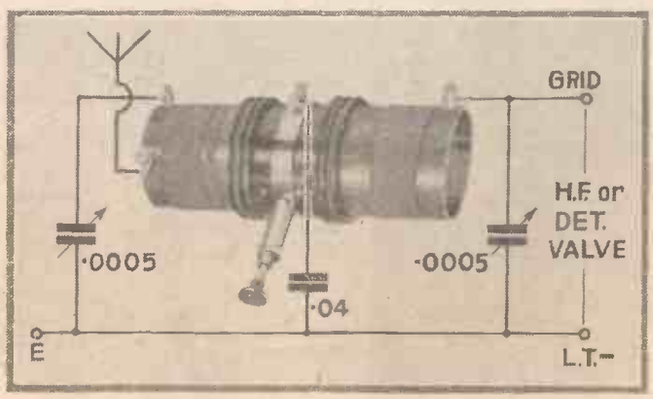


Fig. 6.—This pictorial diagram shows how simple are the external connections of the Varley band-pass coil, which employs the Fig. 5 circuit

What 1931 Gave us —and How About 1932?

By MORTON BARR

WIRELESS is still at the stage where each successive year produces some development or other which tends to make last year's practice look a bit old-fashioned. This may, perhaps, be a drawback from certain points of view; but, on the whole it is a sure sign of healthy progress. From a broad point of view, last year seems to be marked out by intensive developments in the use of high-frequency amplification.

The ether was never so crowded with good things as it is now, but it has never before been so difficult to pick and choose between them. The response of the designers to this problem of selectivity has been to develop new ways and means of improving the high-frequency side of the receiver. Here they have been helped enormously by the introduction of new valves of exceptional power and efficiency with amplification factors measured by the thousand instead of in tens of hundreds.

Band-pass Tuning

With plenty of power in hand, it is possible to use selective circuits of rather more complexity than usual—e.g., band-pass tuning—seeing that any resulting loss of energy can always be made good. For the same reason, reaction has gone completely out of fashion as a means of increasing selectivity. Most modern receivers are of the straight-circuit type, with a chain of inductances and capacities forming a band-pass input to the first valve. In some cases a similar filter circuit is used to couple the H.F. stages together.

The use of the band or filter type of circuit to pre-select the desired signal is preferable to ordinary razor-edge tuning, because it combines reasonable selectivity with good quality. Razor-edge tuning will certainly give all the selectivity that can be desired, but it tends to overshoot the mark by cutting the side-bands of the incoming signal so severely as to strip away much of its "musical" quality.

A band-pass filter, on the other hand, admits both the carrier wave and the side-bands of any desired station, though it excludes any interfering station. That is to say, it will exclude any other station which keeps outside the 9-kilocycle spacing recommended by the International Broadcast Commission.

Unfortunately, the "spacing" rule is not always observed by the different European transmitters, in which case it is practically impossible to prevent overlap.

Constant Amplification

Another tuning problem on which considerable work has been done is that of maintaining a constant degree of amplification at all settings of the tuning dial. Whenever an ordinary tuned circuit is used either as an input to a valve, or as an intervalve coupling, there is a tendency to favour the shorter wavelengths as compared with the long ones, owing to the change in the inductance-capacity ratio as one tunes down the scale.

This tendency is well known to the designer, and in practice he generally compromises by deliberately designing a dual-range set, so that it is just stable on the medium-wave setting, although he knows that this inevitably means a certain loss of sensitivity on the long-wave side of the switch.

Any such sacrifice can be avoided by the so-called constant-coupling principle, where energy is transferred from one circuit to another, partly by capacity coupling and partly by magnetic coupling. In a mixed coupling of this type the natural tendency of the condenser to transfer more energy on the shorter wavelengths and less on the longer is offset by the opposite tendency of the inductive coupling. The two opposite effects counterbalance so as to ensure a constant transfer at all wavelengths.

A rough-and-ready method of securing much the same result is to fix the tuning of the primary circuit at, say, 600 metres when the switch is on the 200-550-metre side. Then as the secondary is tuned to any desired station, the natural tendency to increased amplification on the shorter waves is again offset by the fact that as one moves down the scale the fixed primary gets more and more "off tune," and so serves to cut down excessive energy on a short-wave setting, and prevent any tendency to oscillate that might otherwise arise.

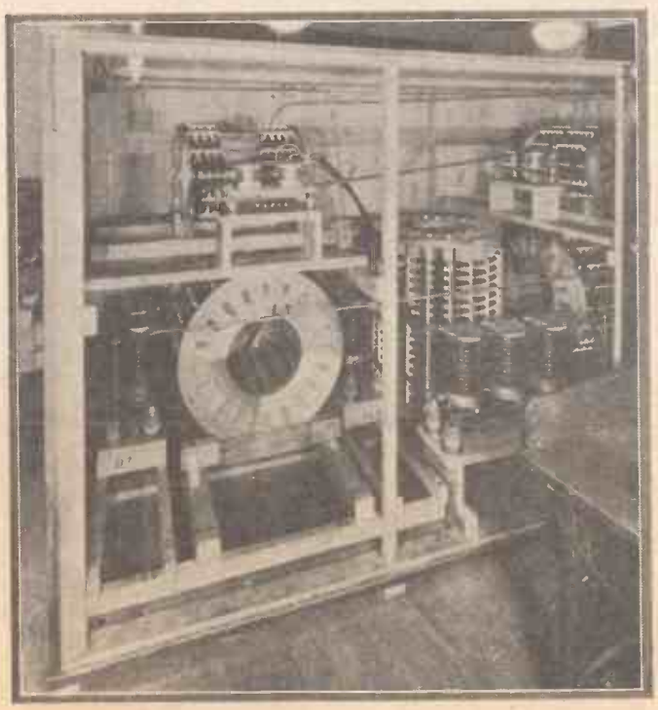
Variable-mu Valves

The appearance last year of a new type of valve, with very unusual properties, marks an event of far-reaching importance. The ordinary S.G. amplifier has a high amplification factor—in some cases as high as 1,500—which keeps constant within fairly narrow limits. The result is that it becomes difficult to keep the loud-speaker volume within bounds when one changes over, say, from a distant station to the local B.B.C. transmitter.

In the new variable-mu valve the ampli-

(*Continued on page* 30)

TWO BROADCASTS ON ONE AERIAL



The filter end of a novel high-power broadcaster evolved by the Bell Telephone Laboratories, by which two programmes can be put out on one aerial. The filter deals with a power of 24 kilowatts and is working at the Bradley, Maine, station, U.S.A.

OUR BROADCAST CRITIC TALKS ABOUT—B.B.C. ORCHESTRA

SURELY it may be said without much fear of contradiction that one of the essentials to satisfactory broadcasts is adherence to the true pitch.

I have grumbled a good deal about some of our broadcast singers in this respect; I now wish to direct the attention of the B.B.C. to the fact that the Symphony Orchestra, supposed to be the finest in existence, is playing out of tune.

I hasten to qualify that statement; emphatically, I do *not* mean the strings. That part of the band is most satisfactory. On the other hand, there has been so much out-of-tune playing in the wood-wind and brass recently that it is high time something was said about it.

There is a tendency in these days for conductors to pass over this grave fault. At rehearsals, if a violin runs off the rails there is a storm at once; yet a horn or a bassoon can miss the pitch by feet and nothing is said. Why? For the life of me, I cannot see any reason for it.

At all events, in my opinion, the intonation of the wind in the B.B.C. Symphony Orchestra is by no means safe, and I want something done about it before it gets worse. Intonation, like Caesar's wife, *must* be above suspicion.

◆ ◆ ◆

Before leaving the subject of the symphony concert I should like to say how I enjoyed the 'cello playing of Antoni Sala; I only wish he had played something more interesting than the Schumann concerto.

◆ ◆ ◆

The Monday-night vaudeville was really good. I thought Elsie Otley sang her songs well, the last of which was quite interesting musically.

Ronald Frankau and his Frankau Optimists gave us a splendid performance. Their matter is so good. Personally, I consider and criticise all these things from the point of view of their originality and general make-up. As far as I can see, it is the only way, because there is so much that lacks originality.

The burlesque on *Cinderella* was really clever; the adenoidal Prince appealed to me as being very funny indeed.

The imitations of well-known actors and actresses have been a trifle overdone lately; even so, when they are as well done as Ernest Shannon and Janet Joye do them, there is little room for complaint. I thought Miss Joye overdid Sybil Thorndyke, all the same. The acme of good imitation is, surely, to imitate; not to present in an exaggerated form.

I think that is a very important point and one that should be realised by broadcasters who give us this form of entertainment. They should remember that *we all know* these actors and actresses, and that we are not slow to recognise an *exact* imitation. We all appreciate the difference between, say, Harry Tate and George Graves; we do not require those differences to be made *quite* so apparent.

Leonard Henry is one of those delightful beings whose foolery is of such an order that he is really, in the highest sense, a "perfect" fool.

◆ ◆ ◆

As soon as he finished, weak from laughing as I was, I switched into the Regional without looking at the programme first. It required an effort on my part to pull myself together sufficiently to listen to what I found to be a broadcast of the Leeds Philharmonic Society's concert (*Messiah*, Part II).

I picked up the beginning of the bass aria "Why do the Heathen so Furiously rage?" Turning to the programme, I was a little surprised to see Norman Allin's name down; it did not seem like him, somehow. Subsequently, I heard that it was Harold Williams and that the change had been announced, presumably while I was laughing at Leonard Henry.

At all events, whether it was either or neither of them, may I congratulate the singer on his fine and spirited rendering of that aria; also of "The Trumpet Shall Sound." Here I must also pay my humble tribute to the fine trumpeting of John Paley, who played magnificently.

Ben Welden as our cartoonist sees him

I enjoyed the soprano—Isobel Baillie, according to the programme—and also Frank Titterton, whom I recognised immediately. As I have recently heard several performances of different parts of *The Messiah*—broadcast and otherwise—all of which have been distinctly poor, I should like to record a word of gratitude and thanks to Dr. Bairstow, the conductor, for his animated rendering of that animated work. The chorus was splendid. It was real Handel.

◆ ◆ ◆

Thinking of Norman Allin, there was no doubt about him in *Der Rosenkavalier*; he was Baron Orchs all right. And a very fine baronial performance he gave. I heard every word, which is exceptional in opera, and all the way from Birmingham, too! There are few operas better suited to broadcasting than that one.

◆ ◆ ◆

There was a good vaudeville in the other programme that night; the sketch was quite acceptable. Gillie Potter was well up to form; I thoroughly enjoyed him.

◆ ◆ ◆

I listened with great interest to Harold Nicolson summing up the series of talks on literature. I think these series must appeal widely to those who are not devoted to music. That is where I think the B.B.C. surpasses the general run of foreign programmes.

◆ ◆ ◆

What did you think of *Yes, and Back Again*? I think there is room for an occasional broadcast of this type, though I can imagine that a good many people would not have patience to listen to it.

◆ ◆ ◆

The European Concert from Brussels was a decided success; I wish we had more of such things. The singer, Berthe Briffaux, was quite unknown to me, but I liked her very much.

◆ ◆ ◆

If there are any lowbrows who wish to learn to raise their brows sufficiently to enjoy something worth while, they should watch for the next broadcast of Cesar Franck's "Symphony in D Minor." Please note its name and look out for it. There is a tune in that symphony that might well be played in heaven.

I am going to ask for that superb work to be included in a Sunday night broadcast as soon as convenient. When I see it coming I shall collect a few personal friends who professedly do not care for any thing better than the dance bands, *and watch the result*. WHITAKER-WILSON.

EASY W MODER YOUR

Some Practical Suggestions for

ALTHOUGH there is apparently an endless stream of new set designs for the amateur constructor, it is obviously impossible to build them all. Nor is there any particular point in such a procedure, for every set is not necessarily better than its predecessor. More than likely the average amateur waits until a design comes along that suits his particular requirements regarding price and performance and then he builds the set for the season. But, supposing he does this, there is every possibility that by the end of the season the set is somewhat behind the times—so rapidly does radio technique progress.

This article has therefore been compiled for the benefit of constructors who feel that their existing sets, while too good to scrap, might well be modified to incorporate some of the latest improvements. Naturally, all the suggested improvements will not be applicable to every set, but there can be few sets of a year's standing that will not benefit from one or other of the proposed modifications.

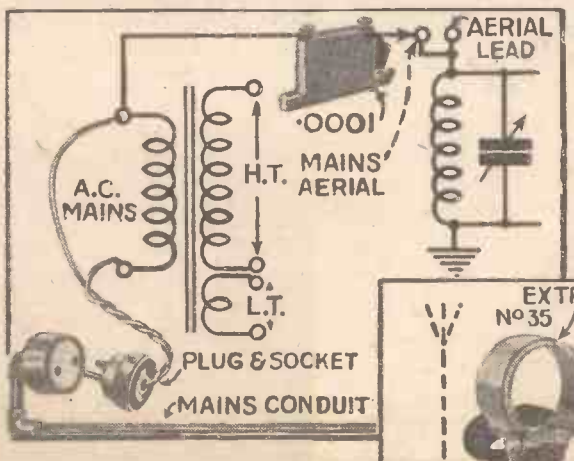
The Aerial System

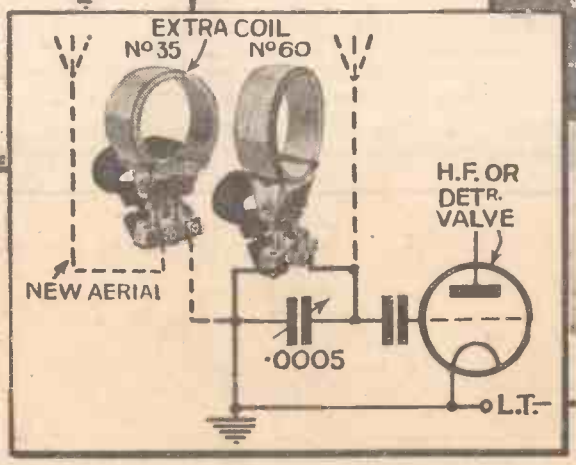
Let us make a start with the aerial system. Are you quite sure your present arrangement is the most suitable for your needs—and for your set? If it is a small set, say a two-valver, used for the reception of a station that is 20 miles or more distant, there is every reason why you should use the best possible outside aerial. Make it a wire of not less than 80 feet total length, and keep the down lead as far away from the wall as possible up to the point of entry into the house.

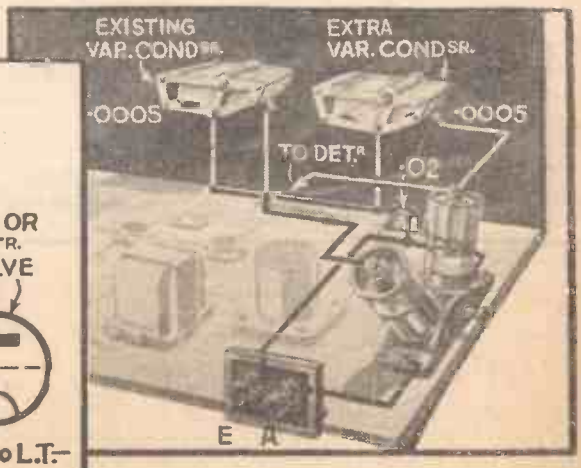
If, on the other hand, such a set is worked close to a broadcasting station, say 5 to 10 miles distant, it is advisable to use only a short wire for the aerial, not more than 50 feet total length. A longer wire is not needed to give loud-speaker strength and if a longer aerial is used you will have trouble in separating the alternative programmes.

The question of indoor versus outdoor aerials is still widely debated. For local-station reception an indoor aerial is usually recommended, but there is one point not often remembered. If the situation is such that electrical interference is bad, the outdoor aerial is preferable. For then the ratio of received signal to local interference is increased, and so some relief from the annoyance of machinery crackles and the like is abated. This advice is particularly valuable to those with big sets using small aerials and marred by local interference. Such sets have enough inherent selectivity to enable them to separate the locals from the foreigners when a fairly big aerial is being used.

The ordinary set does not lend itself to the use of a frame aerial. This type of collector is the least efficient and is rapidly losing favour, even for super-het sets. It

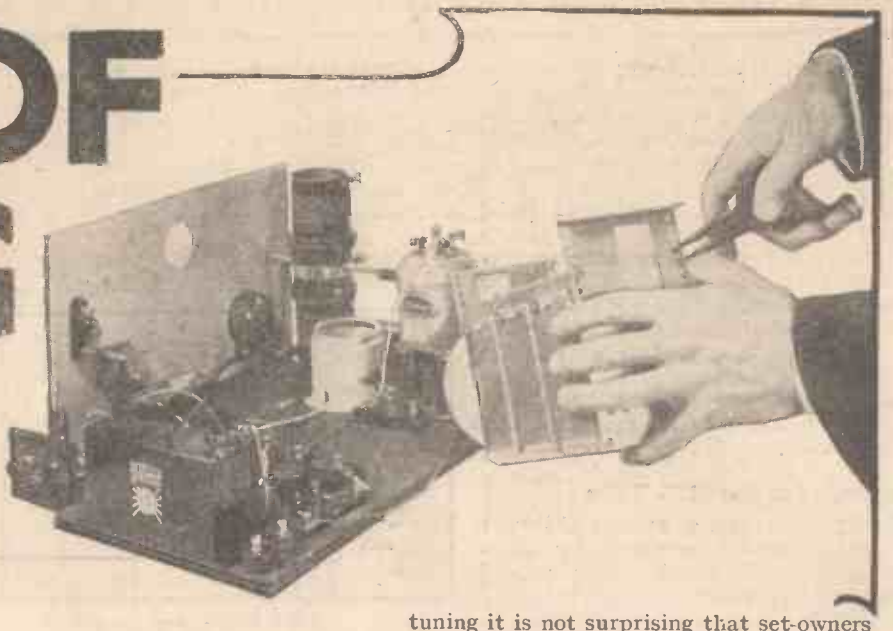






(Left) The essential connections for a mains aerial. (Centre) How an aperiodic aerial coil can be added. (Right) An extra variable condenser added to the panel for use with a band-pass coil

VAYS OF NISING R SET



Bringing Old Sets Up-to-Date.

has been found that for such sets a short length of external wire is much more convenient than a frame, and is certainly much less unsightly.

There is one important aerial development that might be more widely adopted, and that is the mains aerial. On most of the factory-built sets of this season there is a mains-aerial terminal, and most owners of such sets have been surprised how well the device works. It consists of nothing more than a small fixed condenser in series with the aerial terminal of the set and one of the mains leads. In this simple way the conduit of the house supply is utilised as collector of wireless waves, and its somewhat heavy damping is reduced by the series condenser.

There is nothing to prevent the owner of a home-made A.C.-mains set from adopting the system. All that is needed is a good-quality .0001-microfarad fixed condenser. On a three-valver the mains aerial will give the home stations at full loud-speaker strength, as well as a half a dozen or so of the more powerful foreign stations.

Aerial Tuning Developments

Because of the increasing amount of interference between European stations a great deal of work has been done to improve the selectivity of the set at the input—namely, at the aerial-tuning circuit. Old single-circuit tuners being useless for modern conditions, many devices have been produced to sharpen tuning without undue complication.

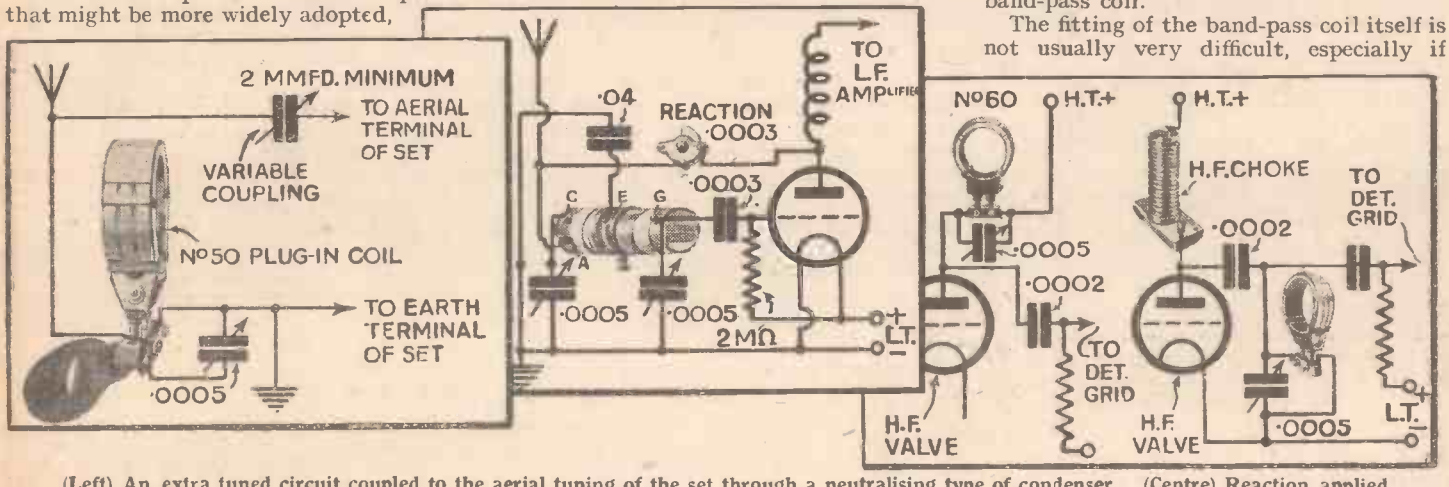
Wavetraps have been more or less abandoned as a means of making simple sets selective. The more scientific plan is to make the tuning more selective over all the wavelengths covered, and the only way to do this is by adding another circuit. Plug-in-coil sets readily lend themselves to treatment, for it is quite easy to add an untuned or aperiodic coil, which will improve selectivity without adding to the tuning controls.

With so much talk about band-pass tuning it is not surprising that set-owners without this improvement are constantly asking for the simplest way of incorporating it. The whole trouble lies in the need for two tuning condensers. Often the panel layout of a set not fitted with band-pass tuning does not permit space for an extra condenser to tune the second half of the band-pass coil.

The fitting of the band-pass coil itself is not usually very difficult, especially if one of the simple inductively-coupled coils is used, such as the Lewcos or Varley. There is no need to have a two-gang condenser to tune the band-pass coil, although for ease of operation such a condenser is obviously desirable.

A form of band-pass tuning that is well worth considering by those with unselective aerial tuning circuits comprises an externally connected coil and condenser coupled to the internal tuning circuit through a small variable capacity, such as a "neutrodyne" condenser. A plug-in coil, No. 60, with a .0005-microfarad variable condenser, will make a good external tuner, and will greatly increase the selectivity of sets fitted with simple single-circuit tuning devices.

To maintain the selectivity of such a



(Left) An extra tuned circuit coupled to the aerial tuning of the set through a neutralising type of condenser. (Centre) Reaction applied to an aerial band-pass coil by connecting reaction condenser between anode and aerial. (Right) Tuned-anode coupling on the left may easily be altered to tuned-grid coupling, as on the right, by the addition of a choke and coupling condenser

"EASY WAYS OF MODERNISING YOUR SET"

(*Continued from preceding page*)

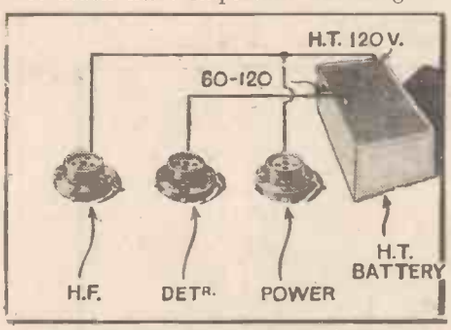
coupled circuit it is necessary to alter the coupling capacity once or perhaps twice, during the exploration of the whole wavelength range. Of course, both the external and internal tuning circuits must be adjusted for every station received.

The application of reaction to aerial band-pass tuning circuits is not always easily seen. Some band-pass coils are now provided with a reaction winding on the secondary section, but for plain band-pass coils used in sets where the first valve is the detector, it is a good plan to obtain the desired reaction through a .0003-microfarad variable condenser connected between the anode of the detector and the aerial lead of the set.

Couplings for the H.F. Valve

During the past few months the most popular system of coupling for high-frequency valves has undoubtedly proved to be the parallel-fed tuned-grid system. This provides better selectivity as a rule than the once-popular tuned-anode coupling. There are other advantages. For one thing the variable condenser in tuned-anode coupling is not at earth potential, and if there is a short circuit between the fixed and moving plates, damage may be done to the power supply.

A much more important advantage of



Separate high tension for the detector valve will ensure smooth reaction and a better chance of hearing foreign stations

tuned-grid coupling is that the tuning circuit is very similar in character and in the loading to the aerial tuning, and ganging is therefore simplified. In fact, it is due to its ganging advantage that tuned-grid is ousting tuned-anode.

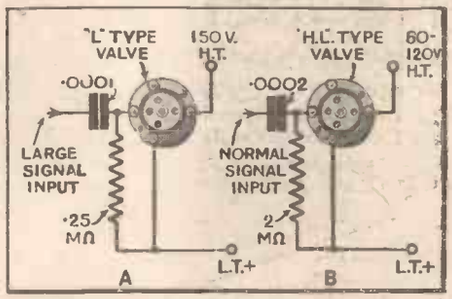
Many sets can be easily converted from tuned-anode to tuned-grid with very little structural alteration. The same coil and condenser will do and the only extras are a .0002-microfarad coupling condenser and a good high-frequency choke.

As one of the diagrams shows, the choke is connected in the anode circuit of the high-frequency valve and the signals developed across the anode end of the choke are transferred to the detector-grid tuning circuit through the coupling condenser. The usual grid leak and condenser are needed for the detector, as the coupling condenser has nothing to do with the detection process, serving as it does the dual function of preventing the high-tension supply from being shorted through the parallel tuning circuit and of passing on the signal voltage from the anode of the high-frequency valve.

If a tapped tuning coil is used, still further selectivity can be obtained by connecting the detector side of the coupling condenser to the tap instead of to the grid end of the coil, as shown.

Those Detector Values

Modern technique favours the grid-leak

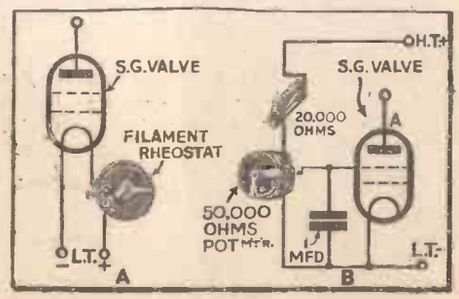


Power-grid detection values are shown on the left and suitable values for normal grid detection are shown on the right

and condenser type of detection for good quality and sensitivity. The anode-bend system of detection, never very highly esteemed except by cranks, is seldom used in present-day sets. The use of grid-leak rectification entails a careful choice of values for the grid leak and for the grid condenser if distortion is to be avoided.

For the average battery-operated set the standard value of the condenser, which may be taken as .0003-microfarad, is on the high side, and might usefully be cut down to .0002 or even .0001 microfarad. The last-named value is accepted as being most suitable for the so-called power-grid detection, which is normal detection adjusted to accept a large signal input and to hand on appreciable power to the succeeding valve.

With a .0001-microfarad fixed condenser and a .25-megohm grid leak, power-grid detection will not necessarily be obtained. To achieve such detection requires a fairly low impedance valve with the maximum high-tension supply on its anode. These values with an "L"-type valve and 150 volts high-tension on the anode provide the right conditions for power-grid detection, but unless a large signal is applied to the grid, as by the reception of the local



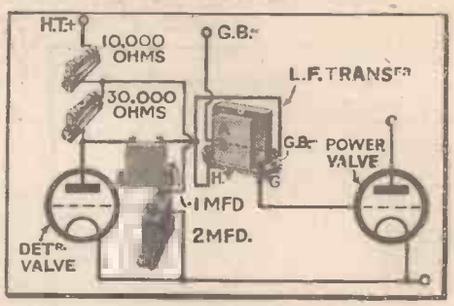
A rheostat in the screen-grid filament circuit will serve as a volume control, as shown on the left. A better method is to use a screen-grid potentiometer, as shown on the right

station or the reception of a distant station through several stages of high-frequency amplification, distortion will be produced. It is clear that power-grid detection is not without its dangers.

There is still another point about the system. I refer to the fact that, if a sufficiently large signal is applied to the grid to obviate distortion, the subsequent amplification, even through one stage, will result in a signal of an amplitude that must be dealt with by a super-power valve.

For normal requirements, as in a three-valver comprising one high-frequency amplifier, a detector, and a pentode or small power valve, working from batteries, I am inclined to suggest that the best compromise is an HL type of valve with a grid condenser of .0002-microfarad capacity and a grid leak of 1 or 2 megohms resistance.

Just one further point about the high-tension supply for the detector. It is a fact that for the best quality of reproduction the maximum anode voltage should be applied to the detector. But for the reception of more distant stations, involving a careful application of reaction, it is desirable, in order to give smooth reaction, to lower the detector anode volts, sometimes to as low a value as 60 volts.



Proper decoupling in the anode circuit of a parallel-fed transformer coupling will often improve results by avoiding all possibility of "motor boating"

If your existing set has a common high-tension supply terminal for the positive connection, it is a good plan, if reaction is ploppy, to break the detector lead and so provide a separate detector voltage.

Controlling the Volume

From the point of view of selectivity it is most important to provide an effective means of controlling the volume at the input. The old idea of allowing the full signal voltage to reach the low-frequency stage before attempting to diminish its intensity has given way to the much more rational way of cutting down the signal before it is amplified and detected. There are many sets in use to-day that would be much more easily able to separate stations if some form of predetector volume-control were fitted.

With a screen-grid valve two ways are available. The simpler is to use a filament resistance in the screen-grid valve stage. This has the advantage of cheapness, but there are one or two drawbacks. As the

(*Continued on page 20*)

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Weekly Hints—Constructional & Theoretical

By W. JAMES

Pick-up Control

I HAVE just had an opportunity of testing a new pick-up, and had brought home to me again the fact that it may be better to use a fairly low resistance potentiometer as the volume control.

Tests showed that it was much better to use a potentiometer of 25,000 ohms than one of 100,000 ohms. The point is, I think, that the higher notes are relatively too strong and in using a low-resistance potentiometer we reduce their strength. The output of the higher notes falls as the resistance is reduced.

At one time we used always to fit a volume control of at least 100,000 ohms and perhaps of 250,000 ohms. With some present-day pick-ups, however, the results are definitely better when the potentiometer has a fairly low resistance, even down to 10,000 ohms.

A resistance of so low a value is an appreciable load and reduces the output, but this is beneficial in many instances. Some pick-ups give a volt or more and this is too much unless the magnification is reduced in proportion.

Simple Mathematics!

Some amateurs still have difficulty in deciding upon suitable values of dropping resistances for a set.

In practice, you find the current to be passed and the voltage to be dropped. Then the resistance required is found by dividing the voltage by the current. Thus if the voltage is 50 and the current is 5 milliamperes, the resistance required is 10,000 ohms.

The point to note here is that the voltage being expressed in volts and the current in milliamperes, the result must be multiplied by 1,000. The value of the current required is usually obtained from the characteristic curve of the valve. Thus, if the valve is to have 100 volts and the current then passing is to be 5 milliamperes and we have a supply of 150 volts, the voltage drop in the resistance must be 50 at 5 milliamperes.

This is worked out above. If you had to drop 50 volts at 2 milliamperes the resistance would be one of 25,000 ohms. For a drop of 25 volts at 10 milliamperes the resistance must be of 2,500 ohms. In grid-bias circuits the drop required may be 20, with a current of 20 milliamperes. In this example the correct resistance is one of 1,000 ohms.

Controlling the Tone

The right place to fit a tone-control is in the detector circuit. If we connect it here we make sure that the last valve has supplied to it only the useful range of frequencies and in the correct proportion in regard to voltages.

Many people add a tone control to the last valve and it seems to work satisfactorily. This may be the easiest place to add a control to a finished set, but it is not the best. The last valve may easily be overworked by the voltages having the frequencies reduced in the anode circuit by the control.

In many cases the higher frequencies are cut down, as in pentode circuits. When a filter is added to the anode circuit the tone is corrected, but the valve is dealing with signals unnecessarily.

If a suitable control had been fitted to the detector circuit the higher frequencies would have been reduced in strength at this point in the circuit and the last valve would not have had to deal with them.

A filter consisting of a resistance in series with a condenser may be fitted in the detector circuit for the purpose of reducing the high notes. This should be in addition to the usual high-frequency by-pass. The filter can be connected across the primary of the transformer.

The site of the new 75-kilowatt Munich transmitter has been definitely fixed at Erdinger Moor and work has started on the construction of the buildings. The plant will be so designed that when necessary its power can be increased at short notice to 150 kilowatts.

"EASY WAYS OF MODERNISING YOUR SET"

(*Continued from page 18*)

filament is dimmed there is a time lag in the reduction of volume, especially with screen-grid valves using fairly thick filaments, between .15 and .2 ampere. Then with this system of screen-grid volume control there is danger of distortion, since the reduction in the filament emission tends to upset the valve's characteristics.

A much better way of controlling the volume at the screen-grid stage, and this is the way most of the latest sets are worked, is to vary the voltage applied to the screening grid. In this way the sensitivity and consequently the over-all volume is finely controlled without time lag or noticeable distortion. It must be admitted that this way is more expensive, as a potentiometer costs 5s. or 6s. compared with the few pence for a rheostat. Still, the results more than justify the outlay, and I advise all readers with screen-grid sets not fitted with a volume control to adopt it.

One of the most effective advances made in the cause of increased sensitivity relates to reaction circuits. Many existing sets would be the better for a slight addition to the reaction connections—namely, a .0001-microfarad fixed condenser between the anode of the detector and earth. This additional condenser often makes all the difference between indifferent and effective reaction. It serves to by-pass high-frequency current to earth. This is particularly necessary when minimum reaction is being applied, for with the old-style reaction circuit this condition implied very poor high-frequency by-passing.

Differential Reaction

To combine the functions of the normal reaction condenser and the .0001-microfarad by-pass condenser it is possible to use a differential reaction condenser, but this is not likely to appeal to the set modifier so much as buying a small fixed condenser.

Many commercial and amateur sets are now using the parallel-feed method of coupling the power valve to the detector. This system has the advantage of getting the best from a transformer with a nickel-alloy core, but its use would be more general if a logical method of de-coupling were more widely adopted.

L.F. Amplifier Improvement

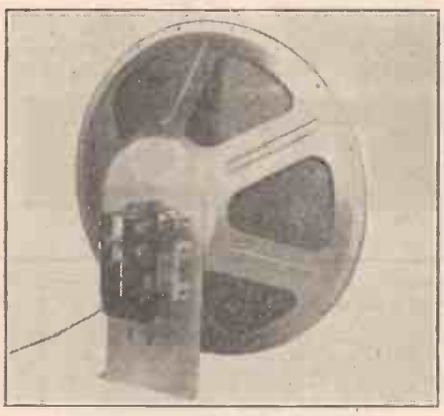
The circuit comprises an anode resistance and a fixed condenser coupling the anode to the primary of the low-frequency transformer. As a rule, no attempt is made to de-couple the anode circuit, which is a pity, because the rise in the impedance of the primary of the transformer resulting from the dissociation of the winding from the direct anode current often leads to incipient "motor boating," which could be prevented with a de-coupling resistance and condenser.

Those using small transformers in the normal way would probably get improved results from the adoption of parallel feed, and those using this system in the generally recommended way might like to try the effect of the de-coupling addition shown by the diagram.

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

Undy 8-pole Speaker

ONE of the best moving iron loud-speaker chassis which we have tested recently is the Undy 8-pole dynamic. This speaker is provided with a large paper diaphragm 13½ in. in diameter and approximately 4½ in. deep, which is suspended by a ring of felt-like material from a very substantial copper-finished metal chassis. On the back of the chassis



Undy eight-pole dynamic speaker

is bolted a plate which carries the operating unit, and which also acts as a support for the speaker, thus enabling it to stand quite rigidly by itself.

The unit which is of the balanced-armature type is strongly designed. Two large U-shaped permanent magnets are employed being fixed about ½-in. apart, the laminated pole pieces being located between them. The armature, which is pivoted at the centre, is adjustable for position between the poles thus enabling the best results to be obtained. The operating coils are tapped to give a range of input impedances, thus ensuring that the speaker shall be matched to output valve of the receiver in use, and that, therefore, the maximum power output and best quality shall be obtained. For best results, of course, the speaker must be mounted behind a substantial baffle board or in some non-resonant cabinet.

On test, the results were excellent for this class of speaker, the frequency response appearing uniform from 100 to 4,000 cycles per second. The sensitivity was also good, but at the same time the speaker was capable of handling large inputs without any signs of the armature rattling against the pole pieces. The overall dimensions of the speaker are 15½ in. in diameter and approximately 8 in. deep. The retail price for the complete chassis is 50s., and 28s. for the unit alone. This represents good value, and the speaker can be recommended.

Bulgin Twin Fuse

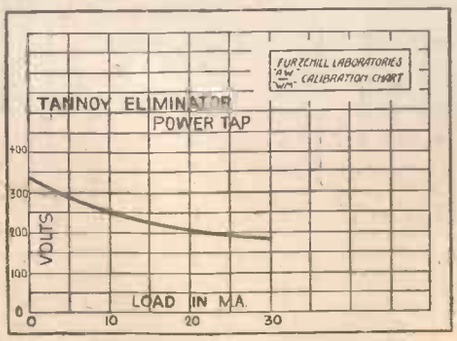
IN these days of mains receivers using high anode voltages some kind of safety device in the nature of a fuse is essential in every receiver. Most commercial made receivers do include some such device, but this is probably far from true in amateur-made apparatus. Even in the more modest battery-driven receivers the provision of a fuse is by no means a useless expense as most readers will probably confirm, having at some time or other had that annoying and costly experience of burning out one or more valves due to the H.T. leads coming into contact with the L.T. circuit.

The Bulgin baseboard-mounting twin fuse holder which we are reviewing this week, is made of moulded bakelite of mottled green colour. A cover, also of bakelite, is provided, so that when in use the fuses and the necessary connections are completely insulated. The holder carries two fuses of the tubular type, which are separated in the holder by means of a bakelite bridge piece between them.

The fuses, which are rated to blow on a 50 per cent. overload, can be obtained, having carrying capacities from 250 milliamperes to 3 amperes. The device retails at 2s. 6d. complete, with two fuses, spare fuses being 6d. each.

Tannoy GB3 Unit

A VERY interesting eliminator which we have tested this week is the Tannoy Model GB3. This eliminator has



Output of the Tannoy unit tested

been designed to supply receivers requiring up to 30 milliamperes in the power stage, and is suitable for use on supplies of 200/250 volts A.C., the primary of the transformer being tapped to allow for the different voltages.

Three high-tension outputs are provided, one suitable for the screen grid, another for the detector, and a third rated at 150 volts 28 milliamperes to supply the power stage. In addition to the above, tappings for three grid-bias voltages and a trickle-charging arrangement are provided, this latter being brought into service by the operation of a switch which cuts off the other voltages.

All voltage outputs are decoupled, and it is interesting to see one of the new small T.C.C. electrolytic condensers in the grid-bias circuits. The H.T. supply circuits

The Tannoy GB3 H.T. unit

are of conventional design, the voltage doubler arrangement being used. A bridge-type rectifier is used for the grid-bias circuits, this same rectifier being used for the trickle-charging arrangement. It will be understood from the above that the grid-bias voltages are sensibly independent of load on the high-tension circuits. Westinghouse metal rectifying units are employed.

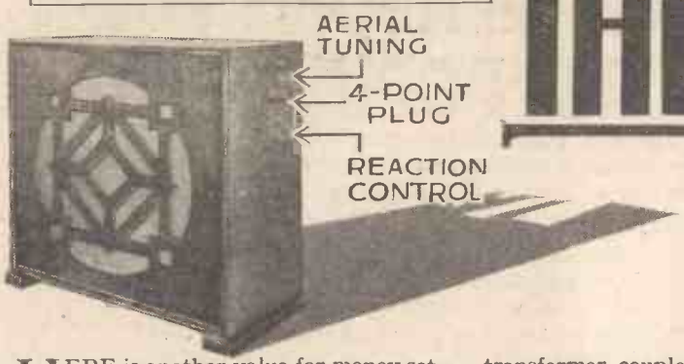
The eliminator is housed in a crackle-finished case, the control switch being mounted on the top, while the plugs and sockets are accommodated on an ebonite panel at one end of the unit. The unit was tested on 240-volts A.C. 50 cycles, and the results were satisfactory, the actual voltages obtained being slightly higher than the rated values. With a load of 28 milliamperes the power-tap voltage was 186, while the screen-grid tap gave .6 milliamperes at 50 volts, and the detector tap 2 milliamperes at 84 volts.

The variation of the voltage with load on the power tap, a full load being meanwhile maintained on the other taps, is shown on the accompanying curve, which should be carefully studied if the load from the power tap is less than 25 or 30 milliamperes as the voltage will be rather higher than the normal value.

The voltages obtained on the three grid-bias taps were 2, 5½ and 16 volts respectively; these values are normal and should suit most requirements.

SETS OF DISTINCTION

THE SUPER TWO



Makers: Hustler Simpson & Webb Ltd.
Price 4 Guineas.

HERE is another value-for-money set—a table cabinet two-valver, housed in a good-looking oak cabinet, with self-contained batteries and cone loud-speaker. The only external connections are the aerial and earth leads. And all for four guineas. Then the B.B.C. wonders why the humble crystal set is dead. It is a salutary thought, though, that a complete two-valver to-day costs no more than the crystal sets marketed at the beginning of broadcasting. This progress!

I have been pleasantly surprised at the results given by the Super Two, which certainly does provide the two local stations at good volume and quite remarkably satisfying quality.

To test this set I used my standard 60-ft. aerial and a low-resistance earth. The makers recommend 50 to 80 ft. of rubber-covered wire, such as Lewcoflex. If the set is to be used close to a powerful regional station, such as Brookmans Park or Moorside Edge, an indoor aerial will, I think, be quite suitable for this set. But outside what I might term the swamp area of the regionals, at say distances of more than fifteen miles, an efficient outside wire will enable the best to be obtained from the set—will enable not only the locals, but a fair sprinkling of the foreign stations to be heard at loud-speaker strength.

Tuning Arrangements

This aerial is connected to one of the terminals provided on the back of the set. A lead goes up from this terminal to the little set chassis, which is mounted at the top left-hand corner of the cabinet, when looking from the back. The connection of the aerial to the pile-wound tuning coils—there are two of them—is controlled by the position of a plug on the control panel, which is let into the side of the cabinet.

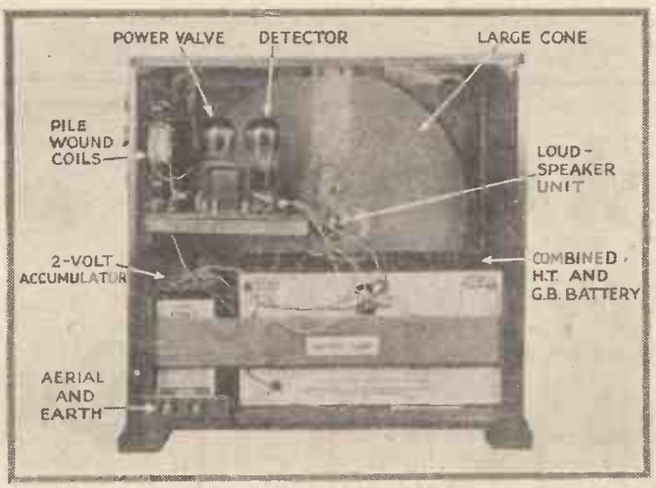
In positions 1 and 2 this plug provides medium-wave tuning, and position 3 is for long waves. If the plug is inserted in the bottom, that is, the fourth position, the filament circuit is broken and the set is, therefore, switched off. It is, of course, essential that the aerial plug be inserted in No. 4 hole whenever the set is not wanted, otherwise the batteries will be run down.

On this neat little chassis are mounted all the components needed for the two-valver. These mainly comprise a tuning condenser, of the bakelite-dielectric type, a reaction condenser of similar construction, the pile-wound coils, and a low-frequency transformer. These components are wired up for the standard two-valve circuit, comprising a leaky-grid detector, with reaction, transformer coupled to the power valve.

The two valves used and specified in this set are selected from the Triotron range, the detector being a type HX and the power valve a type LX.

Connections between the chassis and the batteries are made by means of flexible leads, each of which is clearly marked. As already mentioned, the batteries are self-contained in the cabinet. The filament battery is a Fuller type MSG 2-volt accumulator, and there is a combined high-tension and grid-bias battery, also of Fuller make.

This high-tension unit is of the heavy-duty type, providing 99 volts high tension and up to 9 volts negative grid bias. With the battery leads connected up as instructed by the makers, I found the total anode-current consumption was just over 11 milli-amperes, and of this total the detector accounted for 4.5 milliamperes.



With the exception of aerial and earth the Super Two is entirely self-contained

The self-contained loud-speaker has a robust unit and a very generous-sized cone diaphragm.

I have now covered all the points about the set with the exception of the controls, which are conveniently mounted in an oval-shaped panel on the side of the cabinet. Operation is the last word in simplicity. There are only two knobs to control, the tuning knob at the top and the reaction knob underneath. Both these knobs are clearly marked and travel over scales engraved in degrees from 0 to 25, in steps of 5 degrees.

The marking of the reaction control in this way is specially applauded, for with most stations it will be necessary to use some reaction and for the non-technical members of the family it is just as important to leave available the reaction setting as it is the tuning setting.

The only other control, if I may call it such, is the variable plug for changing the wavelengths or switching off the set. This plug arrangement is none the less clever because it is extremely simple. With this plug in No. 1 socket I got on to the Brookmans stations right away. There was the National, a full-strength signal with the tuning condenser at 5 degrees and the reaction at 7 degrees. Then in came the Regional at 14 degrees, with the reaction untouched. There was complete separation between these two powerful locals.

In fact North National was quite clear of these locals and came in at fine strength at 9 degrees. Just below was Hilversum, almost as strong.

At 19 degrees Midland Regional was a good signal. These readings show the set is well up to two-valve standard, in spite of the very moderate cost of the whole outfit.

Using the No. 2 aerial socket, I found that the upper wavelength limit was extended. This made Midland Regional come in at 13 degrees, enabling North Regional to be heard at 23 degrees, at moderate loud-speaker strength.

In No. 3 socket Daventry came in at 23 degrees, which is nearly at the top of the tuning range. A little more wire on the long-wave coil might be an advantage, especially if a short aerial is to be used.

Good Quality

In receiving these stations I was very well satisfied with the quality. The large cone loud-speaker is sensitive and reproduces speech with clarity. Music was mellow, without any trace of "woofiness."

To summarise, I would say that the "Super Two" is excellent value for money, bringing in the locals very easily, clear of mutual interference; and a goodly number of the foreign stations are available with careful, but not necessarily critical, adjustment of the tuning and reaction controls.

HOTSPOT.

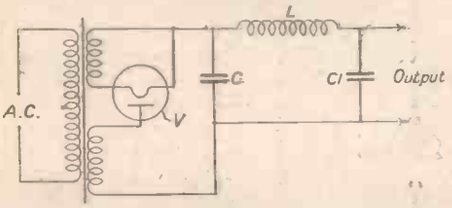
FAMOUS WIRELESS PATENT EXTENSION REFUSED

ON December 8, Mr. Justice Luxmoore refused an application made in the High Court by the British Thomson Houston Co., Ltd., for an extension of the well-known "Eliminator" patent, which has for many years controlled the use of wireless sets driven from the mains, and which therefore expired on the 22nd of last month.

The life of any patent is normally limited to 16 years, after which it becomes public property, although in certain circumstances an extension of this term can be granted.

In the present instance, the full term of 16 years expired on the above-mentioned date, but a further period of protection was asked for on the ground that the patentees were prevented from making full use of the invention during the War period, because they were then engaged in other work of national importance. They applied for a prolongation of four years to make good the time so lost. The application was, however, successfully opposed by the Hazeltine Corporation and Messrs. Brown Boverie and Co.

The eliminator patent covers a method of smoothing-out the current delivered by a rectifying device, so that it can be applied directly to a valve amplifier, without giving rise to hum.



A typical valve rectifier and smoothing circuit

When an alternating current passes through a rectifying device the output is really made up of a series of intermittent pulses of unidirectional current. These combine together to form a direct current, that is to say, they all flow in the same direction, but the current is not perfectly smooth and unvarying. Ripples or irregularities are always present which reflect the frequency of the original A.C. supply.

A typical smoothing circuit is shown in the diagram. It consists of a simple arrangement of one or more chokes L in series with the rectified output, and one or more condensers C, C1 in parallel.

A choke coil readily passes a steady current, but resists the passage of any A.C. component or ripple. On the other hand, if the condensers C, C1 are sufficiently large, say 4 microfarads, they provide an easy path through which the ripples can pass to earth. At the same time no D.C. can take this path.

In future, a simple smoothing circuit of the kind shown in the diagram will not be liable to any patent royalty, whether used for energising a wireless receiver or an electric gramophone. It does not, however, follow that the same freedom attaches to later improvements or modifications of this standard circuit.

"WHY BAND-PASSING IS BEST"

(*Continued from page* 13)

a circuit recommended by the B.B.C. at the inception of the regional stations. The most important advantage of this circuit is that it can be utilised to increase the selectivity of existing sets without making any structural alterations.

An external tuned circuit is coupled to the internal tuned circuit by means of a very small capacity preferably with a neutralising type of variable condenser having a minimum capacity of 2 micro-microfarads.

The degree of selectivity can be controlled by the coupling capacity, the smaller the capacity the greater the selectivity.

There is some loss of signal strength with this Fig. 3 circuit. Here I should mention that some loss is inevitable as the number of tuning circuits is increased. That is why you should judge the selectivity of a circuit not merely by its ability to cut out the local within a few degrees, but also by its ability at the same time to maintain the signal strength of the other stations at a usefully high level.

Now we come to the Fig. 4 circuit, which is a very simple coupled circuit arrangement that appears on the surface to offer great advantages. The two circuits are coupled together by a resistance, and as this means that there is no phase-angle variation over the tuning range it might seem a great advantage over simple band-pass circuits, where with either capacity or inductive coupling alone the selectivity changes with the wavelength.

In practice, it will be found that the Fig. 4 circuit will drop signal strength quite considerably, and will cut the side bands to an extent that will appreciably deteriorate the quality.

We arrive, therefore, at the most successful double-tuned circuit to date, namely, a mixed, band-pass tuner, shown by Fig. 5. The two tuning circuits are coupled together by two means. Firstly, there is the mutual-inductance coupling, which is the inter-linking of the lines of force of one coil with the turns of the other. Secondly, there is the capacity coupling of the .04-microfarad non-inductive fixed condenser, which it will be seen is common to both tuning circuits.

This type of circuit has many advantages. The selectivity is of a high order, and is achieved without sacrifice of quality and with very little loss of volume on distant stations. Moreover, due to the mixing of the couplings, the selectivity remains reasonably constant over the whole of the medium and long wavelengths.

With suitable aerial tapping on the first section of the band-pass, it is quite easy with a good two-gang condenser to match up the circuit so that one-dial tuning control is obtained. The Fig. 5 circuit is the basis of many successful sets, both amateur and factory built. Such a circuit is employed in the Varley square-peak band-pass coil, shown with its external connections at Fig. 6.

I have come to the conclusion that, whatever the next season may have in store for us, there is nothing to equal band-pass tuning at the present time.

HOTSPOT.

NOVEL USES FOR NEON TUBES

A description by J. H. REYNER, B.Sc., A.M.I.E.E., of some interesting experiments for you to try

A NEON lamp costs a few shillings only, yet it is capable of being used in an extraordinary number of ways of interest to the radio user. Even if one has no specific need at the moment a few experiments with this tube are easily carried out, and are quite fascinating.

The familiar Osglim lamp is very suitable for these experiments. It consists of a flat plate over which is mounted a spiral of wire, looking like a bee-hive, the whole being enclosed in a bulb containing neon gas. If this lamp is connected across a D.C. supply of 200 volts or more it glows with a pink radiance which either appears to come from the bee-hive or from the plate according to which way round the lamp is connected. These lamps are used in practice to illuminate passages, etc., where a small light only is required at a very low consumption, the actual power consumed being only about 5 watts.

Neon Tube Action

Now the neon lamp has a peculiar action. The illumination that we see arises from a discharge across the gap from one plate to the other, and this discharge will not take place until the voltage rises above a certain critical value in the neighbourhood of 160

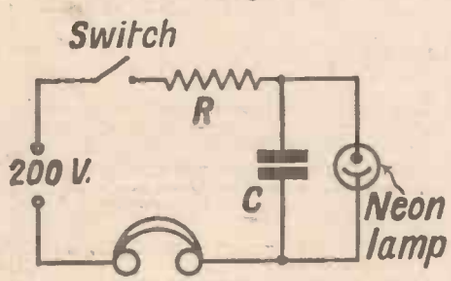


Fig. 1. A simple oscillating circuit for a neon tube

to 170 volts. Once this discharge has taken place, however, it will continue even though the voltage is reduced by some 40 to 50 volts, after which it ceases abruptly. There is thus a sort of backlash in the operation rather like a set with a badly operating reaction circuit. It is this backlash which is utilised in the application of the neon lamp as a tester.

Suppose we connect up a circuit as shown in Fig. 1. On switching on current will flow into the condenser through the resistance R, which will ultimately tend to charge this condenser to the same voltage as that of the supply. The condenser, however, does not charge immediately. The resistance in series acts as a buffer and prevents the current from rushing into the condenser as it normally would do. The larger we make the resistance the more slowly does the charge build up on the condenser, until with a large condenser and a really high resistance of many megohms several seconds may be required to charge the condenser completely.

Let us suppose that the supply voltage is 200. The charge on the condenser will gradually build up from nothing up to a value approaching 200. When it reaches a value between 160 and 170 volts, however, the neon lamp connected across it suddenly becomes conductive and a rush of current will flow, discharging the condenser until the voltage has dropped back some 40 to 50 volts when the neon lamp becomes non-conductive. Therefore, current again begins to flow into the condenser from the D.C. supply, the charge rising relatively slowly due to the presence of the resistance until once again the voltage reaches the critical value, and a discharge follows through the neon lamp.

This process will continue indefinitely. What is more, it will take place at a regular rate, because the time taken for the condenser to charge the necessary 50 volts in order to make up for the discharge through the neon lamp, is determined by the constants of the circuit and if these remain unaltered the discharge time is fixed. The period of discharge can be made to vary from one every five to ten seconds or even more up to frequencies beyond the audible limit, giving us an extraordinarily wide range of variation.

Oscillation Frequency

With a given voltage applied to the system and a given arrangement of the lamp, the frequency of the oscillation set up is proportional to the product of the resistance and the capacity. For example, with 200 volts applied a note of about 500 cycles is obtained when the product of C and R is equal to .001 megohm-microfarads. Thus, for example, if we use a .001-microfarad condenser and a 1-megohm resistance the charge and discharge action just described will take place 500 times a second, and if we listen on a pair of telephones in the circuit as shown in Fig. 1, we shall hear a musical note of this frequency. Similarly using a .004 condenser and a 250,000-ohm resistance will give us the same frequency.

Tuning the Circuit

One possibility immediately presents itself. We can make either the resistance or the condenser variable (or both) and so obtain an oscillator capable of giving a wide range of frequency. The applications of this oscillator are limited, however, because the wave form is nothing like a pure sine wave. The current consists of a comparatively slow rise followed by a very rapid fall which is a most impure wave and gives rise to large numbers of harmonics. There are, however, cases where the harmonics do not matter very much, and in such circumstances an arrangement such as this is quite practicable. There are also ways of purifying the wave form, but it is not proposed to discuss these now.

A COMPLETE LIST OF "A.W." AND "W.M." BLUEPRINTS APPEARS ON PAGE III OF COVER

Another application is that of a tester for comparing the values of resistance and capacity. Suppose, for example, we have a circuit arranged as in Fig. 2. With the switch in position (*a*) we run the tester through a fixed resistance and capacity, the values of which are known. We throw the switch over to position (*b*) and bring into use a calibrated variable resistance and an unknown capacity. By adjusting the value of the resistance until the note heard in the telephones is the same with the switch in either position, we know that the product of the resistance and capacity in each case is the same. If the value of the variable resistance R1 is known, then the value of the capacity C1 is easily obtained. Alternatively we can vary C, and use the method to measure unknown resistances.

It should be mentioned in this connection that the standard neon lamp as marketed has a resistance of about 3,000 ohms in circuit in the cap. For special work of this sort it is better to obtain special lamps

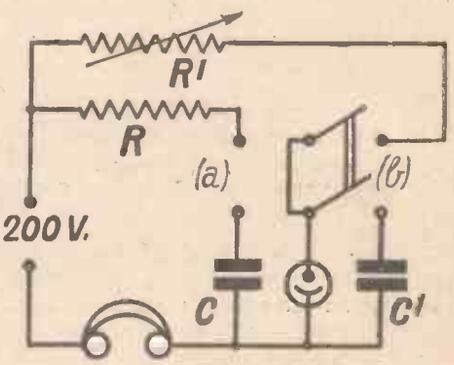


Fig. 2. A circuit in which rapid comparison can be made

in which this resistance has been omitted. These may easily be obtained by ordering specially.

The connection of the lamp makes a slight difference to the frequency. Thus, if the lamp is removed from its socket and re-inserted the other way round, the frequency will change by from 10 to 20 per cent. in most cases. Again, any leakage across the condenser reduces the frequency.

A very useful application of the neon oscillator is to the measurement of very high-resistance leaks. If, in place of the resistance R, we place a sample of insulating material with connections at each end, then no charging or discharging action should take place if the insulation resistance of the sample is infinite. If there is a leak across it, however, even if it is several hundred megohms, a very slow charge will take place and the neon lamp will flash in due course, at regular intervals, perhaps five or ten seconds apart. The measurement of such very high resistances is quite beyond the capacity of the ordinary resistance testing equipment and the neon lamp forms a very convenient arrangement.

Charging from D.C. Mains

SIR,—Having D.C. mains available, I wish to charge my own accumulators. I understand that ordinary electric lamps may be used to act as charging resistances, but I do not know how to determine the current passed by them. Is there a simple method of determining this other than by actual measurement? I do not wish to have to purchase a number of lamps before finding the right one for a particular charging rate. H. G. (Surbiton).

Ordinary metal-filament lamps are rated at a certain number of watts. As the wattage is the product of the voltage and the current, the latter may be determined by dividing the wattage by the voltage. Metal filament lamps pass very little current and are, therefore, only suitable for low charging rates. Where the charging rate exceeds half an ampere, it is better to use carbon-filament lamps. These lamps are rated somewhat differently to metal filament lamps, that is, by candle power instead of by watt power. The wattage, however, may be determined by multiplying the candle power by four. The current consumption may now be determined as for metal-filament lamps, by dividing the wattage by the voltage. The results given by these calculations will only be approximately correct, but they are sufficiently accurate for all practical purposes.—ED.

Faulty Pentode Connections

SIR,—I have recently fitted a pentode output valve to my receiver, and the set now consists of a screen-grid, detector, and pentode. I am using a pentode output choke and also a mains unit capable of giving me up to 60 milliamperes. Since making the change I have had nothing but rushing noises, very weak reception and, apparently, considerable L.F. instability. I have tried all remedies I know to cure the trouble and must own myself beaten. Can you suggest anything that is likely to assist me? I am using 150 volts on the anode of the pentode and have connected the side terminal to the positive H.T. side of the output choke.

E. W. (Llandudno).

If you have connected the terminal on the side of the pentode direct to the power H.T. supply, this is where you have gone wrong. You should interpose a 15,000-ohms resistance between the H.T. supply and the terminal on the side of the pentode, and a 1-microfarad condenser between this side terminal and negative H.T. With your present wiring you have a higher voltage on the auxiliary grid of the pentode than you have on the anode, and this is giving rise to a reverse current between the auxiliary grid and the anode of the valve. —ED.

Charging Station Interference

SIR,—I have had in use for some months the "1931 Ether Searcher," but have never been really satisfied with results. Sometimes the set works splendidly, whilst at other times I have great difficulty in getting beyond the local Daventry and London stations. One of my greatest troubles is pattering noises. I live next door to a cycle and wireless shop so perhaps this has something to do with these noises and my inconsistent reception. Another thing is, if I disconnect the aerial, the pattering noises are considerably reduced, whilst if I disconnect the earth I can continue to receive signals without diminution in signal strength.

C. W. (Hertford).

It is uncertain from your letter whether your receiver is faulty or not. Most of your trouble appears to be due to the nearby interference. We suggest you move your set to the wall of your house farthest from that dividing your house and the shop. You should then try disconnecting your aerial and endeavouring to retune your set. If the interference is still experienced, it is not being picked up solely by the aerial, but also by the earth. You might try using an indoor counterpoise in place of the direct outdoor earth. You should also try erecting and using a single-wire vertical aerial as far away from your neighbour's side of the house as possible. If you still have trouble, try completely shielding the set in a copper-lined cabinet. If you will take every step to ensure abatement of the interference nuisance you will have a better chance of deciding whether your receiver is working up to standard or not.—ED.

Using a Microphone

SIR,—I have been endeavouring to add a microphone to the amplifying side of my wireless receiver. I appear to get results properly, but at odd times the loud-speaker builds up to a roar or singing noise and I have to switch off. This rather interferes with the project I have in view and I should be glad to receive any hints from you with regard to overcoming the trouble.

R. C. (Croydon).

It seems you are attempting to use the microphone in the same room as the receiver and the speaker. This should not be attempted. The speaker should be arranged in a distant room, so that the sound waves projected from the speaker cannot impinge upon the diaphragm of the microphone and so set up an endless chain of waves from speaker to microphone, through the receiver and back to the speaker again.—ED.

Using a Pick-up

SIR,—I wish to add a pick-up to my receiver, but do not wish to interfere with the permanent wiring of the set because it is a manufactured one, and still under guarantee. Is there any way of accomplishing what I require? The set is a four-valve battery-operated one, possessing two stages of low-frequency amplification. H. R. (Westminster).

It is quite a simple matter to do as you suggest and we advise you to obtain one of the special gramophone adaptors which plug into one of the valve holders of the receiver. One terminal of the pick-up should be connected to the "grid" terminal on the side of the adaptor, whilst the other terminal of the pick-up should be connected to a point on the grid-bias battery, giving 1½ volts negative bias. The adaptor should then be plugged up in place of the first L.F. valve in your receiver and the valve inserted in the sockets in the top of the adaptor.—ED.

FIVE CONTINENTS ON THE SHORT WAVES

HOW TO LOCATE THE DISTANT STATIONS

ONE of the great attractions of the short-wave bands is the fact that they are as useful in the winter months as they are in the summer months—and vice versa. The only difference is that certain sections of the short-wave bands vary in their usefulness according to the season. For instance, at this time of the year, the wavelengths from 25 to 50 metres are at their greatest period of usefulness, transatlantic stations on the 30- and 50-metre bands coming in

with a good degree of reliability when conditions are good.

In the summer months, the stations operating on wavelengths between 15 and 25 metres come in at their greatest strength. This does not means, of course, that these wavelengths are no good at all during the winter months—they have quite a good period of usefulness during the daylight hours. For instance, the Javanese stations around 15 metres can still be heard quite well, but their usefulness is not so great on these wavelengths as it would be in the summer months.

On 25 Metres

The following are some of the stations which come in well at this time of the year and which can be picked up in the British Isles quite regularly with small two or three-valve receivers :—

Starting at the lower end of the wave-bands and setting 25 metres as our lowest limit of good reception, with due regard to the time of year, we find station W8XK on 25.24 metres. This station is well known all over the world, being situated at Pittsburgh, U.S.A. Although not such a good signal as a rule as his longer wave brothers, he can often be found coming in at good strength.

Next on our list comes I2RO at Rome, on 25.4 metres. This station generally roars in during daylight hours and provides an excellent means of listening to the Rome programme when the long-wave station is too weak to be received.

The next station, of course, is 5GSW, on 25.53 metres. He is not particularly well received in the British Isles, but proves a real boon to people who live at a distance of over 500 miles from Chelmsford.

Above this we find FYA, at Pontoise, France, on 25.63 metres—rather a weak signal in the British Isles. That completes the cluster of "big" stations on the 25-metre band. They are not hard to find and provide entertainment at nearly all hours of the day.

The 30-45 Metre Range

There is now a gap, except for commercial stations, until we reach VK2ME, Sydney, on 31.28 metres. Despite the enormous distance, this station comes in quite well at times in the British Isles, providing a real thrill for those who want to listen the farthest possible distance on this globe. It is impossible to cover any greater distance than this, unless it can be proved that the signals go entirely over the earth's surface—that is to say, if they completely encircle the entire circumference of the earth.

Our next station is W1XAZ, another American, located at Springfield, Mass., and operating on a wavelength of 31.35 metres. This station comes in quite well at times. If you have never heard him yet, try for him just a degree or so below the next station we are coming to, which is Zeesen, Germany, the "Kurzwellensender," which works on 31.38 metres. He is heard at enormous strength during daylight hours and is generally quite good even at night. He is, at any rate, loud enough to provide a very useful landmark by which to find some of the more distant stations.

Directly above him we find the famous station, W2XAF, one of the very first American stations to be heard in this country (with all due respects to KDKA). His wavelength is 31.48 metres and he relays the programmes of WGY, at Schenectady. Above this station is OXY, at Skamlebaek, Denmark, who can very often be heard at quite good strength in the early evenings.

Next we find VK3ME, who used to be a very popular station, but has fallen off somewhat during the last year. However, he is still on the air occasionally and should come in at quite a good strength. On Sunday evenings we find the short-wave station at Rabat, Morocco, coming in at shattering strength on 32.26 metres. Announcements are made in French and he is not hard to identify, the call being "Radio-Maroc."

Directly above this station there are a whole host of commercial stations, amongst them being the telephony stations used on the transatlantic ships. They work on between 32 and 34 metres. Besides these wavelengths, they work on a number of other wavelengths, according to time and also according to their distance from the land station. They are not hard to identify, their call signs being GLSQ for the *Olympic*, GFWV for the *Majestic*, and WSBN for the *Leviathan*.

Then there are a number of small short-wave broadcasting stations which are seldom heard in the British Isles, owing to the very large number of morse stations on these wavelengths. Around 45 metres there are a large number of amateur stations to be heard at nearly all hours of the clock. Amateur stations from France, Belgium, Denmark, Holland, Germany, and a whole host of other countries are to be heard experimenting with their fellow amateurs in other countries.

On 50 Metres

Now we come to the 50-metre group of stations and here find stations in America, Russia, Honduras, and the Vatican City.

There are no less than seven American stations operating between 49 and 50 metres.

However, you are not likely to hear them all at once, because some of them use very low power and are not heard very well over here.

Station W9XAA, at Chicago, belonging to the Chicago Federation of Labour, can be heard quite well at times, working on 49.34 metres. Slightly below this station, we have what is perhaps the best of the bunch—station W3XAL, at Bound Brook, New Jersey, on 49.18 metres. He can generally be found in the evening from 10.30 to 11 and onwards. On some nights he closes down at 11, to re-open early in the morning. He is possibly the best-received of all the stations in this group.

Another of the American stations is WXAL, on 49.5 metres, located at Cincinnati. The station at Honduras is HRB, on 49.95 metres. He can generally be heard some time after 3 a.m., so if you feel like sitting up around the clock, here is some good bait! Then we have the Vatican City station on 50.26 metres—another very good signal.

The most powerful station of this group

(*Continued on next page*)

RADIOGRAMS

CONSTANT LAMBERT will conduct the Choral and Orchestral Union of Glasgow concert with the Scottish Orchestra on January 5.

A programme of excerpts from Donizetti's opera, *The Daughter of the Regiment*, will be broadcast on the National on January 6. Joseph Lewis will conduct the Wireless Chorus and B.B.C. Orchestra.

Harold Spicer will give an organ recital from the Church of the Messiah, Birmingham, on January 6.

Marjorie Sotham, the inaugurator of the Philharmonic midday concerts in Birmingham, is to join Samuel Clifford in a pianoforte and violoncello recital on January 7.

Little Boy Brum, a pantomime fantasy by Graham Squiers, will be heard on January 8.

An Ulster comedy in four scenes, *Between Two Stools*, is to be broadcast from Belfast on January 9. The author is J. H. McIlveen.

On January 3 Belfast listeners are to hear a service relayed from St. Columb's Cathedral, Londonderry.

Norman Jones will be heard with the Western Studio Orchestra on January 4. His first broadcast for the B.B.C. was in February, 1923.

A Welsh programme for the Western Regional on January 5 includes the Swansea Ladies' Choir.

Mr. Caradog Prichard, who will be one of the chief adjudicators at the Welsh National Eisteddfod next year, will be heard during the Welsh interlude on January 6.

According to an U.S.S.R. official *communique*, the Soviet Union now possesses fifty-five broadcasting transmitters with power ranging from three to 100 kilowatts. It is impossible to compute the number of listeners in that country owing to the fact that for some months no tax has been exacted on wireless apparatus and that owners are not compelled to declare their possession of crystal or valve receiving sets.

It is being urged in some quarters that the Post Office detection vans should be taken off the hunt for "pirates," and utilised instead to track down and silence some of the numerous sources of electrical interference, in the shape of fans, vacuum cleaners, etc., with which wireless listeners are afflicted.

ACCUMULATORS FOR HIGH TENSION

THERE are many owners of large sets who, not having a mains supply available, find that the provision of high tension by dry batteries is not an economical proposition.

Accumulator high tension offers a good alternative and a new C.A.V. accumulator for high-tension purposes, the type G103, will need recharging about only three times a year.

The type G103 is made in 10-volt units having a capacity of 5,000-milliampere hours, and costing 6s. 6d. each. Any number of 10-volt units may be placed in series

One of the type G103 ten-volt H.T. Units

and a 60-volt group, in a wooden crate, costs only 46s. 6d. complete. These cells have many good technical features which make them particularly suitable for a slow discharge over a long period.

Specially shaped positive and negative terminals are provided and the vents are large and accessible. Details may be had free on mention of AMATEUR WIRELESS from Messrs. C. A. Vandervell & Co., Ltd., Well Street, Birmingham.

"FIVE CONTINENTS ON THE SHORT WAVES"

(Continued from preceding page)

is RW 59, at Moscow. He is on the air at all hours of the day and comes in with a roar.

The above selection represents a fairly complete directory to the stations which can be received in the British Isles with a high degree of certainty. There are, of course, several hundred stations which do not figure in this list, but these are not so reliable and are only likely to be heard when conditions are really very good indeed.

If you have never used a short-wave receiver before and are trying out the set for the first time at present, I would advise you first of all to try and tune in some of the stations mentioned before, working on the 30-metre band. They are the easiest to find, and provide a very good landmark for finding other less powerful stations. In the same way as you have probably made a tuning graph for the stations on your medium and long-wave receiver, it is a very simple matter to make one for the short-wave stations and will be a great help in finding unknown stations.

One word more—it is absolutely useless trying to receive distant short-wave stations on nights when the receiver seems "dead." An experienced hand can always tell whether or not conditions for long-wave reception will be good, the minute he turns the receiver on. If the receiver seems very lively and there are plenty of code stations to be heard, then it is almost sure to be a "good" night, and conditions for transatlantic reception should be good. If, however, the receiver seems dead and even the code stations are weak, it is not generally necessary to blame the receiver—if the code stations are poor, the chances for long-distance broadcast reception will be very poor.

MANDER BARNETT.

Postcard Radio Literature

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.

Marconiphone Sets

I HAVE spent a great deal of time in studying the new "Radio by Marconiphone" booklet, which is a catalogue of sets, speakers, batteries, and accessories, such as the Marconiphone pick-up. A brief section is also devoted to Marconi valves. **661**

Cyldon Condensers

The new Cyldon booklet, with a metallised cover, strikes a new note in this kind of production. All the new Cyldon single and ganged condensers are described. By the way, they all have a five-year guarantee. **662**

For American Sets

I am informed by Eta that the range now includes replacement valves for the popular American sets used over here, and a new folder is available, describing these. **663**

Condensers and Resistances

The new metallised resistances obtainable from 100 ohms to 500,000 ohms are described in the new Dubilier folder, which deals also with mica and paper-dielectric condensers, variable condensers, and small parts, such as valve holders and coupling condensers. **664**

Six Circuits

Do you want six good circuits and six free blueprints of sets using Lewcos coils? Lewcos have just produced a book of these and copies can be had through my catalogue Service. **665**

Good Cabinets

Cabinets for every set are illustrated and described in the new Lock book of Cabilock cabinets. Mellotone and Claribelle cabinets are available for housing speakers, which, owing to the baffle effect, make an improvement in tone. **666**

Climax Mains Sets

Climax have two fine mains sets for the new season, a three and a four. These are both obtainable for A.C. and D.C. work and are fully described in a new folder. **667**

Ferranti Sets

A new booklet WB524 has been produced by Ferranti describing A.C.-driven sets and consoles, including the new inductor console.

OBSERVER. **668**

"WHAT 1931 GAVE US"

(*Continued from page 14*)

fication varies in an elastic manner, so that the valve amplifies enormously on weak signals from a distant station, but comparatively little on the much stronger inputs from a station at close range. Some slight alterations are necessary before the new valve can be fitted to a standard set, so as to ensure that variation of the control grid bias does not upset the fixed S.G. voltage, but these are not difficult to carry out, and the resulting advantage of easy volume control is well worth while.

The new valve also makes it possible to utilise automatic volume control so that fluctuations of strength due to fading will no longer irritate the listener when receiving distant programmes. The problem can be solved by using a second rectifier valve to produce an automatic grid-bias voltage for the variable-mu H.F. stages.

If the signals are strong, the output from the regulating valve is automatically increased so that a strong negative bias is immediately applied to the H.F. valves, tending to cut down their sensitivity. If signals are weak, the negative grid bias is automatically lessened, and the H.F. valves at once respond with increased efficiency. In this way the loud-speaker output is kept uniform under all conditions.

Better Detection

The search for a perfect rectifier naturally follows close on the improvements made on the high-frequency side of the set. The old grid-leak rectifier is highly sensitive and fairly satisfactory within certain limits. Where absolutely first-class quality is required, however, it is open to objection, (*a*) on the ground that it tends to damp the tuned input circuit, (*b*) that it works on a bent part of the characteristic curve. For both these reasons it is liable to produce distortion.

The anode-bend rectifier avoids both these defects, but tends to distort on a highly-modulated signal. Power-grid rectification is to be preferred to both, and is, in fact, now generally used for good-quality reproduction. Even here the presence of a grid condenser is, however, still a source of weakness, as it tends to cause damping.

The push-pull detector is the latest arrival and is likely to be widely used in next year's sets. As its name implies, it calls for the use of two separate valves, instead of one, though there is no reason why both should not be contained in the same glass bulb. The signals to be rectified are applied in push-pull, the two ends of the input transformer being connected directly (and not through a blocking condenser) to the two grids.

The absence of the grid condenser prevents any risk of damping or distortion, whilst any H.F. present is balanced out in the output of the two valves, so that there is no likelihood of its reaching the L.F. stages. The rectified signals add together in the output circuit, because they are, in effect, applied to the two grids in parallel across the input transformer, which only offers a high impedance to the carrier wave and a low impedance to the signal frequencies.

BROADCAST TELEPHONY

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

Kilo-Metres	cycles	Station and Call Sign	Power (Kw.)
GREAT BRITAIN			
25.53	11,751	Chelmsford (G5SW)	10.0
242.3	1,238	Belfast	1.2
261.5	1,147	London Nat.	68.0
288.5	1,040	Newcastle	1.2
288.5	1,040	Swansea	0.16
288.5	1,040	Plymouth	0.16
288.5	1,040	Edinburgh	0.4
288.5	1,040	Dundee	0.16
288.5	1,040	Bournemouth	1.2
288.5	1,040	Aberdeen	1.2
301.5	995	North National	70.0
309.9	968	Cardiff	1.2
355.8	843	London Regional	70.0
376.4	797	Glasgow	1.2
398.9	752	Midland Regional	38.0
480	625	North Regional	70.0
1,554.4	193	Daventry (Nat.)	35.0
AUSTRIA			
218.7	1,375	Salzburg	0.6
245.9	1,220	Linz	0.6
285.2	1,052	Innsbruck	0.6
352.1	852	Graz	9.5
453.2	666	Klagenfurt	0.6
517	581	Vienna	20.0
also testing on 1,237 m. from 7.0 p.m. (Mon., Wed., Sat.)			
BELGIUM			
206	1,456	Antwerp	0.4
208.3	1,440	Liége	0.15
215	1,395	Liége	0.1
215.3	1,393	Chatelineau	0.2
216	1,389	Bruxelles Conference	0.2
219.7	1,365.6	Binche	0.1
240.8	1,245.8	Liége	0.1
244.9	1,225	Schaerbeek	0.2
273	1,095	Radio Comte	0.4
280.2	1,071	Brussels (SBR)	0.1
338.2	887	Brussels (No. 2)	20.0
509	590	Brussels (No. 1)	20.0
BULGARIA			
318.8	941	Sofia (Radio Radio)	1.0
CZECHO-SLOVAKIA			
249.6	1,201.8	Prague (2)	5.0
263.8	1,137	Moravska-Ostrava	11.0
279	1,076	Bratislava	14.0
293	1,023	Kosice	2.5
341.7	878	Brunn (Brno)	31.0
488.6	614	Prague	120.0
DENMARK			
281.2	1,067	Copenhagen	1.0
1,153	260	Kalundborg	7.5
ESTONIA			
296.1	1,013	Tallinn	10.0
405.8	644	Tartu	0.5
FINLAND			
291	1,031	Viipuri	13.2
368.1	815	Helsinki	13.2
559.7	536	Tampere	1.0
1,796	167	Lahti	54.0
FRANCE			
220.3	1,361	Béziers	0.5
222	1,351	Fécamp	5.0
245.9	1,220	Sunday after 11.0 p.m.	
247.6	1,261.2	Bordeaux-Sud-Ouest	2.0
249.6	1,203	Juan-les-Pins	0.5
255.1	1,176	Toulouse (PTT)	1.0
265.4	1,130	Lille (PTT)	2.0
271.5	1,105	Rennes	1.2
286	1,049	Montpellier	2.0
287.3	1,044	Radio Lyons	30.0
294.6	1,018	Limoges (PTT)	1.0
304.9	984	Bordeaux (PTT)	15.0
312.6	960	Natan-Vitus (Paris)	0.5
317.3	945.4	Marseilles	0.3
327.5	916	Grenoble (PTT)	3.0
328.9	912	Poste Parisien	1.2
345.2	869	Strasbourg (PTT)	15.0
368.4	814	Radio LL (Paris)	0.5
384.4	779	Radio Toulouse	8.0
447.1	671	Paris (PTT)	5.0
466	644	Lyons (PTT)	2.3
1,445.7	207.5	Eiffel Tower	15.0
1,724.1	174	Radio Paris	85.0
GERMANY			
31.38	9,560	Zeesen	15.0
217	1,382	Königsberg	1.7
217.5	1,370.9	Flensburg	0.6
227.4	1,319	Cologne	1.7
227.4	1,319	Münster	0.6
227.4	1,319	Aachen	0.3
232.2	1,293	Kiel	0.31
239.4	1,253	Nürnberg	2.3
245.9	1,220	Cassel	0.3
253	1,184	Gleiwitz	5.6
259.3	1,157	Leipzig	2.3
209.8	1,111	Bremen	0.2
276.5	1,085	Heilsberg	75.0
283	1,060	Magdeburg	0.6
283	1,060	Berlin (E)	0.6
283	1,060	Stettin	0.6
318.8	941	Dresden	0.3
325	923	Breslau	1.7
360.6	832	Mühlacker	75.0
372	806	Hamburg	1.7
389.6	770	Frankfurt	1.7
419	716	Berlin	1.7
453.2	662	Danzig	0.6
472.4	635	Langenberg	75.0
532.9	563	Munich	1.7
559.7	536	Kaiserslautern	1.7
559.7	536	Augsburg	0.3
556	530	Hanover	0.3
569.3	527	Freiburg	0.3
1,634.9	183.5	Norddeich	10.0
1,634.9	183.5	Zeesen	75.0
2,525	119.3	Konigswusterhausen (press)	15.0
2,900	103.5	Konigswusterhausen (press)	15.0
HOLLAND			
298.8	1,004	Huizen	8.5
299.5	1,001.3	Radio Idzerda (The Hague)	3.0
1,053	285	Kootwijk (testing)	10.0
1,071.4	280	Scheveningen-Haven	10.0
1,875	160	Hilversum	8.5
HUNGARY			
550	545	Budapest	23.0
ICELAND			
1,200	250	Reykjavik	16.0
IRISH FREE STATE			
224.4	1,337	Cork (6CK)	1.5
413	725	Dublin (2RN)	1.5
ITALY			
80	3,750	Rome (3RO)	14.0
247.7	1,211	Trieste	15.0
273.6	1,096	Turin (Torino)	10.5
312.2	961	Genoa (Genova)	15.0
318.8	941	Naples	1.7
331.5	905	Milan	8.5
368.1	815	Bolzano	1.5
441	680	Rome (Roma)	75.0
501.7	598	Florence (Firenze)	30.0
542	554	Palermo	3.7
LATVIA			
525	572	Riga	13.0
LITHUANIA			
1,935	155	Kaunas	7.0
NORTH AFRICA			
363.4	825.3	Algiers (PTT)	13.0
416	721	Radio Maroc (Rabat)	10.0
NORWAY			
235.5	1,274	Kristianssaud	0.6
240.2	1,249.2	Stavanger	0.6
364	824	Bergen	1.35
367.6	816	Fredriksstad	0.8
453.2	662	Porsgrund	0.8
493.4	608	Trondheim	1.8
580	517.6	Hamar	0.8
1,090	275	Oslo	75.0
POLAND			
214.2	1,400	Warsaw (2)	1.9
234	1,283	Lodz	2.2
312.8	959	Cracow	1.5
334.4	897	Poznan	1.9
380.7	788	Lvov	21.0
400.8	732	Katowice	16.0
455.9	605	Wilno	21.0
1,411.8	212.5	Warsaw	158.0
PORTUGAL			
290.5	1,033	Lisbon (CTIAA) also on 42.0 m.	2.0
ROMANIA			
394	761	Bucharest	16.0
RUSSIA			
427.5	701.7	Moscow-Stalin	100.0
720	416.6	Moscow (PTT)	20.0
937.5	320	Kharkov (Rv20)	25.0
967.7	310	Alma-Ata	10.0
1,106	271.8	Tiflis	10.0
1,000	300	Leningrad	100.0
1,034.5	290	Kiev	30.0
1,116	268.5	Moscow Popoff	75.0
1,304	230	Moscow (Trades Unions)	165.0
1,481	202.5	Moscow	100.0
SPAIN			
253.3	1185	Barcelona (EAJ15)	1.0
268.0	1,215.5	Valencia	5.0
348.8	860	Barcelona (EAJ1)	8.0
368.1	815	Seville (EAJ5)	1.5
409.8	732	Madrid España	2.0
424	707	Madrid (EAJ7)	2.0
454.6	660	San Sebastian (EAJ8)	0.6
SWEDEN			
230.6	1,301	Malmö	0.75
257	1,167	Hörby	15.0
306.8	977	Falun	0.65
321.9	932	Goteborg	15.0
435.4	689	Stockholm	75.0
541.5	554	Sundsvall	15.0
770	389	Ostersund	0.7
1,220.5	244	Boden	0.75
1,348.3	222.5	Motala	40.0
SWITZERLAND			
244.1	1,229	Basle	0.65
246	1,220	Berne	0.5
403	743	Söttens	25.0
459	653	Beromuenster	75.0
TURKEY			
1,204.8	249	Istanbul	5.0
1,538	195	Ankara	7.0
YUGOSLAVIA			
307	977	Zagreb (Agram)	0.7
430.4	697	Belgrade	3.0
574.7	522	Ljubljana	2.8

WHEN SUBMITTING QUERIES . . . .

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

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

The designing of apparatus or receivers cannot be undertaken.

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

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

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

As Königswusterhausen is frequently compelled to get into telegraphic communication with the U.S.A. stations for the relay of American wireless programmes, the call letters DJA and DJB have been respectively allotted to the 31.381-metre and 19.737-metre short-wave transmitters.

Sir Gordon Nairne, Bt., one of the governors of the B.B.C., cautions Scottish listeners that while the new Scottish Regional station will be of great benefit to the Glasgow-Edinburgh zone, too much must not be expected of it in the northern parts of Scotland.

Work on the League of Nations 50-kilowatt short-wave station at Prangins, near Geneva (Switzerland), is nearly completed and it is hoped to bring the transmitter into operation on the opening day of the forthcoming Disarmament Conference. The wavelengths to be used are 15 metres during daylight hours and 35 metres at night. A channel of 18 metres is kept in reserve for emergencies.

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

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

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

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," 58-61 Fetter Lane, London, E.C.4.

OUR LISTENING POST

By JAY COOTE

HAVE you noticed during the past week or so how variable is the power of the broadcasts from the new Radio Paris station? As a matter of fact, if you compare the afternoon with the evening transmissions you may find an unaccountable difference. The explanation is that the transmitter was not ready at the time it was officially launched, and for the broadcast of the daily programmes the old plant is frequently brought into action. If you pick up the announcer's opening words you will hear whether the Clichy or the St. Rémy-l'Honoré station is being used.

Even when the new transmitter is being tested it is radiating less than half its ultimate power, and its engineers are by no means satisfied with the quality of its broadcasts. It is unfortunate that in France so much advance publicity should have been given to the new Radio Paris; as a result, most listeners expected too much too soon, with a consequent almost general disappointment.

On the other hand, Hilversum, without a fanfare of trumpets, made good from the start; its increase to 20 kilowatts has brought its transmissions within the reach of a much larger audience. It is truly worth while tuning in this station, as it comes on the air on most days at 7.40 a.m. G.M.T. Following a time signal and chimes, you will hear an excellent programme of gramophone records which can be thoroughly enjoyed whilst you are having breakfast. It is not a bad idea to start the day in this way.

The New Langenberg

Possibly by now you may have picked up stronger signals from Langenberg; I say possibly, as these were due on December 10, but a severe snowstorm brought down the new aerial. Temporary repairs were carried out within a few hours, but this *contretemps* may have postponed the first trials. Anyhow, it is now on the air daily from 2.30 p.m. and all day on Sundays. Personally, I have found it uncomfortably close to Beromuenster and to North Regional; but, as the Swiss station is an early bird, the Cologne programmes at greater strength can be held without interference in the later part of the evening.

Curiously enough, a similar aerial catastrophe befell Florence a few days ago, but in this instance with more serious results, for with the weight of snow the masts collapsed. It had been hoped to bring Radio Firenze into operation between December 20 and 25, and I understand that every effort is to be made to attain this end. From my log, I find that the station tests daily, namely, just about lunch time and again after midnight, when all good Europeans have signed off. From Italy, generally, we are now receiving louder signals, inasmuch as Turin has been recently boosted up to 10 kilowatts and Genoa is now firmly established with its 15-kilowatt plant. On the other hand, for some reason or other, I am not hearing Rome as loudly as I did in the earlier days. It is a curious fact that most of the new high-power stations appear to lose their strength a few months after they have come into operation. Similar experiences have been reported in many quarters in respect to Motala, Oslo, and other stations on the longer waves.

Brussels No. 1 and No. 2 are making a special feature of luncheon-hour programmes between 12.30 and 2 p.m.

It is an S.B. from both stations. From 12.15 to 1.15 p.m. G.M.T. on weekdays and from 10.30 to midday on Sundays you may find a further Brussels transmission on 280.2 metres; it emanates from a small experimental station at Forest, near the Belgian capital.

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Arrow Two (D, Trans)	AW249
Forty-five-Shilling Two (D, Trans)	AW250
Challenge Two (D, Trans)	AW261
Twenty-Shilling Two (D, Trans)	AW274
Room-to-Room Two (D, Trans)	AW298
Big Volume 2 (D, Pen)	AW309
Two Star 2 (D, Pen)	AW315
A.B.C. 2 (D, Trans) with copy "W.M." 1s. 3d.	WM160
Brookman's Two (D, Trans)	WM168
Programme Two (D, Trans)	WM177
Gleaner Two (D, Trans)	WM201
Merlin Two (A.C. set)	WM213
Five-point Two (D, Trans)	WM220
Ever Tuned Regional Two (D, Trans)	WM241
Station Finder Two (D, Trans)	WM253
Music Lover's Two (D, Trans)	WM260
New Economy Two (D, Trans)	WM265

THREE-VALVE SETS

All these 1s. each, post free.

Brookman's By-pass Three (D, 2 Trans)	AW220
1930 Clarion Three (SG, D, Trans)	AW223
Auto Coupler Three (D, 2LF)	AW225
Car Three (D, RC, Trans)	AW244
The "A.W." Exhibition 3	AW247
"A.W." Challenge Kit Three (SG, D, Trans)	AW256
Push-pull D.C. Mains "Two" (D, Push-pull)	AW270
1931 Ether Searcher (SG, D, Trans)	AW271
1931 Ether Searcher (A.C. Model)	AW276
1931 Ether Searcher (D.C. Model) Mains Unit	AW284 AW285
B.B.C. Selective Three (D, RC, Trans)	AW289
Square Peak Three (SG, D, Trans)	AW293
Universal Short-wave Three (SG, D, Trans)	AW301
Olympian Three (SG, D, Trans)	AW306
1931 Britain's Favourite Three (D, RC, Trans)	AW299
Universal Short-wave 3 (SG, D, Trans)	AW301
Olympian Three (SG, D, Trans)	AW306
Three Star 3 (SG, D, Pen)	AW313
Tonality Three (D, RC, RC)	AW321
Short Wave Link (D, RC, Trans)	WM142
Fanfare (D, 2 Trans)	WM157
Brookmans Three (SG, D, Trans)	WM161
Brookmans Push-pull Three (SG, D, Trans) 1/6	WM170
Celerity Three (SG, D, Trans)	WM173
All-nations Three (D, 2 Trans)	WM178
Inceptordyne (SG, D, Pentode)	WM179
Music Marshall (D, 2 Trans)	WM190
Gramo-Radio D.C. Three (SG, D, Trans)	WM196
Five-point Three (SG, D, Trans)	WM209
Falcon Three (A.C. Set)	WM217
New Brookman's Three (SG, D, Trans)	WM218
Five-point Short-waver (D, RC, Trans)	WM223
Plug-in-coil Three (D, 2 Trans)	WM232
Regional Three (SG, D, Trans)	WM236
Gramo Radio A.C. Three (SG, D, Trans)	WM237
Band-pass Inceptordyne (SG, D, Trans)	WM244
Ether Marshal (SG, D, Trans)	WM247
Meridian Short-waver (D, RC, Trans)	WM255
Five-advantage Three (D, RC, Trans)	WM257
Everybody's Radio-gram (SG, D, Trans)	WM258
Double Band-pass Three (SG, D, Trans)	WM259
Everybody's Radiogram (with Automatic Grid Bias)	WM262
New Economy Three (SG, D, Trans)	WM263

FOUR-VALVE SETS

All these 1s. 6d. each, post free.

Horizon Four (SG, D, 2 Trans)	AW237
The £3 3s. Four (SG, D, RC, Trans)	AW303
The £3 3s. Four Improved Model)	AW303A
Everybody's Radio-gramophone (SG, D, RC, Trans)	AW310
Four Star 4 (SG, D, RC, Trans)	AW318
Drum Major (HF, D, RC, Trans)	WM137
Searcher's Four (SG, D, RC, Trans)	WM194
Regional Band-pass Four (SG, D, RC, Trans)	WM211
Five-point Four (SG, D, RC, Trans)	WM216
Regional A.C. Four (SG, D, RC, Trans)	WM222
Supertone Four (SG, D, Push-pull)	WM227
Ether Rover (SG, D, RC, Trans)	WM266

FIVE-VALVE SETS

1s. 6d. post free.

Britain's Super (Super-het)	AW311

SIX-VALVE SETS

All these 1s. 6d. each, post free.

Century Super (Super-het)	AW287
A.C. Century Super (Super-het)	AW295
Mains Unit	AW295A
A.C. Super 60 Radio Gramophone (Super-het)	WM239
The Super 60 (Super-het)	WM229
A.C. Super 60 Table Model	WM245
Super 60 (with Wearite base)	WM249
Super 60 (with Lewcos base)	WM251
1932 Super 60 (Super-het)	WM269

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

Super Senior (Super-het)	WM256
Super Senior (with Lewcos Base and Wearite Coils)	WM261

PORTABLE SETS

Merry-maker Portable (D, 2 Trans)	AW228	1/-
Portable Century Super (Super-het)	AW297	1/6
Picnic Portable (D, RC, Trans)	WM148	1/-
Pedlar Portable Two (D, Trans)	WM195	1/-
Home and Garden Three (D, RC, Trans)	WM246	1/-

AMPLIFIERS

All these 1s. each, post free.

Beginner's Amplifier (1-v.) 9d.	AW210
Brookmans Separator (HF Unit)	AW212
Two-valve Amplifier	AW216
High Quality Amplifier for A.C. Mains	AW275
Add-on HF Screened-grid Unit	AW296
Universal Push-pull Amplifier	AW300
A.W. Record Player (LF, Push-pull)	AW319
Concentrator (HF Unit)	WM169
Selecto Amplifier (HF Unit)	WM210
D.C. Fader	WM242
Quality Amplifier (DC)	WM264

MISCELLANEOUS

"Twin" Brookmans By-pass	AW222	-/6
Simplest H.T. Eliminator for D.C. Mains	AW234	1/-
Choke Output Unit	AW240	1/-
Simple Tester Unit	AW246	-/6
"A.W." Improved Linen-diaphragm Speaker	AW243	1/-
Handy L.T. and G.B. Unit) for A.C. Mains	AW254	1/-
Ohmic Coupled DX Unit	AW255	1/-
Our H.T. Unit for A.C. Mains	AW262	1/-
Gramophone Tone Control	AW264	1/-
H.T. Unit and Trickle Charger for D.C. Mains	AW272	1/-
Booster Speaker	AW286	-/6
"A.W." Tone Changer	AW288	-/6
"A.W." Selectivity Unit	AW290	-/6
B.B.C. Official Selectivity Unit	AW294	-/6
A.C. Trickle Charger	AW305	1/-
Amateur's Linen Speaker	AW307	1/-
D.C. High-tension Unit	AW312	1/-
Output Unit for Pentode Sets	AW316	1/-
"A.W." Short-wave Adaptor	AW317	1/-
Converting a D.C. Unit to A.C.	AW314	1/-
James H.T. Unit for D.C. Mains	WM133	1/-
Two-ampere Low-tension Unit	WM147	1/-
A.C. Mains Amplifier	WM149	1/-
A.C. Mains Unit for All-wave Lodestone Five	WM151	1/-
H.T. Unit for A.C. Mains	WM159	1/-
Short-wave adaptor for Overseas Five	WM192	1/-
Staminator Unit for A.C. Mains	WM202	1/-
"W.M." Standard A.C. Unit	WM214	1/-
"W.M." Standard D.C. Unit	WM215	1/-
Falcon A.C. Unit	WM219	1/-
Loud-speaker Tone Control	WM234	-/6
New Linen Diaphragm Loud-speaker	WM235	1/-
Super 60 A.C. Unit	WM248	1/-
Simple Neon Oscillator	WM250	1/-
Plug-in S.W. Adaptor	WM267	1/-
Super-het S.W. Adaptor	WM268	1/-

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

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