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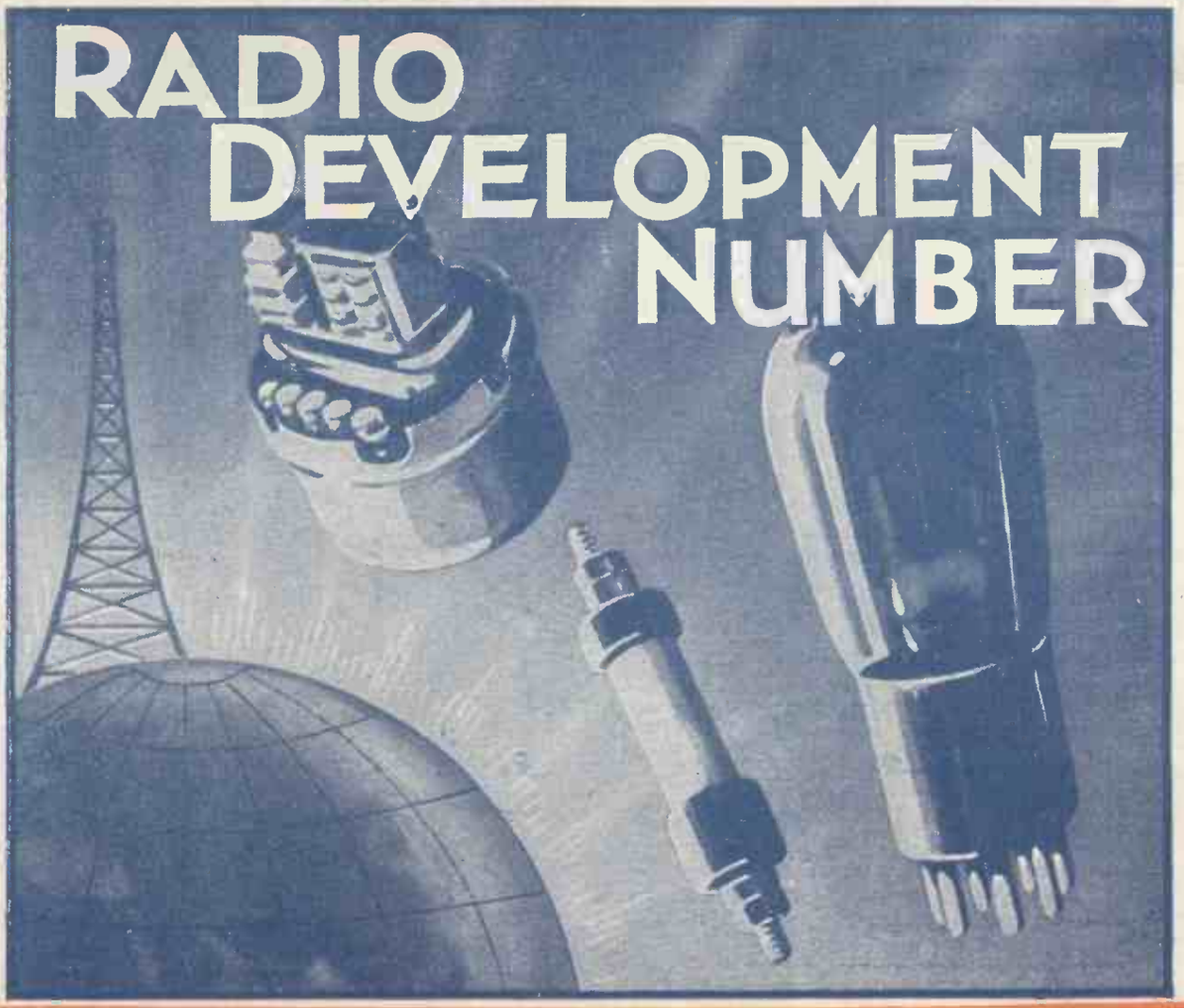

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Don't Forget to Say That You Saw it in "A.W."

No. 568. Vol. XXII. APRIL 29, 1933

Amateur Wireless & Radiovision

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

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

NEWS & GOSSIP OF THE WEEK

ALL THE LATEST!

THIS week's issue, as you can see from the extensive contents, is a special Radio Development number. Never has there been a year when so many new ideas have been brought out in advance of the Radio Exhibition. This number includes specially prepared descriptions of the latest ideas in sets, circuits, valves, batteries, speakers . . . in fact, everything in which big developments have been made. Class B, Q.P.P., Ferrocart, Westector and other developments are authoritatively dealt with.

SUCCESS AT WASHFORD

SO far the signals from Washford high-power station have fairly bombarded the South Wales coast. Apparently the signals have no difficulty in getting across the Bristol Channel without loss of energy. The minimum service area is estimated to be 70 miles radius. Across the water to Pembroke, which is about 100 miles away, signals are expected to provide something like reliable service. These tests have already shown that North Wales will not get good reception, because after dark the indirect ray will cause fading. Welsh listeners not served by the new Welsh stations will therefore have to wait patiently for the Droitwich high-power National station.

SMALLEST POPULATION SERVED

OF all the Regional service areas that of Washford seems to embrace the smallest population. It is estimated that in the maximum possible service area there are only 3¼ million potential listeners. These compare with the four million Scottish listeners and the very much greater populations served by London and North Regional stations.

BELFAST SITE

Engineers Narrowing Down Their Choice

TWO sites to the south of the city of Belfast now appear to be favoured for the final choice for the locality of the new high-power Belfast station. Recent tests have eliminated several of the other possible sites we mentioned some weeks ago, and it should not be long before the B.B.C. knows definitely where its Northern Ireland station will be finally fitted up.

AUSTRALIAN SERVICE CHANGES

A NEW schedule has been drawn up for Australasian subscribers to the B.B.C.'s Empire service from Daventry. The new service will be arranged *on the basis of the best technical times for listening*. In June and July, for a start, the period from 10.30 to 12.30 a.m. B.S.T. will be changed to a period from 5.30 to 7.30 a.m. B.S.T. This will mean that Australian listeners will get their Empire programmes in the early evening. As the seasons change throughout the year, so will the programme-time schedule. Only in this way, the B.B.C. has decided, can a really reliable signal be sent round the world on short waves.

THOSE THREE EMPIRE ANNOUNCERS

TO the Empire announcers team of Messrs. Lampson and Schewen has now been added Mr. Shanklan. These Empire announcers have to work very hard—probably harder than the home announcers! They seem to be bearing up very well under the strain of losing so many hours natural beauty sleep. During the holidays the present staff of announcers will have to be relieved, and there is a strong possibility that a fourth Empire announcer appointment will be made in the near future.

FIRST ARREST AT "B.H."

PEOPLE who are wanted by the police really should not broadcast, because the B.B.C. has an annoying habit of publishing their names in the programmes *beforehand*. The other day occurred the first arrest at Broadcasting House, when an artiste, at the

Also in this Issue—

FEATURES YOU SHOULD NOT MISS

THE HOME-CONSTRUCTOR AFLOAT!

Jack Tar makes his own sets! This picture, taken on board H.M.S. "Hood," shows amateur sets being made for the men to use when off duty

NEXT WEEK: A NEW REGIONAL "ONE" DESIGNED BY B.B.C. ENGINEERS

NEWS & GOSSIP OF THE WEEK—*Continued*

end of his turn, was discreetly whisked away by two waiting policemen. There are crimes *and* crimes, as Strindberg wrote, and we can think of many glaring examples of artistes whose criminal lack of wit in so-called variety programmes might justify their removal by minions of the law at the end of their execrable performances!

NEW SPONSORED PROGRAMMES

THE new sponsored programmes from Athlone on 413 metres have now started up and from 9.45 to 10.45 p.m. you can look forward to hearing advertisers' programmes (many of them directed to British listeners) from Athlone. The Athlone programme is, of course, relayed by Cork on 225 metres. These publicity broadcasts from Athlone constitute the first for British listeners from any English-speaking station on this side of the Atlantic and in view of the sale of Radio Paris to the French Government—and the possibility of the French sponsored programmes starting up from another station—there may be some big changes in advertising "on the air."

ATHLONE'S WAVELENGTH

ATHLONE'S wavelength of 413 metres is not entirely suitable for the reception of the sponsored programmes all over the British Isles. So it is good news that the Saorstat authorities behind Athlone are going to Lausanne next month—together with B.B.C. experts, and broadcasting engineers from all European countries—to discuss the wavelength changes. And as a result of the Swiss Conference, Athlone may get a better wavelength.

SUMMER LIGHTNESS

THE provincial stations of the B.B.C. are to follow the lead of Head Office regarding the lightening of programmes during the summer months. A certain amount of criticism has been roused in the provinces by the decision to discontinue alternative programmes between July 2 and September 16 during the hours of 6.30 and 8 p.m. on week days. At this time one programme only will be provided and the alternative programme transmitters will be closed down. The reduction in the number of talks during the summer is, on the other hand, generally welcomed, and in the Scottish Region there will be only one series of talkes, entitled "Holidays in Scotland."

IN SCOTLAND

"WE are keeping over most of our heavy feature programmes and big plans until the autumn," said an Edinburgh official of the B.B.C. "It is intended to organise a series of public concerts in the big studio at Scottish Broadcasting House, Edinburgh, commencing on April 25, and continuing during May and June. The Scottish Philharmonic Orchestra will be conducted by, among others, three Scottish composers, including Ian Whyte." The last named is the B.B.C. Music Director for Scotland.

BEHIND THE TIMES!

IT seems odd that Radio Paris when it relays parts of the London Musical Festival from May 8 to 19 should make use of a radio link. What is the matter with the highly developed land-lines? Presumably the French will take the Daventry National programme, which must be very well received in Paris. Talking of foreign relays, you may be interested to hear that the B.B.C. will relay from Stuttgart on May 9 a programme of folk music, using, of course, the usual land-line connections.

AFTER "THE BIG STUFF!"

WE hear that Mr. Herbert Glover, the Director of Talks and Outside Broadcasting for the Columbia system of America, is shortly meeting his opposite number of the B.B.C. when he lands in this country from an extensive European tour. Apparently, Mr. Glover has been after "big guns" for relay to America.

DANCE MUSIC IN MAY

DANCE fans will welcome the return to the broadcast programmes of Bertini, whose band gets one of the Monday evening dates in May. The other four Mondays of the month will be equally shared by Syd Kyte and Harry Roy. The rest of the dance schedule remains unchanged.

TWO REGIONS WITHOUT CHIEFS

EDWARD ("RED TED") LIVEING, the popular North Regional Director, is temporarily in London and Cleghorn Thomson has resigned as Director of the Scottish Region, so two of the Regional broadcasting areas are at the moment without permanent chiefs. Some difficulty is likely to be encountered in finding a successor for Scotland, as it is necessary for the new chief to be a Scot and to command the confidence of the Edinburgh and Glasgow factions—no sinecure!

THE FREUD OF RADIO?

ERIC MASCHWITZ (how that young man keeps in the news, doesn't he?) is now making a study of the psychology of listening. He may yet become known as the Freud of broadcasting! Seriously, Eric is determined to re-introduce the *comic song*, with the difference that the new type of song will tell a story in a funny way, as a welcome change from the nauseating sob-stuff of syncopated dance tunes.

OSCILLATION COMPLAINTS

Many More About Man-made Static

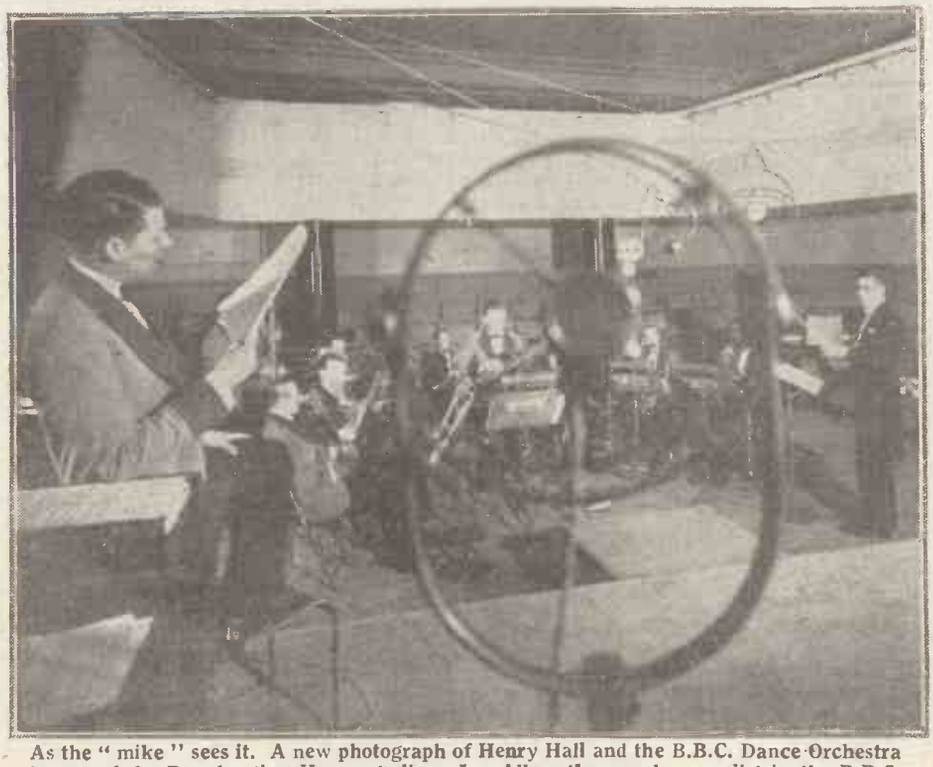
ONE of the most remarkable features of the B.B.C.'s technical correspondence is the almost entire disappearance of complaints about local oscillation. Of course, this is largely due to the fact that most sets of to-day are either non-radiating or are operated by listeners who have at last learned that an oscillating detector is not so sensitive as a "just going to oscillate" detector. Unfortunately, electrical interference is rapidly increasing and complaints to the B.B.C. are growing daily.

POST OFFICE ON THE TRACK

ALTHOUGH the sensible course would be the forbidding of the manufacture of electrical machines without provision for the suppression at source of ether disturbance, the Post Office is at present manfully combating listeners' difficulties by patient and intensive investigation. The first thing they do is to remove the aerial and earth. If the trouble continues a portable set is brought into use as a simple form of direction finder.

SHARMAN'S NEW "FINDS"

EVER on the lookout for new talent for broadcasting, John Sharman, B.B.C. producer of many successful variety shows, has found two new stars, or rather potential stars. One is Tessa O'Shea, a comedienne whose style is said to be a cross between Lilly Morris and Clarice Mayne. "She is full of personality," enthused a B.B.C. man, "is very young—in her twenties—and has *brains*!" Well, judge for yourself on April 29, when Tessa makes her broadcasting *début* from London. The other find is Arthur Askey, who is a funny man of the Leonard Henry type. If he is half as funny as Leonard he will pass!



As the "mike" sees it. A new photograph of Henry Hall and the B.B.C. Dance Orchestra in one of the Broadcasting House studios. Les Allen, the popular vocalist in the B.B.C. Dance Orchestra, is seen on the left

THE VALVE IN RADIO PROGRESS TO-DAY

At the present time it is the valve that is setting the pace for the designer. The rapidity of development in electrode complication is setting the set designers a problem as to the best system to adopt in consideration of cost, efficiency and adaptability

AT the time of writing this review of the valve position as it is at present in this country there is nothing which can be described as *fundamentally new* in valve technique. Under such description would come the thoriated dull-emitter in 1921—the gradual evolution of the oxide coated technique as applied first to battery valves and later the introduction of the separately heated cathode. Possibly the screen-grid valve in 1926 and the early bi-grids represented fundamental novelties as the first attempts to introduce multiple control of the electrode stream.

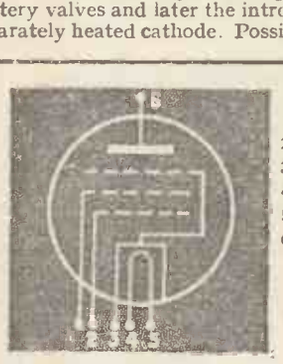
All the "new" types which are appearing, or expected to appear, on the British market may be divided into either :—

(1) Modifications of existing valves design incorporating multiple electrode control.

(2) Combinations of established electrode arrangements into the one envelope or on the one base.

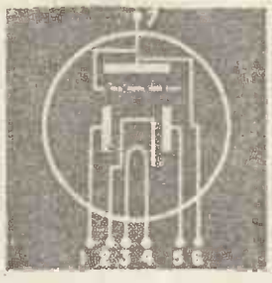
We can then examine the picture more clearly and allocate the various types of valves which are appearing to one or other of these two classifications.

During the last few years we have seen the gradual substitution of the straight "triode" in receiving sets by the tetrode or screen-grid valve and by the pentode, and receivers employing only triodes in all stages are now comparatively rare except in the cheaper battery sets where cost is a primary consideration. The screen-grid tetrode, therefore, is the valve which, naturally enough, appears to have exhibited the most marked progress—in strengthened electrode design, higher efficiency or "mutual conductance," and modification to grid design which has given us the variable-mu valve, a most important development allowing real progress in set design.



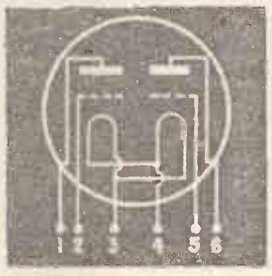
CONNECTIONS
1 Screen grid
2 Control grid
3 Cathode
4, 5 Filament
6 Anode

H.F. OR SCREEN PENTODE



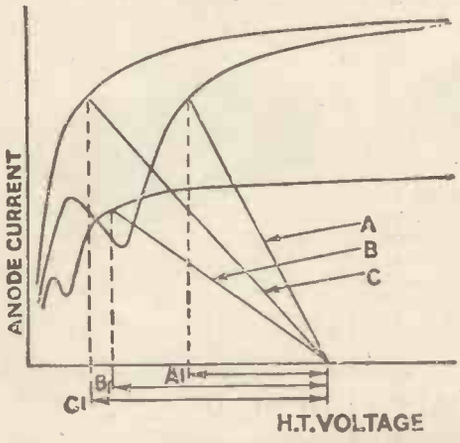
CONNECTIONS
1 Diode anode (1)
2 Cathode
3, 4 Filament
5 Diode anode (2)
6 Triode anode
7 Grid

DOUBLE-DIODE TRIODE



CONNECTIONS
1 Anode valve (1)
2 Grid valve (1)
3, 4 Filament
5 Grid valve (2)
6 Anode valve (2) Class B

CLASS B.



A Load resistance line for screen-grid tetrode.
B Load resistance line for same screen-grid tetrode at lower screen voltage.
C Load resistance line for H.F. or screen pentode. Indicates output voltage in each case.

Diagram shows increase in output voltage obtained by decrease in screen voltage of tetrode, and still further increase in output by introduction of pentode grid. The H.F. pentode gives similar effect to reducing screen voltage, but does so without reduction of mutual conductance. Note flat-topped characteristic of pentode, indicating high impedance

The Screen Pentode

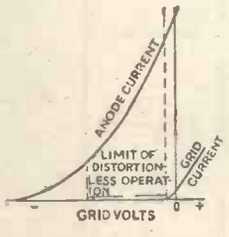
The screen-grid valve as hitherto designed, however, suffers from one or two drawbacks which this year appear to be indicating an amalgamation, so to speak, between it and the pentode. Two of the shortcomings of the screen-grid tetrode are variations in screen-grid current which may in extreme cases attain negative values, sometimes making control of screen volts difficult, and the presence of secondary emission from the anode which limits the load resistance and output voltage permissible without distortion. Both these defects are absent in a well-designed pentode and hence the trend to introduce the third or "suppressor grid" of the pentode into the screen-grid valve. Such a valve, known as an H.F. or "screen" pentode thus combines the advantages of both types and may largely supersede the tetrode.

As the "variable mu" characteristic is to be incorporated in these "screen pentodes" their utility is further increased for use as amplifiers in H.F. or intermediate-frequency circuits. There is no indication, however, that such valves, now in development, will attain the same low values of grid-anode capacity which have been a feature of many screen-grid tetrodes and often of great value in circuit design.

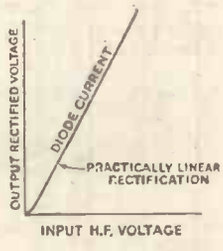
The screen pentode, therefore, can be said to be a multiple control valve with moderately low grid-anode capacity, and absence of secondary emission or negative screen currents, being thus capable of working with a much lower anode voltage, or alternatively with a higher load resistance and greater undistorted voltage output. It is thus likely to be useful in single-stage H.F. or I.F. amplifiers, or as a combined modulator-oscillator in super-het circuits.

Under the second classification come two new classes of valve likely to find wide application and to prove of great usefulness to the set designer and benefit to the user.

In these valves the complete and separate electrode systems of two valves—each a complete unit in itself—are mounted together on a common base and in the same bulb.



Typical characteristic of triode used as leaky-grid detector, in which the input H.F. voltage is limited by the triode characteristics which introduce an ode-bend rectification and distortion. The sensitivity is effected by the L.F. amplifying properties of the triode within the limits of distortionless operation.

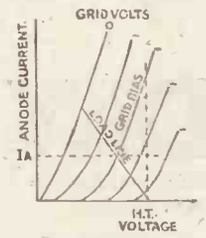


Typical characteristics of diode detector in which a large input H.F. voltage can be handled without distortion, and the rectification is extremely linear for both weak and strong signals. The diode gives no amplification in itself, but its rectified output can be applied to the grid of an amplifying triode in the same bulb, thus restoring sensitivity

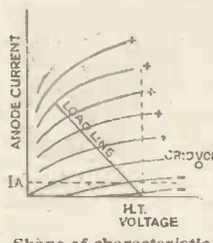
Actually, of course, no technical advantage is gained by this process of combination and the advantage is mainly that of saving space and possibly cost (though the latter point is not

necessarily applicable to the valve manufacturer !).

The first of the multiple valve classes to be considered is the combination of a diode detector and an amplifying element—either triode, tetrode or pentode. Diode detectors have been in use for many years—in fact, the diode was the original form in which a valve was constructed and from whence it obtained its name —a "one-way device." Owing to the demand for high sensitivity, however, the diode pure and simple has not taken its place in commercial broadcast receivers, where for detection use has been made of the amplifying properties of the triode in combination with rectification of the H.F. signal in its grid or anode circuit. Thus, we have grown accustomed to the leaky-grid or anode-bend detector which, in effect, is simply making use of the diode principle with an amplifying element tacked on.



Typical characteristic of ordinary triode power valve, showing value of standing anode current (I.A.) required to enable adequate power output to be obtained. The mean value of I.A. remains constant independent of signal strength, providing no overloading occurs



Shape of characteristic of Class B triode, showing reduced value of standing anode current (I.A.). The mean value of I.A. rises according to the strength of signal. Diagram shows valve designed for negative bias, but electrodes could be so designed to work at zero bias if desired, to obtain similar results

How, then, does the proposed diode-triode, for example, score over our old friend the leaky-grid detector, since both are in essence a combination of rectifier and amplifier in one bulb and the controlled electrons are emitted from a common cathode or filament? The answer is that in the diode-cum-amplifier combination of the new valves the amplifier portion is controlling an entirely separate portion of the electron-emitting cathode and is, in fact, most carefully shielded from the diode section, so that pure rectification of large signal voltages can be effected without affecting the amplifying characteristic of the triode, tetrode or pentode part of the valve. In fact, it would be quite possible to use the amplifying half to amplify signals either *before* or *after* diode rectification, according to the design of dual valve and accompanying circuit.

The double-diode-triode, as an example of one of these multiple valves, thus forms a compact means of distortionless detection of a wide range of signal voltages combined with amplification of the rectified output. It may be applied to a straight set to attain this simple effect, or in more complicated circuits to achieve the result known as *automatic volume control*. This may take several forms, involving circuits of varying degrees of complexity, and is bound to be one of the most valuable applications of this class of valve.

A second example of the multiple-valve class is to be found in the "double Class B" amplifier valve. This year is remarkable for the efforts of the valve manufacturers seemingly to complicate valve construction at their own expense in order to give the user the benefits of saving in space in receivers, reduction in the number of valve holders necessary and, in some cases, lower valve cost. For years the battery set man who wants more undistorted power than that possible from the humble (but by no means to be despised) 2-volt power valve, has perforce been driven to the use of two valve holders for a push-pull output stage —now he will be in a position to get that extra power by the use of one valve only. Incidentally, the characteristics chosen for the multiple output valve are those chosen for the type of circuit known as Class B, in which the maximum increase in power output is obtained for only a slight increase in total working H.T. current, so that a double advantage is gained.

It is unnecessary here to enter into a detailed discussion of what "Class B" entails—that has been adequately described elsewhere—but these new "double" output valves certainly give the battery-set user a chance of real *volume* without the necessity for the addition of many, if any, additional components.

Each section of these double Class B valves consists in effect of a triode, the characteristics of which, taken alone, would resemble those of a very high impedance H-class valve, normally used for resistance-capacity amplification. This is to simplify the grid-biasing arrangements, and in some of such valves the single impedance is so high that no grid bias at all need be used although the combination of the two electrode systems in a correctly designed push-pull circuit can produce a considerable power output without distortion.

A curious characteristic curve is obtained from the Class B valves taken singly, resembling what we are accustomed to see in pentodes. This is due to the fact that the grid voltages are nearly always *positive* instead of the accustomed negative values, and the net result of such an electrode design is that we get pentode efficiency with triode construction.

These double valves for Class B find their chief application in battery sets and do not show up to such clear advantage in A.C. sets where ample power supply is usually available.

The Concluding Instalment of this Article will Appear Next Week

BATTERIES FOR CLASS B AND Q.P.P.

Improvements in dry batteries have resulted in longer life and greater effective working capacity; also manufacturers have produced special types for Class B and Q.P.P. All these improvements are dealt with in this article.

JUST as experts were wondering if the popularity of battery sets was on the wane, owing to high running costs, along came Q.P.P. and Class B to revolutionise battery set operation.

Dry-battery manufacturers lost no time in bringing out special batteries for these new output systems.

A few comparisons between voltage drop under load and increase of internal resistance show the good performance of modern batteries.

A good 60-volt battery by Hellesen, typical of modern design

A Hellesen 99-volt standard capacity battery gave an initial voltage of 100 on load and the internal resistance was only about 120 ohms. Over a lengthy period of working on intermittent discharge the voltage very steadily fell to 50 and not until about two-thirds of the working period had elapsed did the internal resistance rise to a maximum of 800 ohms.

An Ediswan single-capacity type tested under similar conditions showed that 250 hours (working) life are obtained before the cells have dropped under half the rated voltage. What is even better is that the internal resistance remains very low during the greater part of the discharge period. Indeed, at the end of a useful life the resistance is only in the neighbourhood of 500 ohms. The actual capacity obtained on test was 1,760 milliampere-hours, which is over 40 per cent. better than a value which used to be considered standard for the single-capacity cell. These test figures are only selected at random from a large amount of material obtained by the "A.W." Technical Staff.

A Drydex battery produced for Q.P.P. receivers, with an independent grid-bias section

Fine adjustment of voltage on a dry battery is essential and some manufacturers have gone out of their way to provide for this. One type of 120-volt standard-capacity Lissen battery, for example, is tapped at 25, 34, 43, 52, 61, 70, 79, 88, 97, 106, 115, and 120. Incidentally, the Lissen "new process" is typical of the honest endeavour made by battery manufacturers to prevent rapid polarisation and to produce a good milliampere-hour figure per cell.

A Pertrix ultra-capacity battery specially designed for Q.P.P. working

The introduction of Class B and Q.P.P. has induced manufacturers to include an entirely separate grid-bias section in the same carton as the H.T. section. And in addition, the H.T. section is tapped in very small stages, so that you can choose the most economical working voltage.

Among the many Drydex batteries, for example, is one made specially for Q.P.P. and Class B purposes. This, the type HL63, includes a separate 18-volt bias section. The main H.T. section gives 135 volts and is tapped at every 1½ volts from 120 to 135.

Typical also of modern battery development in connection with Q.P.P. are the four latest Pertrix batteries for use with Q.P.P. receivers. The ultra-capacity Pertrix cells for Q.P.P. are not electrically connected with the grid-bias cells, but the grid-bias section is made up with the same ultra-capacity cells as in the H.T. section. The inclusion of the grid-bias portion in the main carton ensures a new bias battery is brought into use along with the H.T. battery, thereby eliminating the risk of damage to the valves in the Q.P.P. stage by excessive anode current, which is caused by an exhausted bias battery.

One of the Lissen New-process super-power batteries

Another typical modern battery for Q.P.P. is the 150-volt standard-capacity Ediswan with a recommended discharge rate of 10 milliamperes. This is a 150-volt job tapped for Q.P.P. and has a separate 18-volt bias section.

Many manufacturers are recommending a 120-volt double-capacity battery for Class B work. The Siemens 1168 is an example of this.

NEW IDEAS IN MODERN RECEIVER DESIGN

(1) Control of Tuning. *Many of the simpler sets, that is with two tuning stages and a single high-frequency amplifier, have ensured accurate ganging all round the dial by the use of a main control knob with super-imposed trimmer knob. In this way the simplicity of tuning is not sacrificed, because for most station-logging only the main knob has to be turned. At the extremities of the tuning scale the additional control on the trimmer is a great aid, as in this set, the Atlas Lambda three-valver, a test report of which appeared in the January 28 issue of "Amateur Wireless."*

1.

(2) Effective Valve Screening. *The great importance of screening between the anode and grid circuits of the high-frequency and detector stages has long been recognised but only within the past year or so has inter-stage screening been carried to its logical limits. Many sets now are built on metal chassis but this is not considered enough, and elaborate precautions are taken to prevent any interaction in the parts fitted above the chassis. In this set, for example, the Sunbeam B33 three-valver, the three valves are well screened from one another. Fuller details were given in "Amateur Wireless" dated January 14, 1933.*

2.

(3) Power Supply Simplification. *Quite a number of the latest sets make use of the metal type of mains rectifier, for obtaining the high-tension and grid-bias voltages from the alternating-current mains. Nowadays the power supply is frequently built in as part of the chassis. In this Regentone Quadradyne set, for example, the metal rectifier is suspended in a convenient position at one end of the metal chassis, with the power output valve immediately behind it. The high-frequency and detector valves are quite distinct. Full test report, "Amateur Wireless" dated April 15, 1933.*

3.

(4) Station Indicating Dials. *One of the most attractive ideas for easing the job of station logging in the new commercial sets is the use of a station-calibrated scale. Here, in the Regentone set, we have a good example of this new tendency. There is a large and easy-to-read horizontally mounted scale, with a pointer moving across it and controlled by the main tuning knob. In addition to the wavelengths for both wavebands a number of the more important foreigners are clearly and accurately marked along the top. Test report in "Amateur Wireless" dated April 15, 1933.*

4.

(5) External Loud-speaker Connections. *Although it is true that the modern type of set consists of a chassis with a self-contained moving-coil or moving-iron loud-speaker, it is nevertheless equally true that many listeners want an external loud-speaker, either in another room or as an addition to the self-contained one. Some sets make provision for cutting out the internal loud-speaker when the external one is wanted alone. In the Six Sixty Super Five, described in "Amateur Wireless" dated April 8, 1933, there is a simple plug adaptor whereby the internal moving-iron loud-speaker can readily be disconnected, or it can be used with an external one.*

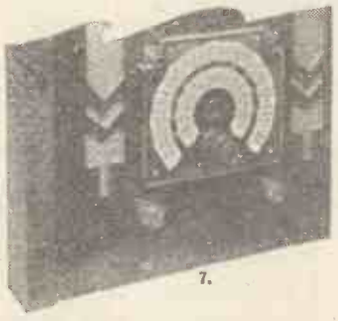
5.

9.

(6) Simplifying the Control Layout. *Many ingenious methods have been adopted by set makers to compromise over ease of control and efficiency of operation. One of the easiest ways of achieving simple-looking control, and at the same time retaining all controls essential to good performance, is to remove some of the subsidiary controls to the side of the cabinet! The psychological effect is very valuable, as in this Bluespot four-valver, described in "Amateur Wireless" dated February 11, 1933. Note the aerial compensator on the left.*

6.

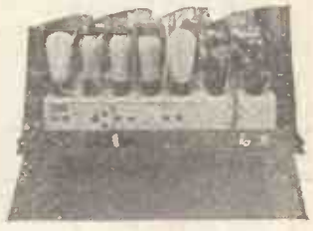
(7) New Tuning Dial Developments. *As already mentioned, the wavelength-calibrated tuning scale has come into its own as a valuable means of simplifying station logging. Various methods have been tried to overcome the obvious difficulty of crowding so much information in so small a space. One of the neatest of the wavelength and station marked dials is on the Six Sixty Chassiset, described in "Amateur Wireless" dated January 7, 1933. In this set the scale is circular, and in conjunction with an ingenious lighting system the stations are made very easy to read.*



7.

(8) Screening in the Modern Chassis. *Some of the latest chassis, for super-hets in particular, are marvels of compact yet effective disposition of components. A very good example is the Marconiphone model 256, described in "Amateur Wireless" dated January 21. In this chassis are arranged altogether seven valves, six of which are for the super-het sequence and the remaining one for the mains rectifier. All these valves, with the exception of the power valve, are metallised, so inter-valve screening is not required, except for the intermediate-frequency amplifier stage, around which is fitted a metal shield to act as an additional aid to screening.*

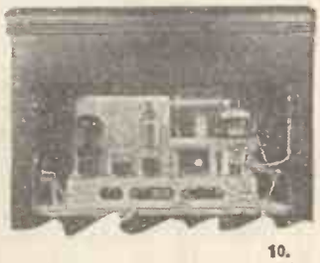
(9) All-wave Tuning Developments. *There is an increasing tendency, especially since the opening of the Daventry short-wave service to the Empire, to design sets that cover all wavelengths from the very short to the long. The difficulty of covering such a wide wavelength range can be solved with special three- or four-waveband coils, but some makers prefer to use inter-changeable coils, as in this Gecophone Overseas superhet, described in "Amateur Wireless" dated February 4, 1933. The coil units for each waveband consist of sets of screened coils, which interlock with the chassis connections.*



8.

(10) Radio Gramophone's Popularity. *To meet the ever-increasing demand for cheap radio-gramophones many set makers have put their chassis in pedestal cabinets, and with the addition of suitable accessories, such as turntable and pick-up, have managed to produce some excellent inexpensive instruments for radio and record reproduction. A good example is the Ekco RG23 three-valver, of which the chassis is shown below, with its metal rectifier for the mains supply forming an integral part of the construction.*

Each week in "A.W." full test reports of well-known sets are given

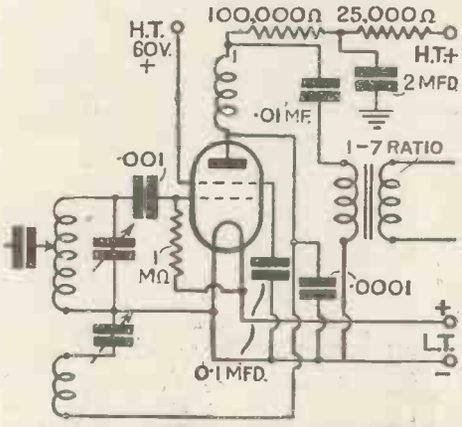


10.

CIRCUIT TENDENCIES

THE LATEST DETECTOR CIRCUITS

WITHIN the past year many improvements have been made in detection to cope with the much greater inputs applied to the detector stage after screen-grid valve amplification. Another reason for increased attention to



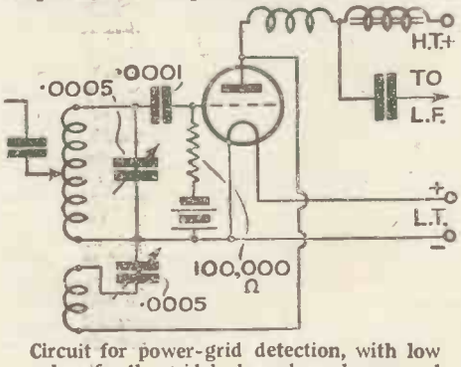
Circuit for using screen-grid valve detector. Note the high grid condenser capacity and decoupling in the anode circuit

detectors is automatic volume control, where the voltage applied to the detector is made to control the amplification of preceding valves.

Screen-grid Detectors

Many sets can now use a screen-grid valve for detection with improved results over the normal triode valve. The best use is for sets having only one high-frequency stage or for simple detector low-frequency sets—for sets, that is, where the input voltage is small. The screen-grid will overload on powerful inputs.

The great advantage in small sets of a screen-grid detector is increased amplification. Although only a small portion of the total high amplification of the screen-grid can be stepped off, owing to difficulties of matching the external anode impedance with the very high valve impedance, nevertheless what little amplification compared with the total is



Circuit for power-grid detection, with low values for the grid leak and condenser and choke fed anode circuit to enable maximum voltage to be applied to anode

obtained is greater than the amplification of the normal triode.

Our circuit shows a good method of using a screen-grid detector. Direct transformer coupling is out of the question owing to the high valve impedance, but resistance-fed transformer coupling is very suitable. We suggest a 100,000-ohm resistance as good average. If higher is used, although matching will be improved, the loss of anode volts through the resistance will be too great.

The anode resistance should be de-coupled with 25,000-ohm resistance and 2-microfarad condenser, and anode choke and by-pass condenser should be used to get rid of high-frequency. Coupling condenser to transformer can be .01 microfarad, with high-ratio step-up transformer after it.

The grid-condenser should be .001-microfarad, as this will enable a larger signal than usual to be handled without overloading. A 1-megohm leak will serve with this condenser. The screen-grid is taken to 60 volts high-tension and a de-coupling condenser is taken from this point to earth.

Power-grid Detectors

Great advantage is, of course, handling of big signal inputs without overloading. Very useful for big sets and super-hets.

A low-impedance valve is used. This naturally has a big grid swing. The high-tension voltage on the anode can be increased—should be, in fact—to 150 or even 200 volts. This will still further increase the valve's grid swing, and it will not overload in its function of amplifier of the low-frequency part of the signal.

As the anode current would probably be excessive with this large anode voltage the grid should be negatively biased, so that the current is kept down, and therefore the wattage, which is the factor that matters in conforming with the makers' working conditions.

Low values are used for the grid leak and condenser, as shown by our circuit. Note the grid-bias battery between the earth and the 100,000-ohm grid leak. These values, by the way, are chosen to prevent frequency distortion, and have nothing to do with the amplifying function of the valve, which is taken care of by the high anode voltage, negative bias and low impedance of the valve.

In the anode circuit, because of the large current and high anode voltage required, it is useless to use a high resistance, so we recommend a good low-frequency choke, say of 200 to 300 henries inductance, with reasonable current-carrying capacity, say up to 10 milliamperes, and as low a resistance as possible.

This choke will be used with a transformer in the usual parallel-feed system of coupling, the only difference being the use of a choke instead of a resistance.

One big advantage of this system of power detection is that little or no alteration to the set is involved. There are other ways of handling a big detector input, but they involve special valves or circuits.

Push-pull Detectors

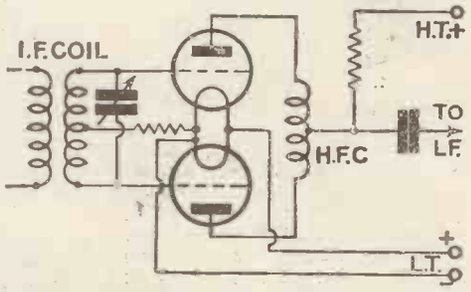
Special use in second-detector position of super-hets and in straight sets with lots of high-frequency amplification and where reaction is not wanted. The main advantage of push-pull detection is the handling of a big grid swing—much more than with a power-grid triode valve circuit.

Also useful for short-wave sets, because the inter-electrode capacity is halved; there are fewer losses and reaction is easier to obtain on low wavelengths.

In use, ordinary triodes are recommended, with an impedance of, say, 10,000 to 15,000 ohms. Small power valves can be used if the anode current can be supplied.

Circuit is shown. We indicate push-pull detector valves following the intermediate stage of amplification of a super-het, but the centre tap can come from almost any tuning coil—say from a tuned-grid coil in a straight set with lots of amplification in front of detection.

Note that owing to the push-pull action no grid condensers are needed. The grid leak should be low, say 100,000 ohms, taken to low-tension negative. The anodes are connected to each end of a centre-tapped high-frequency choke. You might take a centre-



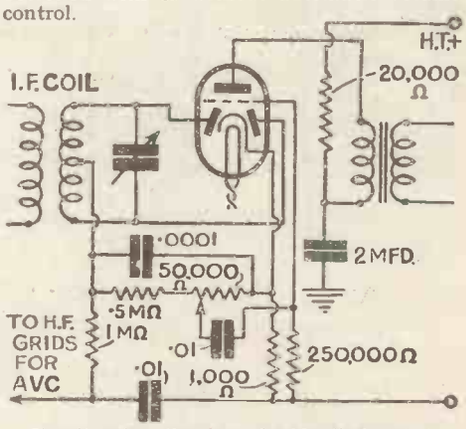
Circuit showing how to use two triode valves for push-pull detection. No grid condenser is needed owing to the push-pull action

tap from one of the numerous binocular chokes on the market. Or two resistances in series could be used, each three to five times the valves' series impedance.

If you should try this circuit with resistances, remember that there will be a voltage drop across them, so increase the high-tension voltage to the maximum.

Double-diode-triode Detectors

These new valves will shortly be on the market, their special use being for full-wave detection with or without automatic volume control.



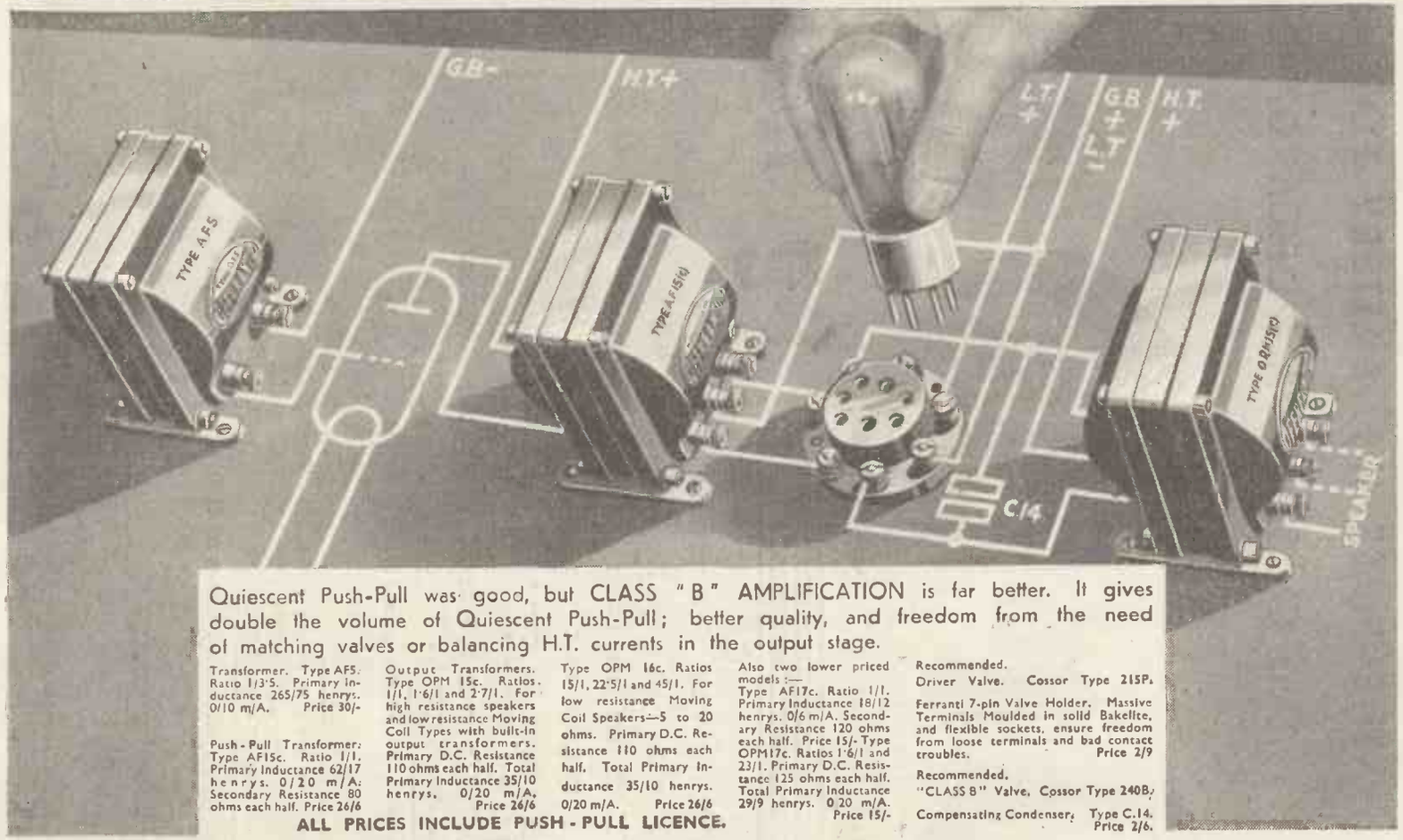
Circuit using the new double-diode-triode valve for push-pull detection and automatic volume control

A diode, remember, is a simple two-electrode valve with a filament and an anode. A double diode has one filament and two anodes for full-wave detection. A double-diode-triode has one filament-heater and two anodes as before, but in addition there is a grid and another anode for the amplifier triode. The one filament is common, that is, to a double-diode and a normal triode, all in one bulb.

As the filament has so much work to do it is at present made only for mains working.

Circuit shows how this new type of mains valve can be used in a full-wave detector circuit with automatic volume control applied to preceding high-frequency amplification. It looks a little complicated but really is quite simple.

'CLASS B' AMPLIFICATION AND FERRANTI



Quiescent Push-Pull was good, but CLASS "B" AMPLIFICATION is far better. It gives double the volume of Quiescent Push-Pull; better quality, and freedom from the need of matching valves or balancing H.T. currents in the output stage.

Transformer. Type AF5. Ratio 1/3·5. Primary inductance 265/75 henrys. 0/10 m/A. Price 30/-

Push-Pull Transformer: Type AF15c. Ratio 1/1. Primary Inductance 62/17 henrys. 0/20 m/A. Secondary Resistance 80 ohms each half. Price 26/6

Output Transformers. Type OPM 15c. Ratios 1/1, 1·6/1 and 2·7/1. For high resistance speakers and low resistance Moving Coil Types with built-in output transformers. Primary D.C. Resistance 110 ohms each half. Total Primary Inductance 35/10 henrys. 0/20 m/A. Price 26/6

Type OPM 16c. Ratios 15/1, 22·5/1 and 45/1. For low resistance Moving Coil Speakers—5 to 20 ohms. Primary D.C. Resistance 110 ohms each half. Total Primary Inductance 35/10 henrys. 0/20 m/A. Price 26/6

Also two lower priced models:—
Type AF17c. Ratio 1/1. Primary Inductance 18/12 henrys. 0/6 m/A. Secondary Resistance 120 ohms each half. Price 15/- Type OPM17c. Ratios 1·6/1 and 23/1. Primary D.C. Resistance 125 ohms each half. Total Primary Inductance 29/9 henrys. 0·20 m/A. Price 15/-

Recommended.
Driver Valve. Cossor Type 215P.

Ferranti 7-pin Valve Holder. Massive Terminals Moulded in solid Bakelite, and flexible sockets, ensure freedom from loose terminals and bad contact troubles. Price 2/9

Recommended.
"CLASS B" Valve. Cossor Type 240B.

Compensating Condenser. Type C.14. Price 2/6.

ALL PRICES INCLUDE PUSH-PULL LICENCE.

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FERRANTI COMPONENTS

The latest and greatest boon to the Battery-set builder.

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

On Your Wavelength!

REFLECTION AND QUALITY

I WONDER how many people appreciate the importance of reflection in sound reproduction. Sound travels from the loud-speaker to our ears in the form of air waves, which can be reflected from walls and other hard surfaces. Most radio enthusiasts know this, but few will realise what an important part this plays in the quality of the reproduction. I had a striking example of this the other day when I was listening to an advance model of one of next season's sets. The test was going on in the laboratory of one of our leading radio manufacturers and, as is often the case, the set was not completely assembled, being in chassis form only, coupled to a loud-speaker mounted in an otherwise empty cabinet.

LOWERING THE PITCH

I DID not like the quality and, somewhat diffidently, said so. It sounded too high pitched for my liking. The engineer on the job, however, did not seem perturbed. He picked up a raincoat lying over a chair—*my* raincoat, as it happened—and draped it over the back of the cabinet. To my surprise, the quality at once became pleasant and the shrillness vanished.

In answer to my inquiring expression, the engineer laughingly explained that with the empty cabinet standing, as it was, only a foot or so in front of a wall, the upper frequencies were not damped at all, but were reflected from the hard surface of the wall into the room. Under normal conditions the cabinet would contain the set and be fitted with a gauze-lined back which would effectively damp much of the "top," leaving a pleasant and evenly balanced reproduction. Throwing a raincoat over the back of the cabinet had the same effect.

It goes to show the indefinite nature of "quality." Reproduction which is pleasant in one room, which is heavily draped, would sound harsh in a room with bare walls and little or no hangings, while a set which is pleasant under the latter conditions would sound "woofy" in a heavily damped room. That is why a tone control is such a useful fitting on a set. The user can adjust the quality to suit his taste, and to suit the room in which the set is used.

VALVE HOLDERS GALORE

THE coming of the seven-pin valve holder brings my collection up to well over a dozen different kinds, all of which have been introduced in the last eleven years. Rather queer contraptions some of them look nowadays. There is, for instance, the Siemen's-Haelske pattern, which supported a fat tubular valve about five inches long with ebonite caps at both ends. The valve lays horizontally between large and rather clumsy-looking clips. Then there is the type required for the old Air Force "C" valve, with four flat spring contacts and a rather similar, though much smaller, affair needed for the test-tube V24. Another test-tube valve, which created quite an excitement in its day, was an unbreakable pattern whose name I cannot for the moment recall, though I believe it was of Canadian origin. Anyhow, I can remember testing it thoroughly by throwing it about the room without doing it the least harm. It was provided with a cap at either end, each having a pair of thin pins which fitted very tightly into spring clips.

The first type of screen-grid valve that we had was the Round S625, which was at first mounted horizontally in a holder with three spring clips at one end and two at the other. Did you know that the four-pin holder was of French origin? In its early days, the four-pin valve was known as the French valve because it was first produced in that country. What bright-emitters these old valves were, is shown by the French word for valve, which is *lampe*.

FASHIONS IN TUNING

IN spite of the ease and convenience of single-knob control, there are plenty of stalwarts about who will have nothing to do with it. A separate control for each tuned circuit is apparently their motto—not because they deliberately like to make things harder, but because they hold that it is the only way to get the best out of the set. Of course, this is true enough, since ganging is, at the best, only a compromise. One robs Peter of a little selectivity in order to cater for Paul, who prefers celerity. Also, one has to bear the womenfolk in mind, and they certainly don't like a set that is too much of a box of tricks.

As a matter of fact, it is rather curious why the hand that is supposed to rule the world so often makes a poor show at bringing in distant stations at their best. Anything that simplifies tuning, such as single-knob control and a dial that is plainly marked with the name of the station, will always get full marks from the ladies. And I venture to prophesy that automatic volume control is going to be another popular feature in the same quarter. No tinkering about—every station comes over in clean-cut fashion. And, above all, no fading. As one might say, they come in pat and stay put.

THE NEW 5XX

WORK has already started on the new Midland station three miles from Droitwich, which is eventually to contain both the National and Regional transmitters, superseding the present 5XX and 5GB. The 100-kilowatt transmitter, working on 1,554.4 metres, should easily cover the whole of the British Isles, whilst the new Regional plant should provide much better reception than is now obtainable from the 399-metre Daventry station. The latter is now six years old. It was put up as an experimental station in 1927, and it is without many of the newer important improvements.

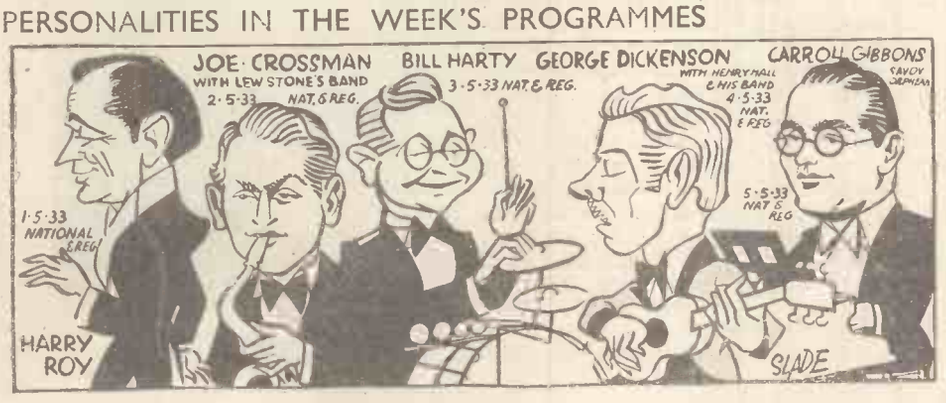
A CROP OF CLASS B's

WE are, I hear, to have quite a crop of Class B valves, and they are to come not only from the big manufacturers, but also from some of the smaller firms. It will be very interesting to see which pattern of Class B eventually becomes standardised. At present we have one capable of a full 2 watts and requiring for maximum output some 11 milliamperes, including the driver valve's plate current. Another pattern, which should be made more on economy lines. It won't make for more than about a watt of output at the outside, but its H.T. requirements will be kept down to an inclusive 5 milliamperes or so.

FUTURE POSSIBILITIES

THERE are all sorts of possibilities outside these two. You might, for instance, turn out an extraordinarily economical valve for half a watt of output or one that would pretty well lift the roof when required, though

PERSONALITIES IN THE WEEK'S PROGRAMMES



On Your Wavelength! (continued)

using a good many milliamperes. I rather expect, myself, that the Class B valve will eventually settle down in a somewhat similar way to the pentode. All of the first pentodes were of the kind requiring a great deal of H.T. Then came the economy pentode, and now we have the two types both standardised. In Class B valves we shall most likely find eventually that many firms will turn out two different patterns on the lines suggested. This will, I think, be necessary to meet the popular demand. Some people like a great deal of noise, whilst others are much more concerned about economising in milliamperes.

"SPONSOREDS" FROM DUBLIN

AT the end of April sponsored programmes—that is, those paid for by advertisers—will begin from the big Athlone station. A good deal of business is expected, and a special publicity company has been formed to sell programme time. I am rather sorry, myself, that Athlone is indulging in this kind of thing, for it seems to me that a good many of the Continental stations have detracted greatly from the entertainment value of their programmes by including large chunks of advertising matter, and it seems a pity that Athlone should have to go the same way. I wonder, really, what is the value of broadcast advertising. I suppose that it *must* pay or people wouldn't do it. Many people, though, I know, turn to something else the moment that the station to which they are listening begins to urge the merits of whatever firm is paying it to do so. One thing about these sponsored programmes from stations that we can easily receive is that they serve as an example and as a warning to us. I haven't heard anything of the suggestion that the B.B.C. should allow advertising since the public have had a taste of it from stations outside the country.

THE LUXEMBOURG NUISANCE

THE worst of all advertising stations will be Radio Luxembourg, which is now frequently to be heard on about 1,200 metres. Now, there is only one factor that can make for a valid claim on the part of any nation to the use of a long wavelength. This is that the area of its country is so large that a long wavelength is necessary to cover it properly. Great Britain, France, Germany, Norway, Sweden, and Poland are very clearly entitled to such wavelengths; but if you glance at your map of Europe you may have some difficulty in finding the Duchy of Luxembourg, so tiny is it. Luxembourg was allotted by both the Prague and the Madrid Conference a wavelength fairly low down in the medium band, which is adequate for covering every inch of its area. Permission to use a long wavelength was quite definitely refused. This giant station, which can use 150 kilowatts when it wants to, was erected not to provide a programme service for Luxembourg. It must, in fact, be an appalling nuisance to all the inhabitants of the Duchy. It was put up by a company with the idea of covering as much of Europe as possible and of making a large income by selling programme time to advertisers of various nationalities.

ASTONISHING DX CONDITIONS

NEVER, so far as I can remember, have spring conditions for long-distance work been so amazing as they are at the time of writing. Continental transmissions are, in fact, coming in now every bit as well as they were during the darkest part of the year in December and January. A good many are to be heard in daylight and the number increases rapidly as dusk draws on. Remember that Central European time is an hour ahead of ours and Eastern European time two hours ahead. Hence it may have been dark for some time in the country from which a transmission originates, though it is still daylight over here. From about eight o'clock onwards the number of stations receivable goes up by leaps and bounds, and presently you find that there is something to be heard at almost every division of the tuning dials. On a recent evening I spent an hour or two in order to discover how many stations there were that could be received strongly and well. The total at the end of that time was forty-six, and this does not include many that were tuned in but were not really worth listening to owing to interference of some kind. Rather a wonderful record for an April evening, I think.

'WARE HARD WIRE

THERE is a good deal of cheap low-grade insulated wire knocking about at the present time, and I advise readers to be on their guard against it when purchasing wire. The main trouble about this stuff is that the conductor is made of hard copper which breaks at the slightest provocation. Good quality wire, which costs very little more, is made of soft drawn or electrolytic copper, and you can shape its bared ends almost as you like with the pliers. But this hard stuff is something more than a nuisance. Nick the wire ever so slightly when you are removing the outer covering of insulation, and it is almost any odds you like that the bared end will break off short when you try to form a loop for bending over the shank of a terminal. The best way to avoid this unpleasant stuff is to insist upon having an end bared when you are making your purchase and to try bending it with your fingers. If it is fairly soft, well and good; but if you find it difficult to bend ask for something else. You cannot go wrong if you purchase wire of well-known British make. You can go very much wrong if you save a halfpenny or two by buying nameless stuff of unknown origin.

CHANGING THE BIAS

Always switch off your set before adjusting the value of the grid bias. If the bias plug is removed while the set is running and

the H.T. is switched on, a current surge may be set up owing to the sudden removal of the biasing voltage on the grid

RADIOGRAMS DE LUXE

HITHERTO, record-changing devices have been playthings of the rich and near-rich, their highly exclusive existence being solely on the more expensive and luxurious radiograms. In one of the best record-changing machines I have seen the records are played off in a vertical position instead of the normal horizontal. This instrument has the great advantage that different makes of 10-inch and 12-inch records can be mixed up for playing off, and, if desired, the almost human selector will turn each record round and play the other side before going on to the next. Another fascinating gadget is the needle-changing device, which grips a new needle to the sound-box for each record and drops the old one out into a "waste" box. The sound side of this spectacular machine is of the acoustic type, and the price is—wow!—too high for me!

NEEDLES TO SAY

THE subject of gramophone needles for radio-grams requires rather more thought than it used to, and the coming of automatic record changers will complicate things still more. The shape of the groove depends on the condition of cutter that made the original wax, and there are liable to be appreciable variations in the shape of the grooves in different makes of records, and even in different records of the same make. The grinding-in process of a needle takes place in the first few revolutions of the record; so make sure you start your records from the very edge. A good needle will play the same *side* of a record without damage, providing it is not twisted in its holder. Cheap and nasty needles are expensive in the long run, if the condition of records is a consideration. Needles that are supposed to play a dozen or so records without changing should not always be taken at their face value.

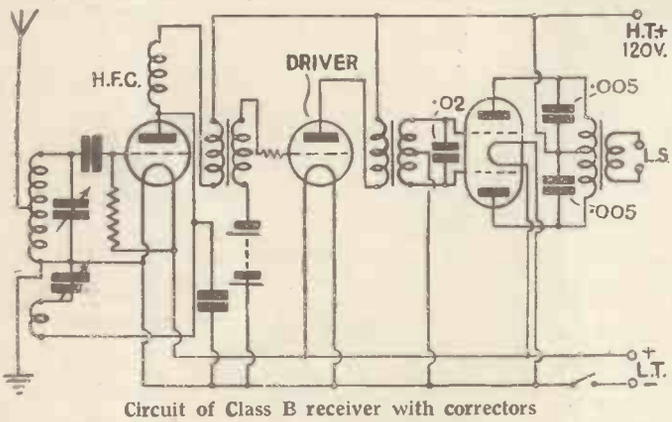
THERMION.

ALL ABOUT CLASS B & Q.P.P.

The introduction of the Class B Valve is of great importance to the battery user, for it makes possible full volume with low H.T. current consumption. In this article J. H. Reyner explains the new system of amplification in a simple manner

THE use of a quiescent method of operation in the output stage is referred to later when describing Q.P.P. By operating two valves in a push-pull arrangement with a very small standing anode current, the signal applied can be made to push up the anode current of each valve alternately, the two anode currents being combined in an output transformer feeding the loud-speaker. By this means the total change of anode current is similar to the applied grid voltage so that distortionless amplification is obtained, but there is practically no anode current when there is no signal.

Because the signal pushes first one valve and then the other, the arrangement is often known as a push-push system, and in this respect the operation is exactly similar to that of Q.P.P. It was not long before special valves were devised for the purpose. These valves, which are known as Class B valves, are similar in construction to an ordinary L.F. type of valve, but they have one important difference.



Circuit of Class B receiver with correctors

No Bias

The ordinary L.F. valve is designed to work with 4 or 5 volts grid bias, and we take particular care to see that the grid is never positive with respect to the filament. If the grid is made positive, grid current flows, the amplification falls off, and distortion is introduced. Because of this limitation it is not possible to make full use of the valve. The anode current with zero grid volts is usually of the order of 10 milliamps, whereas the valve will give five or six times as much anode current as this with safety.

In a Class B valve no grid bias is used. The valve is so designed that with no volts on the grid the anode current is small, usually just over a milliamp. Making the grid negative, of course, has no effect, whereas making the grid positive causes a rapid increase in the anode current up to 40 or 50 milliamps. By using two valves such as this in a push-pull arrangement we can obtain an output of 2 watts for a peak input swing of about 40 volts, while with a peak input of 25 volts an output of just over a watt can be obtained if the anode impedance is slightly altered.

Good News for Battery Users

These figures are very good news for battery users. Being able to obtain momentary outputs of between 1 and 2 watts is of the greatest importance. While the average volume level is about 100 milliwatts, it is quite easy for the grid swing to increase to four or five times this normal value which requires an output of the order of 2 watts. The depth of tone of a mains set is very largely due to its capacity for responding to these sudden calls for power, and the battery set has hitherto been severely limited in this respect.

It is quite fair to say that the introduction of the Class B valve has made the radiogramophone a practical proposition for the battery user for the first time. Here above all else an output of some 1½ to 2 watts is essential. Any ordinary acoustic gramophone will give an output of this order quite easily, and it is rather cold comfort talking about better quality obtainable with electrical reproduction if the signal strength is only about half that obtainable from an ordinary portable gramophone. With Class B valves the output can be easily obtained.

Small H.T.

As in the case of Q.P.P., the great advantage of the system is the small high-tension consumption. It is customary for convenience to put up the two Class B output valves within the same bulb and bring out the leads to a 7-pin base. The steady anode current of the Class B valve taken as a whole (i.e., both halves) is about 2½ milliamps on 120 volts. Momentarily current may peak up to 30 or 40 milliamps, but the average current, of course, is much less than this. It is usually measured with a silver voltameter just as in the case of Q.P.P., and the average current on an evening's entertainment is somewhere around 7 milliamps.

Special arrangements have to be made, of course, to feed this valve, owing to the fact that grid current is flowing. In the ordinary valve no grid current flows and no power is consumed. With this circuit we have what is equivalent to a resistance of about 10,000 ohms across the total input transformer, and this has to be designed just like an output transformer in a small power valve.

The Driver

This preceding valve is known as a driver and is coupled to the Class B valve through a driver transformer which is really a small output transformer having a centre-tapped secondary, matched up to the valve just as we should match a loud-speaker having an effective impedance of 10,000 ohms.

The complete output stage, therefore, consists of a driver valve, driver transformer, Class B valve and output transformer. It is quite sensitive, an output of 9 volts peak being sufficient to supply 2 watts of power. The driver valve, therefore, can quite easily be coupled with a transformer to the ordinary detector stage of a set.

The driver valve, of course, takes a small extra anode current, but this is cheerfully afforded in view of the increased power which is obtainable. Even so it is possible to produce astounding output and quality with very little high-tension consumption.

One of the new Class B transformers—the Ferranti AF15(C)

A 3-valve set consisting of detector, driver and Class B valve can be adjusted to take a steady anode current of about 5½ milliamps and an average current throughout an evening's run of about 8 milliamps.

The circuit of such a set is shown above. There are two points to which mention may be made specifically. The first is the use of parasitic stopping

(*Continued at foot of next page*)

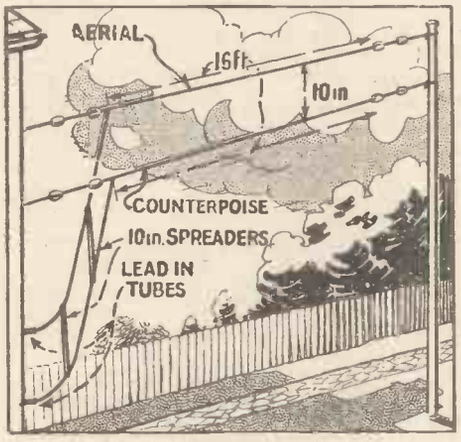
WHAT IS NEW IN SHORT-WAVE WORK?

Special Aerials for the Short Waves

AMONG those who are really keen on short-wave reception below 100 metres there is a growing tendency to install a special and separate aerial and earth system. To-day, the short-wave aerial "peaked" to a particular wavelength or band of wavelengths is coming into its own.

With the short-wave aerial almost invariably goes a short-wave earth in the form of a counterpoise, which is really an arrangement of wires similar in every detail to the aerial but erected some way below it.

Our diagram shows an excellent 20-metre short-wave aerial system incorporating the latest developments. It consists of an aerial



The ideal aerial arrangement for 20-metre band short-wave reception

length of, say, 16 feet, with a similar wire for the counterpoise fitted about 10 inches below it.

The lead-in wires for the aerial and counterpoise are very important. Their length should for preference be half the length of the horizontal, in this system 8 feet each. If this is impracticable, you should choose a length that is a harmonic of the horizontal length, such as 8 feet.

Many enthusiasts will want to erect aerials for each band of short waves covered during reception. Before this can be done, you must know the method of calculating the length of wire in *feet* for any given wavelength band in *metres*.

It is quite easy. Remember that one foot equals about .3 metre, and before the equation can be worked out, you have to reduce your different measurements to a common unit.

Suppose you have an existing aerial and would like to know what is its natural or peak-efficiency wavelength. In other words, you want to find the natural wavelength in metres when you know the length of the wire in feet.

Wavelength equals length of aerial in feet multiplied by .3, multiplied by 4. Thus, with an aerial of 30 feet length you would have a natural or peak wavelength of 30 multiplied by .3 multiplied by 4, which is 36 metres.

Now suppose you are setting about erecting a special aerial to tune a given band of short wavelengths with maximum efficiency. It is also quite easy to find out the right length of wire to use.

The simple equation is length equals wavelength in metres, multiplied by 3.3 and divided by 4. Thus, if you wanted a peak wavelength of 20 metres, you would find the length of wire wanted would be, 20 multiplied by 3.3 and divided by 4, which is 66 divided by 4, which is about 16 feet.

Special short-wave aerials are well worth erecting, and represent one of the most important developments on short-waves. Any given short-wave set will work very much more effectively, it has now been proved, with a special aerial than with a haphazardly-erected aerial and earth.

SHORT-WAVE RECEIVER DESIGN

MOST of the development work on short-wave receiver design has been centred around the ultra-short bands, that is bands below 10 metres. For such short-wave bands the super-het type of set has become almost universal.

Usually, such sets have one intermediate-frequency stage with reaction applied to it—an addition that often increases the strength by as much as 50 per cent.

Although we are dealing with very short fundamental wavelengths, the intermediate wavelength of the short-waver is usually high, about 1,500 kilocycles corresponding to a wavelength of around 200 metres.

Below 10 metres the Reinartz type of set has almost faded out, mainly because it has been found very difficult to obtain smooth reaction with this circuit. The overall magnification is low and such effects as "chasing" and variation of action with different lengths of aerials have finally put this circuit out of court.

A type of set that may possibly gain favour in the future for ultra-shorts is the super-regenerative, especially on the 3- and 5-metre bands.

For normal short-wave working the straight high-frequency set has commanded wide support, for in spite of the general belief about the loss of amplification below 100 metres, experience shows that down to about 20 metres real high-frequency gain is obtained with a good screen-grid stage.

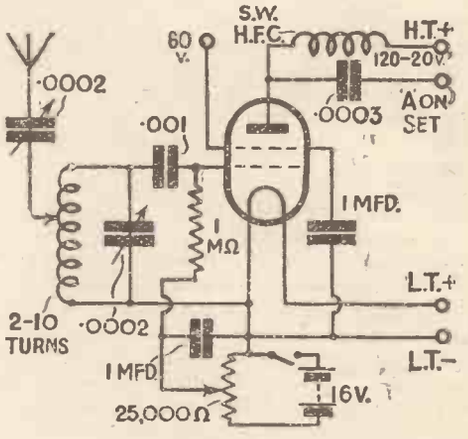
Even down to the lowest of the normal short wavebands, that is down to say, 14 metres, a stage of screen-grid has proved an advantage in maintaining the smoothness of reaction. Moreover, the resulting stabilisation of the detector and its segregation from the aerial tuning means that the detector tuning can be calibrated accurately.

For most listeners, a stage of tuned-grid coupling should be very useful. Our diagram shows how such a stage can be added. There is the usual aerial-tuning coil, from 2 to 10 turns, according to the waveband wanted, with a parallel .0002-microfarad condenser.

The negative bias is applied to the screen-grid valve by a "pot" across a 16-volt grid battery. The grid leak and condenser method of applying this bias is strongly recommended.

In the anode circuit there is a good short-wave high-frequency choke, with a .0003-microfarad coupling condenser going from the anode to the aerial terminal of the set, that is to the grid tuning coil of the detector.

Note that as this is in the nature of an add-on unit for a existing short-waver, there is no need for either a high-tension negative lead on the unit or an earth lead, which will, of course, already be on the set.



Typical screen-grid H.F. amplifier for short-wave reception

We have shown this circuit because it is typical of the trend of progress on short waves. There are, of course, other developments, chief of which is, perhaps, the use of the autodyne super-het system for add-on units, to convert existing broadcast sets to short-wave super-het working.

"ALL ABOUT CLASS B AND Q.P.P."

(*Continued from preceding page*)

condensers across each half of the output transformer. If these are not used it is sometimes found that an inaudible oscillation builds up in the receiver which distorts the quality. The connection of two .005 condensers from each anode to H.T.+, as shown, effectively cures the trouble.

The second point is the tone correction. Since the average loud-speaker rises in impedance as the frequency is increased, it is desirable to include some arrangement for cutting down the sensitivity of the set in the upper frequencies. This can be done by connecting a large condenser across the primary of the output transformer in addition to the parasitic stopping condensers just mentioned, but it is better to correct on the input as this saves anode current. A condenser of the order of .01 to .02 connected across the driver transformer as shown will usually be found satisfactory, giving very pleasant reproduction with just sufficient reduction of the upper frequencies.

The conclusion of this article, dealing chiefly with Q.P.P., will appear Next Week.

H.F. COILS with IRON CORES

W. James explains how to use the new tuning coils which give better selectivity and increased magnification

THE chief feature of the Ferrocart type of coil is that it consists of a winding and a core of special *magnetic* material.

Ordinary coils used for tuning purposes have a winding and no core or, rather, the core is air. Hence the name air-core coil.

It is rather remarkable that a Ferrocart tuning coil should be not only satisfactory, but have advantages over the air-core type. These advantages are very real ones, too.

Improved Efficiency

The first is the efficiency of the coil for its size. An efficient coil tunes much more sharply than a poor coil and the magnification obtainable is greater. The result is better all-round performance, for you get sharper tuning, stronger signals, and less background noise.

The valves do not have to be pushed so hard for a given amount of amplification when these coils are used. And so it will be understood that the new coils do definitely mark a step forward.

Small Coils Practicable

I do not want to be misunderstood over the matter of efficiency. A good coil having a winding of litzendraht, such as I have described in this paper from time to time, is very efficient—roughly as good as the Ferrocart coils which I have tested.

But these coils were large ones, three inches in diameter. They would have to be screened for use in a modern set and three of them, with screens of a size adequate for the purpose and not spoiling their efficiency, would take a lot of room.

Smaller coils are therefore possible with the Ferrocart type.

A set having three Ferrocart coils, used as aerial input filter and inter-valve coupling has a degree of selectivity which, according to my experience, is very good indeed, and likely to be satisfactory under most conditions.

The coils are of normal size. Colvern patterns are made up complete with switch upon a base and are, therefore, convenient to use.

If you open one you will see the peculiar construction. They are much smaller than the screen. Medium- and long-wavelength coils are separate. Both are very accurately matched.

The Effect of the Iron Core

The principle of the coils can be easily grasped. If you take a tube of paxolin or of ebonite and wind a coil of say 100 turns of wire, you will make a coil having a certain inductive value. This might be, say, 180 microhenries, for tuning with a .0005-microfarad condenser over the medium band of wavelengths.

If, now, a core, consisting of a bundle of iron wires, be fitted and the inductance were again measured at a low frequency, it would be found to have increased. Therefore, the number of turns of wire in the coil could be reduced in order to bring down the inductance to the original value.

The point to note is that by fitting an iron core the inductance is increased. Now we are concerned not only in the inductance of a coil, but also, and some these days would say chiefly, in its losses. If the losses are high, the tuning is broad and the amplification is poor.

Iron Increases Losses

A coil constructed in this way would inevitably give poor results, because the use of ordinary iron increases the losses immensely.

It was found, however, that a core could be manufactured which had very slight losses indeed. And in the Ferrocart coil the special core is used.

With this special core comparatively few turns of wire are needed for a given inductance and so it happens that what with the relatively small number of turns and the good core, the net result is a coil of outstanding performance and further, it is of small size.

Stability

One is, of course, bound to ask the question—is the coil quite stable? Will a comparatively heavy current or knock affect its working?

Tests show that the coils are quite stable. A relatively heavy current will not upset the characteristics, neither will ordinary knocks and jars impair the efficiency.

It can be said, therefore, that the Colvern Ferrocart coils are perfectly satisfactory from the mechanical point of view and considered electrically they are superior to other average screened coils.

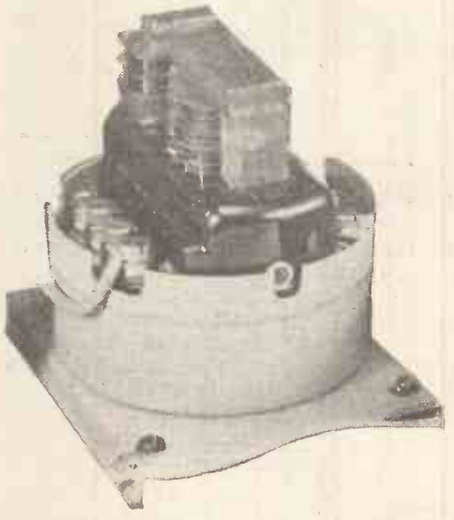
Using the New Coils

Now, such good coils must be properly used. It will be clear that if, say, three of these coils are to be used in a set with one knob tuning, the tuning condenser must be a very accurate job. Slight errors are bound to have, relatively, a greater effect than when the ordinary, more broadly tuning coils are being used.

As the tuning is so sharp, the drive of the condenser must be sound or there will be difficulty in placing the circuit exactly in tune.

Then again, the coils must be used in the right way. It would be stupid by careless use to lower the efficiency of good tuning circuits.

This mistake is easily made. The coils which I have tried have been suitably tapped, however, and full advantage can be taken of their efficiency. Thus, the aerial coil is tapped well down the winding in order to minimise the loading effect of the aerial. This normally tends to broaden tuning and the capacity adds to the difficulty of ganging. By tapping well down the coil the effects are reduced to negligible



A noticeable feature of the new Ferrocart Coils is that they are quite small. It will be seen that there are two separate sections for the long and medium waves

proportions and the signal strength is maintained by the transformer step-up effect.

Detector-circuit Arrangements

Another point to look out for is the detector-circuit arrangement. If you join the grid circuit of, say, a power-grid detector to the top of the coil, the bottom going to the earth in the usual way, a load is placed across the tuning circuit. The tuning is, therefore, made broader. This effect is reduced by taking the grid circuit to a tap and at the same time the strength of the signal is not affected.

These points should be watched. Then the coils will be found very effective, better strength, sharper tuning and improved performance generally being obtained. The coils definitely have a future.

MODERN DETECTORS

The NEW METAL DETECTOR

All about the new metal rectifier which can take the place of the detector valve

By W. JAMES

THERE is a rectifier or detector in every wirelessreceiver.

It is used to rectify the output from the high-frequency stage or the aerial circuit, as the case may be. High-frequency currents are applied to the rectifier and we get the low-frequency component out of it.

Some detectors rectify only. Others rectify and magnify as well.

Thus, the popular leaky-grid detector rectifies and magnifies, but the crystal detector rectifies only.

Naturally, we want the detector to give as much output as possible. But we also want to have the least amount of distortion. Other factors to be considered are the strength of the signal which can be applied without overloading, and then again

This is the Type W4 half-wave rectifier

there is the effect of connecting the detector to a circuit. Sometimes it broadens the tuning and it may have the effect of lowering the high-frequency voltages.

There is now available a new rectifier called the Westector. The Westinghouse metal rectifier, as used in A.C.-mains receivers, high-tension units and trickle-chargers, is well known, and what is more important, the rectifier is of proved reliability, being extensively used.

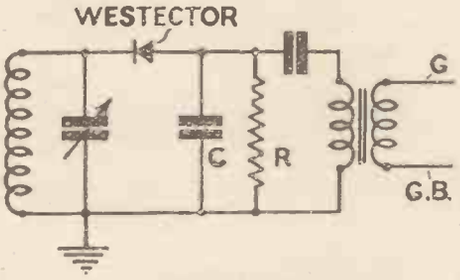


Fig. 1. Simple circuit using half-wave Westector

The Westector is also a metal rectifier. If you opened one you would find the same discs of treated copper and lead washers, but they are very much smaller, about the diameter of the lead of a thin lead pencil.

This rectifier, like the power ones, is of the permanent type. It rectifies only, like a crystal or a diode or a double-diode valve.

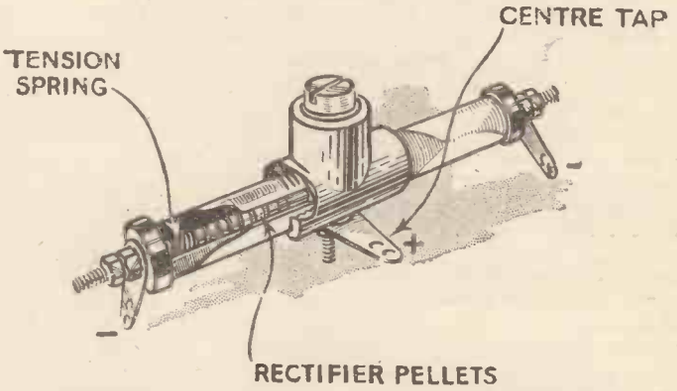
The Westector is made up in a tube having moulded ends with contacts and looks very much like a grid leak. One end of the Westector is red in colour and it is important to note this, as in some circuits it is necessary to connect the rectifier the right way round.

It is not necessary to fix the Westector in any way, as it is so light that it may be safely carried in the wiring. There are several types in both the half-wave and full-wave patterns. The full-wave is centre tapped and the connections given in Figs. 1 and 2 show the simple nature of typical circuits.

In Fig. 1 the half-wave type is used. It has associated with it a low-frequency circuit comprising the load resistance R and the all-important shunting condenser C, values 100,000 ohms and .0001 microfarad.

The grid of the next valve, a low-frequency amplifier or power valve, could be joined to the top of the resistance, but the diagram shows a further coupling. This is a step-up transformer, with its coupling condenser and it is used to step up the voltage from the load resistance to the grid of the next valve.

In Fig. 2, which shows a full-wave centre-tapped rectifier, there is a simple resistance coupling. Notice that the coil is centre tapped but otherwise the circuit is a simple one.



Here is a drawing of the full-wave rectifier: the internal construction of the two types is alike

Type W4, which is a half-wave rectifier, will deal easily with a peak input voltage of 24. The other types will handle larger or smaller inputs, such as 36 volts for the W6.

It will, therefore, be seen that the Westector will handle the strongest of signals.

Now what about distortion? The characteristic showing the variation of the output with input is a straight line; often a fraction of a volt is passed. In other words, the output is strictly proportional to the input for all excepting very weak signals.

Thus, the Westector has two very valuable characteristics; it rectifies all signals of above a small fraction of a volt without distortion and it will deal with very strong signals indeed without overloading.

A signal of 24 volts may not convey much to a reader but, as an illustration, many leaky-grid detectors, even of the power type, overload with signals of a volt or two.

A Westector followed by an amplifying valve will, for a given strong input, have about the same output, for a given input, as the usual power-grid detector. It has the advantage, however, of not affecting the circuit so greatly. Thus, the damping effect of the Westector will be less than that of the power-grid type of detector. This is for two reasons.

First, a leaky-grid or power-grid detector loads a tuned circuit because of the make-up of the grid circuit of the valve, that is the grid leak and grid current.

Then, secondly, there is feed-back from the anode circuit of the valve to its grid circuit through the capacity of the valve, and this has the effect of reducing the strength of the signals in the grid circuit. The matter could be enlarged upon considerably, because a valve detector is a complicated piece of apparatus.

Automatic volume control may be obtained by making use of the voltage developed across the load resistance, the voltage being applied to the grids of the high-frequency amplifying valves.

Delayed automatic volume control is also to be obtained. So it will be seen that the Westector is a useful component.

Westectors are going to be used pretty extensively in the future by manufacturers

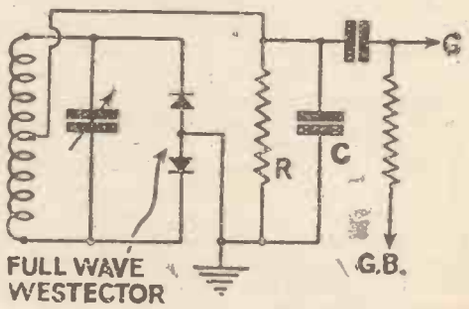


Fig. 2. Typical connections of full-wave Westector

and amateurs as they have certain very real advantages. Westectors are particularly useful in sets giving large high-frequency voltages, such as super-heterodynes, where the output may be enough to apply directly to the power valve without further magnification.

TO BE CONCLUDED WITH NEW VALVE DETECTORS NEXT WEEK

OUR BROADCAST CRITIC

ON THE GALSWORTHY PLAY

MARIE KENDALL

TO enjoy the broadcast of a play like *Escape* you must not previously have seen it on the stage. You can enjoy *Hassan*, for example, all the *more* for having seen it previously, because you find yourself interested in its quaint language, and do not mind knowing how it ends. With a play dealing with a series of events such as Galsworthy puts before you in telling of the escape of a convict from Dartmoor, you really must *not* know how it ends or you will find it hard going until the end actually comes. It is not for you to know whether or not the convict escapes; neither must you have the slightest inkling that he is going to give himself up.

I considered myself fortunate that I had not seen the play on the stage, because I had some chance of being thrilled by the broadcast version.

When Captain Denant (the convict) began his scene with "The Shingled Lady" (Barbara Couper, at her best, by the way) I thought I was in for something impossible, or at least improbable, and at once began to think of what happens to people who help convicts to escape. The scene, however, was so well done, both by Miss Couper and Mr. Quartermaine, that it really seemed feasible.

The scene with the Old Gentleman who fished by the convict's side was even better from the writing point of view. There was a punch in the fact that the old chap "spotted" his man, but acted in a sporting fashion. I thought, however, that the dialogue given to the Four Trippers (whose car the convict stole) was the weakest in the play.

The ending was a stroke of genius. The convict sought sanctuary in the village church. When the vicar (who himself had served as a padre in the war and therefore had a kindly feeling for the convict who had escaped from Germany) was on the point of lying to the villagers when questioned by them, there was a fine dramatic situation. The convict, rather than let the vicar perjure his soul, gave himself up. Mr. Quartermaine's playing at this point held me completely. The production of the play (by Howard Rose) was, in my opinion, perfect.

◆ ◆ ◆

I fear I cannot say as much for the production of *The Saturday Game*, which I heard the previous evening. Another case of weak dialogue It was gay—forcedly so, I thought—but it was not funny nor yet clever. The only thing I enjoyed about it was the representation of the "ping" of the tennis-balls on the racquet and the whizz of the golf-club. *When—O when—are we going to have a Joke-censor? And a Dialogue-censor?*

◆ ◆ ◆

How did you get on with the second of the "Economist in the Witness-box" series? I was a bit muddled over those tariffs. I thought I would rather Commander King-Hall left it to the other Mr. Hall to explain, but he would keep on interrupting. I shall try another next week, though.

◆ ◆ ◆

Jan Smeterlin gave me pleasure by his interpretation of the Chopin G Minor Ballade which, I regret to say, was all I heard of his recital. So many pianists are afraid to use the pedal when broadcasting. I know they tell them not to at Broadcasting House, but it is nonsense. Anyhow, Mr. Smeterlin went his own way with admirable effect.

◆ ◆ ◆

Noel Eadie's voice sounded very beautiful to me in a Mozart aria, and the ever-popular *Caro Nome* from Verdi's *Rigoletto* Her "top C" was as amazing as her breath-control. So far as I am concerned the B.B.C. can ask her to broadcast as often as it likes. I shall always be there.

◆ ◆ ◆

The music hall show this week had some good points about it. I think Jenny Howard is very amusing when she is really north-country, and when she *intends* to sing with that "appalling" tone. She has, however, a voice full of pleasant notes. I am inclined to suggest she does not mix the two, but allows us to benefit from "both voices' separately. She is a good vaudeville broadcaster.

◆ ◆ ◆

Julian Rose was amusing, as usual. I am very pleased he has taken the hint, and now speaks much slower than he did a few months ago. I am sure he will become all the more popular.

◆ ◆ ◆

Clapham and Dwyer gave us "The Poor Woman' stunt again. It is *very* funny, but I could not enjoy it a *third* time!

◆ ◆ ◆

I listened to the modern Italian concert with interest, the more so because the works were new to me. The Italians have not, seemingly, gone in for ultra-modernism to any extent, but I thought they rather spoilt their tradition.

◆ ◆ ◆

Did you hear the "Inconsequential Revue' called "It don't mean a thing"? It didn t to me.

◆ ◆ ◆

I have heard one or two good singers at odd times during the week. Taking them as I think of them: Keith Faulkener, whose diction and general tone was so easy to appreciate that he might have been in the room; Isobel Lamond, whose Brahms group was a model of German liedersinging; Enid Cruickshank, who seemed better than ever in the Verdi opera concert!

◆ ◆ ◆

One or two players Harold Samuel in a Sunday afternoon recital excelled himself but I wanted more Bach from *him*. After all, he is our best Bach player. Helen Perkin's tone in the C Minor concerto of Beethoven (during the Easter Sunday evening symphony concert) showed me that some pianists, at all events, are studying the microphone. Albert Sammons played delightfully.

◆ ◆ ◆

It was a good idea to broadcast *Chu Chin Chow* on Easter Monday. I think it must have been greatly appreciated by listeners disinclined for "heavy stuff." Very good it was, but how inferior the writing is to that of *Hassan*!

WHITAKER-WILSON.

PROGRAMME POINTERS

There have been one or two cases recently of plagiarism of style in the lighter forms of entertainment. I noticed an actor imitating Harry Tate's voice and mannerisms. The imitation was obviously sincere but was also, so to speak, sincerely obvious. Another instance was the adoption of the tone of voice so characteristic of all Claude Hulbert's broadcasts. This was equally sincere, and equally obvious. It seems to me that imitations of this sort, no matter how sincere, are not good from the listener's point of view. There is a difference between direct imitation and mere similarity of style. For example, Alexander and Mose give a similar type of broadcast to that given by Nosmo King and Hubert, but nobody would ever confuse them. Their only similarity lies in the fact that they both talk "Darky." The other form of similarity—that of adoption of some outstanding characteristic—is not, in my opinion, to be encouraged. Originality may be hard to secure—it undoubtedly is—but no good purpose can be served by allowing plagiarisms of style, however sincerely they may be offered.

BUILDING YOUR

HERE ARE CONSTRUC DETAILS FOR THE ALL-I VALVER INCORPORATING OUTPUT, FIRST DETAILS O WERE GIVEN IN LAST WEE

THIS is one of the simplest sets to build which have ever been described in AMATEUR WIRELESS.

The Class B parts do not complicate the construction. The rest of the wiring is just as easy to carry out. There are no more components needed in the whole outfit than in a normal "three," and the wiring is very simple and straightforward.

Class B, the latest economy idea in radio, is a feature for everybody.

And to make sure that everybody—novices in set construction—will be able to make up this "Class B Three," we are giving this week a three-quarter size wiring diagram which makes the construction simple in the extreme.

This Class B outfit is an all-in set. That is, it is intended to be fitted into a cabinet which includes speaker and batteries in the one cabinet.

But the set itself is made up with the usual wooden baseboard and right-angle ebonite panel. This set unit slides into the "all-in" cabinet and is complete in itself.

SIMPLE CONSTRUCTION

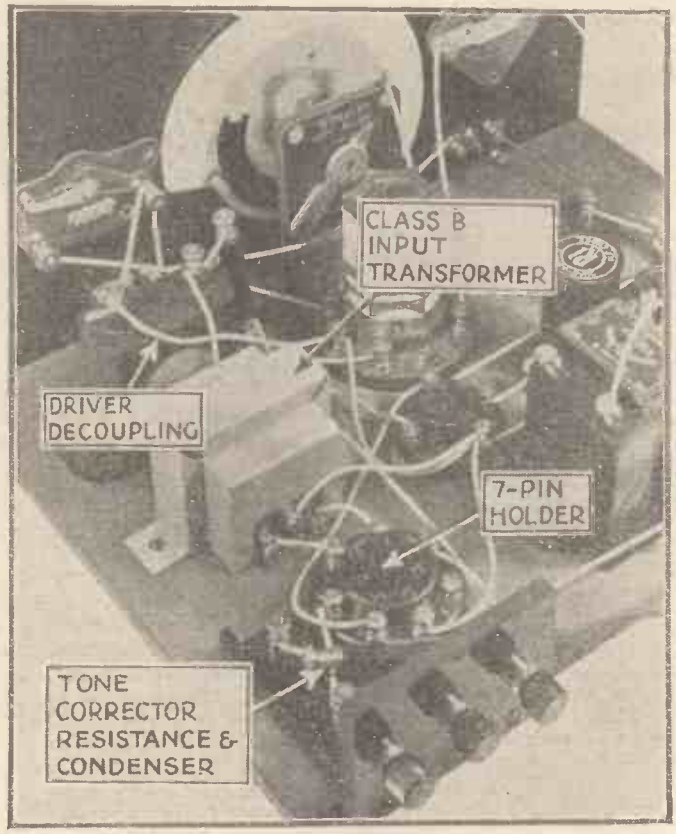
In the cabinet shown the batteries and speaker are accommodated beneath.

The layout of the set unit itself is simple and logical. The centre components of the set are the main tuning condenser and the coil it tunes. Both these parts are mounted on the baseboard. The condenser is clamped to a right-angle bracket and the control projects through to the panel front. The hole has to be cut at the top of the panel, for the escutcheon of the tuning dial, so that the semi-circular scale carrying the degrees marking can be seen.

The selectivity control condenser and also the reaction condenser are carried on the panel, left and right respectively. Beneath, left, is the wave-change switch (pull out for medium-wave working), and right is the on-off switch for the whole set.

The baseboard layout is arranged in the same neat way.

Looking at the set from the back, you have the aerial and earth terminals on the right and the output terminal block on the left. This latter carries three terminals. The little 4½-volt grid-bias battery which supplies the driver valve is stood close to the low-frequency transformer coupling the detector to the driver. **No external bias is needed on the Class B valve.**



This lettered photograph shows the arrangement of the components in the Class B output stage of the receiver

VALVE HOLDER

Some manufacturers have adopted the new seven-pin valve holder as the standard for Class B valves, but as Class B valves with a five-pin base and an external side terminal are available, you may find it necessary to use an ordinary five-pin valve holder.

It is quite easy to follow the connections for this. A seven-pin holder is shown and only six terminals are needed for the Class B valve. These new seven-pin holders, of course, have the holes arranged in different positions from the standard four- or five-pin holder.

Between the Class B holder and the output terminal block are the tone corrector condenser and resistance.

In the wiring diagram you can see these two components connected in series between the outers of the connections to the Class B transformer on the speaker.

The resistance is 15,000 ohms and the condenser .006 microfarad.

The Class B transformer is mounted on the other side of the valve holder, of course, and between it and the panel there are the decoupling resistance and condenser in the anode circuit of the driver.

A full-page layout and wirin

The Wiring Diagram

You will be able to recognise all the components from the wiring diagram and the photographs shown here. A full list of parts necessary is given in the components list.

As you can see, there is nothing very expensive.

No output transformer is shown, as in the speakers recommended a Class B

COMPONENTS REQUIRED FOR

CHOKES, HIGH-FREQUENCY
1—R.I. Quadastatic (Lissen, Telsen, Slektun, Tunewell, Sovereign, Goltone, Lewcos, Graham Farish, Bulgin, Wearite).

COILS
1—Dual-range aerial (Lissen type 5311).

CONDENSERS, FIXED
1—.0002-mfd., 1 .0003-mfd., 1 .006-mfd. (Lissen, Goltone, Sovereign, Telsen, Graham Farish, T.C.C., Dubilier.)
2—2-mfd. (Lissen, Goltone, Sovereign, Telsen, Graham Farish, T.C.C., Dubilier, Ferranti.)

CONDENSERS, VARIABLE
1—.0005-mfd. variable with disc drive (Utility type W322).
1—.0005-mfd. variable reaction condenser (Lissen, Graham Farish, Utility, Polar, Telsen.)
1—.0003-mfd. variable reaction type condenser (Graham Farish, Lissen, Utility, Polar, Telsen.)

HOLDERS, VALVE
2—4-pin holders (W.B., Lissen, Telsen, Benjamin, Graham Farish, Bulgin, Junit, Goltone.)
1—7-pin Class B valve holder (W.B.).

PANEL, BASEBOARD, ETC.
1—12 in. by 7 in. ebonite panel (Lissen, Goltone, Becol, Trelleborg, Peto-Scott.)
1—12 in. by 9 in. baseboard (Peto-Scott, Cameo.)
2—Terminal strips, (1) 2 in. by 2 in., (1) 3 in. by 2 in. (Lissen, Goltone, Becol, Peto-Scott).

RESISTANCES, FIXED
1—2-megohm, (1) 5,000-ohm, (1) 15,000 ohm, (1) 25,000-ohm (Graham Farish "Ohmite").

'A.W.' CLASS B 3

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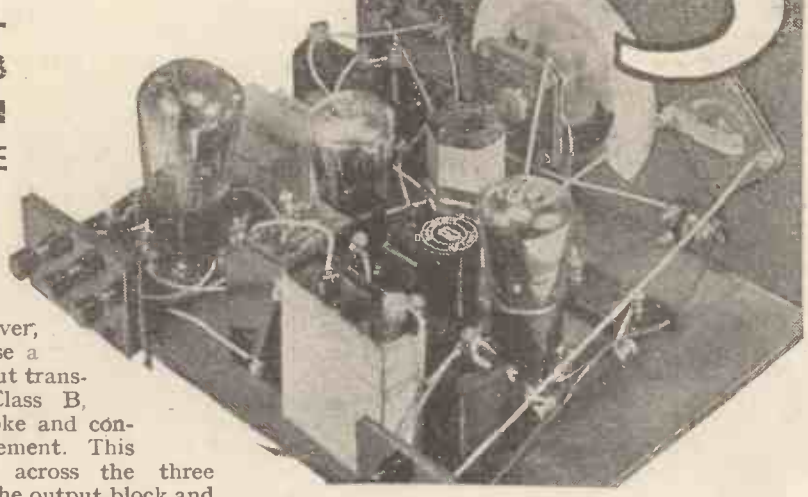


output transformer is fitted on the chassis.

It is, however, possible to use a separate output transformer for Class B, or even a choke and condenser arrangement. This is connected across the three terminals on the output block and replaces any output transformer which you may at present have in the speaker circuit.

ng diagram is given overleaf

The wiring diagram included in this issue shows in plan view the components and wiring on the baseboard. The wires are shown as nearly as possible in their exact positions and, of course, it is very easy to gauge the exact lengths of the leads.

As in any ordinary set construction, the panel drilling is the first job.

THE "'A.W.' CLASS B THREE"

SWITCHES
2—2-point filament switches (Bulgin Junior, Graham Farish, Telsen, Lissen, W.B., Tunewell, Benjamin, Wearite, Goltone, Sovereign).

TERMINALS AND PLUGS
5—Terminals, marked Aerial, Earth, H.T.+, 2 L.S. (Belling Lee, type R, Clix, Eelex, Bulgin).
2—Spade terminals, marked L.T.+, L.T.— (Belling Lee, Clix, Eelex, Bulgin).
4—Wander plugs, marked H.T.+, H.T.—, G.B.+, G.B.— (Belling Lee, Clix, Eelex.)

TRANSFORMERS
1—Low-frequency (Varley Nicore II, Telsen, Lissen, Graham Farish, R.I., Benjamin, Formo, Goltone, Lewcos, Sovereign).
1—Class B low-frequency input transformer (Benjamin, type 8600, Multitone, R.I., Lissen, Varley, British Radiophone).

WIRE, SLEEVING, ETC.
Three yards thin flex (Lewcoflex).
Tinned-copper wire and sleeving (Lewcos, Goltone).
One yard screened connecting wire (Lewcos).

ACCESSORIES

Console cabinet (Peto-Scott, type HL3).
1—120-volt H.T. battery (Lissen, Pertrix, Drydex, Ediswan, Fuller, C.A.V.).
1—4½-volt grid-bias battery (Lissen).
1—2-volt accumulator (Lissen, Pertrix, Ediswan Fuller, C.A.V., Exide).
Permanent-magnet moving-coil loud-speaker (Amplion, Class B).
Aerial wire (Electron).
Earthing device (Graham Farish "Filt").

The only large hole to drill is for the tuning escutcheon. If you are an expert with a fretsaw, then you can cut this hole without extensive drilling. An alternative method, of course, is to mark out the circles with a scriber and slightly inside the circumference of this to drill a ring of holes with an ordinary brace and bit. The centre part can then be knocked out and the edge smoothed off with a half-round file.

When you have drilled the holes for the main condenser control shaft and for the other condenser and switches, you can screw the panel to the baseboard and then carry on mounting the baseboard parts.

The centre tuning condenser should be mounted before the coil is screwed down, however, so that there is plenty of room in which to clamp the condenser to its right angle bracket.

It should not take more than ten minutes to plot out the position of the baseboard parts and to screw them down.

WIRING

Now you can start the wiring. This is done with rigid tinned copper wiring enclosed in sleeving and some of the small parts—resistances and leaks—are carried by the wiring, there being no supporting clips.

Four resistances are connected in this way and all of them are provided with end terminals, so that it is not necessary to solder the wires to them. The photographs and the wiring diagram show you where these resistances are arranged, and they should be kept as neat as possible.

The decoupling resistance for the driver valve, for instance, is supported at right angles to the condenser, while the tone-corrector resistance in the Class B output circuit is wired directly between one output terminal and the tone-corrector condenser.

The Class B transformer has two terminals on the primary side and three on the secondary.

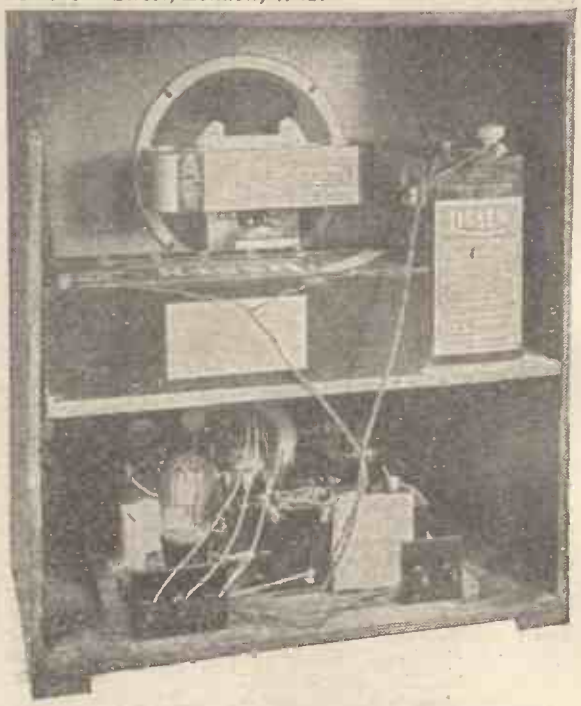
The "P" terminal is connected to the plate of the driver and H.T. plus to one terminal of the decoupling condenser and to the 5,000-ohms resistance.

On the secondary side the terminals marked "G" are connected to the two grid terminals of the Class B valve, while the centre terminal "E" is connected to earth—in this case the negative side of the filament wiring. As has been explained, there is no external bias on the Class B valve.

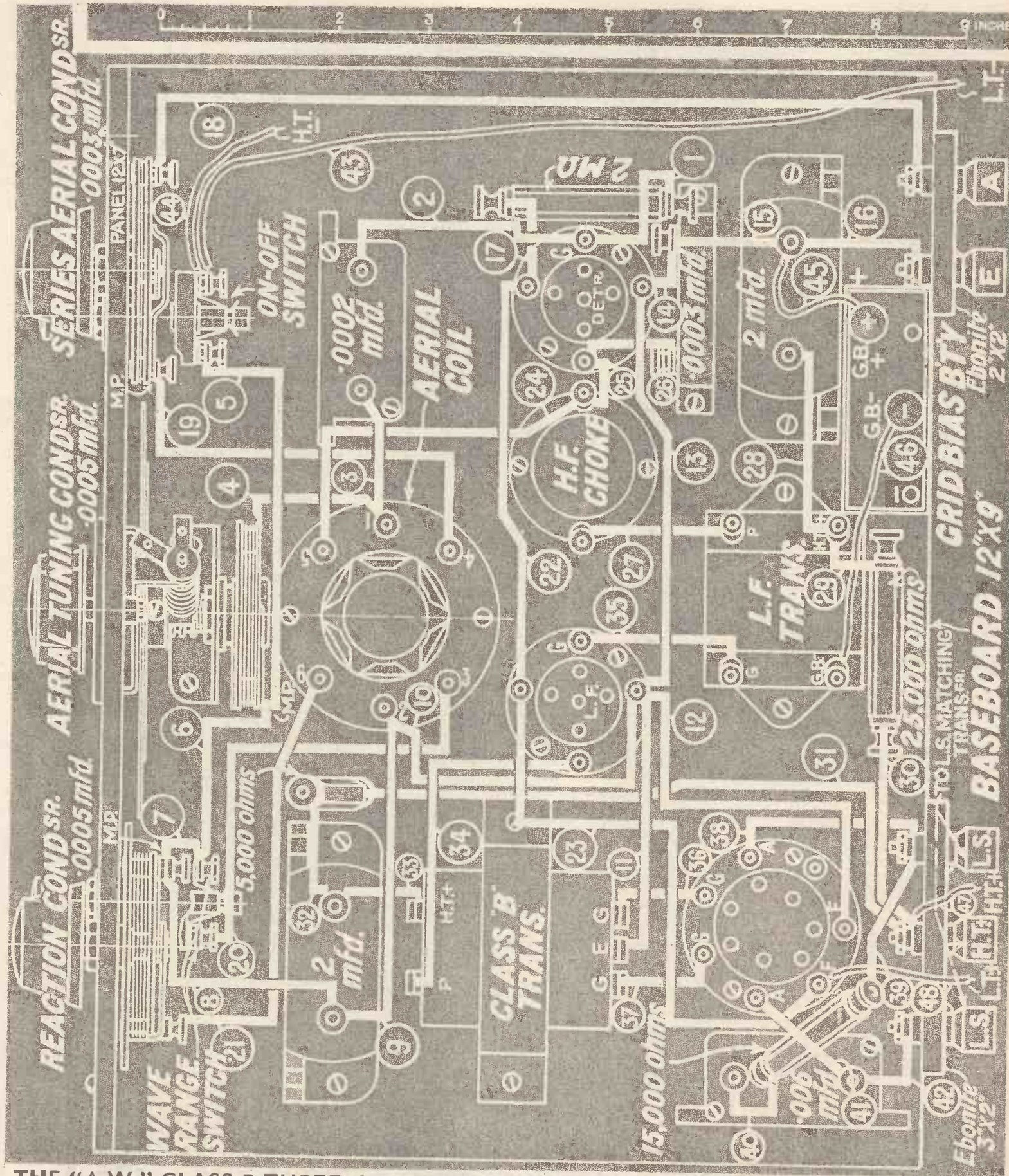
Turn the main tuning condenser fully to one side and set the tuning scale exactly at either 0 or 180, as the case may be. If the condenser is rotated to its fullest extent in a clockwise direction, then the dial should be set at 180. The set screw of the indicator dial should then be clamped down. The battery leads (four only) should be firmly anchored.

Two short flexes can be attached, one to the G.B.— terminal on the low-frequency transformer and the other to the earth terminal on the detector decoupling condenser. Black and red wander plugs should be attached respectively so that the 4½-volt grid battery can be connected up.

Do not forget that you can see this all-in Class B set in the Radio Department windows of Messrs. Selfridge & Co., Ltd., Oxford Street, London, W.1.



Here is the receiver in the cabinet. Note that the batteries and speaker are in a separate compartment and that the set is easily accessible



THE "A.W." CLASS B THREE: Layout and Wiring Diagram. *Constructional details on pages 668-669*

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HOW LOUD-SPEAKERS HAVE IMPROVED

Loud-speaker design has improved concurrent with detail improvements in valves and set components, and here the recent progress in speaker design is critically reviewed

SPEAKER design has been improved in two directions.

There has been the improvement in integral features of chassis design. Sensitivity, capacity for handling a large power output and response over a wide frequency range have been improved by attention to details.

And there has been the improvement in input arrangements, so that there is now no longer the difficulty of matching moving-coil speakers to the set's output stage.

Chief improvements have been made in permanent-magnet speakers, so that price has been reduced and greater reliability can now be placed on the power handling and the sensitivity.

New cobalt steel alloys used in the magnetic system have cheapened the cost of production, made speakers lighter and increased sensitivity.

There is a sort of "threefold value" of power input underneath which it is still impossible to get the best out of a moving-coil loud-speaker. Generally speaking, it is necessary to have an output stage giving about 300 milliwatts in order to work a permanent-magnet moving-coil loud-speaker satisfactorily.

So that for small battery-driven sets which have not Q.P.P. or Class B coupling—and where the output has an average value of less than 250 kilowatts—there is still a large field for balanced-armature and inductor speakers, in which connection no startling improvements have been made of late.

But for all normal sets, there are now big advantages in permanent-magnet moving coils. Even small speakers can handle an undistorted output of 3 watts, and thanks to stiffened cones and freer suspension, the bass response is so satisfactory that a baffle-board area of at least two square feet is needed with the average small moving-coil.

Many speakers are now provided with coppered or otherwise treated pole pieces to prevent rusting, so that there is a minimum air gap between speech coil and magnet pole.

W.B. have introduced a new magnetic system in which the magnet is a composite construction, while the magnet systems of the new Amplions, and Blue Spot, Rola, Epoch, and R. & A., to mention only a few examples, are commendably neat.

Where the magnet is in one piece it is generally of double "U" formation. But in one type of speaker laminations are employed between the magnet pieces.

Early moving-coils suffered in sensitivity through incorrect centring devices which put too great a tension on the diaphragm. A centring disc at the speech coil end is now universally adopted, and in speakers such as the Amplion and Blue Spot this is in the front and is clamped to a small pillar screwed into the nose of the magnet pole. In the W.B. and others, the centring disc of fibre is mounted on the speech coil at the back of the diaphragm, and is slotted to provide critical adjustment. Cone improvements are typified by Celestion, Blue Spot, and others. Cones are now often bakelised and pressed in one piece for strength and lightness.

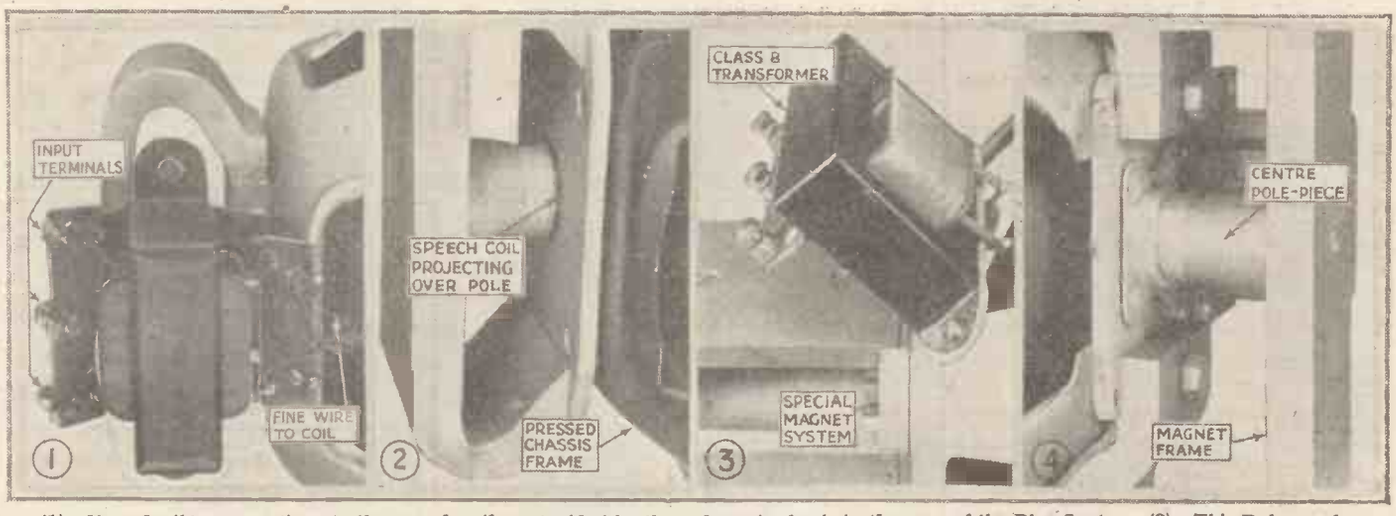
These more delicate and accurate centring devices have resulted in the cutting down of the air gap and the increase in efficiency, but, in the main, improvement in permanent-magnet moving-coils has taken place in the special alloys used in the magnet systems. These improvements are of a metallurgical nature which will not interest ordinary listeners, but the improvement nevertheless is remarkable.

Typical of the modern high efficiency permanent-magnet moving-coil speaker — the Epoch

In energised speakers there is an improvement in the facility now operative in most types for the inclusion of the energising coil as part of the smoothing system of the set. This, of course, is only of use in mains-driven sets. Set manufacturers have for a long time used the energising winding as an additional smoothing choke and so have obtained a "free" source of energising current. And now with many makes of speaker it is possible for amateur set-builders to do this.

Input arrangements to all speakers have been improved. Nickel-alloy core transformers are now fitted in place of the cumbersome external input transformers of a year or so ago. Generally these are tapped for use with triode or pentode valves and push-pull output circuits. With many speakers it is possible to use these input transformers without Q.P.P. provided triodes are used, but speakers with special Q.P.P. input transformers (obtainable in some cases at no extra charge and in others at not more than an extra charge of 2s. 6d.) must be used if pentodes are used in quiescent push-pull.

A recent improvement is the provision of speakers fitted with three-terminal Class B input transformers, so that you do not have to buy a Class B output transformer or tapped choke for your set if you are using one of the new Class B valves.



(1) Very flexible connections to the speech coil are typified by these fine wire leads in the case of the Blue Spot. (2) This Rola speaker has a pressed cone frame as part of the chassis which typifies modern construction. (3) W.B. speaker with a special magnetic system and fitted with a Class B transformer. (4) The sturdy pole piece design of the Amplion represents modern speaker practice

INFORMATION BUREAU

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Please write concisely, giving essential particulars.

A fee of one shilling postal order (not stamps), a stamped, addressed envelope and the coupon on the last page must accompany all queries.

Not more than two questions should be sent at any time.

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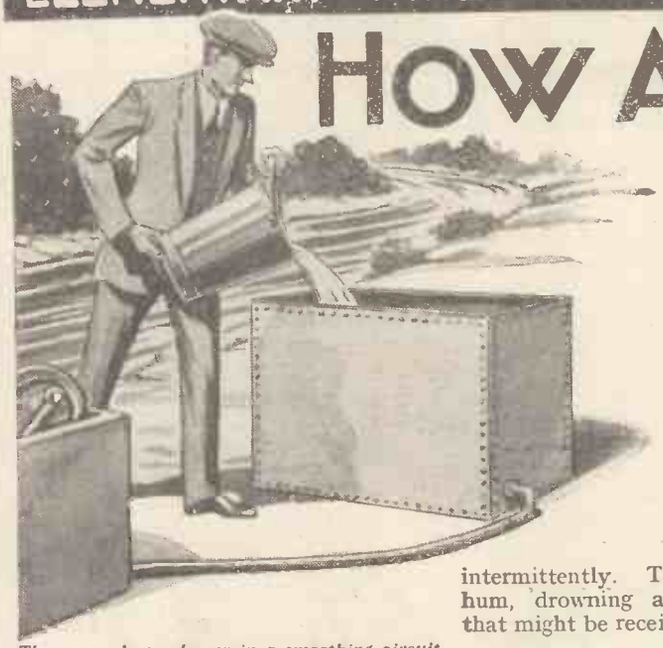
ELEMENTARY WIRELESS COURSE

HOW A·C·SETS WORK



The reservoir condenser in a smoothing circuit reminds us of a tank providing a constant "head" or pressure of water through an outlet pipe, when the tank is being only spasmodically filled by a man carrying water in a bucket from a near-by stream

Another informative article in the complete series on mains working specially for the beginner by J. H. REYNER and the "A.W." STAFF. This week they deal with the methods adopted for working sets entirely from A.C. mains

What is an A.C. set?

A set for operation from an alternating-current electric-light supply.

What is peculiar about it?

Only the method of obtaining the voltages to operate the valves. The set may contain high-frequency amplifying valves followed by a detector and an output valve or in the simplest sets the high-frequency valves may be omitted. We can, in fact, arrange the set in any of the ways we have previously considered, but instead of using batteries for the power supply we take these voltages from the mains.

Like we do with D.C. mains?

Much the same. The filaments of the valves are replaced by independently-heated cathodes consisting of small cylinders inside which is a filament or heater. I have already explained the construction and you will remember that with A.C. we transform the voltage down to 4 volts for running these heaters.

How much current do the heaters take?

Usually 1 ampere. This gets rid of the low-tension accumulator. Now, we have to find a means of replacing the high-tension battery. With D.C. mains this is fairly easy because the voltage is more or less steady and all we have to do is to insert a potentiometer to cut the voltage down to the right value and smooth out any ripples that may be present.

Why can't we do that with A.C.?

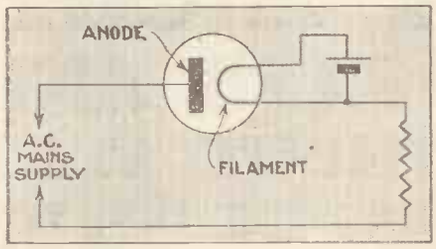
Because alternating current is first positive and then negative. Every time it is positive some anode current will flow, but when it is negative the valves will not work so that the current will flow intermittently. This would produce hum, drowning any ordinary signals that might be received on the set.

I thought you could smooth out any ripple?

Yes, that is so when the ripple is a fairly small variation above or below a steady value. With alternating current the voltage rises to perhaps 300 volts in one direction and then reverses and rises to 300 volts in the opposite direction. The average value is *nothing* so that if we smooth out the ripple we shall be left with no voltage at all.

But there is some method of using A.C., isn't there?

We have to rectify the current so that it only flows in one direction. Then if the voltage varies between 0 and 300,



A simple rectifier circuit, consisting of a valve with an anode and a filament. The alternating current is rectified because current in the valve flows only one way—from filament to anode

in the same direction all the time, the average value will be around 200 and we can smooth out the variations and leave ourselves with a fairly steady voltage.

How do you rectify the current?

One way is to use a valve rectifier. You know that the ordinary valve will only allow current to flow from filament to anode when the anode is positive. The earliest forms of valve only contained a filament and an anode and were used for the express purpose of rectifying the current.

When the anode is negative, no current can flow while when the anode is positive the valve acts as a more or less perfect conductor. Current can flow quite freely up to the limit of the emission from the filament.

We use valves of this type having large filaments which will give many hundreds of milliamps emission if required and we insert this valve in the circuit.

How does this rectifier work?

When the voltage on the anode is positive, current flows through the rectifier into whatever load we provide. If we have a resistance to complete the circuit we shall get a rush of current through this resistance, which will develop a voltage across it. When the anode is negative no current flows and there is no voltage across the resistance.

The next change in voltage makes the anode positive again and once more we obtain current through the load so that we get a series of rushes of current all in the same direction and therefore having some average value with fluctuations above or below this point.

Can you smooth out these fluctuations?

Yes, by using the same methods as we did last week. We had a large condenser across the circuit which by-passed the fluctuations and a choke in series with the supply to the set which passed the steady voltage but held back the fluctuations.

In actual practice we usually feed the rectifier straight into a filter system such as this instead of a resistance. The rush of current through the rectifier then charges up the condenser which we often call the reservoir condenser for this reason. This condenser then discharges at a steady rate through the choke coil and the set.

Does all the current from the rectifier go into the condenser?

No! Some of it will force its way through the set as explained last week. Therefore, we place another by-pass condenser, usually termed the smoothing condenser, on the other side of the choke. Any current of a pulsating or fluctuating character which forces its

way through the choke is then by-passed by this smoothing condenser, leaving the load to carry only the steady current.

How large do we make these condensers?

The reservoir condenser is usually about 4 microfarads. If this is too small it will not sufficiently absorb the variations of current. A good deal of the fluctuating current will then force its way through the choke. If this happens, our supply to the set is not perfectly steady and we hear a hum, which is the very thing we are trying to avoid.

Suppose we consider a man filling a tank with a bucket. Leading out of the bottom of the tank is a pipe which supplies water at a, more or less, steady rate to a machine. The man keeps the tank sufficiently full to maintain a head of water by drawing water in a bucket from a stream close by and pouring it into the tank.

This is a fair analogy of what is happening in the electrical case. As long as the tank is supplied with water at sufficiently regular intervals, the water level will always be above the outlet pipe and there will be a steady flow of water out of the tank to the load.

If the tank is too small the man will very quickly fill the tank up, and any further water he may add will spill over the sides. If the tank is too large the water level will not be high enough to maintain a sufficient pressure through the pipe. We require a tank of such a size that it is just kept not quite full.

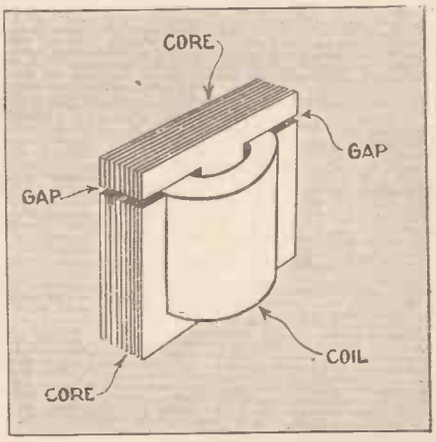
In the electrical case there is a similar value of condenser usually round about 4 microfarads.

What about the smoothing condenser?

This can be made as large as one likes. Its sole purpose is to by-pass any stray current which forces its way through the smoothing choke and anything from 4 to 8 microfarads is usual. More than this is not used for economic reasons.

Is a valve always used?

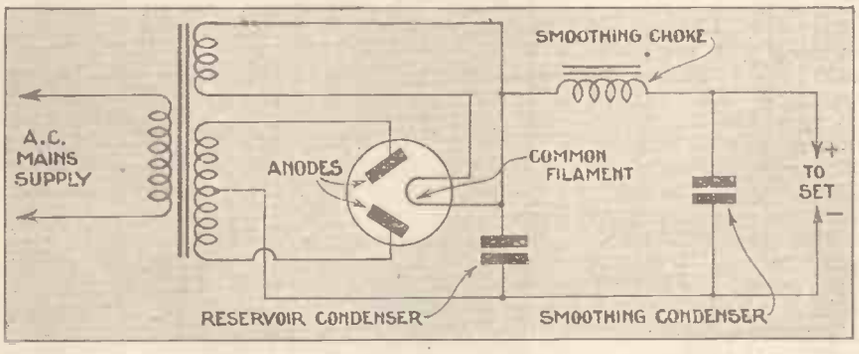
By no means. In fact even the simple valve of the type so far considered is only occasionally used. There are fairly long gaps between the pulses of current in the case we have just discussed. If we could arrange another valve to supply current to the reservoir condenser when the first valve was not working we could supply our current twice as often, and therefore the ripple would be smaller and more easily smoothed.



A smoothing choke constructed with an air gap core so that a satisfactory inductance can be obtained when a large current is flowing through the winding around the core

Can you use two valves like this?

Quite easily. We usually mount both the rectifying elements in one bulb and call it a double-wave rectifier. Then we use a transformer which has a centre-tapped secondary. Suppose we want a supply of 200 volts to our rectifier, we should use the transformer to give us 400 volts and take a tapping in the centre. Relative to this centre point, when the voltage at one end is plus 200, that at the other end is minus 200 and *vice versa*.



A typical double-wave rectifier circuit for A.C. supplies. Note that the valve filament of the rectifier is fed from an auxiliary winding on the mains transformer

We connect each end through a rectifier on to a condenser. When the top end is positive, current flows through the top rectifier into the condenser and charges it up. When the current changes direction the top end becomes negative, but the bottom end is now positive and current therefore flows through the bottom rectifier into the condenser again.

The condenser thus receives current alternately from one rectifier and then the other, and is thus replenished twice as fast and tends to keep a more constant level of voltage so that the smoothing is much easier.

What is a smoothing choke like?

Something like a low-frequency transformer. A number of turns of wire are wound on a bobbin and around this is built up an iron core consisting of thin stampings of special steel. In a transformer, of course, there are two windings, whereas in a low-frequency choke we have only one but the general construction is the same.

How large is a smoothing choke?

It depends upon the circuit. A value of between 10 and 20 henries is quite an average size, but in some chokes we use as much as 100 henries where we want particularly good smoothing.

The physical size of the choke depends upon the current which the choke has to carry. You will remember I told you when dealing with low-frequency transformers that the inductance of the primary winding depended upon the steady anode current of the valve which also has to flow through the winding. The more steady current we pass through the coil, the more the iron saturates and the inductance falls off.

We have just the same trouble here in an aggravated form because the whole current of the set has to go through the choke, and therefore we must make the iron circuit capable of carrying 20, 30 or more milliamps.

Can that be done quite easily?

Not easily because the designer is always looking for compactness. The problem is very simple if one goes to large and expensive construction, but if the dimensions are to be kept small the problem is not easy.

Satisfactory chokes can be made, however, without being unwieldy, the process often being assisted by assembling the iron circuit slightly differently so that instead of being continuous there is a very small air gap.

What does an air gap do?

It prevents the iron circuit from saturating and consequently improves the inductance, when the coil is carrying a large steady current. The inductance with no steady current is much less than with a normal iron circuit, but where we have to carry a fairly large number of milliamps a smaller gap often helps matters considerably.

Do we use a potentiometer with A.C. sets?

Either a potentiometer or series resistances are included just as with a D.C. eliminator. These reduce the voltage if required, but we have this advantage that whereas in a D.C. set we have to start with the voltage of the supply mains, with alternating current we can start here with whatever we like.

If our maximum voltage is 150 we can insert a transformer between the mains and the rectifier which will reduce the voltage to 150 to start with. Then we do not have to waste any voltage, and we only use a potentiometer to give us the subdivisions or tappings.

SETS OF THE SEASON

LISSEN A.C. SKYSCRAPER

THROUGH the great enterprise of the Lissen people, the popular mains consolette type of set, self-contained except for the aerial and earth, is now brought within the reach of every kit constructor.

You all know something about the original battery version of the Lissen "Skyscraper." I reviewed it at the very beginning of the season, and during the past six months or so it has achieved a phenomenal success. I think this A.C. model will be just as popular, for it is easy to assemble, absolutely safe, and gives a first-rate performance when connected up to the aerial and earth.

If you don't want an external aerial, there is a mains-aerial attachment, which means that for local-station reception only an earth is needed—everything else for good reception is in the cabinet.

Two Models

By the way, the model I tested is the consolette, with self-contained moving-coil loud-speaker. There is another kit with table-model cabinet costing only £8 15s. This should appeal especially to those already possessing a good loud-speaker.

Although my test model was supplied already assembled, I should say the constructional work is very easy. There are profuse instructions given on a well-produced sheet, containing a host of hints on building and working the kit.

My test model is housed in a good-looking light-walnut cabinet, comprising the neat metal-chassis three-valver, with safety power unit mounted on the right, and moving-coil loud-speaker at the top.

The cabinet measures about 16 in. square by about 10 in. deep. Black knobs are fitted on the front for the controls. The loud-speaker grille comes above these controls.

The circuit consists of a variable-mu screen-grid high-frequency amplifier, detector, and pentode power output. It is a perfectly straight circuit, but includes all those refinements that make just the difference between mediocre results and really fine results as obtained with this kit.

Accurate Tuning

Lissen screened coils of the dual-range type are used for the aerial tuning and for the tuned-grid inter-valve coupling. A gang condenser tunes these two coils, with a trimmer superimposed on the main control knob for accurately ganging all round the wavelength range of the dial.

Transformer coupling is employed between the detector and the pentode, which is tone-corrected by a .1-megohm resistance as a grid stopper.

The high-tension supply for these valves is obtained from the power unit, which employs a valve rectifier. The filament current is obtained from the usual 4-volt winding on the mains transformer and grid bias by cathode resistances, that for the variable-mu being variable for controlling the volume.

A very good point about the power unit, apart from its obviously robust and safe construction, is the provision of tappings on the transformer for all mains voltages from 100 to 250 volts. Another practical point is the provision of a very stout and lengthy mains cable for the connection of the set to the electric-light supply.

Metal chassis of Lissen A.C. Skyscraper with safety power unit on the left

Control has been made as easy as possible. In addition to the tuning knob with its superimposed trimmer knob at the centre below the tuning scale, are two auxiliary knobs: on the left for combined volume and reaction, on the right for wave changing.

The tuning scale is marked in degrees from 0 to 180. Station searching is made easy by the very complete calibration chart provided with the instruction sheet. All the well-known stations are calibrated, and tests show that these figures are helpful in locating the innumerable foreigners within easy range of the set.

BRIEF SPECIFICATION

Makers: Lissen, Ltd.

Price: £10 12s. 6d., complete with valves, power unit, moving-coil loud-speaker, and consolette cabinet.

Valve Combination: Screen-grid (Lissen AC/SGV), detector (Lissen AC/HL), pentode (Lissen PT425), and mains rectifier (Lissen U650).

Power Supply: A.C. mains, from 100 to 250 volts.

Type: Kit set for A.C. mains, either with self-contained moving-coil loud-speaker, or as table-cabinet set with external speaker.

Remarks: Gives every satisfaction on test. Quality very pleasing.

Simplicity of Control

With regard to the idea of combining reaction with volume in this type of set, the makers contend—rightly, perhaps—that what selectivity is lost by so combining the controls is more than compensated by the greater simplicity of control. Anyway, selectivity is quite good for only two tuned circuits, and there are three alternative aerial coupling connections to enable you to obtain just the right compromise between selectivity and volume on distant stations.

I found that with a 60-foot aerial the A2 connection gave very satisfactory station separation. The trimmer on the tuning also helps to tune out interference.

Plenty of foreigners were clear of interference on tests with this set. Hamburg, though not clear of London Regional, was tuned in more loudly than the interference, and by the time Scottish Regional was reached there was no trace of London.

Sensitivity is extremely good from the bottom of the medium waves to just above the middle of this band, and quite satisfactory for the rest of the way. On long waves the sensitivity is unusually good, Luxembourg, for example, coming through with great punch.

These station-logging tests certainly emphasised the inherent simplicity of operation, and in view of the ease of separating stations there is no reason to regret the fact that reaction is applied at the last part of the rotation of the volume control, which, incidentally, works extremely well in cutting down the locals to normal volume.

With the earth lead connected to the set there is no trace of mains hum. This is, in fact, one of the most silent background mains kits I have tested.

Quality of reproduction is definitely good. Well balanced, I should call it. Normal amount of top-note response and more bass than you might expect from the relatively small dimensions of the cabinet. No boom, thank goodness!

Altogether a worthy development of the "Skyscraper" idea. Whether you buy the table model or the consolette, you will certainly get excellent value for your money.

SET TESTER.

TRANSFORMER DEVELOPMENT

Details of the new transformers with special cores, for ordinary L.F. coupling and for Q.P.P. and Class B input and output

THE special input and output transformers and chokes for Class B and Q.P.P. have rather over-shadowed the development of the transcoupler type of unit which marks one side of transformer development.

The transcoupler idea is really a development of parallel feeding and, in the one case is included all the components necessary for coupling in this way. It is of course cheaper for manufacturers to produce the complete job than to market the separate resistances and condensers. Care is needed in design.

The Ferranti O.P.M.16 (C) output transformer

A Varley Class B input transformer

These special couplers and also ordinary transformers and chokes for L.F. work, are in many cases made with cores of nickel steel alloy. Early transformers made with cores of this type of alloy were fragile and the transformer characteristics could be changed if the component were dropped or knocked sharply. The new products, however, are more stable. Although some of the new cores have the disadvantage of being far too easily saturated (and are, therefore, more suitable for parallel feed), transformers have been produced during the past season which are quite suitable for connection direct in the valve anode circuit, providing a steady current is kept low. Bass response has been improved and only in the case of cheap and poorly designed transformers has the core capacity been reduced so that there is definite distortion.

The special tapped transformers for Q.P.P., and driver transformers and output arrangements for Class B mark another surprising development in transformer design. As the secondary of a Class B input transformer has to handle power, the design of some of these transformers has required great care and it is meritable that, in spite of this, they are being marketed at very reasonable prices. Output transformers and choke condenser systems for Class B have also to be carefully designed. In the case of transformers, it is necessary to have a low primary D.C. resistance in order to cut out any distortion due to high peak output currents which may flow from the Class B valve.

An output choke for Class B, by R.I.

It has been proved that a serious loss of power can result from the use of an inefficient output system with Class B or Q.P.P. Early results with quiescent push-pull in particular, were disappointing because of this lack of power. Transformer manufacturers were alive to the difficulty and produced suitable output transformers, tapped, generally to match the speaker and with suitable primary circuit characteristics. Representative transformers typifying modern design are shown by the accompanying photographs. The latest Class B designs, driver transformers and output chokes and transformers are illustrated. In many cases the new Class B parts are commendably compact.

Typical of modern transformer design, the Lissen Hypernik

One of the new Trix transformers for Class B work. The input transformer is shown

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The second "dip" in the "Broadcast Bran Tub" will be heard by listeners to the Belfast programme on May 12.

The last half-hour of an Orchestral Concert in the Ulster Hall will be relayed by the Belfast Station on May 13.

WHAT OUR READERS THINK

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

The Moscow 500-kilowatter

SIR,—Perhaps it will interest some of your readers to know that the supposed rumour regarding the super-power transmitter of Soviet Russia is fact, not fiction. I recently wrote to the radio authorities in Moscow and in answer they confirmed the truth of this rumour. They state that the power is to be 500 kilowatts. No indication of the wavelength was given, but a Russian transmitter has recently been observed near 165 kilocycles using enormous power. The interference to Huizen was terrific and completely blotted out its signals.

I wonder how many of your short-wave readers have noticed the severe heterodyning of the Moscow 50-metre transmission. Are the Nazis responsible? Anyway, I do not suppose many listeners mind missing a little of Russia's unceasing propaganda. F. A. B. (Halstead).

Batteries for Class B

SIR,—May we draw attention to a point which we feel has not been given sufficient consideration in connection with the use of the new Class B valves, viz., the absolute necessity of providing such valves with an H.T. battery of very low internal resistance capable of giving during its normal life peak currents of 40 to 50 milliamperes. Although the ordinary type of H.T. battery will undoubtedly operate a Class B valve for a time, we are of the opinion that the full benefit to be derived from the new method of amplification will only be secured by the use of the triple-capacity or power type of H.T. battery.

It is possible that objection to this type of battery may be raised on the score of bulk and weight, and also the fact that in existing sets which are modified for Class B amplification the accommodation for the H.T. battery may be limited. In order to meet this objection we are introducing a 120-volt double-capacity battery which, whilst retaining the normal length and breadth of the standard battery, is increased in height to about 3¾ in. This battery is our No. 1168 size, measuring 10 in. by 6 in. by 3¾ in. high, fitted with plug socket tappings in 10-volt steps. List price, 17s. 6d.

The normal discharge rate can be taken as from 12 to 15 milliamperes, i.e., the average discharge rate for a Class B amplification set.

Siemens Electric Lamps and Supplies, Ltd.
(London, E.C.)

Short-wave Reception

SIR,—On a recent Sunday I received WIXAZ, on 31.35 metres, at 13.00 (midday) at R2 strength on the loud-speaker. The call of this modest 5-kilowatt American was distinctly heard. The station was heard for over a period of nine hours on and off. At 22.00 this station was a fine R8 signal and was broadcasting a religious service, every word of which was perfectly intelligible.

Does this constitute a record for so high a wavelength?

The receiver was none other than the famous 1931 "Century Super," which is a successful all-wave receiver if there ever was one.

F. A. B. (Ridgewell).

"My Oldest Stager"

SIR,—With reference to Thermion's remarks under "My Oldest Stager," I have a straight three—detector (Cossor R.C., 85 volts), R.C. (Cossor 210Det., 50 volts and L.F.), and transformer-coupled (Mullard PM2, 110 volts)—receiver in use which contains the following components:—

Original R.I. transformer (about 1922).
Ashley "Claritone" horn loud-speaker (about 1922).
Two Ashley filament resistances (1922).
Bretwood variable grid leak and condenser (about 1925).
Several old Dubilier mica fixed condensers.
Air-spaced preset condenser made up from bits and pieces bought in 1922.

The set gives wonderfully good and pure reproduction, with which I am quite satisfied, with a total H.T. consumption of 3 milliamps. A. H. (Tadworth).

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Always in Line with Latest Design

CLASS B AMPLIFICATION

The following Rola Speakers for valves as under are now ready:

	LIST PRICES
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Rola F5-PM-12-Class B	32/6
or Rola F6-PM-08-Class B	49/6
or Rola F7-PM-08-Class B	60/-
COSSOR 240B VALVE	
Rola F5-PM-14-Class B	32/6
or Rola F6-PM-01-Class B	49/6
or Rola F7-PM-01-Class B	60/-
B.T.H. PD220 VALVE	
Rola F5-PM-12-Class B	32/6
or Rola F6-PM-08-Class B	49/6
or Rola F7-PM-08-Class B	60/-

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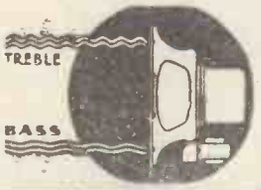

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Post Free from **3/6**

THE NEW **"CLASS B" 9/-** *Mains Volume from a Battery set obtained at insignificant H.T. consumption*

R.C., H.F., L.F., or Detec. 3/6. Power 4/-. Super-Power 4/6. S.G. 7/6. Var-Mu. 7/6. "Class B" type 9/-. Pentode type 10/-.

All in 2v., 4v., or 6v. Metallised 3d. extra. Delivery by return of post.

Cash with order. Cheques and P.O.'s must be crossed and made payable to :— THE 362 RADIO VALVE Co., Ltd. (Dept. Y.3), 415 Mare St., Hackney, London, E.8

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The Camco "Waverley"—a handsome Oak Cabinet that will enable you to convert your set into a handsome radiogram. Its appearance leaves nothing to be desired. Supplied complete with baffle-board. Price, finished in Oak, £5 10s.; Mahogany, £6 15s. Polished wooden panel or converted for Osram Music Magnet Four, 4/- extra. See this Cabinet in our showrooms open 9.15 to 5.45 (Sat. 12.30), and send the Coupon for FREE Camco Cabinet Catalogue.

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21AW

THE FIRST "CLASS B" BATTERY OPERATED RADIOGRAM WITH FERROCART COILS!

Smurthwaite's, famous as makers of specialised sets for wireless experts, have evolved in their research laboratories a means of adapting the "Class B" System to produce a battery operated radiogram equipped with the marvellous new FERROCART Coils at very moderate cost.

No longer need the lack of electric current deprive you of the fine quality reproduction of the best type of radiogram, yet all you need to operate the Smurthwaite "Class B" Radiogram is a standard size dry H.T. Battery.

SPECIFICATION.

CIRCUIT

- One variable mu H.F. stage (Mazda SG215VM) Tuning unit—The marvellous new FERROCART coils and British Radiophone Condenser. Power grid detection—Detector valve Mazda HL2.
- Special intervalve transformer, designed in conjunction with the valve manufacturers, couples the detector to the special "Class B" output stage.
- Moving coil loud speaker—"Magnavox" P.M. model fitted with a special output transformer.

Handsome walnut cabinet. All accessories are the best of their kind. Garrard double spring motor. Harlie de-luxe pick-up with volume control. Illuminated tuning dial.

SMURTHWAITE "Class B" RADIOGRAM

F. W. SMURTHWAITE LTD.
Harmony Works, Ross Parade, Wallington Surrey

21 GNS

A Weekly review of New Components and Tests of Apparatus
Conducted by J. H. REYNER, B.Sc., A.M.I.E.E.

GENERAL INDUCTANCE SPEAKERS

AN inexpensive moving-coil loudspeaker which we have tested this week is that made by the General Inductance Co. This model is known as the "Junior," as distinct from the slightly more expensive speaker, "Senior" type.

The speaker employs a small E-shaped permanent magnet bolted to the back of a rigid metal chassis. A low-resistance moving coil is fitted but the necessary input transformer is included, this being bolted on to the chassis. This transformer is of the tapped variety and allows three impedances to be obtained, these being approximately 13,000, 8,000 and 1,500 ohms.

The diaphragm is of the moulded one-piece type and is interesting in that it is not rigidly fixed at the periphery, but is only lightly held between felt pads. A

The Senior and Junior models of the General Inductance Co. speakers

normal type web-centring device is used, this being held from the centre pole piece.

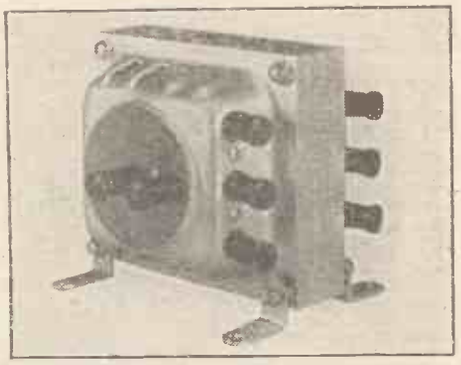
On test the speaker gave very good overall results. The main bass resonance occurred at approximately 100 cycles, below which the output fell off but was still quite good as low as 80 cycles. At the high-frequency end of the scale the response was good up to approximately 4,500 cycles, after which it fell off rapidly.

The speaker retails at the very moderate price of 25s.

WEARITE MAINS TRANSFORMER

WE have tested this week one of the new Wearite mains transformers. This instrument is completely enclosed by means of metal end plates which are provided with ventilation holes to ensure that the windings shall run sufficiently cool. These end plates also carry the necessary terminals, these being of the completely insulated type.

A unique feature of this transformer is the arrangement which has been adopted for selecting the correct input voltage tapping. On one of the end plates is provided a paxolin disc which carries the two terminals for the input supply. One of these terminals is in the centre of the disc, and when the other terminal, which is located near the periphery, is removed the disc can be rotated. Between the two terminals a small window is formed in the disc. With the outside terminal removed the disc is rotated until the correct mains voltage is seen underneath the window. The terminal is then replaced and auto-



A Wearite mains transformer fitted with a novel type of input voltage-tapping arrangement

matically makes connection with the correct tapping. This arrangement is very neat and effective.

The sample tested was rated to supply 250+250 volts at 60 milliamperes, 4 volts at 4 amps and 4 volts at 1 amp for the rectifier valve. The transformer was tested by wiring it up to a suitable rectifier valve and the D.C. output voltage measured across a 4-microfarad reservoir condenser. At a 60 milliampere load the output voltage was 230, this rising to 310 volts on no load. The main low-tension winding gave 4 amps at 3.85 volts, while the rectifier winding gave 1 ampere at 4.1 volts.

This transformer is a good job and can be recommended.

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

OUR LISTENING POST

By JAY COOTE

THE changeover from Greenwich Mean Time to British Summer Time this year has not been noticed by radio listeners to the same extent as in previous years, for although the alteration spells longer daylight hours, our daily log, contrary to what happened in the past, shows but a small falling off in its entries. This is not due to the fact that general reception conditions are better, but solely for the reason that transmitters during the past two years have seen their power considerably increased and also because our present-day receivers are so much more sensitive and selective.

Time Alterations

The actual alteration in the clock which brings us on a level with Central European Time, however, affects us in this way, that when the home stations have closed down there are only one or two countries in Europe from which transmissions are still available. Spain has made no alteration but has stuck to G.M.T., with the result that Madrid, Barcelona and San Sebastian are still on the air until past 1 a.m. B.S.T.; and Reykjavik, normally one hour behind us, can still be picked up at midnight or even later. Portugal has not adopted B.S.T. and therefore you are now given a good opportunity of logging CT1AA, Lisbon, on 282.5 metres. Holland will not go over until May 15 and until that date we shall be forty minutes ahead of Amsterdam time; later, when she puts her clocks on one hour, she will again be twenty minutes in advance of London.

A curious point about this Summer Time business is that although the plan for daylight saving was put forward by an Englishman, William Willett, many years ago, and introduced to Parliament in 1908, Germany was the first to bring it into actual practice early in 1916; she was followed by Austria, Holland, Denmark and Norway, and we adopted it in the May of that year. Since then, Austria, Denmark, Germany and Norway have abandoned the idea.

Writing about time reminds me that in future the best period of the evening to listen to Athlone will be between 9.45 and 10.45 p.m., as this hour is the one which is to be devoted to special sponsored concerts.

By the time these notes are in print we shall have been able to find out whether the French State has authorised Radio Toulouse to use its new St. Agnan transmitter. No doubt the fire at the old station was an accidental one, but it may have proved a very strong lever in the hands of *les bons Toulousains* to obtain a long refused permit.

Radio Luxembourg now appears to have sketched out its daily programmes and with the exception of special concerts destined to individual countries, as already pointed out in previous notes, you will find that they run very much as follows : light music (records) at 7 p.m. B.S.T., followed by news and a symphony concert; a talk in French, German, Dutch or English at 8.30 p.m., with another batch of records; then again a news bulletin (French), light music (9.15 p.m.) and a final news transmission in German at 9.45 p.m. On most evenings we may expect dance music (records) at 10 p.m. At odd times throughout the day the studio broadcasts Stock Exchange quotations and results of sporting and athletic events. From what I learn, Radio Luxembourg "jumped" the wavelength it is using; no authority to monopolise this channel could be given as I understand that a frequency in that neighbourhood was allotted to Vienna for the new high-power transmitter. Luxembourg appears to have got in first on the principle that possession is nine points of the law !

BROADCASTING STATIONS

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

Metres	Kilocycles	Station and Call Sign	Power (Kw.)
13.97	21,470	Daventry (GSH)	15.0
16.88	17,770	Daventry (GSG)	15.0
19.68	15,243	Paris	10.0
19.82	15,140	Daventry (GSF)	15.0
25.20	11,910	Paris	10.0
25.28	11,865	Daventry (GSE)	20.0
25.4	11,810	Rome (2RO)	15.0
25.53	11,750	Daventry (GSD)	20.0
25.60	11,725	Paris	10.0
31.25	9,598	Lisbon (CTIAA)	2.0
31.3	9,585	Daventry (GSC)	20.0
31.31	9,580	Radio Nations	20.0
31.38	9,560	Zeesen (DJA)	8.0
31.55	9,510	Daventry (GSB)	20.0
32.26	9,300	Rabat	0.5
40.3	7,464	Radio Nations	20.0
45.38	6,611	Moscow	12.0
46.6	6,438	Moscow	12.0
48.2	6,220	Rome (2RO)	9.0
49.4	6,073	Skamleback	0.5
49.59	6,050	Daventry (GSA)	20.0
49.6	6,048	Vienna (UOR2)	2.0
49.83	6,020	Zeesen (DJC)	10.0
50.0	6,000	Moscow	20.0
58.31	5,145	Prague	0.5
207	1,449	Seralng	0.2
207.6	1,445	Liege (Wallonie)	0.3
209.8	1,429	Miskolcz	1.25
209.8	1,429	Magyarovar	1.25
209.8	1,429	Pecs	1.25
211.3	1,420	Newcastle	1.0
213.8	1,403	Antwerp	0.4
214.3	1,400	Aberdeen	1.0
215.3	1,393.4	Chatelineau (EL)	2.0
217.1	1,382	Konigsberg	0.9
217.1	1,382	Brussels (Conf.)	0.25
218	1,373	Salzburg	0.5
218.5	1,373	Plymouth	0.2
219.9	1,364.3	Beziers	0.5
220.3	1,362	Binche	0.3
223.2	1,344	Swedish Relays	—
224.4	1,337	Cork (6CK)	1.2
225.9	1,328	Fecamp	10.0
227.4	1,319	Flensburg	0.5
230.6	1,301	Malmo	1.2
232.6	1,390	Kiel	0.25
235	1,283	Lodz	2.2
235.5	1,274	Kristianssand	0.5
237.2	1,265	Bordeaux (S.O.)	3.0
237.9	1,261	Nimes	1.0
238.9	1,256	Nurnberg	2.0
240.7	1,246	Stavanger	0.5
241.3	1,243	Liege	0.3
242	1,238	Belfast	1.0
244.1	1,229	Basle	0.5
245.9	1,220	Berne	0.5
245.9	1,220	Cassel	0.25
245.9	1,220	Linz	0.5
245.9	1,220	Swansea	0.12
247.7	1,211	Trieste	10.0
249.8	1,201	Juan-les-Pins	1.0
250	1,200	Prague (Strasnice)	5.0
250	1,200	Radio Schaerbeek	0.3
252.3	1,189	Barcelona (EAJ15)	6.0
253.1	1,185	Gleiwitz	5.0
255.1	1,176	Toulouse (PTT)	0.7
257.1	1,167	Horby	10.0
259.3	1,157	Frankfurt-a-M.	17.0
259.3	1,157	Treves	2.0
261.6	1,147	London National	50.0
263.8	1,137	Moravska-Ostrava	11.0
265.7	1,129	Lille (PTT)	1.3
267.1	1,123	Valencia	8.0
267.2	1,123	Nyiregyhaza	6.25
268.3	1,117	Bremen	0.3
269.8	1,112	Bari	20.0
271	1,107	Cointe-Liege	0.3
271.5	1,105	Rennes	1.3
273.7	1,096	Turin (Torino)	7.0
276.5	1,085	Heilsberg	60.0
280	1,071.5	Bratislava	14.0
281	1,067	Copenhagen	0.75
282.2	1,063	Lisbon (CTIAA)	2.0
283.6	1,058	Innsbruck	0.5
283.6	1,058	Berlin (E)	0.5
283.6	1,058	Magdeburg	0.5
283.6	1,058	Stettin	0.5
284.9	1,053	Radio Lyons	1.0
286	1,049	Montpellier	0.8
288.3	1,040	Bournemouth	1.0
288.3	1,040	Scottish National	50.0
291	1,031	Viipurl	13.0
293	1,022	Kosice	2.5
293.7	1,021.5	Limoges (PTT)	0.7
296.1	1,013	Hilversum	20.0
298.8	1,004	Tallin	11.0
301.5	995	North National	50.0
304.3	986	Bordeaux (PTT)	13.0
306.8	978	Zagreb	0.75
307.5	975.8	Falun	0.5
308.6	971.6	Vitus (Paris)	1.0
309.9	968	Cardiff	1.0
309.9	968	West Regional	50.0
312.8	959	Cracow	2.0
313.9	955.6	Genoa (Genova)	10.0
315.8	950	Marseilles	1.6
318.8	941	Naples (Napoli)	1.5
318.8	941	Sofia (RodnoRadio)	1.0
319.7	936	Dresden	0.25
321.9	932	Goteborg	10.0
325	923	Breslau	60.0
328.5	913	Poste Parisien	60.0
332.1	903	Milan Sizlano	50.0
332.2	902.9	Poznan	2.0
338.2	887	Brussels (No. 2)	15.0
341.7	878	Brunn (Brno)	35.0
345.2	869	Strasbourg (PTT)	11.5
348.6	860.5	Barcelona (EAJ1)	8.0
352.1	852	Graz	7.0
355.9	843	London Regional	50.0
360.6	832	Muhlacker	60.0
363.6	825	Algiers (PTT)	16.0
265.5	820.7	Bergen	1.0
367.2	817	Fredriksstad	0.7
368.1	815	Bolzano	1.0
368.1	815	Helsinki	13.2
369	813	Seville (EAJ5)	1.5
370.1	810	Radio LL (Paris)	0.8
372.2	806	Hamburg	1.5
376.4	797	Scottish Regional	50.0
381.7	788	Lvov	16.0
385	779	Radio Toulouse	60.0
385	779	Stallno (RV26)	10.0
389.6	770	Leipzig	75.0
394.2	761	Bucharest	12.0
398.9	752	Midland Regional	25.0
399	752	Vladikavkas	10.0
403.8	743	Sottens	25.0
408.7	734	Katowice	16.0
413	725	Athlone	60
416.4	720.5	Radio Maroc (Rabat)	6.0
419.5	715	Berlin	1.5
424.3	707	Madrid (Espan.)	2.0
424.3	707	Madrid (EAJ7)	3.0
430.4	697	Belgrade	2.8
431	696	Parede (CTIGL)	1.5
435.4	689	Makhatch-Kala	100.0
435.4	689	Stockholm	55.0
441.2	680	Rome (Roma)	60.0
447.1	671	Paris (PTT)	7.0
447.1	671	Danzig	0.5
450	666.5	Odessa (RW37)	20.0
452	664	Madona	25.0
450.3	666	Klagenfurt	0.5
453.2	662	Odessa	10.0
453.8	661.3	Milan Vigentino	7.0
455.9	658	San Sebastian (EAJ8)	3.0
456.7	657	Agen	0.5
459.4	653	Beromuenster	60.0
459.4	653	Archangel	10.0
465.8	644	Lyons (PTT)	15.0
472.4	635	Langenberg	60.0
480	625	North Regional	50 0
483	621.1	Ivanovo-Vosnesensk	20 0
488.6	614	Prague	120.0
495.8	605	Trondhelm	1.2
501.7	598	Florence	20.0
501.7	598	Gorky	10.0
509.5	590	Astrakhan (RV35)	10.0
509.3	589	Brussels (No. 1)	15.0
518.7	578.3	Vienna	15.0
525.4	571	Riga	15.0
532.9	563	Munich	60.0
537.5	558	Palermo	3.0
540	5,555	Prague (tests)	10.0
541.5	554	Sundsvall	10.0
550.5	545	Budapest (1)	18.5
555.5	542	Tampere	1.0
559.7	536	Kaiserslautern	1.5
559.7	536	Augsburg	0.3
562.9	532.9	Wilno	22.0
564.9	531.2	Freiburg	0.2
566	530	Hanover	0.3
571.2	525.2	Grenoble (PTT)	2.0
574.7	522	Ljubljana	7.0
585.7	512.1	Tartu	0.5
678.7	442	Tessin	20.0
719.4	416.6	Moscow (RV2)	20.0
743	404	Samara	10.0
746.2	402	Ostersund	0.6
779	383	Petrozavodsk (RV29)	20.0
825	363.6	Sverdlovsk	50.0
833	360.1	Heston Airport	5.0
840	357.1	Budapest (2)	3.0
848.7	353.4	Rostov (RV12)	20.0
857.1	350	Leningrad	100.0
882	340	Saratov (RV3)	20.0
937.5	320	Kharkov (RV4)	20.0
967.7	310	Alma Ata (RV60)	10.0
1,000	300	Moscow	100.0
1,034.5	290	Kiev (RV9)	100.0
1,060	283	Scheveningen-Haven	10.0
1,061	282.7	Tiflis (RV7)	100.0
1,073.5	279.4	Oslo	60.0
1,093.9	276.7	Minsk (RV10)	100.0
1,117.4	268.5	Moscow	40.0
1,153.8	260	Kalundborg	7.5
1,171.5	256	Taschkent (RV11)	25.0
1,190.5	252	Luxemburg	150.0
1,200	250	Istanbul	5.0
1,200	250	Reykjavik	16.0
1,234.5	243	Boden	0.6
1,230	240	Vienna Exp.	3.0
1,266	237	Bakou	35.0
1,304	230	Moscow (T.U.)	100.0
1,354.4	221.5	Motala	30.0
1,380	217.4	Novosibirsk (RV6)	100.0
1,411.8	212.5	Warsaw	120.0
1,445.7	207.5	Eiffel Tower	13.5
1,481	202.5	Moscow (RV1)	500.0
1,538	195	Ankara	7.0
1,554.4	193	Daventry (Nat.)	30.0
1,600	187.5	Irkutsk	10.0
1,620	185	Norddeich (KVA)	10.0
1,634.9	183.5	Zeesen	60.0
1,685.3	178	Kharkov	25.0
1,725	174	Radio Paris	75.0
1,796	167	Lahti	54.0
1,875	160	Huizen	8.5
1,910.8	157	Sverdlovsk	25.0
1,920	156	Blaj	0.75
1,935	155	Kaunas	7.0
2,000	150	Craciunelu	1.0
2,450	122.4	Skoplj'e	20.0
2,625	119	Konigswuster-Hausen (press)	20.0
2,650	113	Eiffel Tower	15.0

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All About Class B

R.I. HAVE tackled the job of Class B conversion in a most thorough manner and have produced a helpful book which gives the most explicit details. Wiring instructions and tables of suitable valves and transformer ratios ensure that you can set up your Class B stage properly. I unhesitatingly recommend this new R.I. publication to all battery users who are considering Class B. **992**

Pertrix and Q.P.P.

I see that Pertrix are using special ultra-capacity cells in their Q.P.P. batteries and that the grid-bias section cells have the same capacity as those of which the H.T. section is composed. There are four batteries in the Pertrix range for Q.P.P. and you should write for details. **993**

New Baker Speakers

Four new additions have now been made to the Permag range of Baker speakers for use with Q.P.P. and Class B sets. And an attractive folder has just been sent me which gives details and working information. **994**

For Summer-time

Jelly acid non-spill batteries are described in the new C.A.V. folder and these are just the thing for use when you take your set out of doors. They are used and recharged in exactly the same manner as the free acid type. And all batteries are supplied charged and jellied ready for use. The folder gives dimensions, and capacity ratings. **995**

Charge Your Own

If you are thinking of charging your own accumulators, then get the new folder from Nash Products, Ltd., describing the N.P. chargers for home use. There are H.T. models which may solve a high-tension accumulator charging problem. **996**

Atlas Components

The enormous popularity of Atlas mains units may overshadow some of the very high-grade components which are also in the Atlas range. Low-frequency transformers, variable resistances, chokes, moving-coil speakers, and even short-wave coils are all made by Atlas and you can get a folder describing these. **997**

OBSERVER

THE MAINS UNIT OF 1933

By PERCY W. HARRIS

FEW listeners who switch on their high-tension mains unit with the comfortable knowledge that it will supply high tension indefinitely, realise how recent is the evolution of a really satisfactory and inexpensive device of this kind or the amount of research which has been necessary to reach the present state of reliability. True, the 1933 mains unit is not greatly different from those of a year ago and nothing sensational has been evolved in this direction during the last twelve months, but it may be of some interest to consider what have been the more important recent developments.

As readers of the recent series on mains working will realise, a mains unit consists essentially of a transformer, a rectifier, a smoothing system (consisting of condensers and chokes) and a voltage regulating arrangement made up of a number of resistances. In every one of these items the last year or two has shown distinct progress.

Improved Transformer Cores

The new high-permeability irons which have meant so much in the development of low-frequency transformers, have not meant so much to the designer of the mains transformer, but they certainly have influenced very considerably the design and efficiency of the iron-cored chokes in the better smoothing units. Not so long ago a choke with enough inductance to give satisfactory smoothing and a low enough resistance to give good regulation and to avoid undue losses, was a bulky and high-priced unit. The new iron, by enabling high inductance values to be had with a small amount of wire, has led to the production of chokes which look very small compared with those of the same efficiency of a year or two ago. True, the new iron itself is much dearer than the older forms but the overall cost of the choke can be kept low and greater efficiency obtained.

Better Condensers

Then take the question of the smoothing condensers, which play such an important part in a mains unit. Generally speaking, the more microfarads we have the better the smoothing. Fixed condensers capable of withstanding high voltages for long periods without deterioration are now commonplace and relatively inexpensive. Fixed condenser breakdowns are much less frequent than they used to be and in general the condensers are less bulky. With the advent of the electrolytic condenser of the self-healing type—used in so many of the commercial A.C.-mains sets—the space required for "lots of microfarads" has been still further reduced, with the added advantage that if a sudden surge should bring about a breakdown of the dielectric the puncture is self-healing immediately the high-voltage surge ceases.

In resistances much progress has been made both in reliability and reduction of cost. A year or two ago wire resistances were about the only ones suitable for heavy currents such as are found in mains units, but recently a number of excellent composition resistors of great reliability have been evolved, the high-resistance materials suffering little change with heat or prolonged use with heavy current. A very practical point about such resistors which are of the same composition all through is that the resistance value can be very accurately adjusted by grinding, a reduction in diameter of the rod bringing about an increase in resistance and a reduction in length a decrease. Thus the final adjustment of value can be made on a machine while the resistor is in an electrical circuit containing a measuring instrument.

So far as rectifiers are concerned we have just the two kinds—valves and the copper-oxide or "metal" rectifier, as it is often termed. Both have their advantages and both their disadvantages. The indefinite life of the copper oxide type is a great point in its favour, while the lower first cost of the valve rectifier must also be taken into account. Increases in efficiency of the valve rectifier have kept pace with the increases in efficiency of the ordinary types of valve.

Q.P.P. and Class B amplification have brought with them special mains-unit problems, which are now being solved. The trouble with both of these systems is that the current demands are constantly fluctuating and it is therefore difficult to keep the voltage from the mains unit constant. Cossors have overcome the difficulty by producing a special bulb which when connected across the output takes a certain definite current on "no load." As the external load of the set increases, the current taken by the special bulb is decreased, the total load on the mains unit remaining the same. In this way the voltage is kept constant.

HIVAC VALVES

READERS will have seen announcements recently of the Hivac valves. We had an opportunity recently of inspecting the factory in Farringdon Road, London, where an up-to-date equipment has been installed, and we actually saw a number of valves of various types being manufactured. A special high-efficiency filament is used and this, in conjunction with up-to-date processes, results in valves of a high order of efficiency and reliability.

Samples of these valves have been received and are undergoing test. They will be reported on in due course; there are several novelties of construction which will appeal to the user. The screen-grid valve in particular is very ingenious. Instead of the usual method of shielding, two separate anodes are used on each side of the filament, each one of which is totally enclosed in a Faraday cage so that the stray capacity is practically non-existent. This construction is the invention of the managing director, Mr. Freedman, who told us of several other ingenious ideas to be incorporated in future valves.

A novel tester was inspected during the visit. It consists of a board covered with meters for reading the filament current and voltage, anode current, internal resistance, slope, amplification factor and a grid current test for softness. The internal resistance and slope are measured dynamically, and numerous changes of connection are therefore necessary in running through the series.

This is done automatically by a push button. The button is depressed and the connections are made for certain static tests, a small pilot lamp lighting up under each of the appropriate meters. Another pressure of the button changes the connection for the next tests and lights a further series of pilot lamps. There are three or four of these push-button operations, after which the cycle repeats itself, so that each valve is given a very thorough test before leaving the works.

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P.M. 12A Screened-grid - - 16/6

P.M. 1HL Non-microphonic Detector 7/-

P.M. 22 Super-power Pentode - 17/6

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