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OPERATING THE STUDENT'S THREE
ACCUMULATOR PASTES.—The following ingredients are required: 4 parts by weight redlead (Pb304), 1 part by weight litharge (PbO), 1 part by weight sulphuric acid (H2SO4), 2 parts by weight specific gravity sulphuric acid. Add the acid gradually to the mixture of redlead and litharge, stirring well until a truly stiff paste has been formed. Thorough mixing is essential, and care must be taken not to make the paste too thin.

How to Apply. Place the grid on a flat board and use a scoop to place the paste in the grid. A wooden spreader should then be used to force the paste into the pockets of the grid. A piece of newspaper is then placed on top of the plate, and another flat board on top of that. This enables the plate to be turned over so that it can be pasted on the opposite side.

Drying. Stack the plates carefully in a warm room to dry. After three or four days dip the plates in sulphuric acid (1.25 parts by weight specific gravity) and re-dry.

Paste for Negative Plates. Use the following ingredients: 5 parts by weight litharge, 1 part by weight of 1.30 specific gravity sulphuric acid. Mix, apply, and dry, as for positive plates.

For a high-rate discharge cell, the paste is essential, and care must be taken not to make the paste too thin.

JELLY ELECTROLYTE.—Jelly electrolyte consists of sulphuric acid to which a given proportion of sodium silicate has been added. Jellification takes place at varying speeds according to the proportions in which the two chemicals are mixed. A suitable mixture whichhardens in five or six minutes is—1 part of pure sodium silicate (1.100 specific gravity) to 3 parts of cold sulphuric acid (1.400 specific gravity).

As jellification takes place fairly rapidly, it is essential to arrange that the entire operation may be carried through without any hitch or delay. The cell to be filled is then placed on top of the plate, and the cell inverted and allowed to drain for about half an hour.

MUSICAL NOTES FREQUENCY. —The frequency of the notes of the piano cover the band from 20 to 4,096 vibrations per second. The lowest note, A, has a frequency of 26, middle C (the centre note of the standard piano keyboard) a frequency of 256, and the top note of the standard piano has a frequency of 4,096. The following table shows the piano notes and their frequencies:

<table>
<thead>
<tr>
<th>No.</th>
<th>Note</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>45</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>56</td>
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<tr>
<td>5</td>
<td>E</td>
<td>67</td>
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<tr>
<td>6</td>
<td>F</td>
<td>78</td>
</tr>
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<td>7</td>
<td>G</td>
<td>89</td>
</tr>
<tr>
<td>8</td>
<td>A</td>
<td>100</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>111</td>
</tr>
<tr>
<td>10</td>
<td>C</td>
<td>122</td>
</tr>
</tbody>
</table>

UNIT OF VOLTAGE.—The unit of voltage is the volt. It is the amount of potential difference between two points when a current of 1 amp passes through a resistance of 1 ohm.

UNIT OF CURRENT.—The unit of current is the ampere. It is a flow of 1 coulomb per second. A pressure of 1 volt will pass a current of 1 ampere through a resistance of 1 ohm.

UNIT OF RESISTANCE.—The unit of resistance is the ohm. It is the resistance which will permit the flow of 1 amp, when a pressure of 1 volt is applied.

(See also page 124)
ROUND THE WORLD OF WIRELESS

Learn as You Go

THE difficulty which many beginners experience is in obtaining a full knowledge of some particular point, in spite of elaborate explanations. It is generally found that such difficulties are cleared up very quickly if some actual demonstration can be made of the point in question, and it is in this connection that practical experience is of such great importance. For instance, the effects of oscillation in a valve may be explained in a very detailed manner, covering involved matter such as negative resistance, etc., but if a milliammeter is included in the anode circuit of a valve, and precision is then applied, the sudden drop in anode current will show instantly that something important has taken place in the valve, and in conjunction with a description of the subject, it is then more obvious just what has happened. The same thing applies to distortion in an L.F. or output valve, and thus some ready means of carrying out such tests will prove of the greatest value to those who are making a study of radio rather than merely using the receiver for the reception of entertaining programmes. The "Student's" Three, described last week, was designed for the purpose of teaching various facts relative to modern equipment, and in this issue we give details of one or two tests which may easily be carried out with this particular receiver.

Mr. S. J. de Lotbiniere

THE B.B.C. announces that Mr. S. J. de Lotbiniere has been appointed a Managing Controller of Programmes, as a result of the recent secondment of Mr. E. L. Wellington, Assistant Controller of Programmes, to the Ministry of Information.

A Dog's Life

DENIS CONSTANDUROS has written a new comedy for broadcasting called "A Dog's Life," which will be heard on April 20th. This treatises the question of evaques from a new angle and also deals with the type of young woman who is so often slandered. Other dog is that every interest in life is made subservient to its welfare. The play will be produced by M. H. Allen.

Double Alibi

ADAPTED by L. J. Ludovici from a short story by Harold Weston, "Double Alibi," to be broadcast on April 19th, deals with a safe-breaker and his mates who attempt to rob a factory safe containing a week's wages. The safe breaker, Sam Crayshaw, has cast-iron alibi, which eventually involves him in worse trouble than if he had had no alibi at all. The play is full of breathless suspense, which should be given its full value by the producer, John Chestell.

Boy Scouts' Programme

A St. George's Day has been adopted by Scouts all over the world as a day of reunion and for the renewal of the Scout promise, it is fitting that it should be chosen for a feature programme about this great movement and that the message from the Chief Scout, Lord Baden-Powell, should be included in such a programme. This message was recorded in South Africa, and will form the finale. Robin Whittworth will produce the feature, which has been arranged by Bresford Webb, of the Boy Scouts London Headquarters.

After a brief introduction indicating the spirit behind the movement, the programme will give some account of its spread to America and to other continents. The main section will contain talks linked by national songs. This will include reference to such events as the floods at the Jamboree in Denmark, the World Jamborees in Holland and Hungary, the help given to earthquake victims in Bulgaria, and the time when Scouting in France was begun as a secret movement. Scouts in exile will be represented by a Polish Scout. An Indian Scout will speak for Asia, a Canadian Scout for North America, and Lord Hampton for Australia. It is hoped also to have a Chilean Scout, as Chile had the first troop after England.

The Arabic Listener

THE B.B.C. announces that the first number of the Arabic Listener, the new B.B.C. publication which will be issued twice monthly, is now on sale. It will circulate in all parts of the Arabic-speaking world, including North Africa, Egypt, Syria, Palestine, Iraq, Arabia, and the Persian Gulf, as well as among the Arab communities in such widely separated places as Singapore, Zanzibar, and North and South America.

The chief object of the journal will be to reprint talks already broadcast in Arabic, but, in addition, it will include special articles on life and activities in Britain, summaries of British comment on Arab affairs and other matters of general interest. It is hoped that the new publication will contribute to the friendly relations existing between this country and the Arab world.

The Arabic Listener may be had on application to the British Broadcasting Corporation, London, England, for 4s. for six months, or 8s. for 12 months, including postage to any part of the world.
Tracking in Superhet Circuits

The Principles and Methods of Keeping the First Detector and Oscillator Circuits in Track are Explained, while Practical Notes on Aligning the Circuits Are Given.

By FRANK PRESTON

It is well known that special gang condensers are made for use in superhet receivers, and that the vanes of the section intended for tuning the oscillator circuit are of different shape from those of the other section, or sections. The reason for this is that the rate of capacity variation must be different in the oscillator circuit to ensure that the best note is of constant frequency. Many experimenters find difficulty in appreciating this point, and argue that both oscillator and signal-frequency circuits have to cover a similar band-width and therefore that specially shaped oscillator vanes should not be necessary. That is, if the wavelength range on one band is, say, 500 to 600 metres, the range of the oscillator circuit must be from 200, plus or minus the I.F., to 600 metres, again plus or minus the I.F.

Ratio of Frequencies

To understand the matter it is necessary to think entirely in terms of frequency. Thus, assuming that the tuning range on one waveband is 200 to 600 metres, the frequency range is 1,600 to 500 kc/s. The oscillator frequency has been halved, the oscillator frequency has been reduced by only about one-third.

On long waves the variation is even more marked. Assume, for example, that the long-wave band extends from 1,000 to 2,000 metres (a fairly average range), the frequency range is from 300 to 150 kc/s; a ratio of 2 : 1. Corresponding oscillator frequencies are 765 and 615 kc/s; a ratio of about 11/12.

On short waves the variation is far less marked, because of the higher frequencies. If it were assumed that a particular S.W. range were from 20 to 30 metres, the corresponding frequency range would be 3,000 to 4,500 kc/s; a ratio of 2.955 : 2, approximately. The oscillator range would be 15,465 to 10,465 kc/s; approximately 2.955 : 2, or near enough to 3 : 2.

Coil Inductance

This will make it clear why tracking condensers are often used for long-wave tuning only, it being sufficient to use a gang condenser with shaped oscillator vanes, and a suitable oscillator coil, for medium waves. Incidentally, the oscillator coil is invariably of lower inductance than the aerial coil. For 465 kc/s the medium-wave winding of an aerial coil has an inductance of 157 microhenries; the corresponding winding of an oscillator coil has an inductance of only about 70 microhenries. The exact value depends upon whether the coil is intended for use with a special superhet condenser or a "plain" gang condenser.

It has become usual, in the case of home-constructor sets at least, to employ gang condensers with a special oscillator section, but it is debatable whether or not this is a good thing. The trouble is that if this gives accurate tracking on medium waves it will not necessarily do so on long waves, and therefore it will be necessary to use a padding condenser for long-wave tuning.

There is a good deal to be said in favour of using a plain condenser for superhet tuning, and having a separate padding condenser for each waveband. This makes necessary some additional preliminary adjustment, but gives greater certainty of the tracking being accurate, and holding more closely over the whole of each waveband.

Tracking Systems

Fig. 1 shows the tuning connections for a triode-hexode frequency changer where a superhet type two-gang condenser is employed. In this case, of course, the oscillator section has specially shaped vanes and has a capacity appreciably lower than 6000 mfd., which is used for first-detector tuning. On medium waves it is sufficient to adjust the trimmers on the gang condenser (if fitted), but before the receiver operates efficiently on long waves, the additional trimmer, wired in parallel with the long-wave section, and also the padding condenser, wired in series with this section, must be set to the trimmer position closest to the middle.

This is a fairly usual arrangement, but there is much to be said in favour of that indicated in Fig. 2. Here, use is made of an oscillator coil with built-in padding tuning windings—one for medium-wave and one for long-wave. In addition, a padding condenser is used for each winding. Thus, each of these must be adjusted in turn when aligning the receiver prior to putting it into use. Some manufacturers make coils of this type with built-in padders of a capacity suitable for the particular windings.

The coils resemble I.F. coils in appearance, and the padders are adjusted by means of a screwdriver.

The most usual arrangement of trimmers and padders for multi-range tuners is shown in Fig. 3. It will be seen that in this case there is a trimmer across each section of both first-detector and oscillator coils, and that padding condensers are provided for all except the short-wave section of the oscillator coil; the reason for not having a padding condenser for short waves will be understood from what has already been written. By combining adjustment of trimmers and padders, it is possible to ensure exceedingly good tracking on all wavebands. Unfortunately for the home constructor, however, it is very desirable that a well-calibrated oscillator be available when carrying out the alignment.

(Continued on page 120.)
For the Beginner

VALVE TYPES EXPLAINED

A Non-technical Article to Help Beginners Understand and Select Valves from the Numerous Types Now Available.

By L. O. SPARKS

It is not very difficult for a beginner to construct his first receiver and obtain very reasonable results, if he follows reliable advice and works to a diagram or blueprint which is accurate in all details. The trouble usually starts when he desires to criticise the initial attempt or start to build something more ambitious, say, for example, a set using more valves or those of different types.

At this stage it cannot be expected that the beginner will know everything about valves. Therefore, bearing in mind the numerous types now available, it is not surprising that some little difficulties and confusion is experienced when it comes to the question of which to use for the new circuit.

To one not well versed in such matters, a valvemaker's booklet does not always make the common or garden points too clear. and, in fact, a beginner need not be surprised if he finds himself more confused than ever after studying one of these booklets, as such an occurrence is not unknown and, strangely enough, this is invariably due not to the absence of details but rather to the number provided. It is the purpose of this article, therefore, to explain, without delving into technical matters, why so many types of valve are produced, their purposes and how to select the right one for any given circuit. You will note I say, "without delving into technical matters." To some readers, this might savour of avoiding the issue and not giving information which will, or should, be required eventually by all newcomers to radio. Well, that is not the case; a beginner will take some little time to acquire sufficient theoretical knowledge to enable him to study the complete theory of the thermionic valve in all its varied forms, and as it would be very detrimental to his progress if he had to hold up his work to this elementary stage until he had reached the desired technical stage, it is far better for sufficient practical knowledge of valves to be gained so that the active side of the hobby can be continued while the technical subjects are being studied.

The Diode and Triode

If the glass bulb is removed from a valve, it will be seen that several distinct parts are assembled within the space enclosed by the bulb, and connected to the valve-pins or leads by means of fine wires passing through the base. These parts are known as electrodes and the number in any one valve is governed by its type. With diode and triode valves, as their names imply, two and three electrodes, respectively, are employed. The electrodes enclosed in a diode are the filament, or heater, and anode, and this simple form forms the most simple type of valve.

The construction of a valve using two diode sections is shown here. The valve is, in this case, a mains full-wave rectifier and the filament and anode of one section can be seen. The triode has three electrodes; these take the form of anode and filament (heater) as in the diode but, between these, is fixed the third electrode in the form of a fine wire mesh or grid; in fact, it is known as the grid. This type of valve is, undoubtedly, the most widely used, as its range of application is very wide, but before discussing it, you should be aware that even with electricity, one cannot get something for nothing. For L.F. amplification, i.e., after the signal has been rectified, it becomes necessary to use a valve of lower impedance, as a valve of higher impedance would have to handle a much larger signal without the risk of introducing distortion which would be created if it were overloaded. The lower impedance valve, remembering previous remarks, and the fact that it is being doing more work than the detector, will, naturally, consume more current in its anode (or plate) than the detector. This is unavoidable, as it must be appreciated that even with electricity, one cannot get something for nothing. Supposing that two valves were used between the detector and the output valve, then the second would have to have suitable characteristics, i.e., even lower impedance, to allow it to cope with the work passed from the detector and not overload the output valve. Similarly, the output valve must be chosen to suit the signal which will be delivered to its grid from the preceding stages.

Triodes

Now to get back to the triode: its range of application is very wide and this is made possible owing to the fact that it is made in several types as regards its impedance and amplification factor, therefore, it is these two items which govern the selection. Generally speaking, if it is to be used as a detector it should have a reasonably high impedance, but a certain latitude is, of course, permissible, according to the complete circuit. For L.F. amplification, i.e., after the signal has been rectified, it becomes necessary to use a valve of lower impedance, as a valve of this type—and this should be noted—can handle a much larger signal without the risk of introducing distortion which would be created if it were overloaded. The lower impedance valve, remembering previous remarks, and the fact that it is being doing more work than the detector, will, naturally, consume more current in its anode (or plate) than the detector. This is unavoidable, as it must be appreciated that even with electricity, one cannot get something for nothing. Supposing that two valves were used between the detector and the output valve, then the second would have to have suitable characteristics, i.e., even lower impedance, to allow it to cope with the work passed from the detector and not overload the output valve. Similarly, the output valve must be chosen to suit the signal which will be delivered to its grid from the preceding stages.

One slip which most beginners make is to attempt to obtain too much amplification with too little thought for the valves which have to do all the work. A given type of valve can only handle a certain maximum signal strength without being overloaded, therefore, like most things, if it is overloaded, something has to suffer, and in this case it is the faithfulness of reproduction of the original signal.

PRACTICAL WIRELESS

SERVICE MANUAL

By F. J. CAMM.
Faithful to his national folk verse, there he successfully appealed for a State grant. His works yielded him but a poor return and its name from the Dumka movement in it.

After the Russian word meaning existence, however, he entered a Prague soil of Czech national art. Effort to infuse the melodic zone of his opera, "King and Collier," entirely reset him. He placed himself more familiar with the great German romantics of that period, notably Schumann and Wagner.

Being compelled to find means of subsistence, however, he entered a Prague concert band and later the orchestra at the National Theatre in Prague. There is no finer training in the world for an intending composer than orchestral playing, it enables him to hear the polyphony and instrumentation of great works in an incomparable way. Beethoven's youthful experiences in the Elector's private orchestra bear ample witness.

Dvorak was evidently a reticent and bashful young man, for all this time he was assiduously composing, a fact only known at the time to a few intimate friends. Much of this work was chamber music and a letter to Simrock concludes: "Please take this into consideration."

Simrock published the Duets, which achieved an immediate success. Dvorak never looked back and his friendship for Brahms grew and grew with the passing years. The two men had much in common.

In the works that followed Dvorak clung closely to the rich sources of Czech folk music. The first series of the famous Slavonic dances appeared for two pianos, four hands, in 1878 and was a huge success. Richter, Buthow, Manns and many other famous conductors commissioned him to write them works. Many visits to foreign countries followed and that to England was particularly successful. The "Stabat Mater" took the town by storm. He visited all our leading festivals.

He wrote the Second Symphony for the Royal Philharmonic Society and although the Fifth, "From the New World," completely overshadowed everything else he ever wrote in fame and popularity, Sir Donald Tovey, in 1924, wrote in the Cambridge Review: "No work in ranking the Second side by side with Schubert's in C and Brahms' four as the greatest symphonies since Beethoven's.

American Visit
In 1892 Dvorak accepted the Directorship of the New York Conservatoire, which he held for three years. He was accorded a splendid reception. That visit would be memorable for the creation of the "New World" Symphony, if for nothing else. Based on some Negro and native Indian melodies and themes given him by students and friends, this splendid and justly famous work is a first favourite with concert audiences throughout the world, and is probably only second in the public's affections by Beethoven's Fifth.

On his approaching return home, he wrote one or two trifles, inspired by nostalgia. Amongst these was the rocco symphony. "Humoresque" has been arranged for every instrument and conceivable combination of instruments under the sun, and has unquestionably found a place among the first dozen or so favourite short pieces.

Another immensely popular work is the brilliant "Carnival" overture, one of three, treated with the same ingenuity. "Papooses" produced a reaction in the public's mind against the "New World"

Brilliant Piano Scores
A great master of instrumentation and orchestral colouring, and a singer in control of those sad and wistfully appealing little numbers the reasons for whose well-nigh devastating popularity I enquired into a few weeks ago. "Humoresque" has been arranged for every instrument and combination of instruments under the sun, and has unquestionably found a place among the first dozen or so favourite short pieces.

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Comment, Chat and Criticism
Biographies of Musicians
MAURICE REEVE, our Music Critic. Reviews in This Article the Life of DVORAK

ANTON DVORAK, the greatest Czech musician and unquestionably one of the master musicians of the nineteenth century, was born near Prague, on the Vltava river in 1841. Coming of a sturdy peasant trading stock, he worked for a time in his father's butcher's business. He had many teachers, of the schoolmaster-musician type then so prevalent in Central Europe. He made a particular study of church music and, through voluntarily playing the viola in the orchestra of the Society of St. Cecilia and other bodies, became familiar with the great German romantics of that period, notably Schumann and Wagner.

Dvorak was evidently a reticent and bashful young man, for all this time he was assiduously composing, a fact only known at the time to a few intimate friends. Much of this work was chamber music and he was evidently studying and playing. It was, however, sufficiently meritorious to warrant his resigning his orchestral desk and devoting himself to composition as a means of livelihood.

Recognising the lead that Smetana was giving, Dvorak decided to follow this lead and elaborate on it to the limits of his powers. He placed himself more and more under the influence of the Baroque and thus gave to his work a perfection of form and architectural detail which it had hitherto lacked. He also dived deep into the wells of Czech, national music and folk lore.

Chamber Music
To his chief works of this period, 1874-5, were numerous chamber compositions, usually including a piano: a serenade for strings, the First Symphony and an early opera, "Rakitin." His "C宗教," entirely reared. Faithful to his national folk verse, there followed the first cycle of songs and the first Moravian duets. He made every effort to infuse his melodic zone into his work with ideas grown and cultivated in the soil of Czech national art. From his earliest days he cultivated a movement of his own and he called it the "Dumka," after the Russian word meaning "nostalgically sad." Many of these are extremely beautiful and one entire work at least, the classical "Dumka" quartet, bears a close resemblance to Haydn and Mozart; the other to build an empire. He possessed a complete mastery over the orchestral palette and scored some marvellous effects. He was not one of the great piano composers but he wrote some scores for that instrument in those chamber works in which he employed it, notably the Dinky Trio and A Major Quintet.

Whilst Smetana grasped and evoked the whole spirit of Czech music and made himself the singer of their past and the prophet of their future, Dvorak is simple, kindly and human. Smetana was the superior in the fusion of intellect and intuition, but Dvorak had a far greater wealth of inspiration and creative versatility. Looked at as a pair, they might be said to bear resemblances to Haydn and Mozart; they were pioneers and as a pair, their music is definitely superior in the fusion of intellect and intuition, but Dvorak had a far greater wealth of inspiration and creative versatility.

Looked at as a pair, they might be said to bear resemblances to Haydn and Mozart; they were pioneers, and as a pair, their music is definitely superior in the fusion of intellect and intuition, but Dvorak had a far greater wealth of inspiration and creative versatility.

The "American" symphony, which was fast deeming it fashionable or smart to despise ancient glories and the gods of the fathers, he proved that sonata form did not perish with Beethoven. Brahms, of course, was also proving the same thing.

Dvorak died in 1904.
ON YOUR WAVELENGTH

The Gadgets Racket

I THOUGHT the gadgets racket had come to a timely or untimely end—I hoped the latter. Just as a reminder that firms believe that there are still mugs to be found, I saw a gadget advertised in two of our nationals recently by two separate firms. Each advertisement made the same claim for the gadget, and the two advertisements were contiguous in the columns. The price of the first was 2s. 6d. and the second 9d.

The Old Tunes

ALTHOUGH all musical compositions are based upon the diatonic scale, the permutation of notes provided by the compass of the piano is such that it would be impossible to play when we consider time, the sharps and flats, and repeat them ever to exhaust the possibilities of musical composition. You have been hearing a great deal recently of a piece entitled "Eighteenth-century Drawing-room." This makes use of the famous Mozart Sonata No. 15, or at least a few bars of the first, or allegro, movement. I do not like to see vintage music apostatized by the comic bands which draw large screws for making banal noises. There should be some law to stop plagiarism. The full Mozart's Sonata No. 15 talks about a quarter of an hour to play, and occupies over twelve sheets of music. It commences with the allegro, and the andante and rondo movements follow.

"Eighteenth-century Drawing-room" makes use of the first few bars of the opening theme. Tuneful though it is, the bars used do not give you sufficient idea of the development. The complete piece is a really beautiful work, much used by music masters as an exercise. It makes use of considerable single-hand fast runs, and finally winds up in the somewhat exultant manner, and by the time one has, however, one or two bound volumes of Vols. 1, 2, and 3 of P.W. available at 12s. 6d. each. Readers will find our handbook "Sixty Tested and Approved Circuits" contains details of most of the popular circuit arrangements, and I recommend those who have returned to the fold to obtain a copy.

A number of builders are building sets for their A.R.P. Depots, and others on volunteer or military service are rigging up their shacks with receivers.

The Neutrodyne Circuit

THE neutrodyne circuit is not so popular as it used to be, for the very good reason that modern component design has reached such a stage that the factors which needed neutralising are no longer there. However, one or two readers have asked queries about it in recent weeks, so I suppose it is not entirely dead.

The whole secret of obtaining successful H.F. amplification is the prevention of feed-back from the plate circuit of the H.F. valve to its grid circuit. In the modern S.G. scheme, this is achieved by very complete screening not only between external circuits but also between the actual electrodes of the H.F. valve itself. With an ordinary three-electrode valve the outside screening may be arranged in just the same way, but obviously, a certain amount of feed-back would take place in the valve itself.

The well-known "Hartline" neutrodyne circuit very ingeniously got round this difficulty by arranging that energy should be intentionally fed-back from the anode circuit to the grid circuit in such a way as to cancel out the amount of unwanted feed-back. This was done by extending the anode coil; the H.T. was tapped on to the centre of the tuned circuit so that both ends of the coil were "live" and at opposite phase. From the end remote from the plate a very small adjustable condenser was used to couple back directly on to the grid of the same valve. When the value of this condenser was exactly right, the circuit was perfectly stable—an unheard of state in those days. A really high amount of amplification could be obtained, and the only drawback was the fact that very complete screening was necessary, although it always is, and that the actual "neutralising" process—the adjustment of the condenser—was often rather tricky to the unskilled hand.

It is well known that a screened-grid valve will overload if the signal is too strong, and that the signal straight off the aerial from a nearby station is quite capable of exceeding the legitimate grid swing. In cases where people want a receiver with better distance-getting properties than the conventional "detector and two L.F." and happen to be situated so near a broadcasting station that a screened grid valve in the first stage will overload, the neutralized triode forms an excellent substitute for the S.G.

Little need be said about operation, except for a description of the actual process of neutralising. Without trying to find the correct position one the set to a local, bringing it up to maximum volume. Now remove one filament lead from the terminal on the H.F. valveholder. Leave the other in position, of course, and its filament switched off. The local will probably be heard at quite good strength if the neutralising condenser is either "in" or "all out." In the one case, the condenser is adjusted so that the signal from the local disappears altogether. Having obtained it, move the tuned condensers slightly to and fro until that it does not come in again.

When the ideal state of affairs has been found, the filament of the H.F. valve should be switched on again, and the set should operate in a stable condition.

Electronic Pianos

I PROPOSE my recent remarks re electrical and electronic musical instruments, I see that pianos that perform like organs, and yet result in greatly decreased expense of construction, are predicted by B. F. Misener, electronic musical-instrument pioneer of Milburn, N.J.

"We have new designs in progress which will greatly reduce the cost, weight, and bulk of the mechanical proportions of these pianos. The number of strings per note at say, 160 pounds tension are used, we can use one string per note at 200 pounds tension, and much shorter; as a result the iron string-plate and its reinforcing wood structure need only be designed for one instead of 20 tons of string tension. Also the key action for these strings can be made very much cheaper, simpler, and lighter, and no soundboard is needed," says Mr. Misener.

"These cheaper pianos, by some additional electrical complications, can be made to perform like organs as well as pianos, and in many tone qualities.

"We are convinced that the music-instrument business is going to be completely changed by all these developments and that the radio industry is going to take over this business, just as it has with phonographs and as it is now doing with organs, guitars, etc.

"The electronic-music-art," concludes Mr. Misener, "is one of the most expensive, 50-year incubation period, and is rapidly emerging into commercial form. Those who foresaw and courage will be the new leaders in this renaissance of the industry which has lain technically stagnant for hundreds of years."
The following is a description of a superheterodyne circuit developed by R.C.A. engineers in which a new type of mixer, known as the 6KS, is employed. The converter valve is essentially a triode-hexode, in which the oscillator and mixer elements are disposed in separate electron streams. The 6KS valve gives improved performance in all frequency bands, but its performance is most spectacular in the high-frequency regions above 15 mels. In these regions interlock is very greatly reduced, and loading of the signal input circuit is not only reduced, but by the proper choice of operating conditions may be made negative in sign.

The reason for the negative input conductance of the signal input circuit in a 6KS valve may be explained as follows. The space current between G1 and G2 is relatively independent of the bias on signal grid G3, due to the interposed screen C5 (see figure). In other words, the sum of the currents in the mixer plate P and the screens G3 and G5 is relatively constant. The electrons passing through G2 will be subject to the influence of G2 and at some high negative bias on G2 will be completely prevented from passing through this grid, resulting in mixer plate current cut-off as in the case of the ordinary triode. However, as the negative bias on G3 is decreased from some high value the mixer plate current will decrease, and the signal grid current will increase. These effects will be accompanied by the building up of a space charge in the G3-G5 space region. Hence, at high values of negative bias on the signal grid the signal input circuit has a low, or comparatively low, negative input conductance. It can also be shown that maximum negative conductance is attained in the signal input circuit when the valve is operating at a low signal grid bias and at a low oscillating strength.

The electrons in the space between G3-G5 will increase and the charge will decrease. This decrease in charge in the G3-G5 space will cause electrons to flow into the signal grid, or current to flow out; thus, an increase in potential of signal grid G3 is accompanied by a change of opposite sense in the current in that electrode, which condition is the criterion of negative conductance.

H.F. Gain Increase

The net input circuit conductance of the 6KS valve will depend in sign and in magnitude upon the relative importance of the two effects operating simultaneously within the G3-G5 space. When the 6KS is operated with a high value of negative bias on G3, the mixer plate current will decrease and the screen grid current will rise. These effects will be accompanied by the building up of a space charge in the G3-G5 region. Hence, at high values of negative bias on the signal grid the signal input circuit has a low, or comparatively low, negative input conductance. It can also be shown that maximum negative conductance is attained in the signal input circuit when the valve is operating at a high signal grid bias and at a low oscillating strength. Since the radio-frequency gain and the image ratio are greatly improved with maximum negative conductance for the 6KS valve, it will be appreciated that it is highly desirable to maintain the conductance value during operation.

However, when utilizing the A.V.C. circuit for automatically increasing the negative bias on signal grid G3 as the I.F. carrier amplitude increases, so as to maintain the converter grid amplitude at the detector input circuit 12 substantially uniform, the negative input conductance of the converter tube actually decreases as explained previously. Hence, with increase of A.V.C. bias, the gain and image ratio of input circuit 1-2 are seriously impaired. Now, as explained previously, a reduction in the converter strength to a low value has the effect of increasing the negative input conductance of the valve, and if the oscillator strength is decreased to a magnitude less than a certain value, the conversion gain is also decreased. Hence, the oscillator grid plate, as well as the mixer grid G5, is connected by lead 21 to a circuit which functions automatically to increase the oscillator grid bias as the carrier amplitude increases. If resistor 22 is the oscillator grid leak resistor connected to the bias resistor 17, the A.V.C. bias applied to the signal grid of valve 10 causes the voltage drop across resistor 17 to decrease.

A.V.C. Effect

The oscillator grid G will become more negative, in this case, with respect to the cathode K, which is biased by the portion of the bleeder resistor 3 between point 4 and earth. In other words, as the A.V.C. bias increases, the oscillator grid G becomes biased in a negative polarity sense with respect to point 4 on bleeder resistor 3. This increase in bias of oscillator grid G reduces oscillation amplitude, and causes an increase in the negative input circuit conductance. Hence, it will be seen that as the A.V.C. bias increases, the input conductance of circuit 1-2 will remain substantially constant at a predetermined low, or negative, value by virtue of the opposing effects of the biasing of grids G3 and G5. Thus the gain and image ratio remain uniform over the entire range of A.V.C. bias variation. Addition, it is to be noted that the increase in A.V.C. bias on the signal and oscillator grids causes a decrease in conversion gain, thereby improving the A.V.C. action. The bias to the bleeder 3 and the amplified A.V.C. voltage developed across resistor 17, and the magnitude of D.C. built up by oscillator action across resistors 22 and 17 in series, are to be proportioned so that the input conductance is maintained substantially constant despite A.V.C. This cannot be done over the entire range of G3, but operation should preferably be confined to that operating region where the input conductance can be maintained substantially constant. There is a sufficient number of variables, namely, oscillator amplitude (by coupling between L and C), a bleeder voltage, magnitude of resistor 22 and resistor 17, to be able to obtain the desired result.

Workshop Calculations, Tables and Formule
By F. J. Camm

ALTHOUGH complete constructional details of this new receiver have been given, there are one or two small points which it would perhaps be desirable to explain for the benefit of beginners or those who have not previously constructed a broadcast receiver. Firstly, with regard to the lead which is connected to the anode of the H.F. valve. This is a screened wire, the screening being intended to prevent instability which might be caused by radiations from the wire. The screening also prevents the lead from acting as a small aerial and picking up energy which would result in poor selectivity, but more of this later. The method of screening is the first point which might need explaining, and it should be carried out with the special braided screening sleeving sold for the purpose. A length is cut off sufficiently long to permit of the metal braiding being turned back at each end to prevent it from coming into contact with the wire which is passed through the insulated sleeving inside it. The ends may then be wrapped or soldered to prevent accidental short-circuits, and a wire twisted once or twice round the lower end and soldered. This wire is joined to the earth terminal as shown in the wiring diagram given last week. The ends of the actual lead are joined to the H.F. choke and to the anode, a cap connector being joined to the lead if a top-cap type of valve is used, and the wire being connected under the terminal if a terminal type of valve is obtained.

Screening

It will be found at a later stage that although the valve is metallised (that is, screened), and the lead to the anode is also screened, the actual anode connector is not protected in this manner and this can give rise to trouble which can only be overcome by using a screen over the valve. The two H.F. chokes are both mounted in screening cases and when mounted on the baseboard they will not be earthed. Therefore, a wire may be joined from the holding-down screws of these two components to the nearest earthed point — actually the filament wiring nearest to the panel. The chokes, incidentally, are of two different types, that next to the H.F. valve being type H.F.0, and that next to the L.F. transformer being type H.F.1. The two coils, although enclosed in metal screening cases, will not be actually screened until the screens are connected to earth and, therefore, the same procedure should be adopted here as in the case of the H.F. choke. A bare wire being connected beneath the holding-down screw nearest the filament wiring already mentioned, and connected to that wiring.

The First Experiment

By way of an initial experiment and to see how a valve functions under varying conditions, a good milliammeter of the low-reading type should be connected to the pair of sockets joined in the detector anode circuit. The illustration on this page shows actually how these sockets are connected to the circuit and it will be seen from this illustration that the meter will be in series with the anode circuit and consequently when the set is switched on the anode current of the valve in the detector stage will be seen on the meter. It will only be a very low value, about 1 mA, and, therefore, a meter with a full-scale reading of 2 mA, or a multi-meter with the range-setter at 2 mA should be used. Without connecting aerial or earth, set the centre tuning condenser to a mid-way position and then slowly advance the reaction control, watching the meter needle as you do so. Suddenly the needle will be seen to dip and if the reaction control is advanced further there will be a slight rise in the reading, not reaching the original setting. Turn back the reaction control until the maximum dip or deflection is obtained on the needle, and this will indicate the fact that the valve is oscillating. Now, in order to confirm the oscillating condition, carry out one of the tests which is used when a superhet is being tested and it is desired to know whether or not the oscillator valve is functioning properly. That is to say, stop the valve oscillating the easiest way being to earth the grid. To do this, moisten your finger and touch the grid terminal of the detector valve and when you do so you will see the meter needle rise to its original setting, removal of your finger immediately causing the needle to drop back to the low setting. Thus by quickly touching the grid terminal in a series of "picks" the meter needle will follow the movements by a series of dips, thus giving a very visual indication that the valve is oscillating effectively. If a really sensitive meter is employed it will be possible to see the needle movement which is obtained as a signal is tuned in, although, of course, the application of reaction will also affect the needle setting.

H.F. Stability

Taking next the H.F. stage, let us see what we can learn from the screening point of view. First of all, erect a very short temporary aerial, and with the 'phones in the detector stage tune in a station which is fairly loud normally. Try to use an aerial of such a size that the volume is reduced to a very low level and preferably is only just audible. Tune in the station very critically on both dials.
A short-wave two-valve designed to offer maximum results for head-
phone reception.

By W. J. DELANEY

Although we have given many constrictual details of short-wave receivers for headphone or loud-
speaker reception, we still receive requests for
receivers designed for specific purposes. It
should be unnecessary to point out that a
receiver designed for general reception
cannot be used for either headphone or speaker
work, and in the general features of design
two different circuits are used. When, however,
we are not sure of the case at the present time, many
listeners desire to make exclusive use of
headphones, there are one or two ways which
may be incorporated so as to achieve a
maximum performance in this particular
connection. News is very prominent
today, and in America there are certain
stations which are not directionally beamed
in Europe. Thus quite a modest
type of receiver will be capable of picking up
these stations on the ‘phones. The only
point is that there must be no hand-capacity
effects, and by this is meant that the frequency
should be provided with the necessary voltage drop
for tho detector stage being obtained by
two-valver is also included.

A theoretical circuit of the 2-valve short-wave for headphone reception.

The Circuit

Taking the circuit from aerial to ‘phones, the main details which will be seen are the
inclusion of a pre-set condenser to enable the
aerial damping to be regulated ; serial damping to be
controlled, and an output circuit to
keep H.F. out of the ‘phones and thus
remove head-capacity effects. In all other
respects the circuit is standard, and two
triodes are recommended. A pentode or
tetrode could be used in the output stage
if desired and would not affect the general
features of the design. The coupling and
winding, if desired would not affect the general
features of the design. The coupling and
winding, if desired would not affect the general
features of the design. The coupling and
winding, if desired would not affect the general
features of the design. The coupling and
winding, if desired would not affect the general
features of the design.

The only important item in a detector stage, although
it is often excluded in short-wave receivers.

The potential applied to the detector grid
is also of some consequence, and—although
it is usual to connect the grid-leak to the
positive side of the detector filament, it
is often found that the bias obtained is
slightly too much for the valve. The
tapped potential divider specified will
directly enable different values to be obtained,
if necessary the grid-leak may still be
connected to the positive side of the filament
without difficulty—the potential divider
being left in circuit.

Layout

The layout is not critical, and a base-
board scheme may conveniently be employed.
No special elaboration is

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...
Electric Soldering Iron

The following is a description of an easily constructed electric soldering iron, which I have found invaluable in radio work. The essential items are a mains transformer from a "scrap" radio set, with a 4 or 6-volt secondary having as high a current capacity as possible, and a carbon rod obtained from a dry cell. The diagram and circuit are self-explanatory, although it is advisable that the carbon rod be of fairly heavy construction to prevent undue resistance and heating.

To use, the clip is placed on the wire to be soldered, at any convenient spot (near to the actual joint as possible, of course), and the carbon tip touched to the jointing position along with the tip of a piece of flux-cored solder. A second or two is sufficient for a good joint to be made.

With this method, dry joints are eliminated, as the wire itself is heated to melt the solder. - W. NEWBOULD (Middlesbrough).

A Simple Adapter

The accompanying illustration shows an adapter which may be inserted in a valveholder of a battery set, and the valve plugged in on top of it. Current readings in the grid, anode and filament can be taken by connecting a milliammeter to the appropriate terminals, the other corresponding terminals being connected by copper strips.

A large valve base must be obtained and holes bored in the sides above each pin. Terminals are then screwed in and connected to the pins with wire. Next the centre piece of an antimicrophonie type valveholder must be obtained. The centre piece must be roughly the same diameter as the top of the valve base and copper strips cut to the shape shown in diagram B must be soldered to each contact.

In some types of valveholder the original copper strips used as contacts and springs may be left and suitable slots cut in them. Four more holes should be drilled near the top of the valve base, between the other terminals. Four terminals fitted with washers are inserted loosely, and the adapter assembled so that the terminals engage in the slots in the copper strips. The terminals may then be tightened up, and after testing for continuity the parts can be glued together. All terminals should be small, as otherwise it may be found impossible to insert the adapter in closely placed sets.

Three copper links should be made as shown in diagram E to connect the corresponding terminals, which should be marked as shown in diagram A.

This adapter may also be used to connect a pick-up or battery set, the leads being taken to the top grid terminal and a filament; all corresponding terminals being bridged with connecting links, except the grids and the adapter, which are inserted in the detector valveholder. Another use is for testing each stage of a faulty battery set. The phone leads should be connected to the two anode terminals, the other three sets of terminals being bridged.

Remote-control Relay

I have made up a remote-control relay for switching off a mains set, together with a press switch for use with relay.

The switch, together with batteries, fits in a box 7 ins. by 4 ins. by 3 ins., which is screwed to the underside of table on which receiver stands—i.e., the leads to extension speaker are two bell wires and a light 3-core flex. Five-pin wafer valve sockets are mounted on skirting board in rooms required to use extension speaker. A 6-core bell flex with a 5-pin base of an old valve at its end is used as a wander lead for extension speaker so that it is a very simple matter to use both extension speaker and operate relay from any room. The diagram should make everything clear. - R. D. Williams (Newport, Mon).

A Dictionary of Metals and Their Alloys

Edited by F. J. CAMM.

This book is a handy and straightforward compilation of salient and useful facts regarding all the known metals, and nearly all the known commercial alloys. Chapters are also included on polishing, metal spraying, rust-proofing, metal colouring, case-hardening, and plating metals, as well as numerous instructive tables. The book costs 5s., or by post 5s. 4d., and is obtainable from all booksellers or the publishers.

GEORGE NEWNES, LTD. (Book Dept.), Tower House, Southampton Street, London, W.C.2.
ALTHOUGH the details of this club, which is sponsored by PRACTICAL WIRELESS, have been published from time to time in past issues, we are repeating the information for the benefit of the many new readers.

The purpose of the club is to bring together all those listeners who specialise in the reception of stations situated in distant parts of the world. It is intended to form a community of kindred minds and its aims are encouragement of DX reception, mutual help and comradeship.

It should be noted that the club has no commercial aims. Membership is absolutely free, and any listener, however slight his interest in DX, can belong to other similar clubs without further incurring any additional financial responsibility.

In a club of this type it is absolutely essential for every member to take an active part by communicating periodically with headquarters, passing on ideas and details of their own experiments, and towards this end, the services of the entire staff of PRACTICAL WIRELESS are placed at the disposal of every member, while space will be set aside in this journal for reports, constructive articles, information, and any details relating to the welfare of the club.

To enable members to keep accurate records of their DX activities and to make their own personal DX stationery available at reasonable prices, while for identification purposes, very neat, well-finished enameled badges can also be obtained.

The A.C.R.

To encourage long-distance reception, which naturally means maintaining a record of degree of efficiency of the receiving station, a very fine certificate, known as the A.C.R., or All Continents Received, is available for those members who report forward QSL cards from transmitters in distant parts of the world, namely, Europe, Asia, Africa, Australia, and America. It should be noted that South America is treated as one continent, and that QSL cards from stations transmitting within the British Isles cannot, of course, be accepted for Europe.

This QSL Racket

While speaking of QSL cards, there is one point we would like to stress. It has already been the object of the B.L.D.L.C. to further in every way possible the interests and progress of their members in all matters relating to radio. Owing to the very nature of the club, no hard and fast rules or stern dictates have been imposed upon its members: no regulations have been issued to attempt to control the activities of those whose names appear on the club's growing list of members. When one is connected with a large band of enthusiastic radiophonicists, such strictures would appear irksome, and should be quite unnecessary, as the radio ham world has its own unwritten page of, call it what you will, rules. It is more than possible for anyone to acquire the most imposing display of verifications from stations which they themselves have never received and which quite possibly fall outside of their scope quite possibly fall outside of their scope and ability to contact with their own equipment. This system has to be killed, and it will be up to every member of the B.L.D.L.C. to do his utmost to prevent the trafficking of such cards.

Correspondence

As far back as September 2nd, the Editor was kind enough to offer 10s. 6d. each fortnight to the sender of the most interesting and described such things as the writer's experiments, constructional work, or station operations. The letters should not be longer than, say, 300 words, and photos or drawings will, of course, add additional interest to the written matter.

It must not be thought from the above remarks that the QSL racket is for our members, but generally speaking, the letters are too brief and do not give sufficient material of general interest, so it is up to every member, especially those in the same district, we must request members to state the requirements and to hear of their individual work. As far back as September 2nd, the Editor was kind enough to offer 10s. 6d. each for tongue to the sender of the most interesting letter, provided it was of general interest and described such things as the writer's experiments, constructional work, or station operations. The letters should not be longer than, say, 300 words, and photos or drawings will, of course, add additional interest to the written matter.

We are pleased to note your interest in QSL cards, thus making it possible for us to further the activities of the club. Unless we are in a position to know members' requirements and to hear of their individual work. As far back as September 2nd, the Editor was kind enough to offer 10s. 6d. each for tongue to the sender of the most interesting letter, provided it was of general interest and described such things as the writer's experiments, constructional work, or station operations. The letters should not be longer than, say, 300 words, and photos or drawings will, of course, add additional interest to the written matter.

Many thanks for your interesting letter. Your log is certainly very good, and it is apparent that your station must be quite efficient in spite of your Heath Robinson aerial. How about the A.C.R. mentioned above? We are interested in your remarks concerning QSL cards, but there is a vast difference between the racket and getting genuine veri's from worthwhile stations.

Member 6320 (Wisbech)

While we hope that the A.C.R. adds to the appearance of your shack, and would like to thank you for the remarks concerning QSL cards which we have received. We thoroughly agree with the points you raise, but unless members take a more active interest it is impossible for us to cover all the ground you mention. About how starting the ball rolling from your area?

Contests

While it is part of the object of the club to enable members to get in touch with each other, especially those in the same district, we must request members to state their requirements and to hear of their individual work. As far back as September 2nd, the Editor was kind enough to offer 10s. 6d. each for tongue to the sender of the most interesting letter, provided it was of general interest and described such things as the writer's experiments, constructional work, or station operations. The letters should not be longer than, say, 300 words, and photos or drawings will, of course, add additional interest to the written matter.

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ADVANTAGES OF MEMBERSHIP

1. No enrolment or membership fees. Members can, therefore, still belong to other similar clubs with similar aims.
2. No commercial aims. Membership is free.
3. Standardised log-books and verification sheets and badges available for members at reasonable prices.
4. Regular reports in PRACTICAL WIRELESS are placed at the disposal of every member.
5. Interchange of ideas with fellow members.
6. Special meetings and visits to be arranged.
7. Regular problems for short-wave listeners.
8. Members' competitions and various other advantages to be announced.

Members are expected to show an active interest in the progress of their common interests in radio matters.

This QSL Racket

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Correspondence

We have stressed many times before that we are interested in letters; in fact, we expect them, from all members, as it is impossible for us to further the activities of the club unless we are in a position to know members' requirements and to hear of their individual work. As far back as September 2nd, the Editor was kind enough to offer 10s. 6d. each for tongue to the sender of the most interesting letter, provided it was of general interest and described such things as the writer's experiments, constructional work, or station operations. The letters should not be longer than, say, 300 words, and photos or drawings will, of course, add additional interest to the written matter.

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POWER OUTPUT

A Comprehensive Account of the Speech or Audio Component of a Receiver

THERE are four important units of measurement with which every wireless enthusiast is familiar. They are volts, ohms, amperes and watts. For the present, however, we are interested in the last unit—watts, with particular reference to output valves. How often have you heard a friend say his power output was two, five, or even twenty-five watts? Now be very careful. There is a distinct difference between anode dissipation in watts and power output in watts, so you must be sure that you are both talking about the same thing. For anode dissipation is a simple measurement of the rate at which the anode of the valve is giving up energy. Power output, on the other hand, is a measure of the rate at which the anode is generating energy. The two terms are not always synonymous.

In order to obtain any amplification a valve must be operated with a load in its anode circuit. In the case of an output valve, the most suitable load is recommended by the manufacturers, and in this particular instance was 7,000 ohms. Knowing the optimum load, it is fairly easy to arrange our load line. First of all assume that 7,000 ohms resistance be placed in series with the anode of the valve. Then, if the grid voltage recommended by the manufacturers be 1 volt at a maximum anode voltage of 250, and the anode current be 6 milliamps, there will be a voltage drop across the load of 42 volts; add this voltage to the maximum anode voltage, making the total 292 volts. This will compensate for the drop in voltage across the load resistance. Now, any change in anode voltage will be accompanied by a corresponding change in anode current; this would not be the case if there was no load in the anode circuit of the valve.

Next calculate the various voltages for variations in anode current. At 2 milliampes 14 volts will be dropped, which, subtracted from 192 volts, will leave 178 volts. Mark this point on the graph. At 6 milliampes 42 volts will be dropped, leaving 150 volts, and at 12 milliampes 54 volts, leaving 138 volts. These points should be marked on the graph as indicated by the letters X, Y, Z. -Draw a line passing through these points and this will represent our load line, when the optimum load is 7,000 ohms.

The next thing is to assume a signal of 14 volts peak value being applied to the grid of the valve when it is biased, say, 7 volts negative. The grid will then swing backwards and forwards from zero volts, 14 volts negative, between the points A, B, which are marked on the load line where it cuts the grid-bias curve at 14 volts respectively. At these points ascertain the anode current and voltage (Continued on next page)

Fig. 1.-Pictorial layout of parts for taking valve characteristics.

Fig. 2.-A theoretical representation of the arrangement shown in Fig. 1.
Anode Dissipation

In order to appreciate the importance of anode dissipation and how it differs from power output, although both are expressed in watts, we will examine the curves of a large output valve with an undistorted output of about 4 or 5 watts. This is shown in Fig. 3. You will notice the curved dotted line of a point touches the load line, but never crosses it. If the slope of the load line were such that it cut the dotted line, greater power output might be obtained, but the life of the valve would be endangered, as the anode dissipation limit fixed by the valve manufacturers would be exceeded. Therefore a compromise is often to be made in order to keep below the anode dissipation limit. This, then, is the relationship between power output and anode dissipation, both calculated in watts, mentioned earlier in the text.

The anode dissipation in watts is the product of anode voltage and anode current at any particular operating point on the anode volts-anode current curve, and in the example given in Fig. 3 the maximum is 25 watts, which must not be exceeded. If we calculate this at the maximum and voltage and anode current recommended by the manufacturers, our results will be as follows:

Anode current 63 milliamps, anode voltage, 400 volts = 25 watts.

At the point O, therefore, the maximum anode dissipation in watts is reached. In determining the position of the load line in Fig. 3 the maximum anode dissipation has to be considered.

Distortion

If load lines were drawn through the working point O (Fig. 3) at different slopes assuming for a moment no limit due to anode current dissipation, OX and OZ would become more nearly equal as the load line becomes nearly vertical, but the power output would fall off rather rapidly. However, if the load line were made more nearly horizontal there would be an increase of power output, resulting in increased distortion. Theoretically, distortionless output is only obtainable with XE equals OZ, but in actual practice a certain amount of distortion can be tolerated, as it is not usually appreciable. In deciding the best position for the load line only has the maximum undistorted output to be obtained, but the load line must cut the anode dissipation curve. In calculating the amount of distortion, it is laid down that the distance between OX and OZ should not exceed the ratio of 11 to 9. If the ratio should exceed this amount the quality of reproduction will suffer. The valve manufacturers, therefore, fixed the load line so that the above conditions are complied with.

Now take a family of curves of an output valve, and calculate the undistorted output for yourself.

For a family of curves of an output valve, and calculate the undistorted output for yourself.
THE "STUDENT'S" THREE

(Continued from page 112)

if the lead is screened, and one of the top-cap screened connectors is employed, it will be necessary to use a "local" lead. There will probably be an increase in strength, due to the lead picking up some of the signal energy. The tuning may shift and you may find a slight readjustment of one or both of the condensers is now necessary to obtain maximum strength, and what is more important, you will probably find that tuning will be flatter or broader, that is, occupying a wider spread on the tuning scale. There may also be a high-pitched whistle accompanying the signal, due to H.F. instability. Similarly, do not try to locate the "dead spots in the "STUDENT'S THREE" on account of this type of instability.

LIST OF COMPONENTS

Two coils, type BP.80. (Varley)
Two 0.0005 mfd. variable condensers, popular type of aerial knobs (J.B.)
One differential reaction condenser, 0.0003 mfd. (J.B.)
Three board-mounted valveholders, two 4-pin and one 5-pin (Bulgin)
One type H.F.6 H.F. choke (Bulgin)
One type H.F.9 ditto (Bulgin)
One 3-point switch, type 5.36 (Bulgin)
One 4 to 1 L.F. transformer (B.T.S.)
Five fixed condensers:
One 0.001 mfd. type 460/5. 0.0002 mfd. type 460/5. 0.0001 mfd. type 3016. One 0.002 mfd. type 460/5 (Dubilier)
Three fixed resistances, 1 watt type:
One 15,000 ohms
One 2 megohms (Dubilier)
One 25 meg. volume control with 3 pt. switch, type VM.62 (Bulgin)
Four terminal mounts and terminals, type P.30 (Bulgin)
Three transformers, type Z.21 (4-pin), H.L.2 and K.T.2 (Oram) One wooden boardcase, 12in. by 9in. One panel 12in. long, 4-pole, galvanometer, leads, leads, leads, etc. (Peto-Scott)
One pair 2,000 ohm headphones (Ericsson)
One W.B. Standard Junior loudspeaker (W.B.)
One 2-volt accumulator (Eska)
One 120-volt H.T. battery (Dynadyne)
One 9-volt G.B. battery (Dynadyne)

PRACTICAL NOTES

Reaction Effects

SOMETIMES when testing out a new receiver, reaction is fierce. After slackening back the receiver to zero the signal returns. The reason is, of course, that at the zero dial reading zero reaction effect is probably found, and one of the condensers is now necessary to obtain maximum strength, and what is more important, you will probably find that tuning will be flatter or broader, that is, occupying a wider spread on the tuning scale. There may also be a high-pitched whistle accompanying the signal, due to H.F. instability. Similarly, do not try to locate the "dead spots in the "STUDENT'S THREE" on account of this type of instability.

A Camera Improvement

When an electron camera of the storage type is being used with a signal mosiag e, it is sometimes annoying by a beam of electrons, an important factor to study is what occurs during the flyback period of the beam after it has completed either its line or frame scan. These steps are usually taken with the beam on the signal plate and its return flight to pass over one or more sections of the mosaic plate there is no detectable signal charge which has been built up in those sections. In some cases the beam is completely suppressed during its return flight, this being carried into effect by applying suitable voltages to the modulator electrode of the neck assembly. This has been found to produce high signal potentials which write themselves by picture margins either dark or too bright.

Dead Spots

Thus we move from instability and parasitic oscillation effects to dead spots. Dead spots may be cured if the fundamental phenomena relative to them are understood. Briefly, dead spots are due to absorption or cancellation, and may be experienced with straight, high-frequency, and superheterodyne circuits. In the latter instance both absorption and cancellation types may be met with, but in straight circuits the absorption type is most common.

Careful attention to the aerial length, and an exquisitely tuned circuit must be employed to eliminate dead spots, to be avoided as it may be regarded in the light of an absorption wave-trap, preventing the pas-
Spot-light Scanning

In spite of the intensive development of the various forms of electron cameras for producing a television signal in the studio or out of doors, it has been proved very conclusively that for certain forms of transmission within a relatively limited scope, the spot-light method presents several advantages. The modern equipment used for this purpose does not employ the old mechanical method, however, in order to produce and control the movement of the rapidly moving intrinsic light area which projects too fast to be televised, but relies on the projection type cathode-ray tube. These have been brought to such a high degree of efficiency that with a suitable high-voltage direct current, a screen capable of withstanding the resultant very intense electronic bombardment, the tiny area of light on the screen is sufficiently bright to be projected by a lens on to a back screen a few feet wide so that any person or object placed before the screen is suitably scanned. The resultant varying light reflections from the surface are made to activate the cathodes of photo-electric cells generally of the multiplier type and in this way a clean, strong, medium-free television signal is generated. This is not a development which has been confined to the laboratory, for several examples of commercial equipment built on these lines have been satisfactorily demonstrated. During the course of several lectures by members of the B.B.C. engineering staff a portable representation of this apparatus was used. Built up in unit form, the demonstrator was able to televise various objects and show the resultant picture on a cathode-ray tube receiver, cable linked to the transmitter. At about the period that war broke out cathode-ray tube light spot scanning was being demonstrated at the Swiss National Exhibition and the resultant signals were made to modulate ultra-short-wave carriers which were picked up by several receivers on view to the visiting public. Then, again, in several of the television telephone booths used so successfully on the European continent cathode-ray tube scanning was used, often with infra-red filters, to reduce the disturbance on the person who was being televised and who, of course, was anxiously to concentrate on the picture of the person to whom he was speaking at the other end of the telephone line. It is to be hoped that the various television firms will continue their development in this quarter, for there is no doubt that the light spot scanner, conceived originally by Baird for his early experiments, has a function to fulfill in many specialized directions.

A Question of Aerials

The large number of people who purchased television receiving sets prior to the closing down of the B.B.C. service at the outbreak of war are no doubt wondering how their aerials are faring after the abnormal weather conditions experienced during part of the winter. On two or three occasions in these columns hints have been given to readers in connection with the care of the sets themselves so as to ensure that at the cessation of hostilities, or earlier if the Postmaster-General can be persuaded to change his mind in regard to a resumption of television entertainment, satisfactory results will once more be obtained on the cathode-ray tube screen. The efficiency of the set itself, however, is naturally dependent on the nature of the input signal passed by the aerial and feeder system to the appropriate receiver connections. With the advent of improvement in outdoor weather conditions the time is now opportune for an examination of the aerial to ensure that it is in a sound condition, both electrically and mechanically. In the majority of cases the television aerial consists of a simple vertical rod, broken at the centre for feeder connection, the length of the rod being approximately 10ft. This is used either with or without a reflector, and since its length corresponds approximately to half the wave-length of the transmissions from the signal station, it is generally referred to as a dipole. A proper explanation of the functioning of this relatively simple aerial would necessitate an excursion into the realms of mathematics, so it is sufficient to remember that the aerial in this form resents the carrier wave for which it has been designed. It is important to note also that if the frequency response of this aerial does not take the form of a sharp curve and only shows approximately a one decibel loss at five megacycles either side of resonance. This is a valuable assurance that the higher modulation frequencies of the television signal will not be seriously attenuated and furthermore, since the signals accepted by the vision radiation were sent out on a carrier of 3.5 megacycles remote from the vision carrier, then a single aerial will suffice for the reception of the dual signals.

Usual Practice

As a rule the aerial is erected on the roof in a clear space and a careful examination should be carried out to ensure that during years it has not been damaged or removed. It is generally found that for certain months no damage has occurred. Most of the aerials are mounted on a mast and it was accommodated on a flat roof to work is simplified. A good example of this method of erection is furnished by the accompanying illustration. First of all, any guys with their insulators inserted should be run over to see that no wire strands are broken and after this, when such a course can be resorted to, the mast should be lowered carefully, taking care not to break or damage in any way the feeder cable which may be of the twin or co-axial type. The dipole elements of an aerial mounted on a wooden strip or held in free space, if of stout metal, should be cleaned, and where connection is made at the centre to the feeder cable the joints should be examined for corrosion, and if electrically poor should be re-soldered carefully and bound with fresh insulating tape. In the accompanying photograph a reflector is shown positioned a quarter of a wavelength behind the dipole aerial. No electrical connection is made to this section of the assembly, its function being only to induce a voltage in the receiving dipole in phase with and almost equal to the signal induced voltage of the dipole. For this to occur, that is, maximum reception conditions, the reflector should be behind the dipole in a line with the pole of the television transmitting station. When replacing the pole and aerial system this point should be watched carefully and the bearing checked on the station with a compass if one is available. The feeder cable should be checked for electrical continuity and insulation. As shown in the photograph, the feeder cable must be taken at right angles to the dipole for a distance of at least a foot. It is generally convenient to attach this cable to the mast as this will prevent the dead weight of the cable from causing any strain to the connections.
NEW PATENTS
These particulars of New Patents of interest to readers have been selected from the Official Journal of Patents and are published by permission of the Controller of H.M. Stationery Office. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription, £2 2s.).


Specifications Published.
519110.-Marcon’s Wireless Telegraph Co., Ltd.-Ultra short-wave circuits.
519111.-Fry, Ltd., and Liebmann, G.-Cathode-ray tubes.
518919.-Marcon’s Wireless Telegraph Co., Ltd., and Brilsford, J. D.-Electrical tuned circuit.
519091.-Rantzen, H. B.-Transmission of television signals over cables. (Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

TELENEWS

Mobile Units
The entertainment and interest value associated with outside television broadcasts is one of the items which is readily being realised by those companies in the United States who are devoting so much of their engineering resources to the development of the transmitting apparatus. This is made up of the transmitting station equipment and the equipment on the receiving side of the subject. To carry this into effect in a thoroughly efficient manner steps are being taken to construct mobile television units on lines resembling those which were adopted originally in this country. The signals generated from this unit can be relayed to the main broadcasting station through the medium of a network of coaxial cable lines, a good deal of which has already been laid in America, or when this is not possible, advantages can be taken of a beamed ultra-short-wave transmission picked up by a delicate receiving set located on a car. The apparatus is completely free from interference so that the clean signal can then be relayed to the main reddistributing transmitter. It is customary to split the functions of the complete mobile unit into four separate sections for convenience, for on many occasions arise when only one section has to proceed to a site in order to carry out the television programme. The first section is, therefore, made up as the camera control and monitoring van. In this, is accommodated the television camera, camera control, sound control, and monitoring equipment, together with the associated sound pickup control and amplifier. With a view to an adequate coverage of the area, the Americans now seem to favour the use of two or three camera units of the mosaic signal plate type, with various forms of lenses so that these entails a mixing control, power supplies, pre-faded and transmitted picture monitors, synchronising pulse generator and picture channel distribution, etc. In practice this apparatus is very similar to studio equipment, but is of a more compact type since it has to be housed in a van of convenient dimensions capable of proceeding to the scene of action under its own motive power.

A Master Frequency Generator
In any complete television system it is essential, if satisfactory results are to be obtained, to have a master frequency generator located at the transmitting end. This equipment is then called upon to furnish agreement, batteries and power units, etc. The changes, if inherent in the standard equipment, are very detrimental to the achievement of perfect synchronisation of pulse generator and picture channel. A D.C. mains supply.

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Full-wave Detection

Sir,—I should like to sincerely thank your correspondents for their most interesting replies to my letter on the subject above.

Empirical in your issue dated March 23rd, says Mr. Ford will have his little joke! I have spent much hard work, hard thought and hard-earned money on the subject of detection, but now I am enjoying the discussions. I have no objection to calling it push-pull detection, but this does not offer a solution. I think it is possible to detect frequency (full radio-frequency wave—but not full-wave detection). The letter from Mr. Taylor in your issue dated March 30th is also much appreciated. Although advantages may be obtained from the use of what is apparently a full-wave detector circuit, it does not follow that full-wave detection is obtained, and although a copper oxide rectifier may be designed expressly for this purpose, it also does not follow that full-wave detection (rectification) is obtained. Mr. Taylor also says that no theoretical grounds could be stated for the impossibility of H.F. full-wave detection. It is agreed that no grounds can be found in accepted theory, but according to the new theory, which I had the privilege of publishing some years ago, detection of radio frequencies simply means the displacement of the base line so that the positive amplitude of the rectified output is generally greater than the negative. I have naturally not had the time to work out the theory in all its details, but it could be stated in more detail as follows: Detection (rectification) of radio frequencies is a displacement of the base line, so that generally the positive amplitude is increased, and the negative is decreased, or that the positive amplitude of the output is permanently greater than the negative. This does not take into consideration any question of detector amplification or losses, which would either increase or decrease both the positive and negative portion of the wave, and would be relatively in proportion.

Half-wave and full-wave rectification of low-frequency alternating current, as given in theoretical diagrams, bears no relation to the new theory of detection of radio frequencies—hence the full-wave detection of radio frequencies is (in the new theory) apparently theoretically impossible. With a perfect crystal it may be possible to displace the base line, so that the whole of the rectified output rises and falls in an increasing wave and decreases with a decreasing wave, with no negative amplitude. Detection would then be complete from the point of view of volume of output, but the quantity of output is not so much a matter. The volume of output at audio frequency will depend upon the difference between the voltages above and below the point of view of volume of output, but now I am enjoying the discussions. I have no objection to calling it push-pull detection, but this does not offer a solution. I think it is possible to detect frequency (full radio-frequency wave—but not full-wave detection). The letter from Mr. Taylor in your issue dated March 30th is also much appreciated. Although advantages may be obtained from the use of what is apparently a full-wave detector circuit, it does not follow that full-wave detection is obtained, and although a copper oxide rectifier may be designed expressly for this purpose, it also does not follow that full-wave detection (rectification) is obtained. Mr. Taylor also says that no theoretical grounds could be stated for the impossibility of H.F. full-wave detection. It is agreed that no grounds can be found in accepted theory, but according to the new theory, which I had the privilege of publishing some years ago, detection of radio frequencies simply means the displacement of the base line so that the positive amplitude of the rectified output is generally greater than the negative. I have naturally not had the time to work out the theory in all its details, but it could be stated in more detail as follows: Detection (rectification) of radio frequencies is a displacement of the base line, so that generally the positive amplitude is increased, and the negative is decreased, or that the positive amplitude of the output is permanently greater than the negative. This does not take into consideration any question of detector amplification or losses, which would either increase or decrease both the positive and negative portion of the wave, and would be relatively in proportion.

Solution to Problem No. 395

M A N N I N G decided that he would improve his three-valve battery receiver from the point of view of volume and quality. For this purpose he obtained another E.F. valve and L.F. transformer, which he included between his existing equipment and the output valve. He experienced very bad distortion and thinking that the trouble was responsible he connected a volume control across the secondary of the transformer feeding the output valve. He still experienced distortion, even at minimum settings of the control. What was wrong? Three books will be awarded for the first three correct solutions. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Fetter Lane, Strand, London, W.C.2. Envelopes must be marked Prize Problems, and must be posted to reach this office not later than the first post on Monday, April 22nd, 1940.

Correspondents Wanted

The following readers are desirous of corresponding with others on the subjects mentioned:

D. King, of The Hall, Stalham, Norfolk, with a view to learning the Morse Code.

F. Lamsley, 64, Canning Road, Wealdstone, Harrow. Wishes to receive correspondence from anyone on short-wave reception. All letters will be answered.

W. H. Reid, 98, High Street, Easton, Bristol, 5, wishes to contact anyone in his district interested in short-wave listening.

R. D. Durham, 26, New Inn Hall Street, Oxford—with any reader who has contrived the "Mite Two"—preferably in his district.

H. G. Vale, 18, Coalway Road, Wolverhampton, with a short-wave enthusiast about 17 years of age. He promises to reply to all letters.

K. J. Blight, Cromie Street, Murton, Victoria, Australia, with any S.W. enthusiast.

R. Woodcock, "Norwood," 110, Amington Road, Tamworth, Staffs, with any S.W. wave enthusiast of about his own age—16.

E. Wilson, 3, Bk. Meal Street, New Mills, Derbyshire, with a young reader, about 15, interested in medium-wave DX.
The "Fluxite Quins" at work.

The Fluxite Quins are always ready to put Fluxite on the soldering job instantly. A little pressure will do the job. Stock up and one charging lasts for ages. Price 6d. or 6d. T.C.

Write for Free Book on the art of "soft" soldering and ask for Leaflet on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE: FLUXITE LTD. (Dept. W.P.), DRAGON WORKS, HULL, HULL - 6, 6.

**FLUXITE SIMPLIFIES ALL SOLDERING**

**PRACTICAL WIRELESS SERVICE**

**BLUEPRINT SERVICE**

**PRACTICAL WIRELESS** 126

April 20th, 1940

**BLUEPRINT SERVICE**

These blueprints are drawn full size. Copies of appropriate issues containing descriptions of these sets can be obtained free of charge if the blueprints are returned within one week of receipt.

**PRACTICAL WIRELESS** A. W. to Amateur Wireless, W. M. to Wireless Magazine.

Send (preferably) a postal order to cover the cost of the blueprint, and the issue is despatched. Any special sets not in the list can be obtained by request to PRACTICAL WIRELESS, 23, 18, 19 Stratford Place, London, W.1.

**SOLVED**

"I don't think it's quite fair," said 0i. "I don't think it's quite fair."

**FREE ADVISE BUREAU COUPON**

This coupon is available until April 7th, 1940, and must accompany all Queries and Hints.

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**TIT-BITS**

This makes a much stronger wheel. It's simple to produce.

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Blueprints, 1s. each.

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Send (preferably) a postal order to cover the cost of the blueprint, and the issue is despatched.

**MISCELLANEOUS**

FREE ADVISE BUREAU COUPON
In reply to your letter

Eliminator Output

"I have an eliminator which should give a maximum of 150 volts, but I only get 60 volts. Can you tell me what is wrong, and, if possible, suggest a remedy?" — J. S. (Plaistow)

THINKING of a very common question and we presume that you are a new reader, or you would have seen the comments which have been repeatedly made in regard to this matter. In the majority of cases such a query is the result of a test being made with an unsuitable type of voltmeter. The output of an eliminator is what might be termed "flooding," that is to say, the current and voltage are closely related, and an increase in current results in a decrease in voltage. A cheap type of meter will take a high current and give a low voltage reading, especially if there are "Detector" and "S.G." tappings which are intended only to supply 2 or 3 mA at the most. Your meter may take 20 mA or even more. Therefore, to measure the output from an eliminator accurately you need a high-resistance voltmeter, or alternatively should take the voltage readings with that type of meter when the receiver is being operated. If, however, the rectifier has been damaged this would account for a reduced output and a replacement of the rectifier is then necessary.

Electrolytic Block Condenser

"I wish to obtain a 6 plus 6 plus 1 mfd. cardboard container 230-volt electrolytic condenser. I require this to repair an A.C. mains receiver and I was wondering if you could advise me where I could obtain one which would serve the purpose." — W. E. M. (Wolverhampton)

YOU have indicated the type as being 6 plus 6 plus 1 mfd. and we would point out that the sign between values in block units usually indicates the polarity of the common lead. Thus 6 plus 6 plus 1 would mean that there are three condensers with a common positive lead to each. There are no receivers which would employ such a block unit and we think you require a 6-6-1 block which is three condensers with a common negative lead. This would be more usual and in the Dubillier range is a block of this type, No. 310, working voltage 250 volts. The pre-war price was 5s.

Cabinet and Aerial

"Could you tell me where to get a metal cabinet? Also with a double aerial for reception, where do the two lead-in wires go to? Are they connected to a transformer, or are they twisted together and plugged into the one aerial terminal on the set? If the former, what transformer is necessary?" — T. W. (S.W.1)

WRITE to E. Paroussi regarding the metal cabinet, or to Peto-Scott. With regard to the double aerial in the usual arrangement is to connect one lead to the aerial terminals on the set and the other to the primary of an aerial transformer. This is the standard type of aerial coil, such as 6-pin plug-in variety, and if your receiver incorporates this type of aerial circuit you can insert the two leads into the aerial and earth sockets. If lost and obtained, however, if you can disconnect the primary winding of the aerial coil from the earth line, and then connect an earth to the receiver, with the apparently earthed aerial terminal and the now free end of the primary winding.

Long-wave Stations

"I should be glad if you could let me have the wavelengths of Tills, Minak, Kiev, Leningrad and Kaunas on the long waves." — D. H. (Aston, Birmingham)

THE wavelengths of the stations in question are as follows: Kaunas, 1,961 metres, 153 kc/s.; Minak, 1,442 metres, 208 kc/s.; Kiev, 1,210 metres, 246 kc/s.; Leningrad, 1,107 metres, 271 kc/s.; and Tills, 1,000 metres, 283 kc/s.

Superhet Tone

"I have a commercial receiver, rather old, which is of the superhet type. I find now, on experimenting, that I can improve the tone and make it much more natural by slightly putting the pointer off the tone point. When it is loudest, however, the tone is rather deep. I have been told that I am getting bad quality by off-tuning, but it seems to me to be better. Can you answer this point for me?" — J. R. C. (Belith)

WHEN a superhet is properly tuned, provided that the circuits are correctly aligned, the tone should be properly balanced, that is, all side bands should be equally reproduced. When off-tune, however, there will be some side band cutting, and this normally results in distortion. Incidentally, this is the reason for the introduction of the visual tuning indicator which permits the user to tune the set on the note to which the ear is tuned and thus reproduction is properly balanced. If, in your case, the feedback is too deep, the trick is to modify the tuning to introduce a form of distortion which probably approaches a whistle and this apparent raising of the tone is apparently more pleasant to your ear than the correct reproduction given by the set in question. As it is an old receiver the reproduction may not be so brilliant as that obtained in modern sets.

Variable Resistance

"I have a volume control in my set which is apparently giving me trouble. It is very erratic in action and before buying a new one I should like to try to mend it. I have taken off the cover and there appears to be a disc of metal inside of which the arm moves. It does not appear possible to me for a disc to vary the resistance, and I wonder if something has worn off or become disconnected in the passage of current. I should like your opinion on this matter before taking it any further to pieces." — L. R. E. (Waford)

THERE is a type of variable resistance in which the variation is effected by what is known as a "swash-plate." This is a springy disc which, as the arm is rotated, is pressed into contact with either a chemical element or a wire-wound element. If the springing has gone out of the plate then it would fail to act properly, but it is more likely that the disc has got into the component and is preventing good contact between the plate and the element. In some cases a chemical element can become worn. There is very little wear with a good swash-plate movement and we therefore suggest that you dismantle the component and clean away any dirt or grease which you find on the plate.

Reaction Efficiency

"I am making a small short-wave set and am interested in several designs which you have published. I am not quite clear regarding the difference between the so-called electron-coupled arrangement and the ordinary reaction circuit, and should be glad if you could explain this and advise me which to adopt. I shall use about three valves and am interested in some really effective long-distance long-wave and medium waves." — J. E. H. (Matlock)

WITH a simple set, as we have before pointed out, the reaction circuit is of the utmost importance and the main efficiency of the set is dependent upon this part of the circuit. You therefore need a very carefully chosen valve or valves which can be handled easily and will produce its maximum effect. We therefore advise the electron-coupled circuit, with potentiometer control for the grid of the first valve. It is a good H.F. pentode. Pay careful attention to the layout and use good quality parts, and you will find that the arrangement will give you all you desire.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

J. A. B. (W.2). The value depends upon the bias voltage required and on the type of valve, i.e., short-circuit or load-line type. The details will all be found in our Encyclopaedia.

A. B. (Coventry). We regret that we do not have the dimensions requested in this question. They do not appear in current lists.

A. T. H. (Mardel). We cannot give details in the absence of data concerning the coupling and connections.

E. A. W. (E.S.15). The transformers are not suitable. You need a special transformer with a low -resistance element.

W. C. (War-lington). Premier Radio can supply the parts.

C. W. B. (Ashbourne). You should communicate with the makers of your receiver.

The coupon on page 126 must be attached to every query.


Classified Advertisements

ADVERTISEMENTS are accepted for these columns at the rate of 5/- per word (minimum charge 2/- per paragraph). Series of discounts of 6 per cent. for 10, 15 per cent. for 20, and 19 per cent. for 25 inscriptions are allowed. All advertisements must be prepaid.

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1 A CABINET for Every Radio Purpose. Surplus Cabinets from noted makers under cost of manufacture. Radiostore Cabinets from 5/-, Unfinished, table and console and loudspeaker cabinets from 1/-.

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LOUDSPEAKER repairs, British, American, any make, 24-hour service, moderate prices.—D. G. Speakers, Pulleyn Terrace, Copenhagen Street, London, N.1.


MISCELLANEOUS

S.W.I. Q.S.L. any design, samples free—East, 44, Devon Ave., Twickenham.

BE TALLER!—Tumbs up your mail today!—Increased height by operation. Details 6d. stamp.—Malcolm Ross, Height Specialist, 112-HV, London, W.5.

MORSE EQUIPMENT

FULL range of Transmitting Keys, Practice Sets, Oscillators, Recorders and other Radio Telegraph Apparatus, including parts, 24-hour service. —Webb's Radio, 13, Sobo St., London, W.1. Phone: Gerrard 2899.

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Morse easily learnt by gramophone records by ex-Service Instructor. Speeds from 2 words per minute. Also private tuition in London. —Masters, Poole Hill, Clapham, Saxes.

NEW CHASSIS

ARMSTRONG CO. recommending the following economically priced Radio Chassis for good quality reception.

ARMSTRONG Model A.28.—Solve All Radio Problems. Chassis contains the latest circuit arrangements including 6 watts push-pull output. Price £3/-00 (excluding tax). Further details from Mr. R. McKevitt, World's Champions Telegraphist. Local distribution, W.1. Phone: Gerrard 2899.

NEW LOUDSPEAKERS

2,000 Speakers, P.M. and energized 4in. to 14in., including several Epoch 18in.—Speaker Specialists, Pulleyn Terrace, Copenhagen Street, London, N.1.

PUBLIC APPOINTMENTS

AIR MINISTRY.

AERONAUTICAL INSPECTION DIRECTORATE. Variances exist for unestablished appointments as follows: for the Wireless, Electronic, W.T. and Instrument branches.

PUBLIC APPOINTMENTS.

All candidates must have good general education, be able to read drawings, understand specifications, use electrometers and other measuring instruments, (a) Applicants for the General Engineering Branch must have at least 2 years experience of working on electrical and mechanical work. An elementary knowledge of materials testing is required. (b) Applicants for the Instrument Branch must have at least 2 years experience of physical, electrical, and mechanical work or instrument making. Candidates with experience of the type of optical instruments are also required. (c) Candidates must have practical knowledge of W.T. and electrical equipment with full 3 months' practical training in radio communication equal to City and Guilds final examination standard.

ACCEPTED candidates will undergo a period of training in inspection as applied to the above subjects, not exceeding three calendar months, and will be paid £2 10s. 0d. during training. Subsistence allowance of £1 5s. 0d. weekly during training is payable to married men normally residing outside the training area. On successful completion of training, candidates will be appointed as Examiners at a salary of £240, if 25 years of age or over, with a corresponding reduction of £12 per annum for each year under 25 on joining (subject to retention in grade in view of service in time of war), and must be prepared to serve in any part of the world.

NORMAL age limits 23 to 60 years, and candidates must state on their applications for which vacancy they wish to be considered—aerodrome, wireless, Wireless, Radio, A.E.F., etc.—Applications must be made on Form 780, copies of which may be obtained on application, by post or on application. —The Inspector—In-Charge, A.T.D. Training School (I.C.S./REC. 53), Brandon Street, Bristol, 1.

RADIO MAP AND GLOBE


RECEIVERS AND COMPONENTS

COULPHONE Radio, Grimsbaw Lane, Ormskirk, 1940, Collins A. C. Grampian Motor Groups 1st turntable, 27/6.—J. A. CHANCE 2/6. We have a large range of equipment.

NEW DEPARTMENT. —ROBERT BLAIR RADIO SOCIETY


SLOUGH AND DISTRICT SHORT-WAVE CLUB

Headquarters: —To H. Head, High Street, Slough. Address: —Club Secretary, 12, Barrington Street, London, W.1.

Meeting: —Tuesday evenings at 8 p.m.

The last meeting was held at the club's head-quarters at the address given above.

The meeting was opened with a discussion of short-wave conditions, particularly the recent sunspot activity reported by Mr. H. J. Hinde, Departmental research group organisator. Following this, a presentation of a very interesting graph which he had drawn to show the change in signal strengths and fading times on W proclaimed and WPGO for the same time G.M.T. each evening for several recent days. The reading was shown by the curve which was examined by all the members and they considered that the normal theory of fading on short waves was not based on signal strength and fading. Mr. K. G. Solly also showed some graphs which he had drawn on the same time period and these compared very favourably with those of the other. Mr. Baldwin (BWWV) demonstrated the new superhet which he has just built and many stations were received at good signal strength enabled communications and improvements for which Mr. Baldwin thanked the members.

Morse practice was then held with Mr. J. Gilbert (GB1PAO) at 1000 I.H., the address of the club was given to the members with the Pots and Emco and received a particular welcome by Mr. Solly. The members were overjoyed at being able to receive stations and these compared very favourably with those of the other. Mr. Baldwin (BWWV) demonstrated the new superhet which he has just built and many stations were received at good signal strength enabled communications and improvements for which Mr. Baldwin thanked the members.

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PREMIER RADIO

MORSE PRACTICE KEYS. - Brass movement on bakelite base, 3, 3. - General-purpose Morse keys, smooth action, heavy traffic, 3/-.

HEAVY DUTY TX KEYS. - Pomegranate alloy, heavy cast base with brass movement, 10/-.

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Special Offer of Record Auto-Changer Units for A.C. mains by famous manufacturer. Play 6 records in turn, Start and Selector. Limited number only at 34/-.

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Incorporating the Standard 3-Band S.W. Col. 11-25-60 meters without coil changes, and suitable for complete conversion. Each kit supplied with steel Chassis and push pull plug-ins, Cols. to tune from 10 to 170 metres.

1 Valve Short-wave Receiver or Auto Changer Kit - 20/-
2 Valve Short-wave Superhet Converter Kit - 30/-
3 Valve Short-wave Receiver or Auto Changer Kit - 40/-

PREMIER SHORT-WAVE SCREEN GRID AND PENTODE KIT

PLACEMENT VALVES FOR ALL SETS


Prices to the last detail, including all valves, wiring diagrams and basic instructions for building and working. Each kit is supplied with a steel Chassis and push pull plug-ins, Cols. to tune from 10 to 170 metres.

1 Valve Short-wave Receiver or Auto Changer Kit - 20/-
2 Valve Short-wave Superhet Converter Kit - 30/-
3 Valve Short-wave Receiver or Auto Changer Kit - 40/-

BATTERY CHARGERS

A.C. MAINS BATTERY CHARGERS for A.C. mains. Westinghouse complete, ready for use for charging 3, 6, 12 volts at 3 amp., 24/-; 6, 12 volts at 3 amp., 24/-; 12 volts at 1 amp., 12/-; 6 volts at 1 amp., 6/-.

PREMIER BATTERY CHARGERS for A.C. mains. Westinghouse complete, ready for use for charging 3, 6, 12 volts at 3 amp., 24/-; 6, 12 volts at 3 amp., 24/-; 12 volts at 1 amp., 12/-; 6 volts at 1 amp., 6/-.

Class B Kits, comprising Driver Transformer, Class B Valve and Holder. Complete with circuit, 11/-.

Premier Pick-up Heads. Will fit any tone-arm, 3/-.

ANOTHER SORT OF TRUSS - T-tube Pick-ups. With arm. Fittings made by O. L. 1/-.

HEAVY-DUTY speakers. Pentode matching.

2-BAND condensers.

1/8, 1/4, 1/2, 1, 2, 3, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see., 1, 2, 5, 10, 15, 20, 30, 45, 50 mfd., 100 see.
Just back from a wide tour of the United States, this ex-Cabinet Minister writes an important series for WAR WEEKLY.

What Will America Do?

The Rt. Hon. A. Duff Cooper has been in America since the outbreak of hostilities, testing public and political opinion on the war of the European democracies against Nazi domination. What does the average American believe about the war? Does he think America can stay out of it? What is the strength of the isolationists? Mr. Duff Cooper saw Mr. Roosevelt at Washington and also Mr. Cordell Hull, Secretary of State. This is a vital series that no one can afford to miss at this critical juncture, and you can read it only in WAR WEEKLY. Get the issue out now.

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