Bacnes

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# Practical Wireless

## and PRACTICAL TELEVISION

3d.

EVERY WEDNESDAY

April 20th, 1940.

## Contents



OPERATING THE STUDENT'S THREE

NEW SERIES

# RADIO ENGINEER'S POCKET-BOOK

### No. 59

**ACCUMULATOR PASTES.**—The following ingredients are required: 4 parts by weight redlead ($Pb_3O_4$), 1 part by weight litharge (PbO), 1 part by weight sulphuric acid (1.12 specific gravity). Add the acid gradually to the mixture of redlead and litharge, stirring well until a fairly 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 specific gravity) and re-dry.

*Paste for Negative Plates.* Use the following ingredients: 5 parts by weight litharge, 1 part by weight of 1.10 specific gravity sulphuric acid. Mix, apply, and dry as for positive plates.

For a high-rate discharge cell, the paste for the negative plates can be varied as below:

Litharge, 99.96 per cent.; lamp-black, .03 per cent.; wood flour, .01 per cent. One-sixth of the total weight of the above of 1.10 specific gravity sulphuric acid.

Use acid of 1.12 specific gravity, charge at the rate of about .02 amp. per square inch of the plate area, counting both sides of the plate.

### No. 60

*Neutralising Spilled Electrolyte.* If electrolyte is spilled, it should be immediately treated with a neutralising solution, such as sodium carbonate (soda) and water, or ammonia and water. Either of these liquids is excellent for checking the effects of acid on clothing. Benches, trays, and other fittings which have become acid-sodden should be treated with a solution of 1lb. of soda to 1 gallon of water, and then dried before coating with acid-proof paint.

**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 which jellifies in five or six minutes is—1 part of pure sodium silicate (1.200 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 with jelly acid should be given a first charge, using ordinary free sulphuric acid. This acid should then be poured off, and the cell inverted and allowed to drain for about half an hour.

### No. 61

**AERIAL DATA**

**NATURAL WAVELENGTH.**—The natural wavelength of an aerial is approximately four and a half times its electrical length (length between insulators plus length of lead-in). Standard aerial of 100ft. has a natural wavelength of about 120 metres. If connected direct to the grid of the detector valve, it would receive transmissions on this wavelength.

The maximum length of aerial, inclusive of lead-in, permitted by the Postmaster-General is 100ft.

**REFLECTOR.**—An arrangement generally employing a dipole aerial, for preventing a signal from being radiated in all directions, or for ensuring maximum reception in a given direction. It consists of a vertical or horizontal aerial behind which is erected a similar aerial (not connected to anything), the spacing between these being adjusted according to the frequency of the signals. A multi-reflector system will generally have the reflectors arranged in the form of a parabola with the aerial at the focal point.

Stranded 7/22 insulated copper wire is best for both aerial and lead-in.

### No. 62

**FRAME AERIAL DATA**

| *Length of Side of Square Frame.* | *No. of Turns.* | *Space between Wires.* | *Inductance. (Micro-henries).* | *Self-capacity. (Micro-farads.* | *Natural Wave-length in Metres.* |
|---|---|---|---|---|---|
| 8 ft. | 3 | ½ in. | 96 | 75 | 160 |
| 6 " | 4 | ¼ " | 124 | 66 | 170 |
| 4 " | 6 | ¼ " | 154 | 55 | 175 |
| 3 " | 8 | ⅛ " | 193 | 49 | 185 |

*The Wire for the Aerial.* The wire for these aerials consists of thin flex, usually 14/36, that is, fourteen strands of No. 36-gauge wire, covered with art. silk in various colours. For the normal broadcast band 75 ft. should be sufficient, although the exact length will depend upon the shape of the aerial, the size of the condenser used for tuning, and the spacing between the turns. As a rule, the wire should be wound on with a space of about 1/10in. between each turn.

### No. 63

**MUSICAL NOTES FREQUENCY.**—The frequency of the notes of the pianoforte covers the band from 26 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:

| | | | |
|---|---|---|---|
| A 26 | G 96 | F 341 | E 1,280 |
| B 30 | A 106 | G 384 | F 1,365 |
| C 32 | B 120 | A 426 | G 1,536 |
| D 36 | C 128 | B 480 | A 1,706 |
| E 40 | D 144 | C 512 | B 1,920 |
| F 42 | E 160 | D 576 | C 2,048 |
| G 48 | F 170 | E 640 | D 2,304 |
| A 53 | G 192 | F 682 | E 2,560 |
| B 60 | A 213 | G 768 | F 2,730 |
| C 64 | B 240 | A 853 | G 3,072 |
| D 72 | C 256 | B 960 | A 3,413 |
| E 80 | D 288 | C 1,024 | B 3,840 |
| F 85 | E 320 | D 1,152 | C 4,096 |

### No. 64

**STANDARD UNITS**

**UNIT B.O.T.**—The Board of Trade Unit is 1,000 watt-hours.

**UNIT CHARGE.**—Any charge which repels an equal and like charge with a force of 1 dyne when they are 1 centimetre apart.

**UNIT MAGNETIC POLE.**—That pole which, if situated in a vacuum at a distance of one centimetre from a similar pole, would give rise to a mechanical force of repulsion of one dyne. The total number of lines of force which pass through a unit magnetic pole $= 4\pi$.

**UNIT OF CAPACITY.**—The farad. A conductor has a capacity of 1 farad when a charge of 1 coulomb raises the potential 1 volt. In wireless practice the practical unit is the micro-farad.

**UNIT OF CONDUCTANCE** is the mho, which is the reciprocal of the ohm.

**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 INDUCTANCE** is the henry. It is the amount of inductance in a circuit which will produce a difference in potential of 1 volt when the amperage is changing at the rate of 1 ampere per second.

**UNIT OF POTENTIAL** is the volt. It is the pressure required to pass a current of 1 amp. through a resistance of 1 ohm.

**UNIT OF POWER** is the power required to perform 1 foot-pound of work per second. It is referred to as F.P.S.

**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)*

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W. J. DELANEY, FRANK PRESTON,
H. J. BARTON CHAPPLE, B.Sc.

# 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 reaction 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, has been 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 Lotbinière

THE B.B.C. announces that Mr. S. J. de Lotbinière has been appointed an acting Assistant Controller of Programmes, as a result of the recent secondment of Mr. R. 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 treats the question of evacuees from a new angle and also deals with the type of young woman who is so fond of her dog that every other 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 a 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 Cheatle.

*Jack Leon, who broadcast from the London Casino last week in the Services programme.*

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*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

*Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*



## Boy Scouts' Programme

AS 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 a 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 Whitworth will produce the feature, which has been arranged by Beresford 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 consist of 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 Finland 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 Australasia. 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 matter 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 beat 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, 200 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 1,500 to 500 kc/s. The oscillator is almost invariably tuned to a higher frequency than the first detector, and therefore if the I.F. in use were the usual one of 465 kc/s, the range of the oscillator tuning circuit would have to be 1,965 to 965 kc/s. It will be seen that in the first case the ratio of maximum to minimum frequency is 3 : 1, whereas in the second it is approximately 2 : 1. In other words, the oscillator frequency varies less rapidly than the signal frequency during tuning.

To obtain a clear idea of this point we might take the half-way point between maximum and minimum frequency on the waveband referred to above. Half-way between 200 and 600 metres is 400 metres. This is equivalent to a frequency of 750 kc/s, and when the input circuit is tuned to this frequency the oscillator must be tuned to 1,215 kc/s. Thus, although the signal 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 $1\frac{1}{4}$ : 1.

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 15,000 to 10,000 kc/s—exactly 3 : 2. The oscillator range would be 15,465 to 10,465 kc/s—approximately 2.955 : 2, or near enough to 3 : 2.

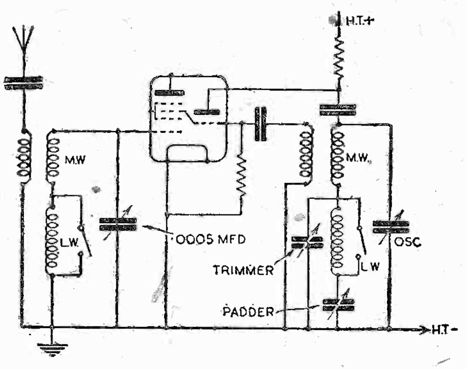



*Fig. 1.—The simple method of padding in the long-wave section of the oscillator tuning circuit; there is both a trimmer and a padder for the long-wave winding and a superhet-type gang condenser is used. Although a triode-hexode is shown the arrangement would be the same for a pentagrid.*

### 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 .0005 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 can operate 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 their optimum positions.

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 two separate 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.

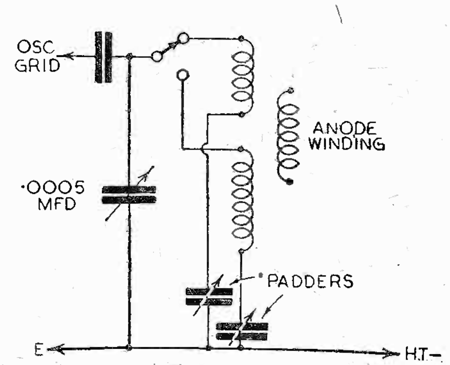



*Fig. 2.—Some oscillator coils are enclosed in a can which also contains two padders. Connections are as shown here. A "plain" two-gang condenser is used.*

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 modulated oscillator be available when carrying out the alignment.

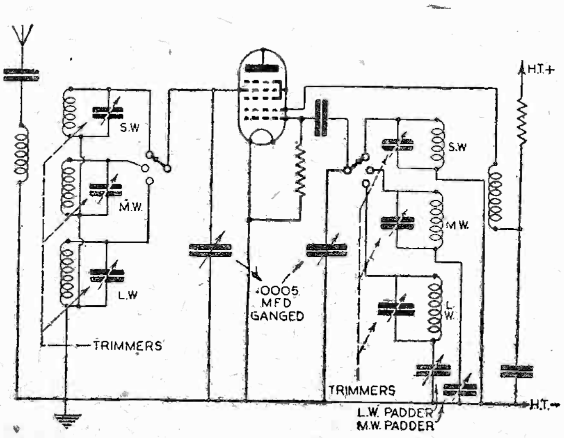



*Fig. 3.—How trimming and padding are usually provided for with three-range tuners. In many cases the tuners are designed for use with a "plain" gang condenser.*

(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 pleasing 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 either modify 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 difficulty and confusion is experienced when it comes to the question of which to use for the new circuit.

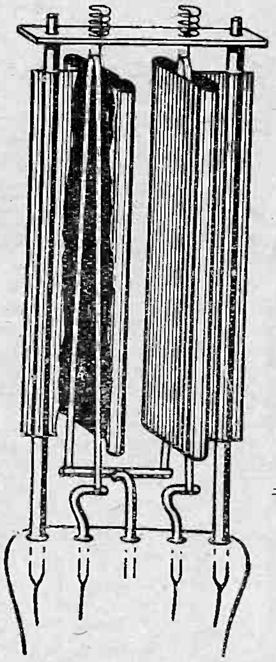
To one not well versed in such matters, a valvemaker's booklet does not always make the common or garden points too clear, and, in fact, a beginner need not be surprised if he finds himself more confused than ever after studying one of these booklets, as such an occurrence is not unknown and, strangely 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 constructional and elementary work 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 legs 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 valve are filament, or heater, and anode, and this arrangement forms the *most simple* type of valve.

They are used chiefly as detectors and rectifiers, the former for the detection or, more correctly speaking, the *rectification* of the minute alternating currents produced by the radio signal, and the latter, i.e., rectifiers, for converting A.C. mains supplies to direct current, as in the case of mains-operated receivers or amplifiers.

In addition to the simple diode, there are double-diodes, which have two anodes, double-diode-triodes, which means that two anodes and a triode section are all enclosed within one bulb, and other even more complicated combinations, but we need not worry about those at this stage. A double-diode is often used as a detector (one diode) and a means of providing automatic volume control, by means of the other diode. In the case of A.C. mains rectifying



*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.*

valves, a single diode would be used for *half-wave* rectification and a double-diode for the more normal *full-wave* system.

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, it becomes necessary to introduce one or two more items which play very important parts in most valves.

Every valve has a certain *internal* resistance which tends to affect the flow of current from the *filament* (or cathode in the case of mains valves) *to the anode*. This resistance is known as the *impedance* or A.C. resistance of the valve, and the value, which varies according to the type of valve, is always quoted by the valve-makers in *ohms*.

Another important item or *characteristic* of a valve is its *amplification factor*, which denotes how much amplification, or, if you like, magnification, will be obtained when it is handling a signal. This factor is also quoted by the valve-makers, thus helping one to choose a suitable valve for a given circuit. It should be noted at this stage that there appears to be some link between *impedance* and *amplification factor*; if a valve list is examined it will be seen that the *higher* the impedance of a valve the *higher* will be its amplification and, conversely, the *lower* will be its anode current consumption, i.e., the less current it will take from the source of high-tension. For example, refer to the valve list again—if you don't possess one or more, then I would advise you to get hold of one from, say, each valve-maker—and compare the valves recommended for use as a detector against those specified as being suitable for L.F. (low-frequency) use. The former will have an impedance in the neighbourhood of, say, 20,000 ohms, with an anode current of about 2 milliamps, while the latter might have an impedance in the region of 5,000 ohms, with an average current consumption of 5 mAs. The example can be taken a step farther by making comparisons between the S.G. and output power valves, when the difference will be more strikingly illustrated.

### 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 will be doing more work than the detector, will, naturally, consume more current in its anode circuit. 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 final 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 the first L.F. 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.

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.

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 excellent, too ; but he did not succeed in investing it with that wonderful idiom which shortly blossomed out, and it was far too much influenced by others' music that he was evidently studying and playing. It was, however, sufficiently meritorious to warrant his resigning his orchestral desks and devoting himself to composition as a means of livelihood.

Recognising the lead that Smetana was giving to the national self-consciousness through his music, 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 classics, 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

The 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, "King and Collier," entirely reset. Faithful to his national folk verse, there followed the first cycle of songs and the first Moravian duets. He made every effort to infuse the melodic zone of his work with ideas grown and cultured in the soil of Czech national art. From his earliest days he cultivated a movement of his own design which he called a Dumka, after the Russian word meaning "passionately sad." Many of these are extremely beautiful and one entire work at least, the celebrated Dumky pianoforte trio, takes its name from the Dumka movement in it.

Then came the "Stabat Mater." All these works yielded him but a poor return and he successfully appealed for a State grant. In 1877 he met Brahms and his publisher Hanslick. Brahms was very struck with his gifts and a letter to Simrock concludes : "Decidedly he is a very talented man. Besides, he is poor. 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, Bulow, 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 overshadows everything else he ever wrote in fame and popularity, Sir Donald Tovey has "no hesitation" in ranking the Second side by side with Schubert's in C and Brahms's 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. This 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 rivalled 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 renowned "Humoresque." This is one 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 conceivable combination of instruments under the sun, and has unquestionably taken its place amongst the first dozen or so favourite short pieces.

Another immensely popular work is the brilliant "Carnival" overture, one of three, the others being styled "Amid Nature" and "Othello." It is impossible to deal in any detail with Dvorak's many great works, but the two concertos for violin and 'cello respectively must not be omitted. The latter is one of the very few really first-class works that that instrument possesses. Also a Scherzo Capriccioso and a Theme and Variations.

Dvorak died in 1904.

### Brilliant Piano Scores

A great master of instrumentation and of orchestral colouring, and a sincere devotee of the highest ideals of his art, Dvorak must be ranked high amongst the world's musicians. He was an inspired creative artist and his intuition may be said to have risen superior to his intellect. In an age which was fast deeming it fashionable or smart to despise ancient glories and the gods of their fathers, he proved that sonata form did not perish with Beethoven. Brahms, of course, was also proving the same thing.

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 brilliant scores for that instrument in those chamber works in which he employed it, notably the Dumky Trio and the 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 thought to bear resemblances to Haydn and Mozart ; the one prospecting and pioneering for the other to build an empire.

A musician who handles the symphonic form with the mastery and originality that Dvorak displayed must take precedence over him who works in smaller media, but taken singly or together, Smetana and Dvorak make a great pair, pioneer and leader, of whom any nation might well be proud.

# ON YOUR WAVELENGTH

*By Thermion*

## 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 (especially when we consider time, the sharps and flats, and repetition), 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 spoliated 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 takes about a quarter of an hour to play, and occupies over twelve sheets of music score. 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 rondo. Those who hear "Eighteenth-century Drawing-room" should certainly purchase the two Parlophone records which give the complete Mozart rendering. Their numbers are E.1142 and E.1143; 12in. records, of course.

## "The Radio Training Manual"

I HOPE that every reader has reserved a copy of "The Radio Training Manual" offered on presentation terms in last week's issue. I have been privileged to see an advance copy of it, and consider it to be a most useful book for the purpose in view. I am amazed that in these days of paper shortage and rising production costs it has been possible to offer it for the money. It is not only a training manual—it anticipates the questions likely to be set to examinees, and really provides the answers to them.

## The Constructor Comes Back

ONE of the most pleasing features of my correspondence during the past few months has been the letters I have received from old constructors who, for one reason or another, had deserted our ranks. I do not know whether it is the shortage of commercial receivers, or the fact that the black-out keeps people in o' nights, but these early constructors are building sets again. Many of them are raking over their junk boxes and asking for circuits and blueprints which we published years ago. Alas, many of our early issues are now entirely out of print. We have, 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 Wireless 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 readers 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 between the actual electrodes in the 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" will take place in the valve itself.

The well-known Hazeltine "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 very easily, 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 rather 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 neutralised 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, tune 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 valve in position, of course, but with its filament switched off. The local will probably be heard at quite good strength if the neutralising condenser is either "all in" or "all out." Adjust the neutralising condenser until the signal from the local disappears altogether. Having obtained it, move the tuning condensers slightly to make sure 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

APROPOS my recent remarks re electrical-musical instruments, I see that pianos that perform like organs, and yet result in greatly decreased expense of construction, are predicted by B. F. Miessner, 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 electronic pianos. Where now three strings per note at, say, 160 pounds tension are used, we can use one string per note at 20 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. Miessner.

"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. Miessner, "is now out of the normal, expensive, 50-year incubation period, and is rapidly emerging into commercial form. Those with foresight and courage will be the new leaders in this renaissance of an industry which has lain technically stagnant for hundreds of years."

# Automatic Gain Control

**Details of a New Circuit Designed Round a New American Valve**

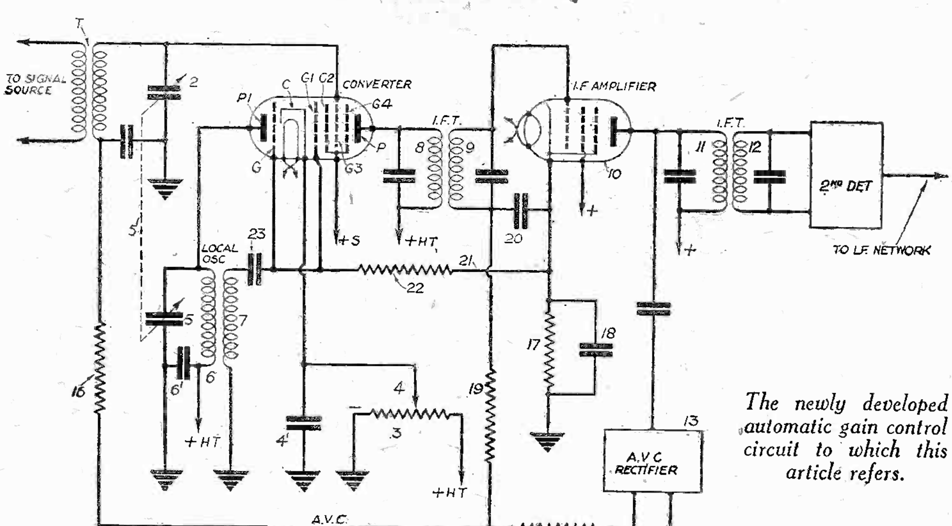
THE following is a description of a superheterodyne circuit developed by R.C.A. engineers in which a new type of mixer or converter valve, known as the 6K8, is employed. The converter valve is essentially a triode-hexode, in which the oscillator and mixer elements are disposed in separate electron streams. The 6K8 valve gives improved performance in all frequency bands, but its performance is most spectacular in the high-frequency regions above 15 mc/s. 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 6K8 valve may be explained as follows. The space current between $G_1$ and $G_2$ is relatively independent of the bias on signal grid $G_3$, due to the interposed screen $G_2$ (see figure). In other words, the sum of the currents in the mixer plate P and the screens $G_2$ and $G_4$ is relatively constant. The electrons passing through $G_2$ will be subject to the influence of $G_3$ and at some high negative bias on $G_3$ 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 $G_3$ is decreased from some high value the mixer plate current will not increase linearly, because the supply of electrons going through $G_2$ is limited. This limitation is brought about because the potential on the mixer grid $G_1$ exerts the primary influence for determining how many electrons shall be available for the remainder of the mixer section.

The grid $G_2$, by virtue of its potential and its location, will draw some value of current, which current will be relatively independent of the potential of $G_3$, with the remainder of the mixer section current passing to plate P. Therefore, by a proper choice of potentials in $G_1$ and $G_2$ there will be a scarcity of electrons on the $G_3$ side of $G_2$ for some range of potential on $G_3$ (low values of negative bias). Then, with electrode potentials selected to cause an electron deficiency in the $G_2$-$G_3$ space over a certain range of bias values on $G_3$, it may be said to a first approximation that the current passing through $G_2$ is constant with respect to the potential of $G_3$ over that restricted range of operation. If the signal grid potential increases, the velocity of the electrons in the space between $G_2$-$G_3$ will increase and the charge will decrease. This decrease in charge in the $G_2$-$G_3$ space will cause electrons to flow into the signal grid, or current to flow out; thus, an increase in potential of signal grid $G_3$ 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 6K8 valve will depend in sign and in magnitude upon the relative importance of the two effects operating simultaneously within the $G_2$-$G_3$ space. When the 6K8 is operated with a high value of negative bias on $G_3$, 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 $G_2$-$G_3$ region. Hence, at high values of negative bias on the signal grid the signal input circuit has a positive, or comparatively low negative, input conductance. It can also be shown that maximum negative input 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. Since the radio-frequency gain and the image ratio are greatly improved with maximum negative input conductance for the 6K8 valve, it will be appreciated that it is highly desirable to maintain the conductance value during operation.




*The newly developed automatic gain control circuit to which this article refers.*

However, when utilising the A.V.C. circuit for automatically increasing the negative bias on signal grid $G_3$ as the I.F. carrier amplitude increases, so as to maintain the carrier 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 oscillator 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 G, as well as the mixer grid $G_1$, 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 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 tend to remain substantially constant at a predetermined low, or negative, value by virtue of the opposing effects of the biasing of grids $G_3$ and G. Therefore, the gain and image ratio remain uniform over the entire range of A.V.C. bias variation. Additionally, 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 from 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 characteristic of $G_3$, 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 7 and 6), a bleeder voltage, magnitude of resistor 22 and resistor 17, to be able to obtain the desired result.

# THE "STUDENT'S" THREE

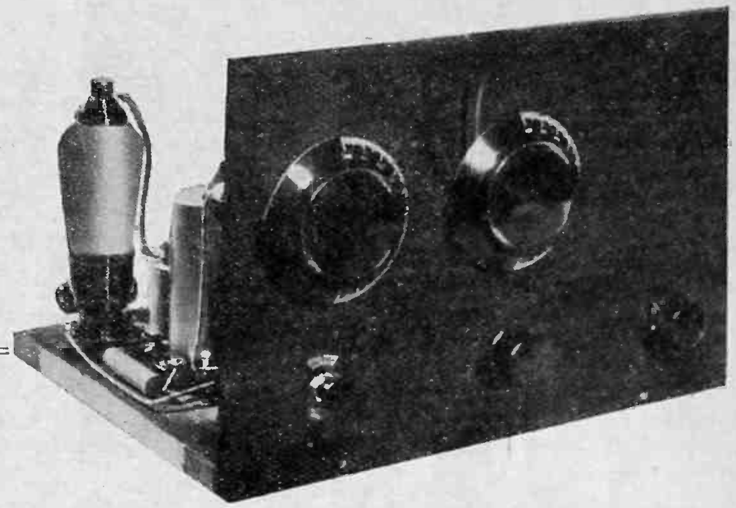
(Second of a Series)

## In this Article Further Constructional and Operating Notes are Given, Together with Some Preliminary Experimental Notes

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

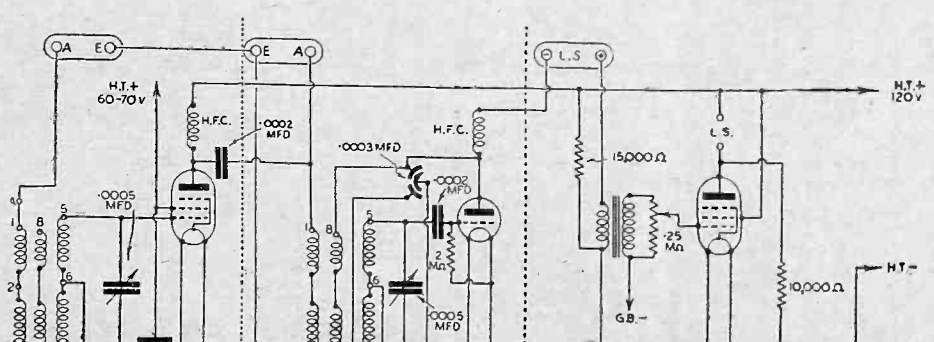
It will be found at a later stage that although the valve is metallised (that is, screened), and the lead to the anode is also screened, the actual anode connector is not protected in this manner and this can give rise to trouble which can only be overcome by using a screen over the valve. The two H.F. 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.9, and that next to the L.F. transformer being type H.F.8. 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. chokes, a bare wire being connected beneath the holding-down screw nearest the filament wiring already mentioned, and connected to that wiring.



*The completed "Student's" Three —ready for insertion in a cabinet.*

### 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 "flicks" 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.

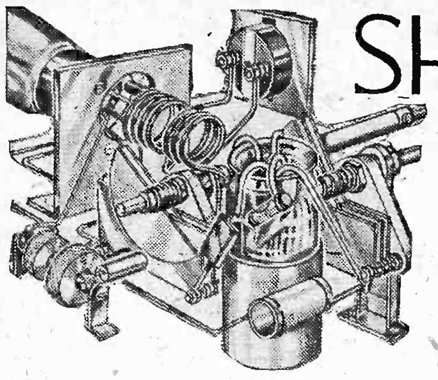



*This circuit diagram shows how the terminal sockets are included.*

### 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,

(Continued on page 121)



# SHORT-WAVE SECTION

## S.W. NEWS TWO

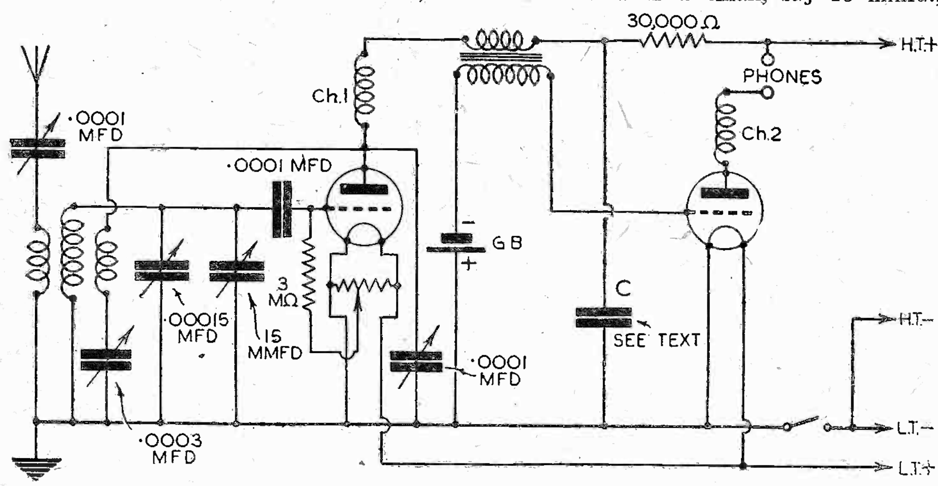
**A battery two-valver designed to offer maximum results for headphone reception.**

**By W. J. DELANEY**

ALTHOUGH we have given many constructional 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 may be used for either headphone or speaker work, and in the general features of design there is no difference. When, however, as is the case at the present time, many listeners desire to make exclusive use of headphones, there are one or two features which may be incorporated so as to offer a maximum performance in this particular connection. News is very prominent to-day, and in America there are certain stations which are using directional aerials beamed on 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 (or more correctly, head-capacity effects) which will result in erratic reaction control. A list of the main stations offering these "beamed" news broadcasts, with times and wavelengths, is given on this page, and a theoretical circuit of a suitable two-valver is also included. Such a set may be built from spare parts, provided that they are of reasonably good design and in good condition.

### 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; band-spread tuning for certainty in obtaining the correct setting, and an output choke 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. Transformer coupling is employed between detector and output stages to give maximum gain and with reasonably good valves, say a general purpose or H.F. type for the detector and a L.F. for the output, quite good signal strength should be obtained from the stations in question. A single H.T. feed is employed, the necessary voltage drop for the detector stage being obtained by means of a decoupling circuit, this giving greater stability and also preventing an uneven discharge of the H.T. battery. A standard 6-pin coil may be used for tuning, and it will be seen that the reaction condenser is on the earth side of the reaction winding, thus permitting the moving vanes of the condenser to be earthed, and facilitating the use of a metal panel if desired. A refinement, which is found desirable where reaction is a critical point (as it must be in a simple receiver without H.F. amplification) is the inclusion of a potential divider in the grid circuit of the detector valve and a pre-set condenser for by-pass purposes in this stage. It has been pointed out in previous articles on reaction that the by-pass capacity is an 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 enable different values to be obtained, and if necessary the grid-leak may still be joined to the positive side of the filament without difficulty—the potential divider being left in circuit.




*Theoretical circuit of the 2-valve short-wave for headphone reception.*

### Layout

The layout is not critical, and a base-board scheme may conveniently be employed. No screening or other elaborations are needed, and the parts may be laid out in almost the same positions as they occupy in the theoretical circuit. Wiring should, however, be carried out with stiff wire, and if the ordinary thin tinned copper wire is used it should be stiffened by cutting off about three feet and clamping it in some way and then carefully stretching it until it is felt to give. Although this is not usually recommended as it fractures the surface, it will be found that it will provide sufficient rigidity to the wire to enable the set to be efficiently wired. Battery leads of the four-way type may be employed, or lengths of flex may be cut off and provided with plugs. Condenser C may be of 1 or 2 mfd., or preferably may be of the electrolytic type. Both chokes should be of the standard short-wave type, whilst the transformer may have a ratio up to 5 to 1. If desired, the special Eddystone band-spread assembly may be used for tuning, or a standard .00015 mfd. tuning condenser may be used for the band-setter with a small, say 15 mmfd., condenser for the band-spreader. The aerial series condenser need not be mounted on the panel, as it is generally found that it may be set when the set is installed initially and then requires no further adjustment unless the aerial is modified. If it is panel mounted it will probably be found that the adjustments made will so affect the main tuning settings that it will not be a simple matter to log stations at given settings.

**U.S.A. BEAMED NEWS TRANSMISSIONS**

**12 m'n't WRUW 25.58 metres (Except Mondays)**

| | | | | |
|---|---|---|---|---|
| **A.M.** | | | | |
| 12.30 | WCAB | 31.28 | ,, | Tues., Fri. |
| | | 49.5 | ,, | Wed., Thur., Sat. |
| 12.45 | WCAB | 49.5 | ,, | Sun., Wed., Thur., Sat. |
| | | 31.28 | ,, | Sun., Tues., Fri. |
| 1.0 | WCAB | 49.5 | ,, | Mon. |
| 2.55 | WCAB | 49.5 | ,, | Mon., Wed., Sat. |
| | | 31.28 | ,, | Sun., Tues., Fri. |
| 5.0 | WCAB | 31.28 | ,, | Sun., Tues., Thur., Fri. |
| **P.M.** | | | | |
| 2.0 | WGEA | 19.56 | ,, | Daily. |
| | WCBX | 16.83 | ,, | Daily. |
| 3.0 | WCBX | 16.83 | ,, | Sunday. |
| 5.0 | WCBX | 16.83 | ,, | Sunday. |
| 6.0 | WNBI | 16.87 | ,, | Daily. |
| 7.30 | WCBX | 25.36 | ,, | Monday to Friday. |
| 9.30 | WGEO | 31.48 | ,, | Sunday. |
| | WRUL | 25.45 | ,, | Mon., Wed., Thur., Frid. |
| | WCBX | 25.36 | ,, | Mon. to Fri. |
| | WRUW | 19.83 | ,, | Mon., Wed., Thur., Fri. |
| | WGEA | 19.56 | ,, | Daily. |
| 10.55 | WGEO | 31.48 | ,, | Mon. to Fri. |
| | WGEA | 19.56 | ,, | Mon. to Fri. |
| 11.15 | WGEA | 19.56 | ,, | Sunday. |
| 11.50 | WCBX | 25.36 | ,, | Mon. to Fri. |

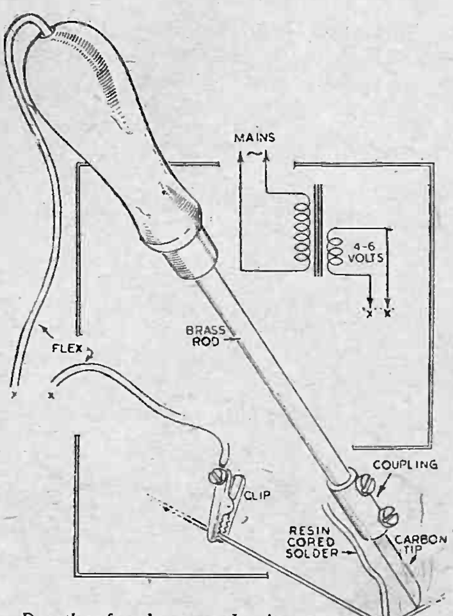
### Operation

When the receiver has been completed, it may be connected for preliminary trials to a good outdoor aerial. When found to work satisfactorily it is advised that different aerials and positions be tried, as the beamed transmissions may be found to be heard better when the aerial is pointed in some directions than others. The earth also may be found worthy of experiment, and in many cases it may be found that it can be dispensed with entirely. A great deal depends upon the aerial and the actual position of the receiver. A capacity between batteries and receiver and earth will often act as a counterpoise and give as good results as an orthodox earth connection. H.T. should be 120 or 150 volts, and the G.B. adjusted according to the makers' requirements for the particular valve in use. Remember that results cannot always be obtained from America, in spite of the directional aerial system, and therefore if you are unsuccessful at the first attempt in hearing the signals, try on another night, in case conditions are not suitable. Results from other parts of the world may be no criterion as to the conditions.

# Practical Hints

## 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



*Details of a home-made electric soldering iron.*

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 holder should 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 (as 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).

## THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.

### SPECIAL NOTICE

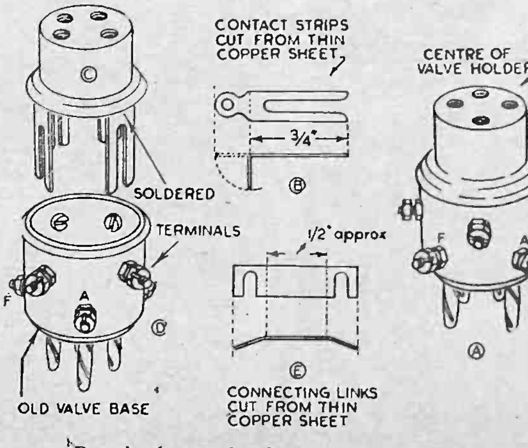
All hints must be accompanied by the coupon cut from page 126.

## 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 low in the sides above each pin. Terminals are then screwed in and connected to the pins with wire. Next the centre piece of an anti-microphonic 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 and 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.

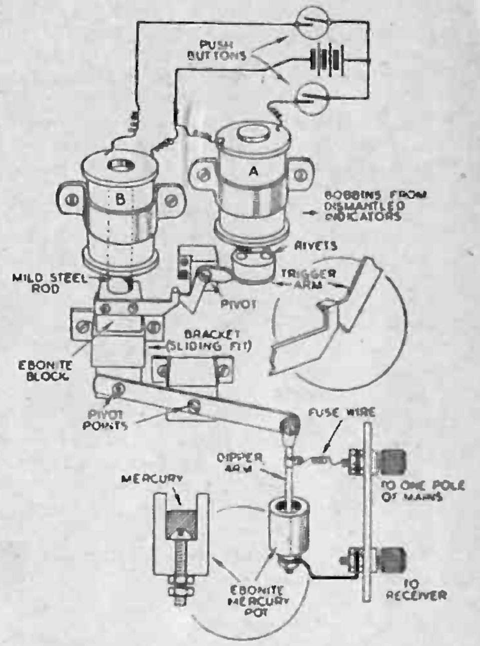
This adapter may also be used to connect a pick-up to a battery set, the leads being taken to the top grid terminal and a filament; all corresponding terminals being bridged with connecting links, except the grids and the adapter, which are inserted in the detector valveholder. Another use is for testing 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.



*Details of a simple adapter for testing purposes.*

## 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 7½ins. by 4ins. by 3ins., which is screwed to the underside of table on which



*A remote-control relay system for switching off a mains set.*

receiver stands—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 5-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).

# B.L.D.L.C. The British Long-Distance Listeners' Club

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 solely 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 all members can, therefore, still 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 to further this, 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 own activities, certain stationery is available at reasonable prices, while for identification purposes, very neat, well-finished enamelled badges can also be obtained.

## The A.C.R.

To encourage long-distance reception, which naturally means maintaining a reasonable 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 can forward QSL cards from transmitting stations situated in the five continents, namely, Europe, Asia, Africa, Australia, and America. It should be noted that North and South America are 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 always 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 ever-growing list of members. When one is connected with a large band of enthusiastic radio amateurs, such restrictions would appear irksome, and should be quite unnecessary, as the radio ham world has its own unwritten page of, call it what you will, but the word etiquette seems the most applicable. Perhaps it would be better described as the true spirit of amateur radio, and when it is appreciated that this spirit, or etiquette, is not in force in one county, country, or continent, but throughout the whole world, it must be realised by all who enter the amateur ranks that they undertake to uphold in every respect these unwritten laws.

One of the most flagrant violations of the true amateur spirit is this "racket" of obtaining QSL cards from any source other than the transmitting stations. Considerable publicity has already been given in these pages to the practice adopted by certain people of exchanging and bartering QSL cards, thus making it possible for anyone to acquire the most imposing display of verifications from stations which they themselves have never received and ones quite possibly well out of their scope and ability to contact with their own equipment. This system has to be killed, and it is up to every member of the B.L.D.L.C. to do his utmost to prevent the trafficking of such cards.

## Correspondence

We have stressed many times before that we welcome 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 fortnight 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.

It must not be thought from the above remarks that we do not hear from our members, but, generally speaking, the letters are too brief and do not give sufficient material of general interest, so it is up to everyone to get busy in this respect and communicate with us from time to time.

## Member 6480 (Bala)

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 pleased to note 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)

We hope that the A.C.R. adds to the appearance of your shack, and would like to thank you for the remarks contained in your letter which we were very pleased to receive. 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. How about starting the ball rolling from your area?

## Contacts

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 whether they are agreeable for their name to be published in these columns, or whether only their membership number. If no definite instructions are given, then the number only will be used.

Will all members note that member 6331 has changed his address, and contacts can now be made with him at Mr. T. H. Plater, 341, Milligan Road, Leicester.

Member 6415, of 35, Greenfield Road, Smethwick, Staffs, would like to get in touch with any other members in his district. He is 15½ years old and very keen on S.W. work.

Member 6529, of 533, Southport Road, Orrell, Liverpool, 20, who is apparently a very keen enthusiast and a morse fan, would like to make contact with any other members.

Member 6364. Cheering news from this member, who also sends in details of his latest log to prove that conditions are not too bad; 41 stations were received during 28 days in last month. He goes on to say: "My Rx is home built, 0-v-2, working from a battery eliminator and using 'phones. Aerial is 50 degrees east-west with a 45 degree slope. I would also like to second Mr. G. F. Swaysland's remarks regarding a DX contest. I think it would be a good idea for the B.L.D.L.C. to arrange something like this."

Well, concerning the contest, what is the general opinion? Let us have your views and suggestions, but remember that it is rather more difficult to obtain veri's now than in normal times.

### AIMS OF THE B.L.D.L.C.

THE purpose of the club is solely 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.

The B.L.D.L.C. has no commercial aims. Membership is free. Members can, therefore, still belong to all other similar clubs with similar aims without further incurring any additional financial responsibility through their membership of the B.L.D.L.C.

In order to give members the opportunity of exchanging ideas, the services of the entire technical staff of PRACTICAL WIRELESS are placed at the disposal of every member.

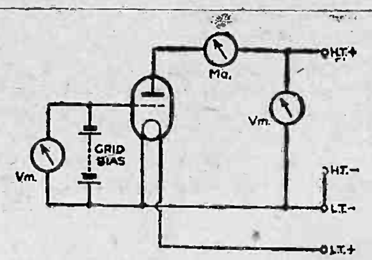
PRACTICAL WIRELESS, furthermore, will set aside a special section in which reports of reception, constructive articles, information, etc., and the internal affairs of the club will be discussed.

### ADVANTAGES OF MEMBERSHIP

1. No enrolment or membership fees.
2. Organisation centred in Great Britain.
3. Standardised log-books and verification sheets and badges available for members at reasonable prices.
4. Regular reports in PRACTICAL WIRELESS.
5. Interchange of ideas with fellow members.
6. Members in same district placed in touch with one another when desired.
7. Special meetings and visits to be arranged.
8. Regular problems for short-wave listeners.
9. Members' competitions and numerous other advantages to be announced.
10. Members are expected to show an active support of the Club by communicating with Headquarters periodically, concerning their experiments, logs or general radio work. They are also expected to co-operate with other members in their area to the extent of furthering the progress of their common interests in radio matters.

# POWER OUTPUT

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




*A theoretical representation of the arrangement shown in Fig. 1.*

THERE are four important units of measurement with which every wireless enthusiast is familiar. He knows to what they refer, and they are always cropping up in everyday conversation between radio enthusiasts. 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. We will discuss anode dissipation in connection with power output later, for sometimes, when dealing with the latter, anode dissipation has to be taken into consideration.

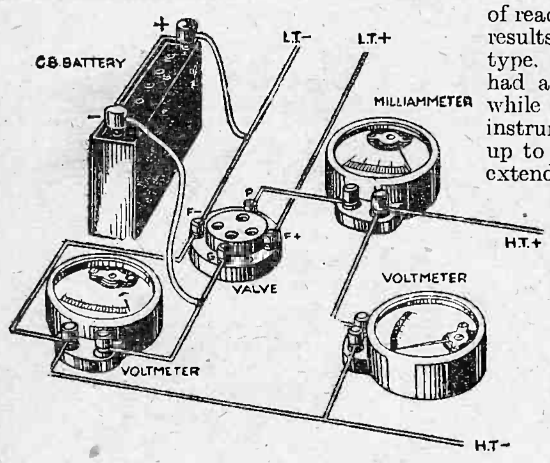



*Fig. 1.—Pictorial lay-out of parts for taking valve characteristics.*

Now, what is this power output, and how is it calculated? Is it just one of those common, everyday calculations such as amperes × volts equals watts, or is it something a little more complicated? Yes, it is! But if you follow this explanation carefully you will have at your finger-tips a method of approximately calculating the power output of a valve, and, therefore, be enabled to select the most suitable valve for your particular purpose. For instance, if you wish to operate a mains receiver at reasonable volume in a medium-sized room, about 2 to 2½ watts output is generally considered quite ample. If you want something still nearer realism, and have no neighbours who would object, employ a 5-watt output valve. After all, many constructors like that extra reserve of power even if not constantly employed. If you are interested in public-address work, then you can go higher still and use an output valve giving 10 or 25 watts, or even greater power output. However, our chief interest at the moment lies in ascertaining how this power output is calculated.

### Necessary Factors

In order to make the necessary calculations, all that is necessary is the anode volts-anode current curves of the output valve, together with the load impedance in ohms. These curves are obtainable for the majority of output valves, and are supplied by the valve manufacturers in their catalogues.

The writer happened to have a spare 2-volt power valve, so decided to take the necessary curves himself, and calculate the power output in order that readers might have an opportunity of following through the whole process from a concrete example. Take a glance at the circuit shown in Fig. 1. This will show you the circuit of the hook-up required in order to obtain the necessary data.

You will notice that this is quite a simple arrangement, and for ease of operating it was assembled on a small baseboard. All that was necessary was a valveholder and a few terminals, and every wireless man usually has these at hand. The necessary connections can then be made to the batteries and meters. The volt-meter should be capable of reading up to 250 volts, and for accurate results should be of the high-resistance type. Actually, the voltmeter employed had a resistance of 1,000 ohms per volt, while the milliammeter was a first-grade instrument. If the milliammeter only reads up to 10 milliamps it will be necessary to extend the range, and this can be carried out quite easily by following the instructions given in earlier articles on increasing the range of meters.

### Taking a Reading

Having fixed your valve in the holder and connected up your batteries and meters, arrange the first set of readings with zero grid-bias. This can be done by connecting the grid and filament together, or, preferably, by disconnecting the grid-bias battery, and connecting a piece of wire across the battery terminals. Now arrange to adjust your anode voltage in steps of 20 volts or thereabouts, and make a note each time of the anode current readings obtained. Next, connect your grid-bias battery in circuit, and arrange for 3 volts negative bias to be applied to the grid of the valve (this can be checked by means of the low-reading voltmeter connected in parallel with it). Repeat the process outlined above and again jot down the readings: this will give you data somewhat similar to that in the table of meter readings. Of course, different types of valves will give different readings. Continue increasing the grid-bias potential until you have applied approximately twice that recommended by the valve manufacturers.

The writer completed the series of readings up to 14 volts negative grid-bias, but only two sets of the readings are shown in the table mentioned.

Our next step is to plot these readings on square paper, and the graph reproduced in Fig. 2 shows the resultant anode current and voltage curves, which is what we require.

### The Load Line

We now have the anode volts-anode current curves, and our third requirement is the load line. It is well known that 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 7 volts at a maximum anode voltage of 150, 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 192 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 milliamperes 14 volts will be dropped, which, subtracted from 192 volts, will leave 178 volts. Mark this point on the graph. At 6 milliamperes 42 volts will be dropped, leaving 150 volts, and at 12 milliamperes 84 volts, leaving 108 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 to 14 volts negative, between the points A-B, which are marked on the load line where it cuts the grid-bias curves at zero and 14 volts respectively. At these points ascertain the anode current and voltage

*(Continued on next page)*

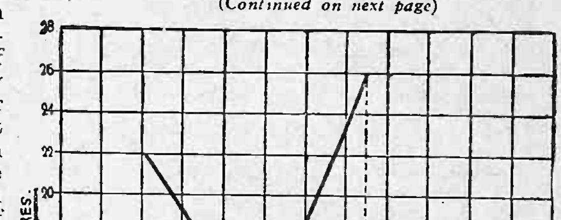



*Fig. 2.—A family of characteristic curves.*

## POWER OUTPUT

*(Continued from previous page)*

which in this case will be: At zero grid volts 13.6 milliamps 98 volts and at 14 volts grid-bias 0.4 milliamps 188 volts. Subtract the smaller figures from the larger and this will give us 13 milliamps and 90 volts.

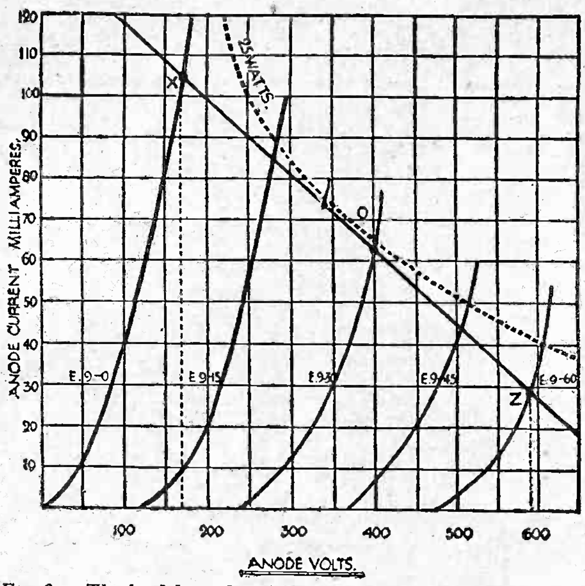



*Fig. 3.—The load-line plotted, together with the line indicating maximum anode dissipation.*

Our next step is to multiply these together and divide by 8, and the result will give us the power output in milliwatts.

$$\frac{13.2 \times 90}{8} = 148.5 \text{ milliwatts.}$$

Therefore the undistorted output of this particular valve is roughly 150 milliwatts, not very great, but quite suitable for use as an output valve in a portable receiver.

"Yes, all very simple," you exclaim; "but where do you get the figure eight from, and why should we divide by this particular number?"

It has to be borne in mind that the values of anode current and voltage with which we have been dealing are maximum values, and what we require is the R.M.S. values. To obtain these we divide both current and voltage by $\sqrt{2}$. Now $2\sqrt{2}$ multiplied by itself will give us 8, which is, of course, so much simpler to employ and gives precisely the same results.

### 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 which at one 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 has often to be made in order to keep below the anode dissipation line. This, then, is the relationship between power output and anode dissipation, both calculated in watts, mentioned earlier in this article.

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 anode voltage and anode current recommended by the manufacturers our results will be as follows:

Anode current 63 milliamps, anode voltage 400 volts $-\frac{63}{1,000} \times \frac{400}{1} = 25$ w.

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 maximum anode 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. If, however, 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 when OX equals OZ, but in actual practice a certain amount

**GRID VOLTAGE ZERO**

| Anode voltage. | Anode current milliamps. |
|---|---|
| 20 | 0.4 |
| 40 | 2.3 |
| 60 | 5.6 |
| 80 | 9.6 |
| 100 | 14.0 |
| 125 | 21.0 |
| 150 | 26.0 |

**GRID VOLTAGE 3 VOLTS NEGATIVE.**

| Anode voltage. | Anode current milliamps. |
|---|---|
| 20 | 0 |
| 40 | 0 |
| 60 | 0.6 |
| 80 | 2.3 |
| 100 | 5.6 |
| 125 | 10.5 |
| 150 | 16.5 |

of distortion can be tolerated, as it is not aurally appreciable. In deciding the best position for the load line, not only has the maximum undistorted output to be obtained, but the load line must not cut the anode dissipation curve. In calculating the amount of distortion which is permissible 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. It is extremely interesting, and you will gain a lot of useful information on the operation of your output valve.

## TRACKING IN SUPERHET CIRCUITS

*(Continued from page 110)*

It might be asked what is the precise function of the padder; it is the same in all cases, notwithstanding the precise position which it occupies in the circuit. By being in series with the oscillator tuning condenser, it lowers the effective capacity of the latter. The capacity of two condensers in series can be found from the simple formula: $C = \frac{c1 \times c2}{c1 + c2}$. From this it can easily be seen that if a .0005-mfd. variable condenser is wired in parallel with a .0005-mfd. fixed condenser the maximum capacity is .00025 mfd. When the capacity of the variable condenser is halved, the capacity of the fixed condenser remaining unchanged, of course, the effective capacity is .000166 mfd. In other words, although the condenser has been moved through half its range the effective capacity has been reduced by only one-third. This is precisely what is required as we have already seen. In practice, the padding condenser is generally of the pre-set type.

### Padder Adjustment

When aligning a superhet of the type with separate padders for medium and long-wave bands, the procedure is, very briefly, as follows: Tune the receiver to a steady, weak signal on the medium-wave band and adjust the trimmers of the I.F. transformers. Then tune to a station near the lower end of the medium-wave band and adjust the trimmers of the gang condenser for maximum volume and to bring in the station at the correct setting of the condenser scale. Next tune to a station near the top of the medium-wave band and set the padding condenser, meanwhile slowly "rocking" the tuning knob. Go back to the lower wavelength station and re-check the setting of the trimmers; revert to the higher wavelength and once again test the adjustment of the padding condenser. This process might seem rather laborious, but it is necessary if the ganging is to be accurate.

A similar procedure should next be carried out on the long-wave band, first setting the trimmer in parallel with the long-wave winding, on a station at the lower end of the band, and then dealing with the padder after tuning to a station near the top of the band; do not alter the previous settings of the trimmers on the gang condenser.

On short waves it is often sufficient to set the trimmers which are in parallel with the short-wave sections of both input and oscillator windings.

In all trimming and tracking operations, start with a weak signal—preferably by substituting a short length of wire for the aerial—and turn down the volume control after each adjustment which increases signal strength. When A.V.C. is provided, and this is not delayed, the A.V.C. line should be put out of action prior to carrying out the adjustments.

## THE "STUDENT'S" THREE

(*Continued from page 115*)

using a minimum of reaction. Now, when properly tuned, slip off the screened sleeving for the anode lead and note whether there is any alteration in the signal strength. If the station is what might be termed a "local" 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, if the lead is screened, and one of the top-cap screened connectors is employed, as well as the metallised valve, you may find that the signal which you found originally at a very low level will be completely inaudible, showing that the anode cap itself was also picking up energy. It is this stray wiring effect which is so important in powerful receivers where there is a great deal of amplification, many of the complaints of poor selectivity which are often made against such a receiver being attributable to the effects of the signal pick-up on the wiring. In cases where the receiver is situated very close to a powerful station, it may even be necessary to enclose the set in a metal box, with the casing effectively earthed to overcome this trouble.

### LIST OF COMPONENTS

- Two coils, type BP.80. (Varley).
- Two .0005 mfd. variable condensers, popular log type, with two large control knobs (J.B.).
- One differential reaction condenser, .0003 mfd. (J.B.).
- Three baseboard-mounting valveholders, two 4-pin and one 5-pin (Bulgin).
- One type H.F.8 H.F. choke (Bulgin).
- One type H.F.9 ditto (Bulgin).
- One 3-point switch, type S.36 (Bulgin).
- One 4 to 1 L.F. transformer (B.T.S.).
- Five fixed condensers : One .1 mfd. type 4603/S. Two .0002 mfd. type 4601/S. One 2 mfd. type 3016. One .02 mfd. type 4601/S (Dubilier).
- Three fixed resistances, ½ watt type : One 10,000 ohms. 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 valves : type Z.21 (4-pin), HL.2 and KT.2 (Osram).
- One wooden baseboard, 12in. by 9in. One panel 12in. by 8in. Wire for connection, flex for leads, screws, etc. (Peto-Scott).
- One pair 2,000 ohm headphones (Ericsson).
- One W.B. Stentorian Junior loudspeaker (W.B.).
- One 2-volt accumulator (Exide).
- One 120-volt H.T. battery (Drydex).
- One 9-volt G.B. battery (Drydex).

# PRACTICAL NOTES

## Reaction Effects

SOMETIMES when testing out a new receiver, reaction is fierce. After slacking back the reaction to zero code signals are heard. The reason is, of course, that at the zero dial reading zero reaction effect is not in evidence, and the detector valve is still in oscillation due to excessive plate voltage.

H.T. voltage to the detector plate should be reduced. It is not unknown for inexperienced short-wave constructors to remove reaction turns and ruin a set of commercial coils, finding later that reaction is still fierce or has entirely ceased, according to the number of turns removed. A higher capacity reaction condenser is sometimes fitted, and patchy reaction or one big dead spot results.

Sometimes reaction turns are increased and oscillation is damped entirely, especially within the fundamental and harmonic tuning ranges of the aerial system, individual coils, and tuned circuits.

## 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 also to the earth lead will generally enable absorption dead-spots to be avoided, as it may be regarded in the light of an absorption wave-trap, preventing the passage of signals at certain frequencies—those of the combined aerial-earth system or harmonics of it.

## A Camera Improvement

WHEN an electron camera of the storage type is being used with a signal mosaic which is scanned by a beam of electrons, an important point to study is what occurs during the flyback period of the beam after it has completed either its line or frame scan. Unless suitable steps are taken there is always the possibility that the beam on its return journey may pass over one or more sections of the mosaic not yet scanned and so partially neutralise the 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 evidence themselves by picture margins either too dark or too bright. One proposal which has been put forward to overcome this defect, is to force the beam of electrons during its return flight to pass over a section of the mosaic signal plate which has already been subjected to the signal generation process. This can be undertaken very readily by applying specially shaped pulses to the deflector system and that section of the screen which has still to be picture scanned is in no way impaired in so far as its acquired electrostatic potentions are concerned.

# PRACTICAL TELEVISION

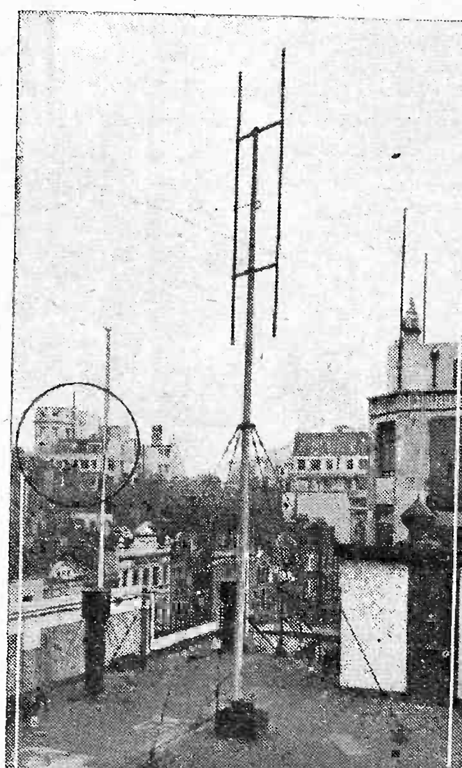
April 20th, 1940. Vol. 4. No. 199.

## 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 scans the subject 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-value anode voltage and 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, mush-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 monitor 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 anxious 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 fulfil in many specialised 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 Postmater-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 seasonal improvement in outdoor weather conditions the time is now



*A typical short-wave aerial, used for television, with reflector. This picture also shows, in the circle, the tower from which our editorial offices take their name. The aerial mast is on the top of the tower immediately above our research laboratories.*

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 wavelength of the transmissions from the signal station it is designed to receive, 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 resonates to the carrier wave for which it has been designed. It is important to note also that 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 valuable, as it ensures that the higher modulation frequencies of the television signal will not be seriously attenuated and furthermore, since the sound signals accompanying the vision radiation were sent out on a carrier 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 its non-use for the past six or seven months no damage has occurred. Most of the aerials are mounted on a mast and when this was accommodated on a flat roof the 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 the 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 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 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 dipole and 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 and, 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.

# LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes, price 2s. each.

## 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 10s.).

### Latest Patent Applications.

5119.—Chakravarti, S. P.—Band-pass filters for radio and television systems. March 19th.

5213.—General Electric Co., Ltd., and Biggs, A. J.—Wireless receiving-sets comprising dial lamps. March 20th.

4930.—Hamilton, C. G. Cole, and Morris, T. C.—Radio receivers and installations. March 16th.

5228.—Philips Lamps, Ltd.—Adjustable electric resistances. March 20th.

5230.—Philips Lamps, Ltd.—Superheterodyne wireless receivers. March 20th.

### Specifications Published.

519110.—Marconi's Wireless Telegraph Co., Ltd.—Ultra short-wave circuits.

519111.—Pye, Ltd., and Liebmann, G.—Cathode-ray tubes.

518969.—Marconi's Wireless Telegraph Co., Ltd., and Brailsford, J. D.—Electrical tuned circuit.

518979.—General Electric Co., Ltd., Rose, W. R., Clark, F., and Forbes, A. D.—Tuning devices for radio receivers and the like. (Cognate Application, 369/39.)

518991.—General Electric Co., Ltd., and Peters, W. H.—Wireless-receiving apparatus.

519051.—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 energy into the transmitting side of this 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 then be fed 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, advantage is taken of a beamed ultra-short-wave transmission picked up by a delicate receiving set located in an area completely free from interference so that the clean signal can then be relayed to the main rediffusing transmitter. It is customary to split the functions of the complete mobile unit into four separate sections for convenience, for 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 all the television cameras, signal generator control and monitoring equipment, together with the associated sound pick-up control and amplifier. With a view to an adequate coverage of the event 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 this entails a mixing control, power supplies, pre-fade and transmitted picture monitors, synchronising pulse generator and picture channel distribution amplifier. 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 the fundamental line and frame synchronising frequencies to all parts of the station. It is well known that the success which attends any interlaced system of scanning in television depends upon the rigidity of the lock, or the accuracy of the time relation between the frame and line frequencies, and it is for this reason that various types of designs have been developed to ensure that this factor is met under the widest variety of practical conditions. The normal practice is for the frame frequency to be derived from the time controlled alternating current mains. It is then necessary to make some provision so that an electrical inertia is introduced, and thereby prevent the transmitted signal from following any sudden changes in the phase of the electrical mains supply. These changes, if inherent in the built-up equipment, are very detrimental to the achievement of perfect interlacing, and must be counteracted by patented methods in the circuit design. In its completed form the apparatus is then called upon to furnish synchronising pulses to the cameras in the studios, the telecine scanners and the radio transmitters. In addition to this, the equipment should also be capable of providing electrically-generated test signals for checking up the degree of linearity, contrast and adjustment, which is a daily routine test in any modern high-definition television transmitting station. This is carried out on special internal circuits, and then again at the commencement of any broadcast this same master frequency signal generator is called upon to supply the tuning signal in bar form for radiation from the transmitting aerials. This enables the viewer or service engineer to ascertain whether the receiving set is functioning normally at the receiving site.

NEW SERIES

# RADIO ENGINEER'S POCKET-BOOK

(See also page ii of cover.)

## No. 53

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

| Degrees. | Sine. | Cosine. | Tangent. | Degrees. | Sine. | Cosine. | Tangent. |
|---|---|---|---|---|---|---|---|
| 15°30′ | 0.2672 | .9636 | 0.2773 | 23° 0′ | 0.3907 | .9205 | 0.4245 |
| 16° 0′ | 0.2756 | .9613 | 0.2867 | 30′ | 0.3987 | .9170 | 0.4348 |
| 30′ | 0.2840 | .9588 | 0.2962 | 24° 0′ | 0.4067 | .9136 | 0.4452 |
| 17° 0′ | 0.2924 | .9563 | 0.3057 | 30′ | 0.4147 | .9099 | 0.4557 |
| 30′ | 0.3007 | .9537 | 0.3153 | 25° 0′ | 0.4226 | .9063 | 0.4663 |
| 18° 0′ | 0.3090 | .9510 | 0.3249 | 30′ | 0.4305 | .9025 | 0.4770 |
| 30′ | 0.3173 | .9483 | 0.3346 | 26° 0′ | 0.4384 | .8988 | 0.4877 |
| 19° 0′ | .03256 | .9455 | 0.3443 | 30′ | 0.4462 | .8949 | 0.4986 |
| 30′ | 0.3338 | .9426 | 0.3541 | 27° 0′ | 0.4540 | .8910 | 0.5095 |
| 20° 0′ | 0.3420 | .9397 | 0.3640 | 30′ | 0.4617 | .8870 | 0.5206 |
| 30′ | 0.3502 | .9367 | 0.3739 | 28° 0′ | 0.4695 | .8829 | 0.5317 |
| 21° 0′ | 0.3584 | .9336 | 0.3839 | 30′ | 0.4772 | .8788 | 0.5430 |
| 30′ | 0.3665 | .9304 | 0.3939 | 29° 0′ | 0.4818 | .8746 | 0.5543 |
| 22° 0′ | 0.3746 | .9272 | 0.4040 | 30′ | 0.4929 | .8704 | 0.5658 |
| 30′ | 0.3827 | .9239 | 0.4142 | 30° 0′ | 0.5000 | .8660 | 0.5774 |

## No. 54

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

| Degrees. | Sine. | Cosine. | Tangent. | Degrees. | Sine. | Cosine. | Tangent. |
|---|---|---|---|---|---|---|---|
| 30°30′ | 0.5075 | .8616 | 0.5891 | 38° 0′ | 0.6157 | .7880 | 0.7813 |
| 31° 0′ | 0.5150 | .8572 | 0.6009 | 30′ | 0.6225 | .7826 | 0.7954 |
| 30′ | 0.5225 | .8526 | 0.6128 | 39° 0′ | 0.6293 | .7772 | 0.8098 |
| 32° 0′ | 0.5299 | .8480 | 0.6249 | 30′ | 0.6361 | .7716 | 0.8243 |
| 30′ | 0.5373 | .8434 | 0.6371 | 40° 0′ | 0.6428 | .7660 | 0.8391 |
| 33° 0′ | 0.5446 | .8387 | 0.6494 | 30′ | 0.6494 | .7604 | 0.8541 |
| 30′ | 0.5519 | .8339 | 0.6619 | 41° 0′ | 0.6561 | .7547 | 0.8693 |
| 34° 0′ | 0.5592 | .8290 | 0.6745 | 30′ | 0.6626 | .7490 | 0.8847 |
| 30′ | 0.5664 | .8241 | 0.6873 | 42° 0′ | 0.6691 | .7431 | 0.9004 |
| 35° 0′ | 0.5736 | .8192 | 0.7002 | 30′ | 0.6756 | .7373 | 0.9163 |
| 30′ | 0.5807 | .8142 | 0.7133 | 43° 0′ | 0.6820 | .7314 | 0.9325 |
| 36° 0′ | 0.5878 | .8090 | 0.7265 | 30′ | 0.6884 | .7254 | 0.9489 |
| 30′ | 0.5948 | .8039 | 0.7400 | 44° 0′ | 0.6947 | .7193 | 0.9657 |
| 37° 0′ | 0.6018 | .7986 | 0.7536 | 30′ | 0.7009 | .7132 | 0.9827 |
| 30′ | 0.6088 | .7934 | 0.7673 | 45° 0′ | 0.7071 | .7071 | 1.0000 |

## No. 55

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

| Degrees. | Sine. | Cosine. | Tangen | Degrees. | Sine. | Cosine. | Tangent. |
|---|---|---|---|---|---|---|---|
| 45°30′ | 0.7133 | .7009 | 1.0176 | 53° 0′ | 0.7986 | .6018 | 1.3270 |
| 46° 0′ | 0.7193 | .6947 | 1.0355 | 30′ | 0.8039 | .5948 | 1.3514 |
| 30′ | 0.7254 | .6884 | 1.0538 | 54° 0′ | 0.8090 | .5878 | 1.3764 |
| 47° 0′ | 0.7314 | .6820 | 1.0724 | 30′ | 0.8141 | .5807 | 1.4020 |
| 30′ | 0.7373 | .6756 | 1.0913 | 55° 0′ | 0.8192 | .5736 | 1.4282 |
| 48° 0′ | 0.7431 | .6691 | 1.1106 | 30′ | 0.8241 | .5664 | 1.4550 |
| 30′ | 0.7490 | .6626 | 1.1303 | 56° 0′ | 0.8290 | .5592 | 1.4826 |
| 49° 0′ | 0.7547 | .6561 | 1.1504 | 30′ | 0.8339 | .5519 | 1.5108 |
| 30′ | 0.7604 | .6495 | 1.1709 | 57° 0′ | 0.8387 | .5446 | 1.5399 |
| 50° 0′ | 0.7660 | .6428 | 1.1918 | 30′ | 0.8434 | .5373 | 1.5697 |
| 30′ | 0.7716 | .6361 | 1.2131 | 58° 0′ | 0.8480 | .5299 | 1.6003 |
| 51° 0′ | 0.7771 | .6293 | 1.2349 | 30′ | 0.8526 | .5225 | 1.6319 |
| 30′ | 0.7826 | .6225 | 1.2572 | 59° 0′ | 0.8572 | .5150 | 1.6643 |
| 52° 0′ | 0.7880 | .6157 | 1.2799 | 30′ | 0.8616 | .5075 | 1.6977 |
| 30′ | 0.7934 | .6088 | 1.3032 | 60° 0′ | 0.8660 | .5000 | 1.7321 |

## No. 56

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

| Degrees. | Sine. | Cosine. | Tangent. | Degrees. | Sine. | Cosine. | Tangent. |
|---|---|---|---|---|---|---|---|
| 60°30′ | 0.8704 | .4924 | 1.7675 | 68° 0′ | 0.9272 | .3746 | 2.4751 |
| 61° 0′ | 0.8746 | .4848 | 1.8041 | 30′ | 0.9304 | .3665 | 2.5387 |
| 30′ | 0.8788 | .4772 | 1.8418 | 69° 0′ | 0.9336 | .3584 | 2.6051 |
| 62° 0′ | 0.8830 | .4695 | 1.8807 | 30′ | 0.9367 | .3502 | 2.6746 |
| 30′ | 0.8870 | .4618 | 1.9210 | 70° 0′ | 0.9397 | .3420 | 2.7475 |
| 63° 0′ | 0.8910 | .4540 | 1.9626 | 30′ | 0.9426 | .3338 | 2.8239 |
| 30′ | 0.8949 | .4462 | 2.0057 | 71° 0′ | 0.9455 | .3256 | 2.9042 |
| 64° 0′ | 0.8988 | .4384 | 2.0503 | 30′ | 0.9483 | .3173 | 2.9887 |
| 30′ | 0.9026 | .4305 | 2.0965 | 72° 0′ | 0.9510 | .3090 | 3.0777 |
| 65° 0′ | 0.9063 | .4226 | 2.1445 | 30′ | 0.9537 | .3007 | 3.1716 |
| 30′ | 0.9100 | .4147 | 2.1943 | 73° 0′ | 0.9563 | .2924 | 3.2907 |
| 66° 0′ | 0.9135 | .4067 | 2.2460 | 30′ | 0.9588 | .2840 | 3.3759 |
| 30′ | 0.9171 | .3988 | 2.2998 | 74° 0′ | 0.9613 | .2756 | 3.4874 |
| 67° 0′ | 0.9205 | .3907 | 2.3559 | 30′ | 0.9636 | .2672 | 3.6059 |
| 30′ | 0.9239 | .3827 | 2.4142 | 75° 0′ | 0.9659 | .2588 | 3.7321 |

## No. 57

NATURAL SINES, COSINES, AND TANGENTS—*Continued*

| Degrees. | Sine. | Cosine. | Tangent. | Degrees. | Sine. | Cosine. | Tangent. |
|---|---|---|---|---|---|---|---|
| 75°30′ | 0.9682 | .2504 | 3.8667 | 83° 0′ | 0.9926 | .1219 | 8.1444 |
| 76° 0′ | 0.9703 | .2419 | 4.0108 | 30′ | 0.9936 | .1132 | 8.7769 |
| 30′ | 0.9724 | .2335 | 4.1653 | 84° 0′ | 0.9945 | .1045 | 9.5144 |
| 77° 0′ | 0.9744 | .2249 | 4.3315 | 30′ | 0.9954 | .0959 | 10.3854 |
| 30′ | 0.9763 | .2164 | 4.5107 | 85° 0′ | 0.9962 | .0872 | 11.4301 |
| 78° 0′ | 0.9782 | .2079 | 4.7046 | 30′ | 0.9969 | .0785 | 12.7062 |
| 30′ | 0.9800 | .1994 | 4.9152 | 86° 0′ | 0.9976 | .0698 | 14.3007 |
| 79° 0′ | 0.9816 | .1908 | 5.1446 | 30′ | 0.9981 | .0610 | 16.3499 |
| 30′ | 0.9833 | .1822 | 5.3955 | 87° 0′ | 0.9986 | .0523 | 19.0811 |
| 80° 0′ | 0.9848 | .1737 | 5.6713 | 30′ | 0.9990 | .0436 | 22.9038 |
| 30′ | 0.9863 | .1650 | 5.9758 | 88° 0′ | 0.9994 | .0349 | 28.6363 |
| 81° 0′ | 0.9877 | .1564 | 6.3138 | 30′ | 0.9997 | .0262 | 38.1885 |
| 30′ | 0.9890 | .1478 | 6.6912 | 89° 0′ | 0.9998 | .0174 | 57.2900 |
| 82° 0′ | 0.9903 | .1392 | 7.1154 | 30′ | 0.9999 | .0087 | 114.5887 |
| 30′ | 0.9914 | .1305 | 7.5958 | 90° 0′ | 1.0000 | .0000 | ∞ |

## ACCUMULATOR DATA. No. 58.

ACID OF 1.840 SPECIFIC GRAVITY

| *Required Specific Gravity at 70° F.* | *Water* — *Parts by Volume.* | *Acid, 1.840 Specific Gravity.* — *Parts by Volume.* |
|---|---|---|
| 1.400 | 14 | 10 |
| 1.350 | 18 | 10 |
| 1.300 | 21 | 10 |
| 1.250 | 27 | 10 |
| 1.225 | 29 | 10 |

ACID OF 1.400 SPECIFIC GRAVITY

| *Required Specific Gravity at 70° F.* | *Water.* — *Parts by Volume.* | *Acid, 1.400 Specific Gravity.* — *Parts by Volume.* |
|---|---|---|
| 1.300 | 4.5 | 10 |
| 1.280 | 5.5 | 10 |
| 1.275 | 6.25 | 10 |
| 1.265 | 6.4 | 10 |
| 1.255 | 6.65 | 10 |
| 1.250 | 6.75 | 10 |

CURRENT-CARRYING CAPACITY OF LAMPS FOR CHARGING PURPOSES

*Carbon-filament Lamps*

| *Candle-power.* | *Voltage.* | *Current passed.* |
|---|---|---|
| 8 | 110 | .254 |
| 16 | 110 | .509 |
| 32 | 110 | 1.018 |
| 8 | 220 | .127 |
| 16 | 220 | .209 |
| 32 | 220 | .509 |

*Metal-filament Lamps*

| *Candle-power.* | *Voltage.* | *Current passed.* |
|---|---|---|
| 8 | 110 | .09 |
| 16 | 110 | .18 |
| 32 | 110 | .36 |
| 8 | 220 | .049 |
| 16 | 220 | .09 |
| 32 | 220 | .18 |

| *Condition of Cells.* | *Actual Hydrometer Readings at Temperatures shown below to give 1.280 at 60° F.* | | | | | | |
|---|---|---|---|---|---|---|---|
| | 40°F. | 50° F. | 60°F. | 70°F. | 80°F. | 90°F. | 100°F. |
| Fully charged | 1.288 | 1.284 | 1.280 | 1.276 | 1.272 | 1.268 | 1.264 |
| Half discharged | 1.207 | 1.204 | 1.200 | 1.196 | 1.193 | 1.189 | 1.186 |
| Fully discharged | 1.115 | 1.113 | 1.110 | 1.107 | 1.104 | 1.101 | 1.098 |

# Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

## Full-wave Detection

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

"Empiricist," in your issue dated March 23rd, says that 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 (rectify) the "full" radio-frequency wave—but not by 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 or zero voltage line so that generally the positive amplitude is increased, and the negative amplitude is decreased, and 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 (in the new theory) to the 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 or zero voltage line so completely that the whole of the rectified output rises and falls in an increasing positive and decreasing positive direction, with no negative amplitude. Detection would then be "complete" from the point of view of volume of output, but the question of quality of output is another matter. The volume of output at audio frequency will depend upon the *difference* between the voltages above and below the base or zero voltage line. Different methods of detection and different conditions in the detector circuit produce an output which may have a different positive/negative ratio. In some forms of detection in general use the rectified output may consist of a wave which falls 75 per cent. below the base or zero voltage line, and rises 100 per cent. above it, so that the negative amplitude is 75 per cent. of the positive—which means that, broadly speaking, only 25 per cent. of the wave can be used as an audio-frequency output. If the negative amplitude were 90 per cent. of the positive, there would be only 10 per cent. effective audio output, with considerably reduced volume. After amplification in the L.F. amplifier there should still be 10 per cent. of the wave as effective audio output. The negative portion of the wave cancels out a proportion of the positive voltage.—D'ARCY FORD (Exeter).

## TAP, Ankara

SIR,—I should like to take this opportunity of thanking you for your very interesting paper, and I am glad to see that it has not changed owing to the war. I am much relieved to see that you have discontinued to print letters in which the writers request to swap their QSLs.

I find conditions have been poor lately, but I should like to report a very interesting programme given by TAP (Ankara), on Saturdays, at 21.30 B.S.T. in English. The station invites English listeners to send in reports, and to ask any questions concerning Turkey, its towns or any other relevant question. The writer is asked to state the date in his letter on which it is most suitable for him to listen in to TAP, and the announcer will give him a call over the air, and answer his questions. TAP'S QRA, "Correspondence Dept.," Radio Ankara, Ankara, Turkey.—E. G. GRAY (Abergavenny).

## Comradeship!

SIR,—I feel I ought to write and thank you for publishing my request for back numbers in this week's issue.

As a matter of interest and as examples of the good spirit amongst radio amateurs, I would like to inform you that as early as Wednesday evening a local ham left me a large pile of back numbers and on Thursday I received an offer from Wakefield (all free and post paid), followed by another caller from two miles away. Friday brought a card from Wirral and a 7d. post paid parcel from Sussex. I have replied to every one of these.—W. G. ANDREWS (Liverpool, 14).

## Dead Spots

SIR,—I was very interested in Mr. J. Kidd's (Melton Mowbray) letter, in the current issue of your paper. His problem of not receiving signals from Canada or South Africa is exactly the same as mine. Even during the weeks before the "great Easter electrical storm," when DX conditions were very good, I could not find a single Canadian or South African station. I have used two aerials. The first is an inverted L, 30ft. high and 30ft. long, running due east and west, the second is an indoor one, approximately the same height, 25ft. long and running in *three* directions, which rather spoils the idea of directional effect. The receivers have been varied, too. I have used from a simple one-valve right up to my Trophy "V," and get the same results with all the sets. I wonder if any other readers have had similar experiences, and whether Melton Mowbray and Wallasey are "dead spot" areas for reception from certain parts of the world.

Anyway, this has made me start experimenting with aerials, and I had no idea how interesting this branch of my hobby could be. Most of my knowledge of radio has come from your valuable paper—carry on the good work, PRACTICAL WIRELESS!—ERIC H. WILLIAMS (Wallasey).

# Prize Problems

### PROBLEM No. 396

MANNING decided that he could improve his three-valve battery receiver from the point of view of volume and quality. For this purpose he obtained another L.F. valve and L.F. transformer, which he included between his existing detector stage and the output valve. He experienced very bad distortion and thinking that overloading 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 opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 396 and must be posted to reach this office not later than the first post on Monday, April 22nd, 1940.

### Solution to Problem No. 395

The accumulator Purvis was using was in need of recharging, and when it stood unused over-night it regained a certain amount of power, which enabled it to work the set satisfactorily when next switched on for a short time.

The following three readers successfully solved Problem No. 394 and books have accordingly been forwarded to them: F. D. Collen, 130, St. John's Road, Tunbridge Wells, Kent; R. Alland, 12, Gamble Lane, Farnley, Leeds; C. W. Hildersley, 43, Litchfield Gardens, Willesden Green, N.W.10.

## 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. E. G. Durham, 25, New Inn Hall Street, Oxford—with any reader who has constructed 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.

L. Woodcock, "Norwood," 110, Amington Road, Tamworth, Staffs, with a short-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.

**FREE ADVICE BUREAU COUPON**

This coupon is available until April 27th, 1940, and must accompany all Queries and Hints.

PRACTICAL WIRELESS 20/4/1940.

# Practical Wireless BLUEPRINT SERVICE

These Blueprints are drawn full size.

Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices *which are additional to the cost of the Blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

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**Wireless Magazine ... ... 1/3 " "**

The index letters which precede the Blueprint Number indicate the periodical in which the description appears : Thus P.W. refers to 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 (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

## PRACTICAL WIRELESS

| | *Date of Issue.* | *No. of Blueprint.* |
|---|---|---|
| **CRYSTAL SETS** | | |
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| The " Junior " Crystal Set .. | 27.8.38 | PW94 |
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| Sixty Shilling Three (D, 2 LF (RC & Trans)) .. .. .. | — | PW34A |
| Leader Three (SG, D, Pow) .. | — | PW35 |
| Summit Three (HF Pen, D, Pen) | — | PW37 |
| All Pentode Three (HF Pen, D (Pen), Pen) .. .. .. | 29.5.37 | PW39 |
| Hall-Mark Three (SG, D, Pow) .. | — | PW41 |
| Hall-Mark Cadet (D, LF, Pen (RC)) | 16.3.35 | PW48 |
| F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three) .. .. .. .. | 13.4.35 | PW49 |
| Cameo Midget Three (D, 2 LF (Trans)) .. .. .. .. | — | PW51 |
| 1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen) | — | PW53 |
| Battery All-Wave Three (D, 2 LF (RC)) .. .. .. .. | — | PW55 |
| The Monitor (HF Pen, D, Pen) .. | — | PW61 |
| The Tutor Three (HF Pen, D, Pen) | 21.3.36 | PW62 |
| The Centaur Three (SG, D, P) .. | 14.8.37 | PW64 |
| F. J. Camm's Record All-Wave Three (HF Pen, D, Pen) .. | 31.10.36 | PW69 |
| The " Colt " All-Wave Three (D, 2 LF (RC & Trans)) .. .. | 18.2.39 | PW72 |
| The " Rapide " Straight 3 (D, 2 LF (RC & Trans)) .. .. | 4.12.37 | PW82 |
| F. J. Camm's Oracle All-Wave Three (HF, Det., Pen) .. .. | 28.8.37 | PW78 |
| 1938 " Triband " All-Wave Three (HF Pen, D, Pen) .. .. | 22.1.38 | PW84 |
| F. J. Camm's " Sprite " Three (HF Pen, D, Tet) .. .. | 26.3.38 | PW87 |
| The " Hurricane " All-Wave Three ((SG, D, Pen), Pen) .. .. | 30.4.38 | PW89 |
| F. J. Camm's " Push-Button " Three (HF Pen, D (Pen), Tet) | 3.9.38 | PW92 |
| **Four-valve : Blueprints, 1s. each.** | | |
| Sonotone Four (SG, D, LF, P) .. | 1.5.37 | PW4 |
| Fury Four (2 SG, D, Pen) .. .. | 8.5.37 | PW11 |
| Beta Universal Four (SG, D, LF, Cl. B) .. .. .. .. | — | PW17 |
| Nucleon Class B Four (SG, D (SG), LF, Cl. B) .. .. | — | PW34B |
| Fury Four Super (SG, SG, D, Pen) | — | PW34C |
| Battery Hall-Mark 4 (HF Pen, D, Push-Pull) .. .. .. | — | PW46 |
| F. J. Camm's " Limit " All-Wave Four (HF Pen, D, LF, P) .. | 26.9.36 | PW67 |
| " Acme " All-Wave 4 (HF Pen, D (Pen), LF, Cl. B) .. .. | 12.2.38 | PW83 |
| The " Admiral " Four (HF Pen, HF Pen, D, Pen (RC)) .. | 3.9.38 | PW90 |
| **Mains Operated** | | |
| **Two-valve : Blueprints, 1s. each.** | | |
| A.C. Twin (D (Pen), Pen) .. | — | PW18 |
| A.C.-D.C. Two (SG, Pow) .. | — | PW31 |
| Selectone A.C. Radiogram Two (D, Pow) .. .. .. .. | — | PW19 |
| **Three-valve : Blueprints, 1s. each.** | | |
| Double-Diode-Triode Three (HF Pen, DDT, Pen) .. .. | — | PW23 |
| D.C. Ace (SG, D, Pen) .. .. | — | PW25 |
| A.C. Three (SG, D, Pen) .. .. | — | PW29 |
| A.C. Leader (HF Pen, D, Pow) .. | 7.1.39 | PW35C |
| D.C. Premier (HF Pen, D, Pen) .. | — | PW35B |
| Unique (HF Pen, D (Pen), Pen) .. | — | PW36A |
| Armada Mains Three (HF Pen, D, Pen) .. .. .. .. | — | PW38 |
| F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen) | — | PW50 |
| " All-Wave " A.C. Three (D, 2 LF (RC)) .. .. .. | — | PW54 |
| A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen) .. | — | PW56 |
| Mains Record All-Wave 3 (HF Pen, D, Pen) .. .. .. | — | PW70 |
| **Four-Valve : Blueprints, 1s. each.** | | |
| A.C. Fury Four (SG, SG, D, Pen) .. | — | PW20 |
| A.C. Fury Four Super (SG, SG, D, Pen) .. .. .. .. | — | PW34D |
| A.C. Hall-Mark (HF Pen, D, Push-Pull) .. .. .. | — | PW45 |
| Universal Hall-Mark (HF Pen, D, Push-Pull) .. .. .. | — | PW47 |
| **SUPERHETS.** | | |
| **Battery Sets : Blueprints, 1s. each.** | | |
| £5 Superhet (Three-Valve) .. | 5.6.37 | PW40 |
| F. J. Camm's 2-valve Superhet .. | — | PW52 |
| **Mains Sets : Blueprints, 1s. each.** | | |
| A.C. £5 Superhet (Three-valve) .. | — | PW43 |
| D.C. £5 Superhet (Three-valve) .. | — | PW42 |
| Universal £5 Superhet (Three-valve) .. .. .. .. | — | PW44 |
| F. J. Camm's A.C. Superhet 4 .. | 31.7.37 | PW59 |
| F. J. Camm's Universal £4 Superhet 4 .. .. .. .. | — | PW60 |
| " Qualitone " Universal Four .. | 16.1.37 | PW73 |
| **Four-valve : Double-sided Blueprint, 1s. 6d.** | | |
| Push Button 4, Battery Model .. / Push Button 4, A.C. Mains Model } | 22.10.38 | PW95 |
| **SHORT-WAVE SETS. Battery Operated.** | | |
| **One-valve : Blueprint, 1s.** | | |
| Simple S.W. One-valver .. | 23.12.39 | PW88 |
| **Two-valve : Blueprints, 1s. each.** | | |
| Midget Short-wave Two (D, Pen) | — | PW38A |
| The " Fleet " Short-wave Two (D (HF Pen), Pen) .. .. | 27.8.38 | PW91 |
| **Three-valve : Blueprints, 1s. each.** | | |
| Experimenter's Short-wave Three (SG, D, Pow) .. .. | — | PW30A |
| The Prefect 3 (D, 2 LF (RC and Trans)) .. .. .. | — | PW63 |
| The Band-Spread S.W. Three (HF Pen, D (Pen), Pen) .. | 1.10.38 | PW68 |
| **PORTABLES.** | | |
| **Three-valve : Blueprints, 1s. each.** | | |
| F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) .. | — | PW65 |
| Parvo Flyweight Midget Portable (SG, D, Pen) .. .. | 3.6.39 | PW77 |
| **Four-valve : Blueprint, 1s.** | | |
| " Imp " Portable 4 (D, LF, LF (Pen)) .. .. .. .. | — | PW86 |
| **MISCELLANEOUS** | | |
| **Blueprint, 1s.** | | |
| S.W. Converter-Adapter (1 valve) | — | PW48A |

## AMATEUR WIRELESS AND WIRELESS MAGAZINE

| | | |
|---|---|---|
| **CRYSTAL SETS.** | | |
| **Blueprints, 6d. each.** | | |
| Four-station Crystal Set .. .. | 23.7.38 | AW427 |
| 1934 Crystal Set .. .. .. | — | AW444 |
| 150-mile Crystal Set .. .. | — | AW450 |
| **STRAIGHT SETS. Battery Operated.** | | |
| **One-valve : Blueprint, 1s.** | | |
| B.B.C. Special One-valver .. | — | AW387 |
| **Two-valve : Blueprints, 1s. each.** | | |
| Melody Ranger Two (D, Trans) .. | — | AW388 |
| Full-volume Two (SG det, Pen) .. | — | AW392 |
| Lucerne Minor (D, Pen) .. .. | — | AW426 |
| A Modern Two-valver .. .. | — | WM409 |
| **Three-valve : Blueprints, 1s. each.** | | |
| £5 5s. S.G.3 (SG, D, Trans) .. | — | AW412 |
| Lucerne Ranger (SG, D, Trans) .. | — | AW422 |
| £5 5s. Three : De Luxe Version (SG, D, Trans) .. .. .. | 19.5.34 | AW435 |
| Lucerne Straight Three (D, RC, Trans) .. .. .. .. | — | AW437 |
| Transportable Three (SG, D, Pen) | — | WM271 |
| Simple-Tune Three (SG, D, Pen) | *June* '33 | WM327 |
| Economy-Pentode Three (SG, D, Pen) .. .. .. .. | *Oct.* '33 | WM337 |
| " W.M." 1934 Standard Three (SG, D, Pen) .. .. .. | — | WM351 |
| £3 3s. Three (SG, D, Trans) .. | *Mar.* '34 | WM354 |
| 1935 £6 6s. Battery Three (SG, D, Pen) .. .. .. .. | — | WM371 |
| PTP Three (Pen, D, Pen) .. | — | WM389 |
| Certainty Three (SG, D, Pen) .. | — | WM393 |
| Minitube Three (SG, D, Trans) .. | *Oct.* '35 | WM396 |
| All-Wave Winning Three (SG, D, Pen) .. .. .. .. | — | WM400 |

# In reply to your letter

## Eliminator Output

**"I have an eliminator which should give a maximum of 120-150 volts, but I only get 60 volts. Can you tell me what is wrong, and, if possible, suggest a remedy?"—J. S. (Plaistow).**

THIS is a very common query 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 "floating," 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. (Whitehaven).**

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 few 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 Dubilier range is a block of this type, No. 319, working voltage 220 volts. The pre-war price was 5s.

## Cabinet and Aerial

**"Could you tell me where to get a metal cabinet? Also with a doublet 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 doublet lead-in the usual arrangement is to connect the two leads to the primary of an aerial transformer. This is the standard type of aerial coil, such as the 4-pin or 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. Better results are obtained, however, if you disconnect the primary winding of the aerial coil from the earth line, and then connect an earth to the receiver, with the lead-in wires taken to the 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 Tiflis, Minsk, Kiev, Leningrad and Kaunas stations 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; Minsk, 1,442 metres, 208 kc/s; Kiev, 1,210 metres, 248 kc/s; Leningrad, 1,107 metres, 271 kc/s; and Tiflis, 1,060 metres, 283 kc/s.

### RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

## 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 tune 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. (Beith).**

WHEN a superhet is properly tuned, provided that all 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 see when the set is dead on tune and thus reproduction is properly balanced. If, in your case, the tone is too deep, the effect of modifying the tuning is 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 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 over 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 lost and should like your opinion on this matter before taking it any further to pieces."—L. E. R. (Watford).**

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 springiness has gone out of the plate then it would fail to act properly, but it is more likely that some grease or oil 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, but 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 keen on some really effective long-distance logs on short 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 arrangement which can be handled easily and will produce its maximum effect. We therefore advise the electron-coupled circuit, with potentiometer control for the screen voltage of 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-base or long-base.

**A. T. (Todmorden).** The details will all be found in our Encyclopædia.

**A. D. B. (Coventry).** We regret that we do not now have details of the valves in question. They do not appear in current lists.

**A. T. H. (Margate).** We cannot give details in the absence of full data concerning the amplifier and connections.

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

**W. C. (Warrington).** Premier Radio can supply the meter.

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

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

# RADIO CLUBS & SOCIETIES

*Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.*

### ASHTON-UNDER-LYNE AND DISTRICT AMATEUR RADIO SOCIETY

**Headquarters:** 17a, Oldham Road, Ashton-under-Lyne.
**Hon. Sec.:** K. Gooding (G3PM), 7, Broadbent Avenue, Smallshaw, Ashton-under-Lyne.
**Meetings:** Wednesdays, 8 p.m., and Sundays, 2.30 p.m.

THERE was quite a good rally of members and friends at a recent meeting when the R.S.G.B. National Field Day Film was shown. The arrangements for the projection were ably carried out by a real old-timer in Mr. Leslie Gordon (ex G6ZY) who now devotes his spare time to photography. Later in the evening Mr. Gordon gave an entertaining impromptu talk when he compared the modern amateur equipment with that of 20 years ago. Appropriate "cine" music was provided by an audio-amplifier and records loaned by Mr. C. Noke (G6DV).

At the same meeting Mr. J. Partington (G5PX), the President, outlined the society's future programme which includes the construction of a Steel-wire Audio Recorder.

In view of the fact that most of the members are now building superhet receivers. Messrs. W. P. Green (Chairman) and J. Cropper (G3BY—Treasurer), have arranged to collaborate in a series of lectures dealing with superhet principles and design.

### SLOUGH AND DISTRICT SHORT-WAVE CLUB

**Headquarters:** Toc H Headquarters, High Street, Slough (above Messrs. Lilley and Skinner's Shop).
**Hon. Sec.:** K. A. Sly, 16, Buckland Avenue, Slough.
**Meetings:** Alternate Thursdays at 7.30 p.m.

THE last meeting was held at the club's new headquarters at the address given above.

The meeting opened with a discussion of short-wave conditions, particularly the recent sun-spot activity and its effects upon reception. Mr. Hine, research group organiser, presented a selection of very interesting graphs which he had drawn to show the signal strengths and fading times on WGEA and WGEO for the same time G.M.T. each evening for several months past. The co-relation shown between the curves was examined by all the members and they remarked upon the similarity between readings taken on signal strength and fading. Mr. K. Sly also showed some highly interesting graphs on the same two stations and these compared very favourably with those of Mr. Hine.

Mr. Baldwin (2BWV) demonstrated the new superhet which he has just built and many stations were received at good volume; members suggested alterations and improvements for which Mr. Baldwin thanked them.

Morse practice was then held with Mr. J. Gilbert (2DDG) at the key. Mr. Gilbert is one of the many members with the Forces and received a particular welcome since he was the founder of the club.

The more members we can obtain the greater shall we be able to enlarge the scope of our meetings. Members of His Majesty's Forces will be welcome at all times, and will be enrolled as honorary members. The subscription is 2s. 6d. annually and 3d. per meeting to cover the cost of hire of room.

### ROBERT BLAIR RADIO SOCIETY

**Headquarters:** L.C.C. Evening Institute, Blundell Street, Islington, N.7.
**Hon. Sec.:** W. Jennings, 82, Craven Park Road, London, N.15.

THE above society met again on April 4th, and a series of interesting lectures on the Outline of Wireless has been planned by Mr. E. W. A. de Kretser, our technical instructor. An up-to-date test bench which includes a cathode-ray oscillograph is available for the full use of its members.

A morse code section, which proved very successful last term, will also be carried on, and beginners are especially welcome.

All inquiries should be addressed to Mr. H. Shelton, 5, Gordon House, King's Cross, N.1.

### ROMFORD AND DISTRICT AMATEUR RADIO SOCIETY

**Hon. Assist. Sec.:** H. G. Holt, M.P.S., 5, Butts Green Road, Hornchurch.

THE Romford and District Radio Society resumed Tuesday evening meetings as before at the Red Triangle Club, on April 2nd, 1940, at 7.45 p.m.

This was the annual general meeting and all the retiring members were re-elected unanimously.

New members are welcome and any inquiries should be addressed to Mr. H. G. Holt, 2DXI, at the above address, who as assistant secretary for the duration will give any help that may be required.

## RECEIVERS AND COMPONENTS

**RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. TELEPHONE: HOLborn 4631.**

**COMPLETE KIT** of parts to build Lissen Hi Q Battery Short-wave receiver. 5-91 metres switched. Brand new goods boxed, with circuit and instructions. Listed, £4/15/-. Our price, **£1/19/11** less valves.

**ALL-WAVE** super-het. chassis, 5 valve A.C. Latest Mullard valves: T.H.4.B., V.P.4.B., T.D.D.4, Pen A.4, L.W. 4/350v. Ranges: Short-wave, 16-48 metres. Med.-wave, 200-560 metres. Long-wave, 800-2,200 metres. Size of Chassis: 14½" long, 7½" deep. Height overall, 8½". Controls tuning at side, volume on/off at side, wave change. Provision for pick-up. Complete with valves and knobs, **£4/17/6.** Special speaker, 1,500 ohms field, **10/6** each.

**L.F.** transformer. Lissen Hi Q. Ratio 3-1. High grade, boxed. List 6/-. Our price, **2/3** each.

**H.F.** choke. Lissen Hi Q. Compact disc type with feet. Boxed. List, 2/6. Our price, **6d.** each.

**ULTRA-SHORT** and short-wave choke. Lissen Hi Q. Inductance 100 microhenries. Boxed. List, 2/-. Our price, **1/-** each.

**ULTRA-SHORT** and short-wave double-wound low-resistance choke. Lissen Hi Q. Resistance less than .05 ohms. Boxed. List, 2/6. Our price, **1/3** each.

**LOW-LOSS** Ceramic valve-holders. Lissen Hi Q. Base-board and chassis. .5- and 7-pin., **10d.** and **1/-** each.

**MANSBRIDGE** type condensers. Lissen Hi Q. 250 D.C. working. Moulded case with feet. .1 mfd. and 1 mfd., **6d.** each.

**ROTARY** coil unit. Lissen Hi Q. Four-band from 4.8-91 metres, can be selected by a turn of the knob. With circuit. Boxed. List, 15/6. Our price, **6/11.**

**LOW-LOSS** short-wave variable condensers. Ceramic insulation. Brass vanes. Lissen Hi Q. Minimum capacity 5 micro-micro farads. Two types. Boxed, with knobs. 160 m.mfd. List, 7/6. Our price, 3/6 each. 20 m.mfd. List, 5/6. Our price, **2/11** each.

**MICA** condensers, Lissen. New. Boxed. All useful sizes, OUR selection. **1/3** per dozen.

**SPEAKER** cabinets, finished black rexine. Circular face. Metal grille. Size 8½" x 9½" x 4½", **4/6** each.

**SCREENED** 3-way flexible, 4 yards for **1/6.**

**MEDIUM-** and long-wave coil units, with valve-holders and sundry resistances, **9d.** each. (No circuit.)

**MIXED** tubulars, wire-ends. OUR selection, **2/6** per dozen.

**4-PIN** base-board valve-holders. Lissen. 2 for **3d.**
**4-1** L.F. transformers. Lissen. Boxed. **2/6** each.

**CONE** speaker unit. Lissen. Complete with reed and chuck. Boxed. **1/-** each.

**SPAGHETTI** resistances. Lissen. Many useful sizes. OUR selection, **1/3** doz.

**4-PIN** valve adapters. Lissen. **6d.** each.

**PUSH-PULL** switches. Lissen. 2-point, **4d.** each. 3-point, **6d.** each.

**RICE-KELLOGG SENIOR** 12" moving-coil speakers, 20 watts. Field 1,000 ohms. 11 ohms speech coil. Without speech transformer, **32/6** each. With transformer tapped 3,000 ohms and 7,000 ohms, **35/-** each.

**GRAMPIAN** 10" 10-watt, 2,500 ohms energised speakers. Heavy cast frame, **15/-** each. With heavy-duty pentode speech transformer, **17/6** each.

**HEAVY-DUTY** speech transformers. Pentode matching, **2/11** each.

**2-GANG** straight condensers. Plessey. **1/6** each. Ditto, 3-gang, **2/-** each.

**ROLA** P.M. speakers. Latest type 7½" cone with pentode transformer. Boxed. **14/6** each.

**CLOCK-FACED** dials. 5" x 3½". With printed 3-wave scale. Ox-copper escutcheons and glass, **3/6** each. Ditto, less escutcheon, **2/6** each.

**HORIZONTAL** dials, with plain scale. 7½" x 3½" and pointer, **1/-** each.

**FILAMENT** transformers, input 200-250v., output 4v. 4 amps., 4v. 6 amps., **4/11** each.

**MAINS** transformers, Plessey, 350-0-350v., 90 m.a., 4v., 2.5 amps., 4v., 6 amps., **8/6** each.

**MAINS** transformers. G.E.C. American windings, 350-0-350v., 65 m.a., 5v. 2 amps., 6.3v. 2.5 amps. Suitable for replacements in G.E.C. models, **5/6** each.

**MAINS** transformers. Wearite. Type R.C.1, 250-0-250v., 80 m.a., 4v. 2.5 amps., 4v. 4 amps., **9/11** each. Type R.C.2, 350-0-350v., 120 m.a., 4v. 2.5 amps., 4v. 4 amps., **12/6** each. Type R.C.3, 350-0-350v. 150 m.a., 4v. 2.5 amps., 4v. 2 amps., 4v. 5 amps., **15/-** each. Type R.C.4, 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.6 amps., **21/-** each. All the above centre-tapped windings. Type R.C.5, 100-watt auto transformer, 100-110v., 200-250v., reversible, **12/6** each. Type R.C.B., 350-0-350v. 80 m.a., 5v. 2 amps., 6.3v. 5 amps., **6/11** each. All transformers 200-250v. tapped primaries.

*(Continued in column 3.)*

# PREMIER RADIO

**MORSE PRACTICE KEYS.**—Brass movement on Bakelite base, **3/3.** General purpose Morse keys, smooth action, heavy contacts, **5/10.**

**HEAVY DUTY TX KEYS.**—Tungsten contacts, heavy cast base with brass movement, **10/-.**

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## DE LUXE S.W. KITS

Complete to the last detail, including all Valves and coils, wiring diagrams and lucid instructions for building and working. Each Kit is supplied with a steel Chassis and Panel and uses plug-in Coils to tune from 13 to 170 metres.

| | |
|---|---|
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| **1 Valve Short-Wave Superhet Converter Kit** | **23/-** |
| **1 Valve Short-Wave A.C. Superhet Converter Kit** | **26/3** |
| **2 Valve Short-Wave Receiver Kit** | **29/-** |
| **3 Valve Short-Wave Screen Grid and Pentode Kit** | **68/-** |

**REPLACEMENT VALVES FOR ALL SETS**

**EUROPA MAINS VALVES.** 4 v., A.C. Types, **A.C./H.L., A.C./L., A.C./S.G., A.C./V.-M.S.G., A.C./H.P., A.C./V.H.P. (5-pin),** all **5/3** each. **A.C./H.P., A.C./V.H.P. (7-pin), 7/6; A.C./Pens-I.H., 7/6; A.C./P.X.4, 7/3; Oct. Freq. Changers, 8/6; Double Diode Triodes, 7/6; 350 v. F.W. Rect., 5/6; 500 v. F. W. Rect., 6/6; 13 v. .2 amps. Gen. Purpose Triodes, 5/6; H.F. Pens and Var.-Mu H.F. Pen., Double Diode Triodes, Oct. Freq. Changers, 7/6** each. **Full and Half-Wave Rectifiers, 6/6** each.

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*(Continued from column 1.)*

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**1 WATT** resistances, Polar N.S.F. **4d.** each, **3/9** dozen. All sizes up to 2 meg.

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**VOLUME** controls. American C.T.S., finest made, divided spindles. Length 2½". With switch, 2,000, 5,000, 10,000, 25,000, 100,000, 250,000, 500,000, and 1 meg., **2/6** each. Wire wound, 5 watt (less switch), 2,000, 5,000, 10,000, 20,000, and 25,000 ohms, **2/-** each.

**24 MFD.** can type, electrolytics, 450v. working, **1/-** each.

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**TUBULAR** wire-end non-inductive paper condensers. All sizes up to 0.1, **5d.** each, **4/9** dozen.

**ENERGISED** speakers, Plessey 6" cone, 1,500 ohms field, **5/11** each.

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**RAYTHEON** first-grade valves. Largest stockists, all types in stock, including glass series, glass octal series, metal series, bantam series, single-ended series, and resistance tubes, all at most competitive prices; send for valve lists. All orders must include sufficient postage to cover. Hours of business: 9 a.m.-6 p.m. weekdays. Saturday, 9 a.m.-1 p.m. Please write your address in block letters.

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**B.I.** 4 mfd. Resin Oil-filled Condensers, 450v. working, 2/3 each; .1 mfd., .25 mfd. 1,000v. working, 2/3 each.

**NEW** 1/16 h.p. Induction Motors, 220 A.C., 1,430 Revs., Ball Bearings, 25/-; Townsend Buzzers, H.F. Buzzers, 4½v. to 10v., 3/6; Cossor Valves, 210 H.F., 210 Detector, 2/3; Microphone Carbon Inserts, **1/3**, Microphone 80-1 Transformers 1/9. Tapped Resistance 550 ohms 2/9. 350 ohms 2/3. London Central Radio, 23, Lisle Street, W.C.2, Gerrard 2969.

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**"H.A.C."** one-valve Short-wave Receiver, famous for over 5 years, now available in kit form; complete kit of precision components, accessories, full instructions, 12/6, post 6d., no soldering necessary; descriptive folder free on request.—A. L. Bacchus, 109, Hartington Road, S.W.8.

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