## A WIND-DRIVEN GENERATING PLANT

See page 220

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Edited by F. J. CAMM

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# Practical Wireless

and

# ★ PRACTICAL TELEVISION ★

6D.

EVERY MONTH

April, 1941.

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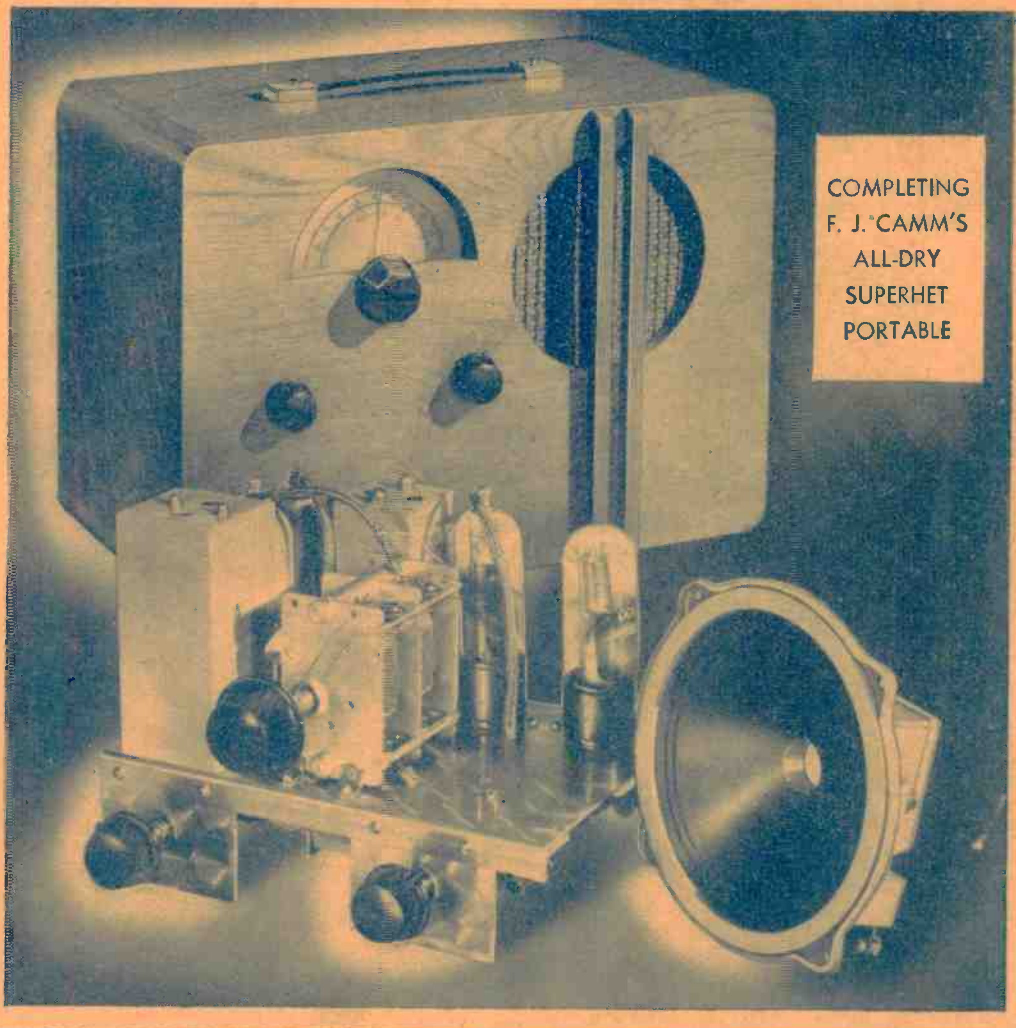

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EDITED BY
F. J. CAMM

Staff:
FRANK PRESTON.
L. O. SPARKS.

# COMMENTS OF THE MONTH

By THE EDITOR

## The Position of the Constructor

THERE seems to be an impression that during the war it is illegal to build a wireless set at home. I do not know the source of this erroneous idea, which seems to have permeated even official quarters. I received a letter the other day from a reader who wished to build a set and he applied for a wireless receiving licence. He was informed at the Post Office, after he had explained that it was for a home-constructed receiver, that "It is illegal to build sets during the war." That, of course, is untrue. It may be that the Post Office official had confused the ban on amateur transmission, and on the construction of amateur transmitters during the war, for the Post Office confiscated all amateur transmitters towards the latter end of 1939, and licences have been suspended and the issue of new licences abandoned for the duration of hostilities.

Let me make it perfectly clear that there is no ban on home-constructed receivers. In certain directions there is a component shortage, because manufacturers are producing chiefly for export, and only a small proportion of their output reaches the Home market. Quite naturally this has given a fillip to home construction, and receivers are now being built at home in greater numbers than before the war. There have been calls from all over the country for the various blueprints we issue, and our range covers nearly every requirement. It is wise, before deciding on a receiver, to ascertain whether the components are available. Most of them are, but certain components are in great demand by the Services, and very properly they must be supplied first. Even in these cases, the worst that can happen is that there may be a delay in delivery, and especially in connection with certain types of valve. But, generally speaking, the supply of components is good, and stocks adequate to meet requirements. I would advise readers, however, to keep to the simpler types of set, which do not call for the more elaborate types of modern valve. If other readers have been informed that there is a ban on home construction during the war, I should be glad if they could write to me, so that I can take up the matter in appropriate quarters.

## Queries

MANY readers do not comply with our query rules, and it is now necessary to stress them. In the first place, every query must be accompanied by a coupon cut from the current issue, and a stamped addressed envelope if a postal reply is desired, otherwise the reply will appear in the columns of this journal.

We do not, for obvious reasons, supply circuit diagrams of complete multi-valve receivers, nor do we suggest alterations or modifications of receivers described in contemporary journals. Similarly, we do not undertake to suggest alterations or modifications to commercial receivers. We do not undertake to answer queries over the telephone, nor to grant interviews to querists.

Another important point—please be brief, and get down to the point of your query at once. Discursive letters take time to read, and interfere with the promptitude of our service. We make every endeavour to reply by return of post.

It would also help us if readers would write their queries on one side of the paper only.

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## Repair Work and the Purchase Tax

WE have received a large number of enquiries from dealers asking for a definition of their position in relation to the Purchase Tax. Now that the manufacture of wireless sets for the home market is restricted, and the supply of raw materials controlled, a large business is being done in reconditioned and second-hand receivers, and it was not clear as to whether dealers would have to pay the Purchase Tax on goods thus offered for re-sale. If they were liable they would have to register as manufacturers. Their position is defined by Section 41 of the Finance (No. 2) Act, 1940, which states that manufacture is the making of goods or the performing of any process in the course of making goods. It does not, therefore, cover repair work, nor the reconditioning of an article, provided that the operations performed do not really amount to the making of what is virtually a fresh article.

It follows that liability to register as a manufacturer does not arise from reconditioning and repair work whatever the extent of the turnover, but liability to register as a wholesaler may occur if the reconditioned or repaired goods, being the property of the repairer, are intended for re-sale to retailers, but not if intended for re-sale to customers.

Sales by registered persons are not exempt from tax on the ground that the goods concerned are second-hand or reconditioned, but no tax is chargeable on sales of such goods where transactions are between retailers and their customers, and the same applies if a registered firm is dealing with the goods in its capacity as a retailer.

# Problems of Amateur Receiver Design—8

## The Most Suitable Arrangements for Detector and Second-detector Circuits: Simple A.V.C. as Applied to a Superhet.

By FRANK PRESTON

IT has often been stated that the detector stage is the most important in the whole receiver, and there is full justification for this statement. It is the "bridge" between H.F. and L.F.; in consequence, any lack of efficiency is clearly shown in the output from the speaker. As far as "straight" circuits are concerned, the detector circuit has become practically stereotyped, but even with this type of circuit there are many points which require careful attention, particularly when the set is intended for short-wave or all-wave use.

### Leaky-grid and Power-grid

Leaky-grid detection is almost universally employed. It is the most efficient and also the most convenient when reaction is to be provided. And reaction is practically essential in the interests of both sensitivity and selectivity if there is not more than one H.F. stage. Anode-bend detection can be ruled out for broadcast-reception purposes, for it has no special value in a modern receiver. Power-grid detection is often considered better than leaky-grid when good quality is desired, and when there is a good deal of pre-detector amplification; but this is merely a modified application of leaky-grid, where the values of the grid condenser and leak are reduced, and where a comparatively high voltage is applied to the anode of the detector valve. Many of the advantages attributed to power-grid are not realised in normal practice, due to the fact that there is insufficient H.F. amplification to load the detector, and because it is not a practical proposition to apply a sufficiently high anode voltage and at the same time provide a high enough anode load and effective decoupling.

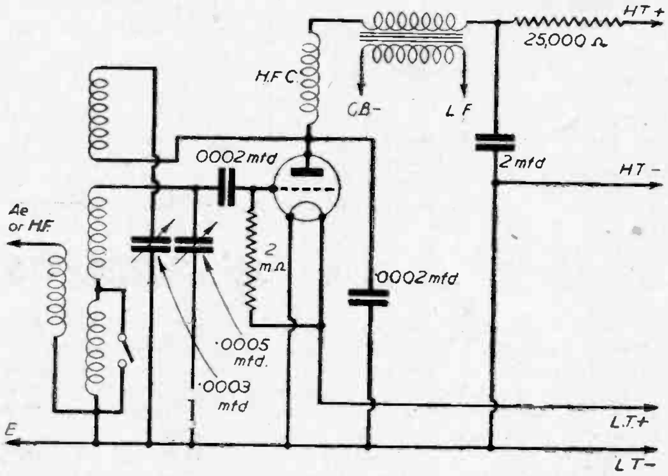



*Fig. 1.—The usual arrangement of leaky-grid detector with reaction. It is most suitable for nearly all "straight"-circuit receivers.*

The leaky-grid detector, with reaction, takes the form shown in Fig. 1. It will be seen that values of .0002-mfd. and 2 megohms are assigned to the grid condenser and leak. These are good average values, which cannot be improved upon when using a general-purpose triode or H.F. pentode or tetrode in a broadcast receiver. In the case of a set intended primarily for S.W. reception it is frequently found to be rather better to substitute values of .0001 mfd. and 5 megohms.

### Obtaining Smooth Reaction

Reaction control is by means of a .0003-mfd. variable condenser between one end of the reaction winding and earth; this matter was dealt with in an earlier article of this series when explaining the choice of tuning coils. Provided that a little care is taken in finding the most suitable value of reaction condenser (coil makers generally state the most suitable capacity), and in adjusting the H.T. voltage, it should be fairly easy to ensure a "smooth" control of reaction. That is, the set should break into oscillation almost imperceptibly. If the values are badly chosen there will be a sudden "plop" as oscillation starts and ceases, whilst "reaction overlap" will be troublesome. That means that if, for example, oscillation starts when the reaction condenser is advanced beyond a setting of 85 degrees the condenser may have to be set back to 70 degrees before oscillation ceases. When that is the case it is impossible to use reaction to its full extent without running the risk of the set suddenly bursting into oscillation while listening to a weak signal.

### Pentode or Tetrode Detector

There are various methods of improving reaction control, but if the simple rules given above are applied there is no reason why "artificial" arrangements need be resorted to. It is, nevertheless, nearly always worth while to replace the triode detector shown by a tetrode or H.F. pentode, using the circuit given in Fig. 2. It will be noticed that control of screening-grid potential is by means of a 100,000-ohm potentiometer. In practice, it will be found that the potentiometer acts as a very good additional reaction control, but it should be possible to find an optimum setting from which little deviation will be necessary while the set is in use.

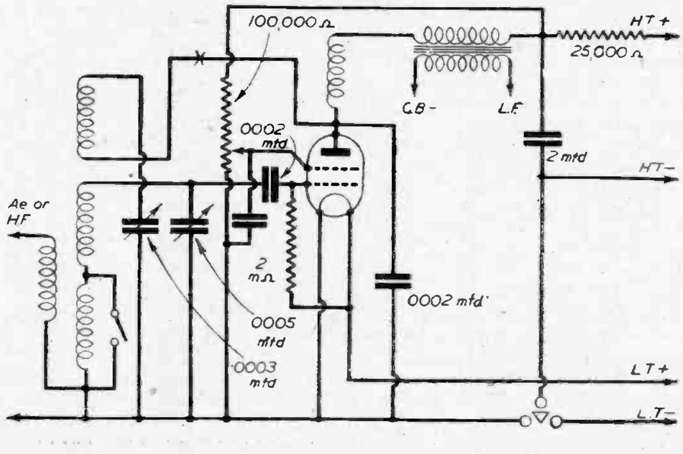



*Fig. 2.—It is generally an advantage to use an H.F. tetrode or pentode as detector, with the connections shown here. Note the three-point on-off switch to isolate the S.G. potentiometer.*

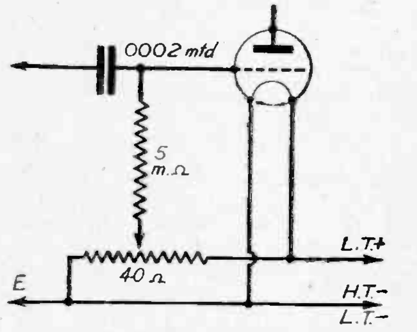



*Fig. 3.—In S.W. sets it is often an advantage to "return" the grid leak to a potentiometer connected across the L.T. supply.*

The best setting is that by means of which smooth reaction can be obtained, and also at which the minimum variation of reaction-condenser capacity is necessary to maintain the set on the verge of oscillation over a complete waveband. Especially when the receiver is used for DX reception, it is highly desirable that the reaction condenser should require to be moved through only a very few degrees while "searching" with the tuning condenser. When there is a wide variation in the setting between minimum and maximum tuning condenser settings, the reaction control has to be operated at the same time as the tuning control to maintain the receiver in its most sensitive condition. Additionally, if the reaction setting has to be altered to any appreciable extent after picking up a signal the tuning will be upset and further careful adjustment necessitated.

### For Short-wave Reception

When dealing with a short-wave receiver there may be some slight difficulty in obtaining the desired smoothness and steadiness of reaction control, even when using a pentode or tetrode detector. In that case, the introduction of a fixed resistor in the reaction circuit at the point marked X in Fig. 2, should be helpful: the most suitable value generally lies between 100 and 250 ohms. This resistor may be useful on the broadcast wavelengths if parasitic oscillation—evidenced by the fact that the reaction condenser does not seem to give complete control—is noticed, but it should not be necessary if the other points referred to have been fully observed, and if the components are properly arranged and spaced.

Another addition which is often an advantage in a S.W. set from which the greatest possible degree of efficiency is desired, is a grid-leak potentiometer as shown in Fig. 3. This may be a pre-set chassis-mounting component of 40 ohms or a fixed one of the type supplied by manufacturers of S.W. components. The latter has a one-third tapping point, and is generally best connected so that the tapping is one-third of the resistance from the positively-connected end. When using it, however, it is worth while to try the effect of reversing the end connections.

## Superhet Second Detector

Automatic volume control can be applied to a "straight" set, but those who wish to employ this refinement will generally build a superhet, with which it can be applied more effectively. The second detector of a superhet may be similar in all major respects to one of the detector circuits already dealt with, except that reaction cannot normally be applied, due to the use of an I.F. transformer not fitted with a reaction winding. It should also be borne in mind that whether the set is a short-waver or a broadcast type the second detector will operate on a comparatively long wavelength; there is, therefore, no need to take the precautions sometimes necessary in a S.W. set of the "straight" pattern.

Since reaction is ruled out, it is better to use a diode or double-diode second detector. This is simpler, does not take any H.T. current, and can be used to supply A.V.C. in a very simple manner. In passing, it should be mentioned that some form of reaction is required should the set be required for the reception of C.W. The best method to adopt in that case is to provide an additional triode heterodyne or oscillator valve coupled to the second-detector circuit: it is scarcely necessary to consider that aspect of the question here, however.

## The Double-Diode-Triode

Although there are many ingenious methods of using double-diode second-detector valves, the average constructor is advised to adopt a simple circuit such as that shown in Fig. 4. It will be seen that a double-diode-triode valve is shown, but the triode portion could be a separate valve individually supplied with heater or filament current. Although values are assigned to the main components, it should be understood that these vary to a certain extent according to the particular valve employed. They are given by the valve maker on the instruction slip provided with the valve. The diode anode marked D.1 serves as the second detector proper, while anode D.2 is for A.V.C. Low-frequency output for the first L.F. valve (the triode section of the two-purpose valve in the circuit reproduced) is developed across the load resistor marked R.1, while the A.V.C. voltage is developed across R.2.

The network comprising resistor R.3, and the two .0002-mfd. fixed condensers forms an effective H.F. "stopper," preventing H.F. from passing into the low-frequency amplifier. Resistor R.4 is a decoupler for the A.V.C. circuit, and would normally be connected to the bottom of the grid coil of the frequency-changer and, through another decoupling resistor, to the lower end of the secondary winding of the I.F. transformer feeding the I.F. valve—the first I.F. valve, should more than one be used.

The resistor marked R.5 serves as a bias resistor for the triode portion of the double-diode-triode valve and also provides a "delay" voltage for the A.V.C. action. That is, it provides a small voltage which is in opposition to that developed across R.2, and used for biasing-back the grids of the controlled valves. The result of this is that the gain of the controlled valves is not reduced until a signal above a certain minimum strength is received. Consequently the sensitivity of the set on weak signals is not reduced, as it would be if no delay voltage were provided.

Of the other resistors shown, R.6 is the anode load resistor for the triode portion of the valve, whilst R.7 is the usual L.F. volume control used to vary the input supplied to the grid of the L.F. triode.

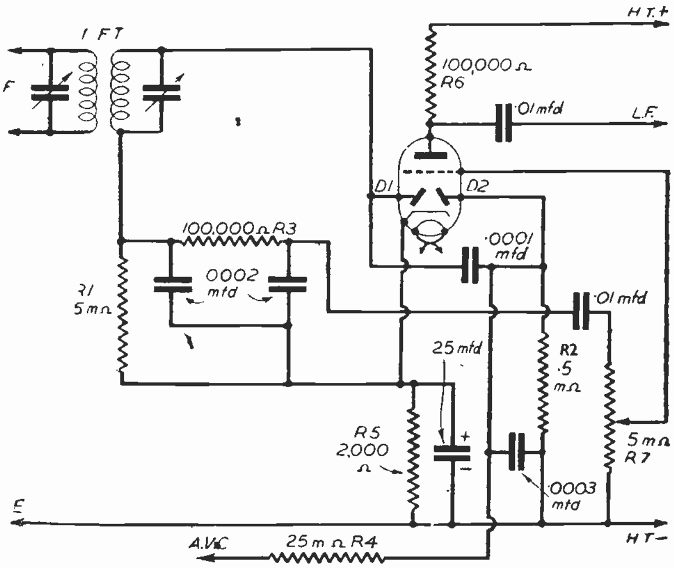



*Fig. 4.—The most suitable all-round circuit for a double-diode-triode used as second detector and A.V.C.*

# Record Results of Broadcast Appeals

It is interesting to note that more than £500,000 has now been subscribed to broadcast appeals since the beginning of the war, and this record figure does not include the first two months of the war when the Sunday night appeals were suspended. The total for the 12 months ending October, 1940, was £481,167, a record for all time, and since then the total has reached £550,903. Appeals in 1936 produced the highest total for a peace-time year with £205,000.

For the first time a broadcast appeal is known to have realised over £100,000, and out of 60 Sunday appeals up to the end of 1940, only 10 have produced less than £1,000. An appeal has been broadcast every Sunday except one last June when the sudden collapse of French resistance made it impossible to give an appeal arranged on behalf of the French Red Cross. Appeals have also been made on Christmas Day, as in peace-time, for Wireless for the Blind; in 1939, £13,642 was subscribed to an appeal by an unknown blind man who was making his second broadcast for the Fund, and Mr. Ernest Bevin's appeal last Christmas has already brought in over £10,170.

## For the Forces

The appeals have reflected many aspects of the war; the majority have been for the relief of distress, and for welfare work in this country, including many on behalf of men and women serving in the Forces, and seamen and lifeboatmen. Special mention must be made of the appeals on behalf of British refugees from abroad and from the Channel Islands and the appeal for the Lord Mayor of London's Air Raid Distress Fund. Appeals have also been made for the relief of distress among the people of five countries allied or friendly to Britain—Poland, Finland, Turkey, Norway and Greece—and two appeals have been made for overseas missionary work.

The restriction of appeals to one each Sunday has often made it necessary to appeal on behalf of a group of charities, but this system has had considerable success and often it has been possible to present a much stronger appeal than could have been made on behalf of any of the individual units. Unfortunately, the three appeals made jointly on behalf of all the Voluntary Hospitals in Great Britain and Northern Ireland have not produced enough money to justify the experiment, and attempts are being made to find a better way of persuading listeners to support the voluntary hospitals.

The appeal made by "Mac" in the Children's Hour in November, 1940, is in some ways the most remarkable of all. He asked for £1,500 for one mobile X-ray Unit, and was sent over £14,800, which is being handed over to the Red Cross for the supply of units in different parts of the United Kingdom.

Apart from these direct appeals many talks and other broadcasts have been given in support of appeal campaigns in the Press and elsewhere, in particular the Red Cross. The B.B.C. has organised its own competition in aid of the Penny-a-Week Fund. Many announcements have also been broadcast about the material needs of comforts funds both for the Forces and Civil Defence Services, and for the civilian population.

# Piezo-electric Crystals

## How Specially Cut and Ground Quartz Crystals are Used in Pick-ups and Microphones, and Also to Replace Oscillatory Circuits

THE use of quartz crystals in radio work has extended very rapidly since it was found a few years ago that suitably cut crystals could be made to perform a number of useful functions. Quartz crystals—often described as piezo-electric crystals—must not, of course, be confused with the detecting or rectifying crystals used in conjunction with a cat's whisker for receiving purposes. They are entirely different in every respect, and the name piezo-electric means pressure-electric, the prefix being derived from the Greek. One important property of these crystals is that a potential is developed between two faces if a pressure is applied across those faces. Conversely, if a potential is applied between the faces a pressure of mechanical stress is set up.

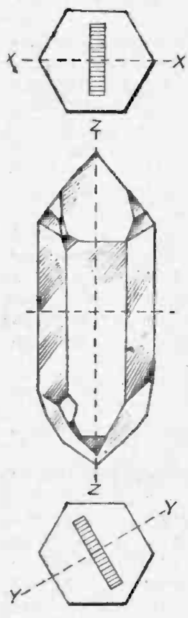



*Fig. 1.—This illustration gives an impression of the general appearance of an uncut quartz crystal, while the meaning of X and Y cuts is conveyed by the two cross-sections.*

### Mechanical to Electrical Vibration

Thus it is that by applying a fluctuating pressure across the faces, a varying potential or voltage can be obtained. This property is employed for so-called crystal pick-ups and crystal microphones. A suitably-cut crystal is mounted between two metal plates, one of which is attached to the stylus or to a diaphragm; as the stylus or the diaphragm is set into vibration a variable voltage is developed which can be applied to an amplifier and thence to a transmitter or loudspeaker. It will be seen from this that the crystal behaves in almost the same manner as the electro-magnet of a conventional pick-up or electro-magnetic microphone.

### Fixed-tune Oscillatory Circuit

These quartz crystals have another, and probably still more important application. If they are cut in a special manner and to a precise thickness, they have a natural vibration of a certain number of cycles or megacycles a second. In other words, a crystal can be cut which has, in effect, the same properties as an oscillatory circuit comprising a coil and condenser. By varying the thickness of the crystal the natural frequency can be altered. We will show a little later how this property is put to use in a transmitter.

It is not only in transmitters, however, that the oscillatory property can be employed, for it is possible to use a suitable crystal in a receiver of the superhet type. It is used in such a way that it allows the passage of signals of one particular frequency, while rejecting all others. Consequently, the so-called "crystal gate" is primarily suitable for use at the end of an intermediate-frequency amplifier. The crystal is more accurate in its discrimination than is even a first-class tuned circuit, and by its use it is therefore possible to ensure an extremely high degree of selectivity.

*by The Experimenters*

### Crystal "Wafers"

The crystal itself is not actually a crystal as this term is generally understood, but is a thin slice cut from a quartz crystal, the general appearance of which is as shown in Fig. 1. The slice or wafer which is cut from the crystal is usually somewhere about an inch in diameter or square, although this dimension is not important. After cutting, it is of paramount importance that the crystal wafer be ground and polished so that the faces are absolutely flat and perfectly parallel to each other. It is equally important that the thickness be exactly in accordance with a figure which can be calculated when it is known to what frequency the crystal should tune and in what manner it was cut from the original crystal.

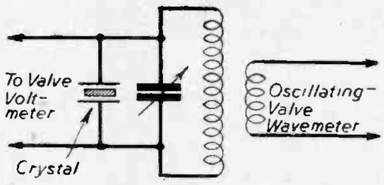



*Fig. 2.—A simple method of checking the natural frequency of a crystal.*

There are three main axes to consider in connection with quartz crystals, and these are marked X, Y and Z in Fig. 1. The Z axis, which runs from point to point, is called the optical axis (quartz is used for a variety of optical purposes) but this is not of direct importance in radio work. The other two axes are at right angles to the optical axis and run through the corners of the hexagon, and at right angles to two parallel faces. An X-cut crystal is therefore as shown at the top of Fig. 1, where the edge of the crystal is shown shaded; a Y-cut crystal is as shown at the bottom of Fig. 1.

### Frequency-thickness Calculation

In order to calculate the required thickness it is necessary to know whether an X or Y cut is to be employed. It is then known—as a result of experimental work—that the thickness of an X-cut crystal should be

$$\frac{2.86 \times 1{,}000}{\text{frequency}},$$

where the thickness is in mm. and the frequency in kc/s. The calculation is similar for a Y-cut crystal, except that the figure 2.86 is replaced by 1.96. It will be seen, therefore, that a Y-cut crystal for, say, 3,000 kc/s (100 metres) would require to have a thickness of

$$\frac{1.96 \times 1{,}000}{3{,}000},$$

or .653 mm. approximately.

In practice it is not unusual to employ a cut different from either of the "standard" cuts referred to, since there are certain objections to both of these. For example, the frequency of an X-cut crystal becomes less as the temperature rises; the frequency of a Y-cut crystal, on the other hand, increases slightly with a rise in temperature. An advantage of the Y-cut—which is the more widely employed of the two—is that oscillation is more readily maintained with it. Unfortunately, however, this advantage leads to a disadvantage in that the crystal is more liable to parasitic oscillation.

Manufacturers of crystals for radio work have found, from experience, angles of cut which tend to confer the advantages of both of the cuts referred to. Thus, by choosing particular angles in relation to the crystal faces and to the optical axis, they are able to cancel out the so-called temperature coefficient. It is because of the large amount of accurate and painstaking work entailed, and because any crystal having the slightest flaw must be rejected, that the cost of frequency-control crystals is comparatively high.

### Frequency Measurement

Having cut a crystal, it is possible to measure its natural frequency by using a circuit on the lines of that shown diagrammatically in Fig. 2. It will be seen that a tuning circuit is coupled to the output from an oscillating-valve wavemeter and is in turn connected to a valve voltmeter; the crystal is in parallel with the tuning circuit. When the tuning circuit and wavemeter are tuned to the frequency of the crystal there is a sharp dip on the scale of the valve voltmeter. This is

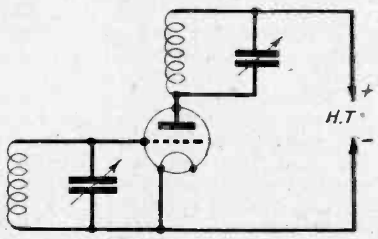



*Fig. 3.—The standard tuned-plate tuned-grid circuit of a simple transmitter oscillator.*

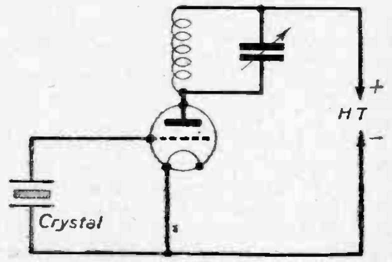



*Fig. 4.—This crystal-controlled circuit should be compared with the oscillator circuit shown in Fig. 3.*

because the crystal then absorbs energy from the tuning circuit; the electrical energy is used in making the crystal vibrate mechanically.

### Frequency Control

It is now possible to see how the crystal can be used for controlling the frequency of a transmitter. Fig. 3 shows a simple valve oscillator of the type known in transmitting parlance as tuned-plate tuned-grid, and the valve will oscillate only when the two tuning circuits are brought into resonance. The "reaction coupling" is actually effected by the self-capacity of the valve itself. This type of oscillator was fairly widely used by amateur transmitters before the outbreak of war, from which time all amateur transmission has, of course, been banned.

Now look at Fig. 4, and compare it with Fig. 3. With the exception that the crystal replaces the grid tuning circuit, the two arrangements are the same. It will be seen, therefore, that if the plate circuit is tuned to the crystal frequency the valve will oscillate, but if the tuning is shifted, oscillation will cease. Thus it is that the crystal effects complete control; if tuning were upset for any reason the valve would cease to oscillate and, therefore, transmission would cease. And since the frequency of the crystal remains absolutely constant, to all intents and purposes, the frequency of the transmitter cannot alter.

If it were desired to transmit on any other frequency, a different crystal would have to be fitted in place of that already in use. In practice it is not difficult to use one transmitter for two or three different frequencies by having a suitable number of crystals which can be brought into circuit in turn by means of a rotary switch. Crystals are often made in "plug-in" form so that, in any case, it is simple enough to change from one frequency to another. Another method of working on more than one frequency is by the use of so-called frequency-doubling circuits.

It should be mentioned in passing that the simplest method of tuning a transmitter fitted with a crystal is by moving the knob of the tuning condenser until the needle of a milliammeter in the anode circuit of the oscillator valve moves back; a sudden drop in anode current indicates that the valve is oscillating. Another practical point concerning the circuit shown in Fig. 4 is that it would be necessary to use a grid-leak in order to bias the grid of the valve.

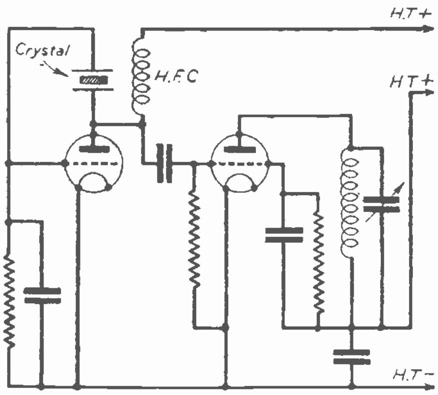



*Fig. 5.—A modified and improved form of the arrangement shown in Fig. 4.*

### A Better System

Another method of using a crystal control in a transmitter is shown in Fig. 5, where it will be seen that the crystal is electrically isolated from the oscillator by means of a valve; it is, nevertheless, virtually in the grid circuit of the second valve shown, which has a tuned-anode circuit. This is a better practical proposition than the simpler arrangement previously mentioned, and is one which is fairly widely employed in commercial radio work.

It is scarcely necessary to mention that crystal control is almost universally employed for telephony transmitters throughout the world, since it is the only ready means of maintaining an absolutely steady frequency regardless of aerial and their conditions. Moreover, the tuning is perfectly sharp without there being any danger of spoiling quality by "losing" part of the side bands. When amateur transmitting was permitted, the applicant for a transmitting licence had to prove that he had a suitable crystal or alternatively an accurate wavemeter; the crystal was clearly the more suitable. At the commencement of the war, crystals were among the important components which the Post Office took in charge until transmitting is again permitted. This applies to crystals for use on high frequencies and not necessarily to those which are intended for use in a superhet. I.F. amplifier or to those used for pick-ups and other corresponding instruments. Such crystals can still be obtained.

# ITEMS OF INTEREST

### U.S. Radio Amateurs and War Department

RADIO amateurs in the U.S.A. may communicate now with station WAR, the War Department's radio net control station, during certain specific periods. The programme will expand activities of the Army amateur radio system, which would be utilised in an emergency. Station WAR will use a 4,025 kilocycle frequency every Tuesday, Wednesday, Thursday and Friday between 7 and 8 p.m., E.S.T., to communicate with amateurs on the 3,500-4,000 kilocycle frequency band.

### Canada's New S.W. Station

THE Canadian Broadcasting Corporation's new 7.5 kW short-wave station, recently completed at Vercheres, Quebec, at a cost of approximately £15,000, is intended to serve the French-speaking communities in remote areas of the Quebec Province which are outside the service area of the existing network of medium-wave stations.

Licence fees provided $2,906,605 of the C.B.C.'s total income of $3,752,061 for 1939-40. Commercial broadcasting accounted for $700,867.

### To Foil Saboteurs

A SPECIAL guard house, 75 feet high, is being installed on the broadcasting transmitter grounds of Stations WLW and WLWO, at Mason, Ohio. The house is being built as a protection against saboteurs, and will be manned constantly. Several months ago, the equipment in WLWO's tuning house, used to switch the international station from one frequency to another, was destroyed in a fire of undetermined origin. Since that time, the transmitter grounds have been patrolled 24 hours a day by a staff of 12 guards.

Also following the fire, officials of the broadcasting division of the Crosley Corporation, owners of the two stations, installed a high metal fence around the transmitter grounds.

The Mason broadcasting site contains the most powerful broadcasting equipment known to exist. Station WLW, which operates at a regular power of 50,000 watts, can be stepped up to 500,000 watts for experimental purposes, under the call letters W8XO. Station WLWO, its international short-wave subsidiary, operates with 100,000 watts input power.


*Radio amateur, Private N. C. Richardson, sending a message, while Major Davis Talley checks it in the WAR receiving station in the United States.*

# Negative Resistance

## A Simple Explanation of a Little-used Term Met With in Amateur Radio

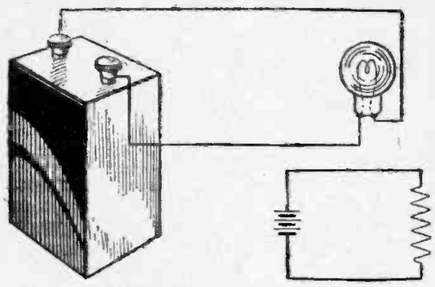


*Fig. 1.—A direct current supply across a resistance.*

IN certain textbooks, and also in various papers on electricity, the term "negative resistance" occurs, and it would appear from correspondence that this term causes a certain amount of confusion in the mind of the non-technical listener. It would seem that this is because the term "positive resistance" is seldom seen, and it is not a simple matter, therefore, to compare two opposite types of resistance in order to arrive at a decision concerning one of them. It is well known that when a voltage is applied to any conductor there is a restraining force at work endeavouring to prevent the flow of electricity. This restraining influence will vary with the material being used and the form in which that material is arranged, and it is practically always referred to as "resistance"—but actually it should be referred to as "positive resistance," if the flow of electricity is a steady unvarying current. Thus in Fig. 1

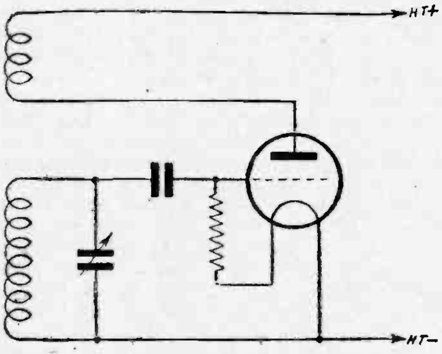



*Fig. 3.—Circuit diagram showing a standard reaction arrangement, the degree of coupling between the coils being variable.*

we see a battery joined to a resistor, which may be the filament of a valve or any similar device, and the current flowing through that resistance will be a steady, unvarying current of a certain value determined by the voltage of the battery and the size and kind of material from which the resistance is made. This is an example of "positive resistance."

### A.C. Instead of D.C.

The supply of current from a battery is, of course, what is known as a direct current, and is flowing always in one direction. If, however, instead of using this type of supply we use an alternating supply, what happens to the current flow when the changes in direction and polarity take place? It has already been explained in these pages that an alternating current starts from zero, rises gradually to a certain positive value, and then, at the same speed, drops back to zero, passing on to a negative value and again returning to zero. Therefore, if an A.C. is applied to a pure resistance, there will be a gradually increasing difference of potential between opposite ends with a periodic change in polarity, and there will be a fixed relationship between the potential difference, and the voltage, and the value of the resistance, just the same as with the direct-current supply. If, however, instead of using a pure resistance we use an ordinary arc, and superimpose an A.C. supply on a D.C. supply applied to that arc, we find a different state of affairs. Firstly, the alternating current will always flow through the arc in the opposite direction to that in which the alternating difference of potential is acting, because the total current will be reduced owing to the fact that at certain moments currents are flowing in an opposite direction. From this it may be seen that instead of an arc consuming energy in a circuit of this nature and thus tending to stop the flow of A.C., it actually encourages the A.C. circuit and supplies energy.

### The Duddell Circuit

Now look at Fig. 2, which shows an ordinary arc circuit across which is joined an oscillatory circuit (a coil and condenser in series). If the resistance is adjusted until the arc is struck there will be a steady flow of current through the arc; but a steady current cannot flow through a condenser, and thus it was discovered by Duddell that an alternating current is set up in the circuit formed by the arc and the coil and condenser, and this is due to what is known as the negative resistance of the arc. Due to this fact also, it is found to be impossible to strike an arc from a source having the exact voltage required by the arc itself, but it must be connected to a much higher source of supply with a resistance in series.

### The Ordinary Reaction Circuit

The ordinary valve as used in a wireless receiver also has the ability to provide negative resistance under certain conditions, and the most popular arrangement is generally referred to as the reaction circuit. By referring to the ordinary detector valve circuit (Fig. 3) and comparing it with the points just mentioned, we find that if the anode is joined to the positive terminal of a battery (or source of direct current), and the heated filament is joined to the negative pole of that battery, there will be a steady direct current flowing from filament to anode inside the valve. Ignoring, for the time being, the effect of a potential on the grid, if an increase in anode current is required it will be necessary to increase the anode potential, and thus in this condition the valve offers a positive resistance to A.C. We know, however, that the potential on the grid can have a very marked effect on the flow of current in the valve, and for this reason the L.F. valve is biased to reduce the anode current. Thus an increase in anode current may be obtained (without varying the anode voltage) by modifying the grid potential, but if this applied potential is of a certain value it will be found that the increase in current may be obtained and yet the anode potential may be decreased. In this condition the valve offers negative resistance, and the conditions are satisfied by connecting an inductance coil in both anode and grid circuits and arranging these in such a manner that there is a degree of coupling between the two inductances. The degree of negative resistance is governed by the degree of coupling between the two coils, and in theory it should be possible to adjust this coupling to such a point that the resistance could be reduced to zero, but various small fluctuations in the ordinary valve circuit prevent this ideal from being obtained. As the degree of negative resistance increases, however, the changes in anode current due to an applied E.M.F. in the grid circuit will grow, and thus whereas, without the negative resistance effect, a weak signal in the grid circuit would produce no change in anode current, we are enabled, with the aid of this effect, to obtain changes in anode current from very weak signals and thus build up the strength of an otherwise inaudible station. This is, of course, one of the most valuable properties of the reacting detector valve, and the effects are well known to every listener. With reaction it is possible to hear many stations which are otherwise inaudible.

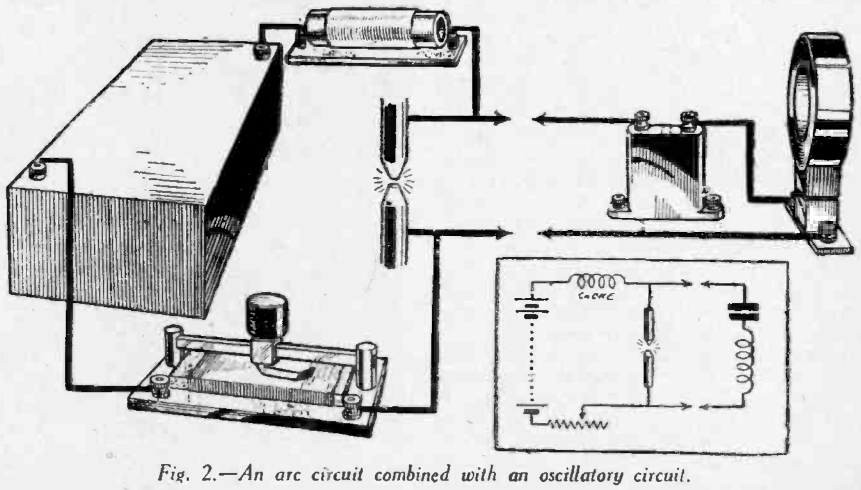


*Fig. 2.—An arc circuit combined with an oscillatory circuit.*

# ON YOUR WAVELENGTH

By Thermion

## Dance Band Advertisement

ONCE again I raise my voice in protest against the blatant manner in which dance-band leaders are allowed to advertise themselves at the beginning and end of their programmes. At the end of the programme the conductor will come to the microphone and tell you, as if you didn't know, that you have been listening to Bill Brown and his band. He will inform you in a soft ululating voice that you will hear him again on such-and-such a date, you lucky people! Then the lady crooner will come to the microphone and bid you good night, and tell you that you have been listening to so-and-so's band. Often the B.B.C. announcer, at the end of all this, also will tell you that you have been listening to so-and-so's band, whilst the band triumphantly plays itself off with a verve which suggests that it has just won the Battle of Waterloo over again.

The B.B.C. has always set itself against free advertisement over the air. Why does it permit these dance-band leaders, performing a very elementary task, to advertise themselves in this persistent way? If their bands play in easily-distinguished style, it should not be necessary for them to announce their names at all. The answer, therefore, must be that as you cannot tell one band from another, it is necessary for the announcer to impress it upon you, as well as the lady crooner, and the dance-band conductor. If dance-bands were performing some really clever and intricate piece of work, one can understand them being anxious to collect some credit, but when their turn merely consists of a musical *mélange* or montage of tripey Tin Pan Alley tunes, I should have thought that any self-respecting citizen would have been anxious not to have had his name associated with such drivel. I commend these points to those who arrange programmes at the B.B.C.

Another point somewhat relevant. When I listen to the news I do not care who is reading it. I do not wait for my favourite announcer, any more than when I have a meal at a restaurant I insist upon being served by a particular waiter. I suggest, therefore, that the B.B.C. discontinues the practice of allowing announcers to introduce themselves by saying "This is the news, and this is Tom Smith reading it." I suppose that some of the announcers at some time must have got together and insisted that they have some measure of the credit. They want to be in the limelight. It ought to be stopped, even though it may offend their doting relatives, who sit at home, whilst their loved one is announcing, with looks of seraphic sublimity upon their otherwise vapid and vacuous countenances.

## Cycling Broadcasts

I AM pleased to note, as an old cyclist, that the B.B.C. is devoting considerably more programme time to cycling matters. I hope they bring to the microphone real cycling authorities such as Frank Urry, "Wayfarer," Percy Brazendale, and others of similar lifelong experience. Each of these men has been cycling all his life for the love of the pastime. They are free from commercial interests, and could bring richness of experience, and wealth of anecdote as flavouring essences to their talks. The sport of cycling should not be given programme space. It interests at the most 30,000 people in this country, whereas there are 12,000,000 cyclists. The part cannot be greater than the whole.

## Songs Off the Radio

ACCORDING to an announcement made a few weeks ago, 40,000 of America's most popular song-hits have been barred from 650 radio stations in America owing to a dispute over royalties. The radio stations have put the bar up to the music-mongers of Tin Pan Alley because of the dispute between the American Society of Composers, Authors and Publishers, and Broadcast Music Incorporated. Apparently the broadcasting industry decided that they were being charged too much, for they contributed over a million pounds in royalties in 1939, and were threatened with a further rise by the music-mongers. It was to meet this cartel that the B.M.I. was formed. The latter announced that they would pay composers on the basis of 1 per cent. per performance per station. This would mean that if a song is played on 100 stations once in a day the composer would receive about 5s. This, in my view, is far too much, considering that it cannot take more than a couple of minutes to write the words and music of most of the songs. The real difficulty is, of course, that each piece of musical tripe coming from Tin-Pan Alley is written and composed by Bill, Al, Ed, Lou and Jol somebody or the other, and each of these wants a rake-off. However, during the strike, the broadcasting companies did not receive any protests from irascible fans of the so-called composers.

I wish that a somewhat similar situation could arise in this country, for I am quite certain that the B.B.C. is being used directly and indirectly as a vast advertising organisation for music publishers. And why is it that jazz music seems to attract the low orders of mentality?

## Is It the Greatest Flop?

I DO not quite agree with an article in a Sunday newspaper some weeks ago that the B.B.C. is "the biggest flop of the war." During 1939 the B.B.C. spent £4,500,000 of our licence money. The writer of the article asks whether we are getting value for our money, and if not, he blames Sir Allan Powell, chairman of the B.B.C.; Mr. B. E. Nicolls, controller of programmes; Val Gielgud, Director of Drama; John Watt, Director of Variety; and Sir Adrian Boult. He says that on every side the British programmes are criticised, laughed at, and ridiculed by public figures, and by ordinary men and women. Its programmes are neither uplifting nor entertaining. They are consistently dull, and even the dullest is marred by repeated blunders of the worst psychological kind. They must know, the writer thinks, that the B.B.C. has become the laughing stock of the public; scores of music-hall jokes make it absolutely certain.

I think there is general dissatisfaction with the programmes, and I think that we could do with a change of personnel at the B.B.C. Some fresh blood with some fresh ideas, so to speak. Whilst I do not like the work of Val Gielgud, John Watt, or Sir Adrian Boult, I am quite prepared to believe that others do, but I do not see why I am not entitled, during some part of the year, to have people in their positions who will provide me with the sort of stuff I do like. I am entitled to my turn. If a particular theatre is running repertory and I do not like the cast, I do not go again. With the B.B.C. you have to put up with their radio repertory company, if I may continue the metaphor. Of course, you must have a permanent staff behind the programmes, but in view of the fierce criticism of the B.B.C. during recent years, some changes ought to be made in the programmes and/or the personnel, to see if the public is better served and better pleased.

## More Accent

"You-ah now about to he-ah"
A minatory voice,
So didactic thy pronouncements,
I would cheerfully rejoice
If some other task employed thee,
And you spoke not in the mike,
And some other voice, less "culshawed"
Spoke as lowbrow listeners like.

Can it be that you, mistaken,
Fancy that it proves you're "class"?
Not at all, for our reaction
Is to dub you "silly ass."
Many millions daily mock you,
At your verbal swanking scoff;
When they hear you start announcing
What's their comment? "Switch it off!"

Brother, then—or is it sister?—
Put a sock in it, we pray,
For at times we miss the "item"
Whilst your voice we "fade away."
"Minis-tah of Agri-culshaw"
Only fills us with disgust;
Try, do try, to speak in English,
If announce again you must.

"TORCH."

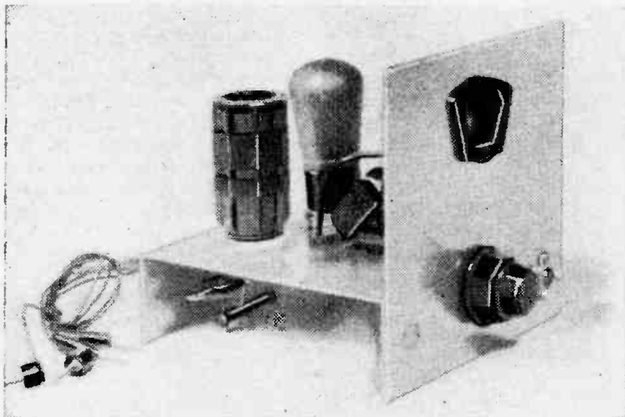
## Our Roll of Merit

*Our Readers on Active Service—Thirteenth List.*

A. Hannaford (L/Cpl., R.E.), Chester.
L. A. C. Gray (R.A.F.), Fife, Scotland.
R. Baker (Cpl.), Lanarkshire.
E. Howgate (Gnr., R.A.), Nottingham.
J. F. White (Seaman, R.N.), Bute.
T. I. Bowen, (Cpl., R.A.F.), Yorks.
C. L. Redshaw (A.C.2, R.A.F.), Kent.
G. Hazelwood (Gnr., R.A.), Grays.
W. G. Webb (Sapper, R.E.), Palestine.
S. Young (Driver, R.A.S.C.), Home Forces.
W. A. Taylor (L.A.C., R.A.F.), Kent.

# A Small Frequency-meter

## A Description of a Handy Unit for the S.W. Listener



*This view of the completed unit gives a good idea of its neat appearance.*

IT is surprising that only a small number of listeners possess a frequency meter as part of their equipment. Even amateurs in the good old days seemed to lack this item—almost a necessity in their case. After handling a good frequency meter you begin to wonder how you managed without one.

The accompanying photographs show a small frequency meter recently constructed by the writer. This was built up on two old pieces of aluminium, which already had a few holes in them, but with careful planning the components were made to cover these.

### Component Values

The unit is really the same as a one-valve short-wave receiver, only in this case a fixed condenser of .0002 $\mu$F capacity takes the place of the more usual variable reaction condenser. This keeps the unit oscillating whatever the position of the tuning condenser.

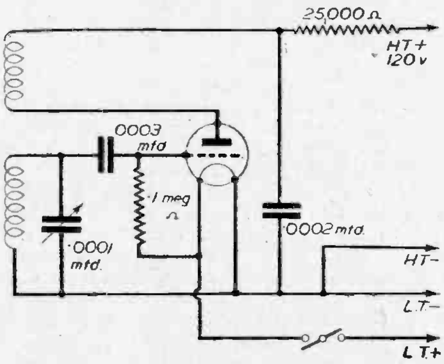
A resistance of about 25,000 ohms takes the place of the H.F. choke normally found in the anode circuit; one end of this being taken direct to H.T.+.

To keep the tuned circuit more stable a low L./C. ratio is necessary, and so a .0001$\mu$F fixed condenser was joined across the tuning condenser of the same capacity. This was afterwards found to offer no advantages, and has since been removed.

An Eddystone "White-spot" coil is used, and this covers roughly 75 to 155 metres, giving harmonics on all the short-wave bands.

### Constructional Details

It is quite possible that an old chassis and panel, which can be utilised for the assembly, will be found in the spares-box. Very little space is required for the components mentioned and, owing to the simplicity of the wiring, the unit can be made very compact if so desired. Low-loss valve-holders were used and as these are of the "Frequentite" type, care should be taken when tightening their fixing bolts.




*Theoretical circuit diagram.*

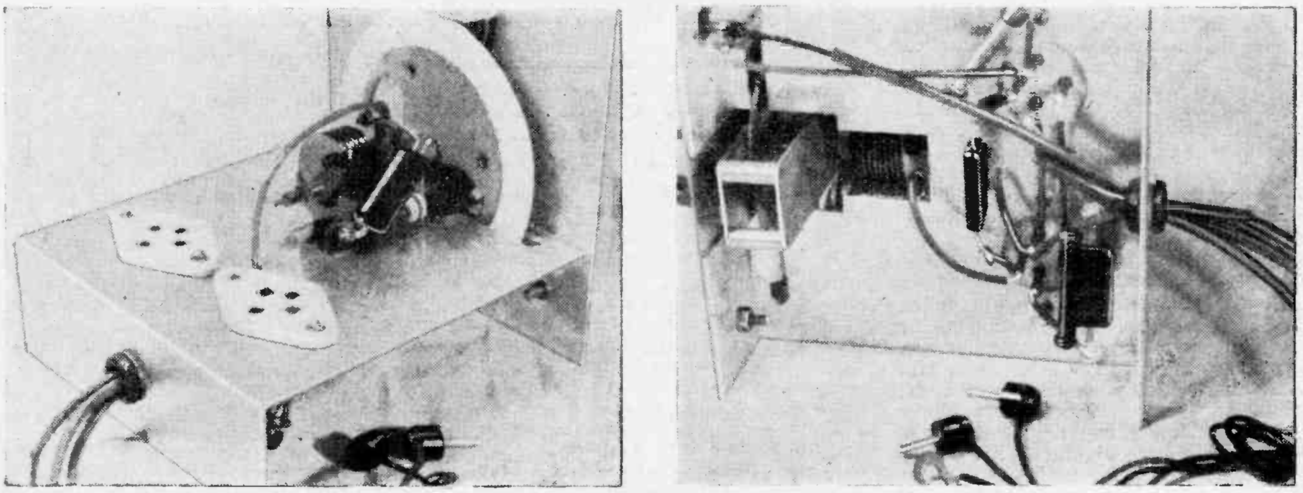
The chassis is of one piece, the front and rear runners being formed by bending over at right angles the edges to a depth of approximately 2½in. The panel bolts straight on to the front runner, therefore it is held perfectly rigid without the necessity of using brackets. A suitable size for the chassis would be 6in. by 6in. by 2½in., whilst the panel need only be 6in. by 8in., though this will depend on the type of slow-motion drive employed. If a rubber grummet is available, it is advisable to use it in the hole drilled in the rear runner for the leads, to remove any possibility of them being frayed or cut by the metal.

With a meter of this type, it is necessary to make all wiring as rigid as possible, and to see that the connections are perfectly secure. Any excessive movement of parts or wiring can upset the calibration; for the same reason the valve or operating potentials should not be altered once the meter has been checked and graphs made.

### Operation

With the batteries connected this wavemeter is all ready for use. Tune in on your receiver a station of known wavelength, say 20 metres, and rotate the dial of the unit, starting from the low wavelength end of the scale. The fourth harmonic will be heard first when the frequency meter is tuned to 80 metres (i.e., four times 20 m.= 80 m.). Next, the fifth harmonic will be heard at 100 metres, and so on. By repeating this on one or two other stations you should get enough points to plot a curve on a piece of graph paper. It is then an easy matter to find any wavelength (or frequency, if you prefer it) on your receiver. For instance, if you tune in an unknown station, turn the dial of the frequency meter until you hear a beat note. Then, by reading off the frequency from the graph you have just made, multiply it by 2, 3, 4, etc. (according to where you are in the frequency spectrum), and there you have the frequency (or wavelength) exactly, provided that you plotted your points correctly in the first place!

You will notice that there is no aerial on this unit. If some of the higher harmonics are too weak, a short antenna may be joined to the "top" of the grid coil (via a small condenser) to increase the strength of the radiations.



*Top and underside views, showing the layout of components.*

# Modern Factory Production Methods—7

## Engineers' Reports, and the Routine of the Service Workshop

By "SERVICE"

THE first few days after the release of a model to the trade and public are anxious ones for the factory staff. Their only contact with the model they have produced is through the sales organisation and the service department.

The sales department, naturally, have a big say in things, but their information is not always to be relied on; not through any intentional effort to mislead the factory, but due, perhaps, to excessive zeal on the part of the sales representatives who may have rather "oversold" the model to their dealers. The representatives may have extolled the various new features to obtain the orders, but when the dealer receives the first consignment the appearance or performance of the instrument may not quite come up to his expectations, although the model itself may be good value at the price offered.

The dealer may casually remark to this effect to the representative the next time he calls round, and the latter may put in a report to his sales manager that the models delivered to that dealer are unsatisfactory. This may be reported to the factory authorities, who often are quite justified in adopting the attitude that they cannot accept such reports without some "concrete" evidence as to the type of fault complained about. They depend more on the reports obtained from the service department, who have to hold the balance as fairly as possible between the sales department and the production people.

### Importance of Reports

Only by sending a report to the factory, giving cold statistics which can be fully backed up by evidence such as service engineers' reports, or returned faulty components or receivers, can a really true picture be obtained as to the way the receiver is behaving in the field.

We will take various headings which appear on a typical service engineer's report and consider why that particular information is required, viewing it in the light of an investigation into why a receiver has been reported unsatisfactory.

The first information asked is often the mains voltage of the supply on which the receiver is being used, both rated and measured. These two values are required because in many districts the actual voltages of the mains supplies are higher or lower than their rated voltage. The prospective customer, or even the dealer, may not know this and, therefore, when they follow out the installation instructions given in the booklet accompanying the new receiver they adjust the mains transformer—and the motor in the case of radiogramophones—to the setting required for them to operate from the rated voltage.

A complaint of sluggish motors, or insensitivity on radio, may quite well be due to a lower mains voltage, and by adjusting the instrument for the actual voltage results will be satisfactory.

### Serial Numbers of Sets

The next item of information asked is generally the serial number of the instrument. The importance of this is not merely confined to its usefulness in checking up whether the receiver has been registered under any guarantee plan, but it also intimates at once whether that particular instrument was one that was released before a certain modification was effected, such as has been described in earlier articles.

For example, in last month's article it was mentioned that through a mistake a batch of chassis may have passed through the inspectors with a fault which caused them to be unstable on a certain wavelength. Directly the fault was discovered a modification would be effected to overcome it, and the serial number of the first instrument having one of these modified chassis in it would be recorded and given to the service department.

Therefore, with this information in their possession a report of a receiver whistling on a certain wavelength will enable them to check up from the serial number that it was one of the batch of faulty instruments, and that by instructing the engineer to carry out a certain modification a cure would be effected.

### Operating Conditions

The next data essential for analysis of the reports will be operating conditions. This need only be a short statement as to the type of aerial used, how long is the earth wire and the type of earth employed, but it does give valuable guidance to the person analysing the reports. Reports might reach the factory authorities through the sales department that a new receiver was particularly noisy, but the true facts may be that the receiver, which, for example, is a highly sensitive one, requires a good earth to prevent noisy reception or slight instability.

A district in which there are a lot of flats would not be very good for this kind of instrument, unless the people installing it made quite sure that an earth connecting to a rising water main was used instead of connecting the earth wire to the pipe that happened to be nearest the instrument. This might be part of a central-heating installation which never really reaches true earth, but which picks up most of the electrical interference in the neighbourhood, thus causing unsatisfactory results with a sensitive receiver.

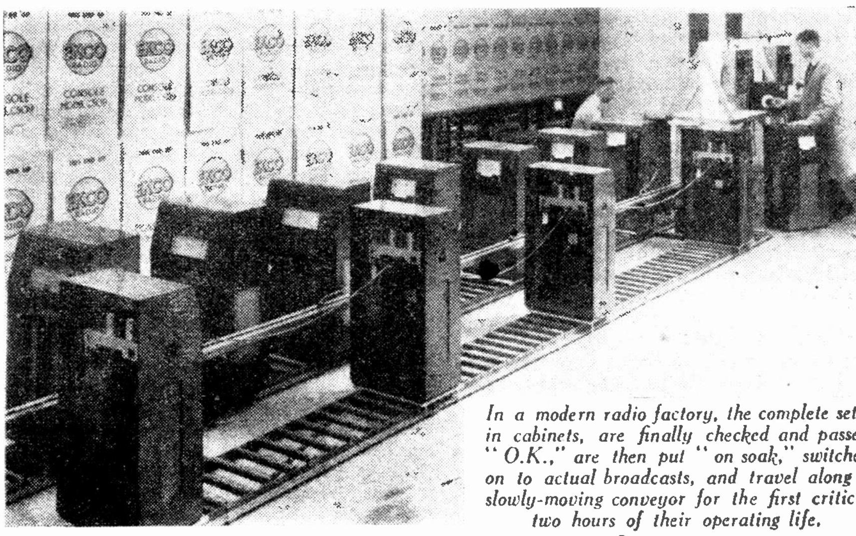
Another important feature of the service engineer's report is that it must give a clear, concise résumé of the trouble experienced, and not a rambling account with the essential data hidden in statements of what the customer said to him, and what he said to the customer.

### Tabulated Information

The information required is best given in the form of columns headed Symptoms Cause, Cure, with a space beneath for general remarks. In this way the information can be easily examined, and with very little editing passed on to the factory people, or made up into notes from which other service engineers may profit.

There is no need to go further into the many details which may be required of service engineers, as these examples will show exactly how important such information is.

All engineers' reports which come into the service department will be sorted, and probably all those concerning the new models will be passed to a member of the staff fully qualified, generally by previous service and factory experience, to analyse them to collate the information into statistical facts.



*In a modern radio factory, the complete sets, in cabinets, are finally checked and passed "O.K.," are then put "on soak," switched on to actual broadcasts, and travel along a slowly-moving conveyor for the first critical two hours of their operating life.*

### Service Department

At the same time, the workshop side of the service department will be receiving back from dealers faulty instruments, and here again any of the new models will generally be passed on to a selected engineer for investigation before normal repair work is carried out on the instrument. His reports will be passed to the person responsible for getting out the report while the next, and often overlooked, source of information as to how the model is faring is the stores issues of new parts to replace faulty ones returned by dealers.

The dealers have ordered them to repair faults in receivers and every faulty part represents a faulty set which has given dissatisfaction. When instruments are under guarantee it is the usual practice that the new part ordered by the dealer will be supplied and invoiced, but that a credit will be passed on the receipt of the faulty component.

### Faulty Components

These faulty components when they arrive back, should be directed to the workshop engineer as if they were a faulty receiver, and when his report on the components is passed through to the statistical department the latter will thus have a complete picture of the number of receivers which have given trouble. They can compare this figure with the number of instruments issued by the factory, thus arriving at the percentage of faulty instruments against sales. So that if 5,000 instruments have been issued from the factory, and 65 receivers are reported faulty, the percentage of trouble is 1.30. This will be the overall position, but in addition a full analysis will be prepared of the types of faults.

The full analysis will show, often in percentages, which faults are most numerous and which, therefore, require first attention. This full report will be submitted at a meeting of all concerned, together with samples of the faulty parts and supporting information with regard to inspectors' labels, serial numbers, and so on.

The reporting of faults to the factory authorities is a job for a responsible person who has had long experience of fault diagnosis, with particular regard to the cause of the faults. Many a good service engineer can find a fault, but many are apt to jump to conclusions as to the cause. This can give rise to a great deal of wasted effort where new receivers are concerned, and the factory staff are on tip-toes to rectify any weaknesses shown up in this field.

An example will illustrate this point. A receiver which passed all tests, including heat runs, satisfactorily, gave trouble a short time after release. The mains smoothing choke got very hot and exuded the impregnating composition, with which it had been treated, all over the chassis, and on to the cone of the speaker beneath it, thus causing distortion and ultimate cessation of signals when the composition trickled into the speech gap.

### Tracking a Fault

The first thought was that the impregnating composition was faulty and running at too low a temperature or that, despite previous tests, the heat rise in the cabinet was too great. Investigations along these lines were started, but, thanks to a careful study of fault analysis, it was noted that output valves were also giving trouble and were being replaced because of low emission or short life.

To the service engineer in charge of analysing the faults on the new receiver it seemed that there might be a tie-up between the two faults. How had the valves lost their emission so quickly? The same type had been used on other models quite successfully. Had a faulty batch been issued by the valve makers? Did the valves go soft and pass such a heavy anode current that the smoothing choke was overheated?

So the valve experts examined the returned valves but were not able to get very far in their investigations before the missing link in the chain of diagnosis arrived in the form of a field engineer's report which showed that the engineer had caught the receiver in the act! He had found the choke very hot and dripping with impregnating composition; he had found the output valve nearly melting its glass and passing some 70-odd milliamps; but what he also found was that the valve had no bias due to an intermittently shorting electrolytic condenser across the cathode bias resistor. That condenser was the real cause of the trouble, and changing the type stopped the complaints.

As stated earlier in this article, the investigation and fault diagnosis of new receivers is generally carried out by experienced engineers of the service department. After they have obtained all the information they require, the receivers will be passed to the service workshop for repair in the ordinary way. This is the last department in the sequence of factory layout, and a description of the service workshop and the methods employed therein will be of interest and value to readers who aspire to senior positions in a manufacturer's service department.

### Service Workshop Equipment

The service workshop of a radio manufacturer is only different from that of a good radio dealer's workshop in its size, staff and stores. The equipment used is often less costly than that employed by an enthusiastic service engineer. The personnel are often less knowledgeable of radio as a whole than the independent service man because they are concerned only with the products of the one company, and get to know the faults automatically without a great deal of thinking. As previously stated, troubles will be analysed by a technical staff right from the early days of production, and notes are circulated throughout the organisation, tabulated for easy reference under Symptom, Cause and Remedy.

Other aids available to the manufacturer's service staff help to speed up repair work. Cradles as used on the production floor are often used so that the chassis may be placed in them to facilitate fault finding and repair work. A set of test valves will be kept handy for use in every chassis for a preliminary test run. A specially made-up oscillator giving the I.F. used on the firm's receivers, and kept running constantly off the mains supply, will be instantly available for quickly checking I.F. circuits, and stage by stage fault finding.

For scale calibration and wavelength pointer adjustments, several transmissions on various wavebands will be available. These emanate from an oscillator, the output of which is rich in harmonics. The oscillator is operated from the mains, and its output is either coupled to a small aerial so that the receivers in the workshop can pick up the signals on their own test aerials, or the transmissions will be wired round the repair benches to conveniently placed sockets or terminals close to each engineer. The latter know from experience where these harmonics lie in relation to the fundamental. For example, an oscillator operating at 1,000 m. will give harmonics at 500 m., 125 m., and so on. These signals might be modulated by a fairly high L.F. note of 800 cycles.

Another oscillator, with a signal modulated at 400 cycles, would be adjusted to a fundamental of 1,800 m. for the top end of the long-wave band with harmonics —recognisable from the first oscillator by the lower note—of 900 m., 450 m., 225 m., etc. Thus, the engineers on the repair benches can test the receiver at any wavelength they please. This is useful in testing a suspicious oscillator, or mixer stage, in a superhet receiver to see that it maintains oscillation over all the wavebands covered by the receiver, especially when a low-voltage mains supply is a condition under which the set is to operate at the owner's locality.

### Classifying Repair Work

In a large service workshop it is usual to separate the work into various types to be carried out by operators who become expert on one particular class of receiver or component.

Imagine a large building with, say, a dozen benches running in rows across it, and a gangway at each side. The first bench may have half a dozen lads, or girls, supervised by a charge hand or foreman. These may handle loudspeakers and pick-ups. The foreman examines each job that comes in and diagnoses the fault and marks the papers accompanying the component accordingly. He then passes the work on to the operator best able to do the repair and advises on any problems that may arise. The repaired item is then passed to an inspector in a sound-proof cabin who gives either his O.K., or a reason for rejection.

A row of test cabins may extend along one wall of the building, each cabin with an experienced inspector equipped with all the necessary test gear or test specifications to enable him to pass or reject the type of work put up for his examination.

The second row of benches in the workshop may deal exclusively with portable receivers; the next row, simple superhet receivers, and so on, until the last row, with perhaps more floor space than the others, will deal with large models and radiogramophones. Certain members of this section will be experts on motors, and automatic mechanisms.

### Simple Test Equipment

Mention was made above to test cabin inspectors with special equipment. The "outside" service engineer may be inclined to say, "Ah, there you are; that's why they are able to do the jobs that I trip up over!" This is not so. Any enthusiastic service man can get together all the necessary service equipment to duplicate the tests often at small cost from the proverbial junk box. If he cannot afford or build an audio-frequency oscillator for testing loudspeaker units, then he must make up a playing desk with motor and a good pick-up, feed this to a good quality amplifier, such as has been described in this journal, and connect the loudspeaker to it. Then by playing a few "test" records he can soon hear whether the loudspeaker is O.K. or not. A selection of three or four records is quite sufficient, and only parts of these need be played. A deep organ piece for low notes, a soprano or triangle for high frequencies, and a small string orchestra or talking record for general intelligibility will cover the range of most loudspeakers.

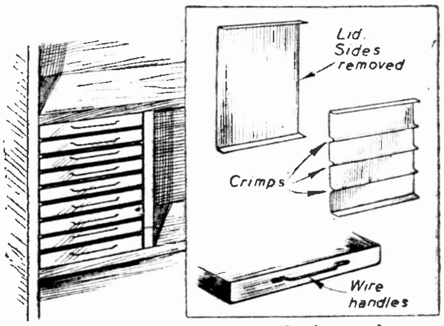
This arrangement is also suitable for testing pick-ups if a simple clamp is fitted to the motor board of the record player to hold the base of the pick-up being tested. Motors also may be tested for even running and torque by fitting them to the motor board, and playing records which have heavy passages in them or long-sustained notes. Another use for this versatile arrangement of "test gear" is for testing amplifiers and the L.F. side of receiver chassis.

Many manufacturers use such equipment in their service workshops, and readers who are service men will appreciate that they need not overestimate the equipment or the abilities of the manufacturers' service workshop engineer. This statement is in no way a criticism of the latter. It is made to increase the "outside" service man's self-confidence by showing him that he can do what they can do if he is willing to think hard round his problems, and make up test gear of a simple type for himself.

# Practical Hints

## Chest of Drawers from Tobacco Tins

I HAVE made a useful chest of drawers for holding nuts and bolts, plugs, spades, etc., entirely out of rectangular cigarette tins. The lids are removed by taking out the hinge pins; the side flanges of the lids are then cut off, leaving



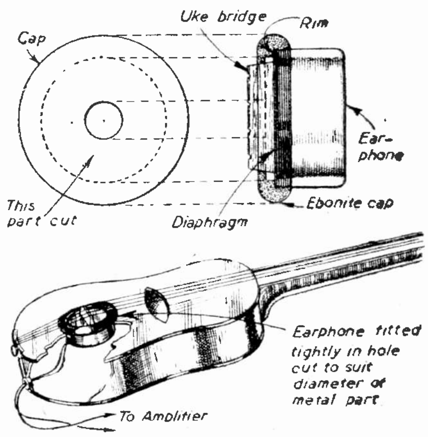

*A neat chest of drawers made from tobacco tins.*

flat plates with end flanges. Three equally-spaced crimps are now formed as shown in the sketch. The crimps should be about $\frac{3}{16}$in. wide to act as runners for the drawers.

The hinge wires are bent to form handles and are put back into the hinge-holes in the tins. The runners are fixed with small, deeply countersunk screws to suitable wooden or metal supports. In my case they are attached to side pieces between two shelves.—P. A. SHEARS (Cheltenham).

## An Electrified Ukelele

HAVING seen an electrical banjo in a musical store, I decided to try my hand at making one. Having tried an old earphone as a mike, I decided to use this as the sounding unit. First of all I cut a hole with fretsaw in the ebonite cap of the earphone, a little smaller than the diaphragm, so that when it was screwed down it held the diaphragm firmly. I had already purchased a second-hand ukelele cheap, and into the top I cut a hole a fraction smaller than the metal part of the earpiece so that it could be fitted in tightly. The bridge was placed on to the diaphragm and the strings fitted. The leads from the 'phone were then fitted to the pick-up terminals of a set, and it gave quite good reproduction and volume.—D. A. ROXBURGH (Newcastle-on-Tyne).

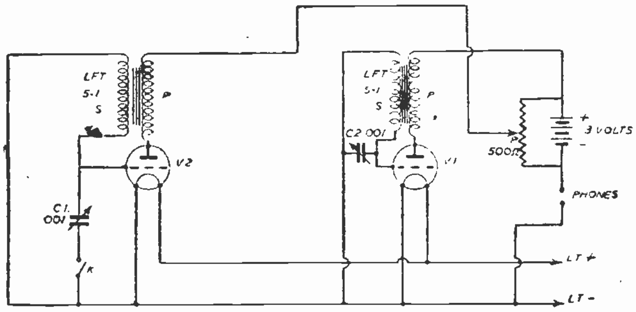



*Details of earphone and electrified ukelele.*



## A Dual-note Oscillator

THE following wrinkle is for training one's ears to discern between two interfering morse signals. It works on this principle: A steady low-frequency note is generated by the valve oscillator V1. Valve V2 also generates a low-frequency note, which is keyed by key K. The two notes are mixed together, producing a beat frequency which is found by adjustment of




*Circuit diagram for a dual-note oscillator.*

preset condensers C1 and C2. The potentiometer P is used for controlling the strength of the "wanted" signal. By adjusting the condensers and the potentiometer it is possible to make the "wanted" signal almost submerged in the steady note of V1.

Both L.F. transformers are of 5 to 1 ratio.

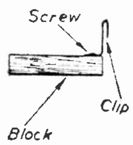
The method of operation is as follows: After connecting the batteries and 'phones, plug in V2. A steady whistle should be heard, and when the key is pressed the note should get lower. The farther C1 is screwed in the lower the note will get. Then plug in V1 and press the key and adjust C1 and C2 till a suitable beat note is audible. Weaken the note by means of the potentiometer till it is just readable above the background note of V1. The volume control would probably work better if it was connected in series with the anode H.T.+ lead of V2, but in this case it would have to be of a much higher resistance, say 1 mΩ.—F. BURNS (Belfast).

## A Simple Morse Recorder

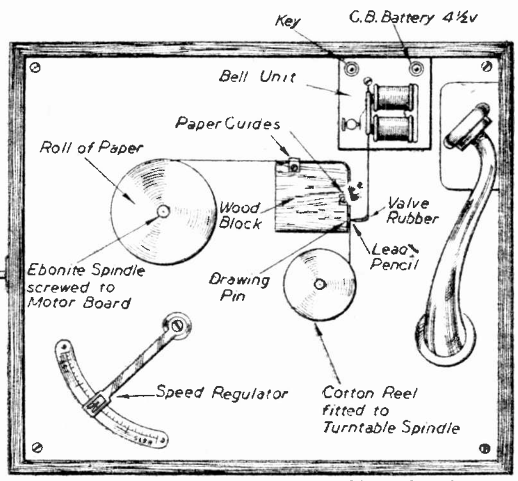
ALL that is needed for this simple recorder is a gramophone and a 6d. bell unit. The turntable of the gramophone is removed, and the bell unit fitted as shown in the sketch. It will be found that the speed can be regulated as required. A cotton reel is fitted over the spindle to receive the tape after recording. The reel of paper is mounted on a bolt driven up through the motor board. The weight is taken from the bell, the gong removed, and the arm is then bent at a right-angle, a small piece of cycle-valve rubber being fitted on the bend in the piece of metal to hold the small piece of pencil lead.

A piece of wood, slightly more than the width of paper it is anticipated will be used, is fitted, as shown, together with paper guides which are merely wire bent over to stop the paper riding too high. A drawing pin is inserted in the wood at the place where the arm strikes it to act as a hard base for the pencil.

In this instance a till roll, sawn in half with a fretsaw, was used to take the impression, but it was found that for small messages the margins from a newspaper gummed together will do. A morse key and battery are fitted to the two terminals of the bell, and if the end of the arm is placed about $\frac{1}{4}$in. away from the drawing pin, an exceedingly firm impression is made on the paper when the key is used. It was found that the motor can be so regulated that about 20 words can easily go on to about 3ft. of paper, and at this speed the dash is about $\frac{1}{4}$in. long.—FRANK H. WRIGHT (Petworth).



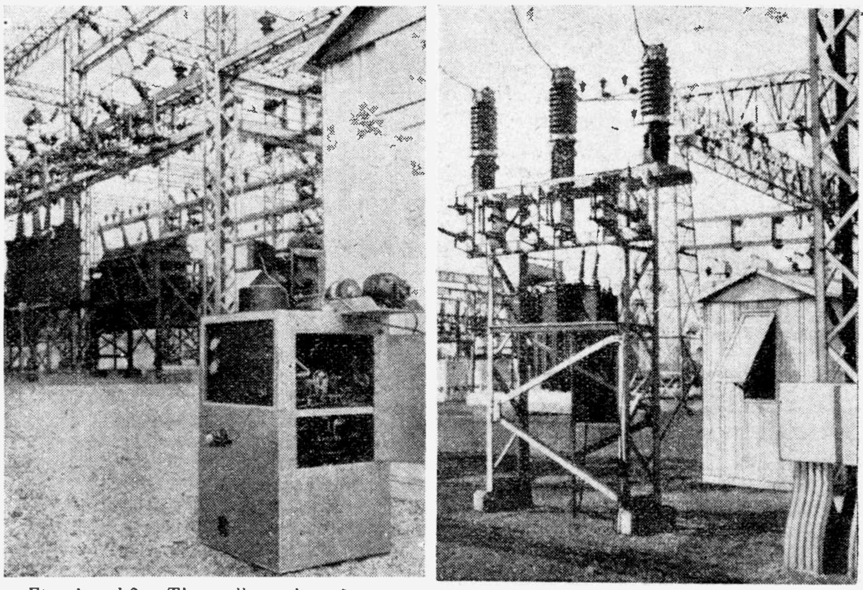



*A morse recorder made from odds and ends.*

# An Automatic Cathode-ray Oscillograph

### *Studying Transient Currents in Power Systems*



*Figs. 1 and 2.—The oscillograph, and on the right the capacitance potentiometer and protective equipment installed between the power lines and the oscillograph.*

IN studying transient currents in telephone circuits and power systems, apparatus is required which will operate instantly and move quickly enough to record the initial part of the pulse. Oscillographs have been found suitable for this purpose. Usually they have been unattended and operated automatically by the disturbance to be recorded.

Until recently galvanometer-type instruments have been used. They were capable of recording only up to 3,000 cycles and depended on film movements for wave-shape resolution. With instruments of this type a lamp must be lighted and the film started before recording begins. This takes at least a hundredth of a second, during which interval transients of importance may occur on the power system. Frequencies above 3,000 cycles may also be involved. These deficiencies led to the search for a recorder capable of faster starting and of a greater frequency range.

## Record High Frequencies

An oscillograph with automatic features was chosen because it can record very high frequencies and requires only a few micro-seconds to release the beam. As developed by the Bell Laboratories in America, this oscillograph has, in addition to the cathode-ray tube, circuits which make the disturbance start the sweep action and the film movement. It also has power supplies and a photographic mechanism, including a lens system to project the trace from the screen of the cathode-ray tube to 35-mm. motion-picture film. The initial part of the record is made by sweeping the cathode-ray beam, and during this interval the film starts to continue the recording. A complete record includes an automatic calibration and a clock picture to indicate the time the disturbance occurred. A schematic diagram of this oscillograph is given in Fig. 3, with an outline of the circuits and a view of the photographic operating mechanism.

## Three-phase Power System

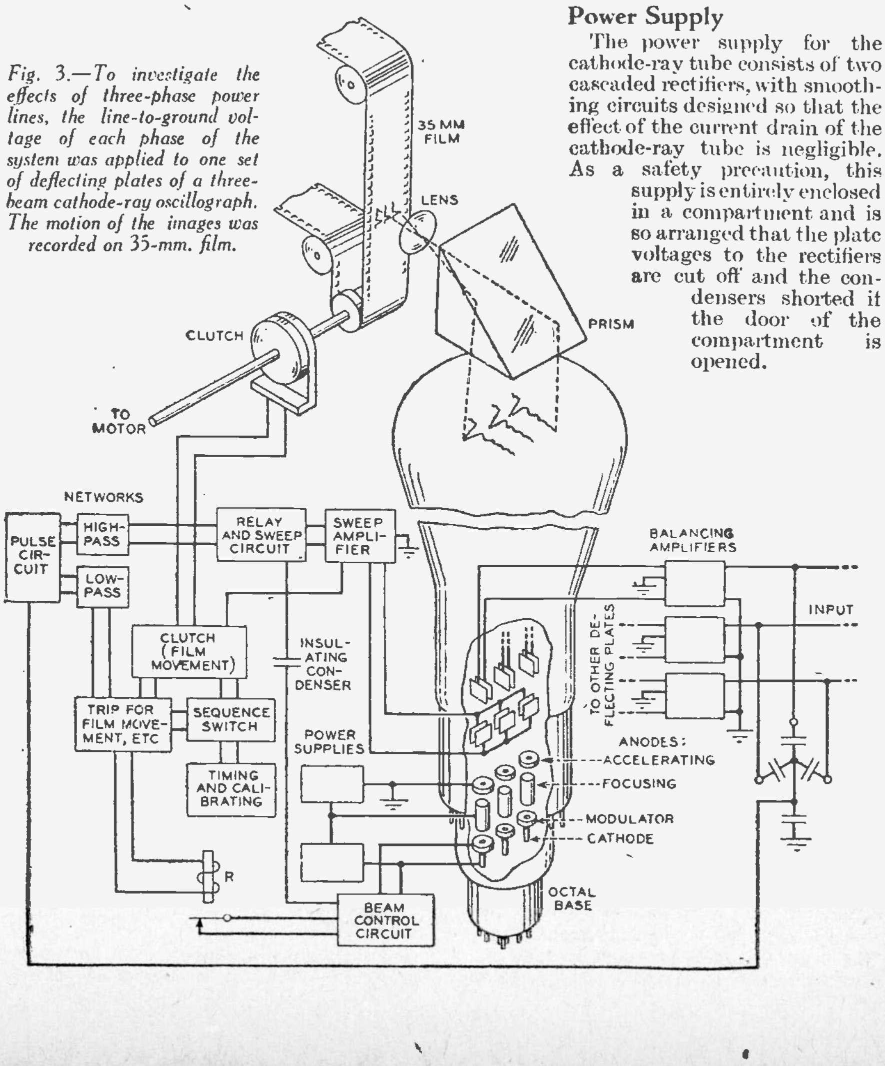
This apparatus was used in an investigation of over-voltages on a three-phase power system, conducted by the Joint Sub-committee on Development and Research of the Edison Electric Institute and the Bell system. Three recording elements were required, one for each phase, and this led to the choice of the Western Electric 330C cathode-ray tube, which is a development of the Bell Laboratories. This tube has three complete units enclosed in a single glass envelope, thus making unnecessary three separate tubes with the attendant complication of the photographic system and increase in bulk. Each unit has a hot cathode, a modulator to control the magnitude of the beam current, a focusing electrode, and an accelerating electrode. The accelerating electrode imparts energy to the electrons and forms the beam, which strikes the screen where part of the energy is radiated as light. Two mutually perpendicular pairs of plates are provided for each unit. When a field is established between either pair of plates, the beam deflects towards the more positive one, and the deflection is proportional to the amount of the applied voltage.

The line-to-ground voltages of a three-phase system are applied to the deflecting plates through networks which provide a balanced input, because a well-focused beam is maintained only when the pair of plates is balanced with respect to the potential of the accelerating electrode. The other pair of plates in each group is connected to the sweep circuit to resolve the wave shape on the fluorescent screen.

## Power Supply

The power supply for the cathode-ray tube consists of two cascaded rectifiers, with smoothing circuits designed so that the effect of the current drain of the cathode-ray tube is negligible. As a safety precaution, this supply is entirely enclosed in a compartment and is so arranged that the plate voltages to the rectifiers are cut off and the condensers shorted if the door of the compartment is opened.

*Fig. 3.—To investigate the effects of three-phase power lines, the line-to-ground voltage of each phase of the system was applied to one set of deflecting plates of a three-beam cathode-ray oscillograph. The motion of the images was recorded on 35-mm. film.*



Voltage to trip the oscillograph is obtained from the drop across a condenser between ground and the neutral formed by three Y-connected condensers, as illustrated at the right in Fig. 3. The other terminal of each of these condensers is connected to one phase of the three-phase circuit under observation. When unbalance occurs on the power circuit, voltage appears across the condenser in the neutral. This voltage is fed to a rectifying circuit which converts it into unidirectional pulses, thus assuring that the succeeding trip circuits will operate on incoming waves of polarity. The pulses are fed through discriminating networks to two trip circuits, one of which is high speed and the other slower and sensitive only to low frequencies.

The relay which trips the high-speed circuit consists of two electrically interlocked vacuum tubes. A pulse of any frequency above 1,000 cycles per second, of sufficient magnitude to operate this relay, excites the beam and sweeps it always at the same rate across the screen. By adjusting this high-speed relay and the sweep circuit the sweep speed may be varied in discreet steps in the ratio of approximately 2 : 1, from about 1/2,000th to 1/6,000th of a second. This range of speeds was considered adequate because the transients of interest in this study were those which arise within the power system itself due to the faulting of a conductor rather than those impressed on the system of lightning. The output of the sweep circuit is fed to an amplifier which delivers a balanced output to the deflecting plates. A portion of this voltage is used to energise the clutch circuit by means of a cold-cathode tube and relay. This clutch-energising circuit is self-resetting and, if the transient is short-lived, the clutch remains closed only long enough to give a film advance of about six inches so as to provide an unexposed piece of film for recording the next transient.

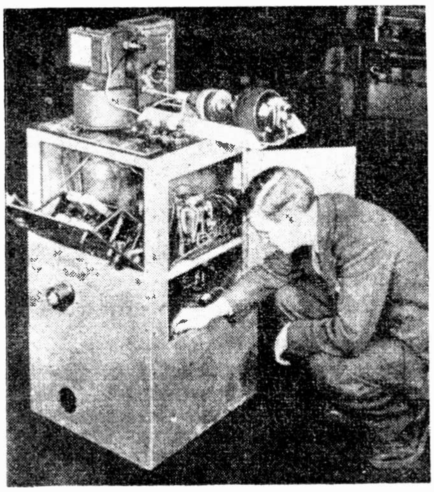


*Fig. 4.—The photographic mechanism of the oscillograph with the film magazine and clock on top. The oscillograph tube is mounted in a metal cylinder, shown just below the clock, to protect it from stray magnetic fields.*

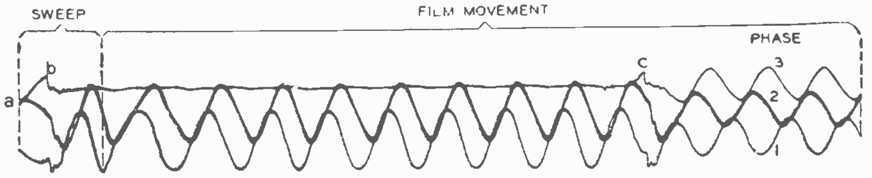



*Fig. 5.—Oscillograph record showing a fault on one phase (3) of a power line. The cathode beams are swept across the screen when the fault occurs to record the voltages on all three phases for approximately the first cycle while the film movement is starting. The rest of the record is obtained on the moving film. At (a) transient disturbance operates high-speed trip ; (b) phase-to-ground fault develops—low-frequency trip operates ; (c) breaker clears fault.*

## Power Over-voltage

When the surge which trips the high-speed relay contains, or is followed by, power over-voltage, a more extensive record is made. It includes the initial resolution by the sweep, about three seconds resolution by film movement, a calibration and a clock picture. To obtain this additional record at the proper time, there was added a low-speed trip circuit, sensitive to 60 cycles and its lower harmonics. It consists of a cold-cathode tube and associated relays, which take control of the clutch and beam circuits and energise the sequence switch. The beam circuits are controlled by the insulated relay R (Fig. 3). which actuates mechanically a contact, located in the high-voltage compartment, and keeps the beam active during the resolution of the record by film movement. The film movement initiated by the low-frequency trip circuit is terminated after a predetermined time by the sequence switch, which records on the film the calibration and a clock picture to show the time of operation. This film movement also resets the tripping circuit.

## Tripping the Relay

Since the initiating transient of most power-system disturbances, as well as those due to lightning, contains higher frequency components, any disturbance will trip the relay and release the beams for the initial sweep, but a complete record will be made only when power system over-voltage of fundamental frequency, or its lower harmonics, is present. Otherwise, the film only moves forward sufficiently to provide an unexposed section for a succeeding record.

The photographic system for recording the screen image is shown pictorially in Fig. 3. The images on the screen are recorded on 35-mm. motion-picture film. The cathode-ray tube and the optical system are oriented so that the beam's path across the screen will be recorded with the time axis longitudinally along the film. A clock picture can be made at the end of a record to indicate the time of the disturbance.

## The Oscillograph

Fig. 4 shows a picture of the oscillograph. The photographic mechanism is on the top with the film magazine near the rear left-hand corner and a clock projecting in front of it. The clock has two faces, one visible so that the operator can check the time, and the other enclosed for photographing. At the right of the film magazine are the clutch and the motor which drives the film. The panel at the front of the instrument carries the meters and the trip sensitivity controls. The projection under the panel is the motor, which operates the ventilating fan. All the control apparatus and the power supply equipment are contained within the case.

This oscillograph has been used to record phase-to-ground voltages on a 44-kilovolt transmission line. Capacity potentiometers, one for each phase, reduced this voltage to a value suitable for the oscillograph. The schematic diagram of the potentiometer and its associated protective equipment is shown in Fig. 6. The protection equipment is designed so that gap G2 will break down if condenser C1 fails. The resultant current will open the fuse and gap G1 will ground the system until it is cleared by circuit breakers. Additional protection is furnished by protector blocks at the terminals and by grounding the oscillograph case.

## Records Obtained

The records obtained with the original sweep speed, which was fairly high, did not disclose any very high frequencies in the initial part of the disturbance on the power system under observation. Consequently, the circuits were arranged so that the resolution due to the sweep gradually merges with that from the film movement, thereby producing a continuous record. An example of the results obtained by the method is shown in Fig. 5. Comparison with records of faults obtained with a string oscillograph has effectively closed the gap of approximately one cycle required to start the string oscillograph.

In addition to the extensive data on over-voltages which have been obtained in this investigation, much experience has been gathered on problems met in adapting oscillographs for continuous automatic operation under routine field conditions.—*Bell Laboratories Record.*

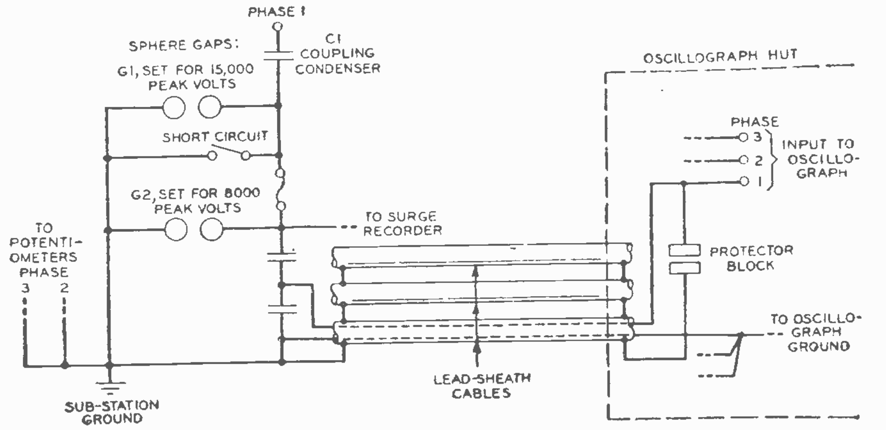
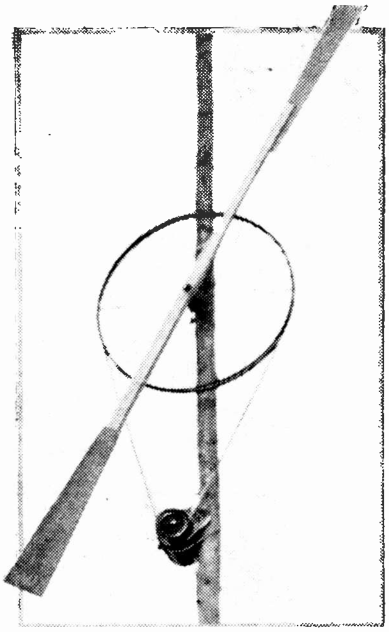



*Fig. 6.—Schematic diagram of the potentiometer, including protective equipment, by which the oscillograph is connected to the power line.*

# A Small Wind-driven Generator

## Constructional Details of a Serviceable Plant for Small Accumulator Charging and Other Purposes

By F. DAY LEWIS



*The complete wind-driven generator arranged for indirect drive.*

THIS small generator plant is constructed around an ordinary car dynamo of either the 6- or 12-volt pattern, and is capable of giving varying currents from about 1-6 amps, depending on the wind strength. Apart from the dynamo, spare parts can be used in its construction, and the expense is not great.

In order to allow for different makes of machines the following description is of a general nature, as well as referring to a particular case, and as the outfit is intended as an emergency one, there are very few refinements added (e.g. brakes, etc.), so as not to complicate the working. Individual experimenters can, of course, try various additions which they think suitable to their particular requirements.

A wind-driven generator of this type is very suitable to use with a battery, as the basis of an emergency lighting supply, and many other purposes will suggest themselves to the constructor.

### The Dynamo

This can be either a 6- or 12-volt model, but the latter is recommended, if obtainable, as it will generate sufficient charging voltage even under slow-running conditions. These dynamos are usually of the high-speed type, and so the propeller must have sufficient speed of rotation, as well as turning force. The ends of the dynamo are usually open, or have holes in them, and these are covered by means of a plate of zinc or tin cut to shape and screwed to the end by means of soft-threaded screws. A thin washer of felt or other material soaked with waterproof paint is placed between the end and the plate to exclude water from the armature. The holes for the screws are drilled beforehand.

The cut-out is removed from the dynamo casing, and all holes not required are filled with wax or compound, and the whole outside well painted. It is presumed that the machine has good brushes, and is in good electrical order.

A pulley wheel is usually affixed to the armature spindle by means of a screwed bolt, and if this bolt is only the correct length with no spare (at least half an inch) then a longer bolt of the same thread will be required: this is to take the flywheel mentioned later. In certain cases this wheel is not however, wanted.

### The Propeller

This is made from a solid or jointed piece of wood, and is either 5ft. or 7ft. long; in the writer's case the jointed one is used, as this is easier to alter. The pitch and direction of the vanes with respect to the wind direction will determine the direction of rotation of the propeller.

A piece of wood 5ft. long and 4in. square is required, and this is marked off on the ends as shown in Fig. 1, where a clockwise direction of rotation is required for the dynamo armature. If anti-clockwise rotation is wanted, then the markings are reversed. Then mark down the side of the wood from each end to within 4in. of the centre point, and cut away the pieces of wood in the two halves so that only the blades remain. The blades are then cut and shaped so that they diverge from 4in. at the ends to 2in. near their centre point on the propeller. This is indicated in Fig. 1, and any spare unwanted wood is removed from the square centre of the propeller.

Next two vanes are cut from plywood, each being 3ft. long, 6in. at the top, 3in. at the bottom, and about ⅛in. thick; these are screwed to the blades of the propeller to give additional length and driving force as required. When first making these, fix them so that alterations can later be made. When the whole is working well, then the job can be completed and well painted.

The total length of the finished propeller should be either 5ft. or 7ft., and this will depend on something to be explained later in the article.

### Mounting the Dynamo

There are three methods of doing this and two of these will depend on whether a direct drive between the propeller and armature will result in sufficient driving speed to generate a charging voltage.

The direct method is illustrated in Fig. 2, and it will be seen that the dynamo is fixed to the pole about 3ft. from the pole top by means of a heavy iron bolt passing through the dynamo supporting plates; nuts and washers hold the whole assembly quite rigid, and a top stay wire gives additional support. A flywheel (old gramophone turntable, of cast iron) is bolted to the armature shaft in place of the unused pulley wheel; and to this flywheel the propeller is fixed with nuts and bolts. The propeller is stopped by an additional wire from the pole top, which is brought across to catch the blades and stop rotation when the machine is not charging. The leads from the armature are lengthened and brought down the pole side, and to the charging board.

The cut-out is mounted on this board with an ammeter, and to test, wait for a good windy day, connect up and watch the charging rate. If it is very low, and will not rise when the propeller is rotating fast, then it is obvious that this direct drive between the propeller and armature is not providing sufficient speed, and for that particular model the next method should be tried.

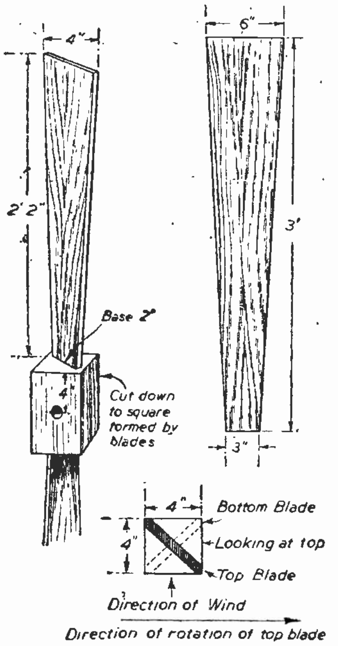
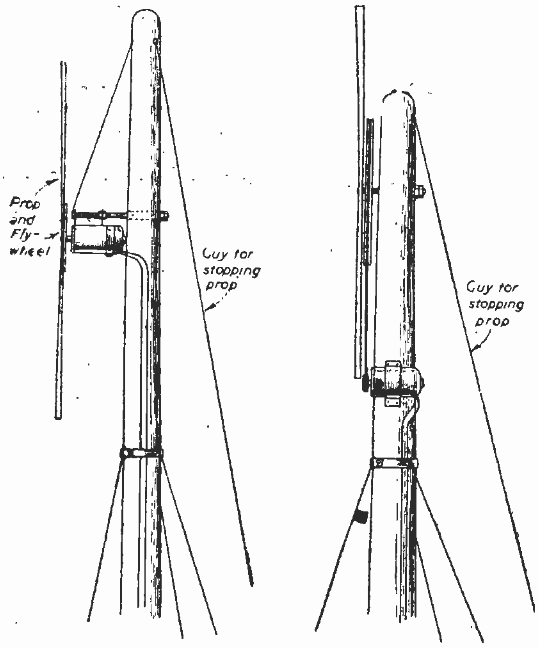



*Fig. 1.—Details of the propeller blades.*




*Figs. 2 and 3.—Methods of mounting the dynamo for direct and indirect drive respectively.*

### Indirect Drive

This is shown in Fig. 3, and in this case the pulley is left on the dynamo shaft, and the machine is mounted on the side of the pole by means of a metal strap, as shown. Above this, and at about 4ft. from the centre of the dynamo, is mounted a narrow gauge cycle wheel of 26in. diameter. This wheel is mounted by means of a long-threaded bolt, the threads taking the wheel bearings, etc. The wheel must be in alignment with the pulley wheel on the dynamo. Around the two, and pulled tight, is placed a rubber belt of small cross-section, and preferably round.

The propeller in this case must be made longer to allow for the extra torque

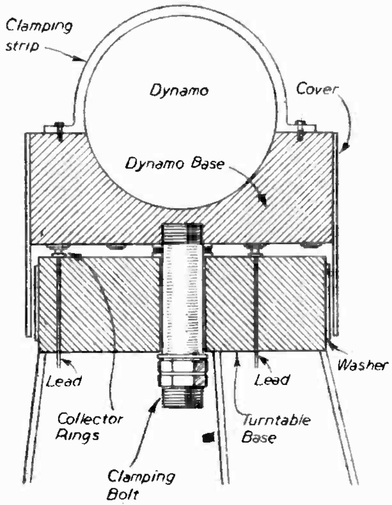



*Fig. 4.—Sectional view of the turntable, showing the dynamo fixing clamp.*

required, and the vanes are moved apart so that the total span is 7ft. It is then bolted to the cycle wheel. In cases where the direct drive is a failure, this indirect drive method is usually satisfactory.

## Turntable Mounting

In Fig. 4 is shown the turntable, but the cost of having this made in an engineering shop will compel most readers to use the simpler methods; the writer uses the direct mounting.

For those who can construct the turntable, or have it made for them, the following description will be useful. The base is made from a solid piece of metal, and the legs are also of strip metal screwed to the base. A centre hole to take the clamping bolt from the dynamo base plate is next drilled.

The dynamo base-plate can be of very hard wood or metal, and is shaped to take the body of the machine, a top clamping band holding the whole securely in position. On the outside of the circular base-plate is fixed a covering to overlap the turntable and prevent water getting in; this is a very close fit, and oiled felt is recommended for lining the inside edge of this cover.

Insulated from this dynamo base plate, and fixed to it, are two concentric brass collector rings, and bearing on these are two springy pieces of brass, as shown. The rings are connected to the armature, and the springy pieces of brass are connected to the leads down the pole.

Between the two base plates the ball-races and bearings are placed, and when assembled the clamping bolt passes through these ball-races, through the bottom plate, and is held in position by spring washers and nuts.

The method of mounting the dynamo on the pole is shown in Fig. 5. Fixed to a long bolt which projects from the top of the machine is a wind vane to keep the face of the propeller into the wind. When the wind changes the whole should freely turn around. Needless to remark, the balance of the whole assembly must be carefully adjusted to ensure best results.

## The Pole

The pole should be about 30ft. high, and thick enough to bear the weight of a ladder being placed against it for the purpose of inspecting the apparatus without having to take the pole down. The bottom of the pole should be free from defects.

In order to keep the propeller into the wind in the case of the direct-mounted machines, some way of turning the pole will be required, although it will be found that there is nearly always a certain direction of prevailing wind, and this means that even when the wind changes slightly the propeller will continue to rotate.

A piece of metal piping about 4-6ft. long is embedded in hard ground, or ground and concrete, in a vertical position, and the bottom of the pole is shaped to fit into this with the pole bottom resting on a smooth surface, and free to turn. The pole should be a good fit without much play, and the supporting wires must allow a certain amount of rotation of the pole without undue strain. There are collars which have hooks attached which are ideal for this purpose, and these, when placed around the pole and the guy wires attached, will allow free movement of rotation while keeping the pole from swaying.

## Operational Details

When the apparatus has been tried out and found satisfactory, it should be well overhauled and painted, and finally installed. The purposes of the cut-out is to prevent the battery discharging back through the dynamo when the latter is not generating enough voltage. In case the cut-out fails it is a good protection to have a 5 amp. fuse in circuit with the battery, as this would prevent a dangerous current burning out the armature.

When disconnecting the cut-out from the dynamo, watch the connections, and at the charging board the extended leads must correspond to the original connections. Heavy gauge wire is necessary, and ordinary house-wiring cable is suitable.

When obtaining the generator, ascertain the working revs. for the standard voltage and current, and, if possible, get a machine with a slow running speed, because the greater the speed required the more trouble

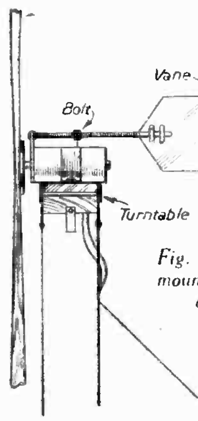



*Fig. 5.—Method of mounting the dynamo on the pole.*

experienced in getting a large charging current.

The propeller should be attached to the flywheel (or cycle wheel) in dead centre, and should rotate freely on either when lightly turned by the hand. Care should be taken in the case of the indirect drive to see that the propeller will not foul the belt, if it does the blades may need shaving or the propeller will need to be moved slightly away from the wheel.

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### Latest Patent Applications

17745.—Godfrey, G. W., and Ultra Electric, Ltd.—Tuning of radio receivers. December 16th.

17872.—Poole, R. B., and Taylor, L. W.—Television apparatus, etc. December 19th.

17948.—Standard Telephones & Cables, Ltd.—Radio-receivers. December 20th.

### Specifications Published

530319.—Thornton, A. A. (Philco Radio & Television Corporation).—Wide-band amplifiers.

530523.—Telefunken Ges. Fur Drahtlose Telegraphie.—Deflection coils for cathode-ray tubes.

530578.—Kolster-Brandes, Ltd., and Tiller, P. A.—Adjustment devices for radio receivers.

530426.—Hazeltine Corporation.—Automatic control system for television receivers.

530776.—Scophony, Ltd., and Rosenthal, A. H.—Secret transmission of television and like signals.

530777.—Blue, A. H. and Wood, R. D.—Television and like apparatus.

530693.—Marconi's Wireless Telegraph Co., Ltd., Rust, N. M., Brailsford, J. D., and Goodenough, E. F.—Band-pass filters.

530835.—Marconi's Wireless Telegraph Co., Ltd.—Preselection tuning systems for radio-receivers.

530793.—Marconi's Wireless Telegraph Co., Ltd.—Electric motor control for radio-receivers.

530841.—Kolster-Brandes, Ltd., and Mason, M. D.—Adjustable inductances and the like.

530886.—Standard Telephones and Cables, Ltd., Beatty, W. A., and Braendle, E. W.—Tuning systems for radio-receivers.

530914.—General Electric Co., Ltd., and Peters, W. H.—Cathode-ray tube assemblies.

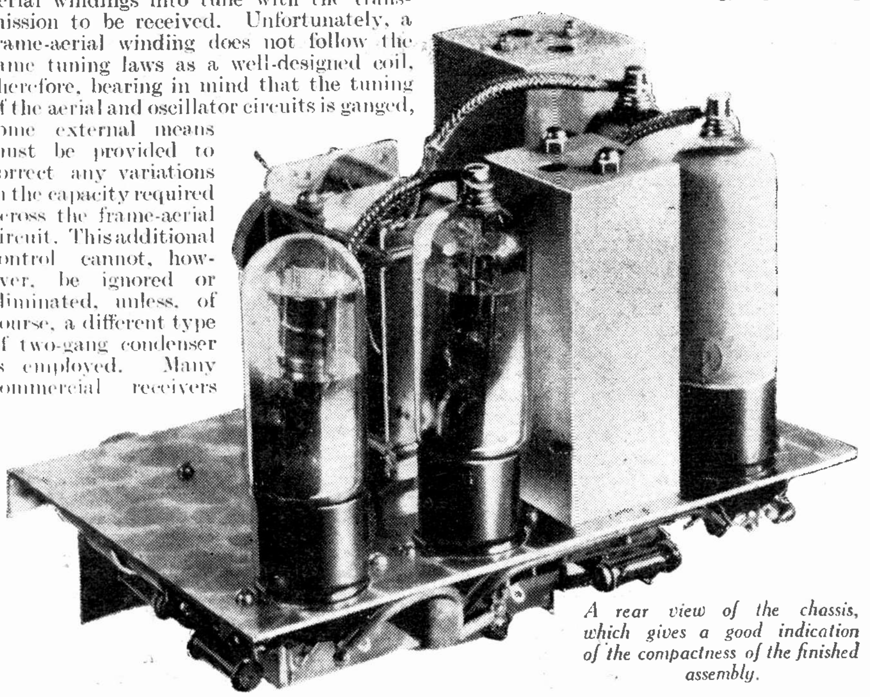
531102.—Philips Lamps, Ltd.—Radio-receivers adapted to be tuned to a plurality of predetermined stations by means of push-buttons.

*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.*

# F. J. CAMM'S ALL-DRY

## Details of the Constructi[on] and the Fitting of the Rec[eiver in its] Cabinet, are Giv[en]

AN examination of the plan drawing, shown on this page, will reveal the fact that an addition has been made to the chassis as described last month. This consists of a small variable condenser having a capacity of .0002 mfd.—plus a small strip of metal which acts as a mounting bracket. The object of the condenser is not to modify the main circuit, but to provide a quick and easy means of bringing the frame-aerial windings into tune with the transmission to be received. Unfortunately, a frame-aerial winding does not follow the same tuning laws as a well-designed coil, therefore, bearing in mind that the tuning of the aerial and oscillator circuits is ganged, some external means must be provided to correct any variations in the capacity required across the frame-aerial circuit. This additional control cannot, however, be ignored or eliminated, unless, of course, a different type of two-gang condenser is employed. Many commercial receivers overcome the trouble by having a small vernier condenser operated by a knob concentric with the main tuning control. From the constructor's point of view, this procedure would be somewhat more costly and, after all, the additional control would still be present, even if not as a separate component. The moving vanes are connected direct to the common negative-earth line, whilst the fixed are taken through the chassis—using screened sleeving—to the fixed vanes of the rear section of the two-gang tuning condenser. A word of warning about the mounting of the condenser is necessary, owing to the limitation of space.



*A rear view of the chassis, which gives a good indication of the compactness of the finished assembly.*

### Gang-condenser Fixing

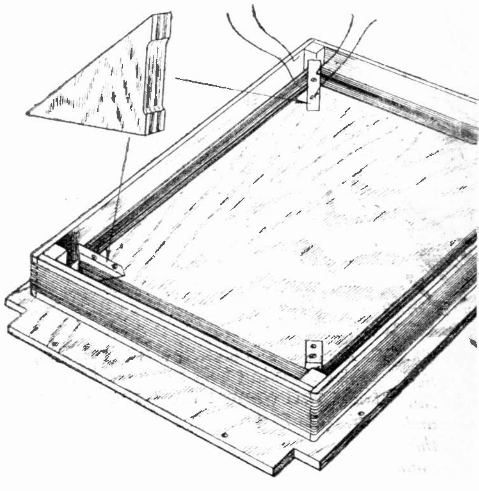
On the original plan drawing, page 188, it will be seen that the right hand front bolt, when viewing the top of the chassis from the rear, holding the two-gang condenser in position, also anchors the end of the piece of metallised sleeving used to earth the frame and moving vanes of the condenser. This bolt must be removed and replaced by one of the counter-sunk head type, inserted from *under* the chassis, thus bringing the nut on top. This will still hold the sleeving and condenser as before, but the object of making the change round is to allow clearance for the additional vernier or trimmer condenser. When bolting the small strip of metal which acts as the mounting bracket for the trimmer in position, it is equally necessary to use short bolts of just sufficient length to pass through the bracket and the turned down edge of the chassis. The hole for the connection to come through to the fixed vanes of the two-gang condenser is drilled in the position indicated on the plan on this page, i.e., so that it just clears the screening can of the I.F. transformer mounted under the chassis.

### The Switch

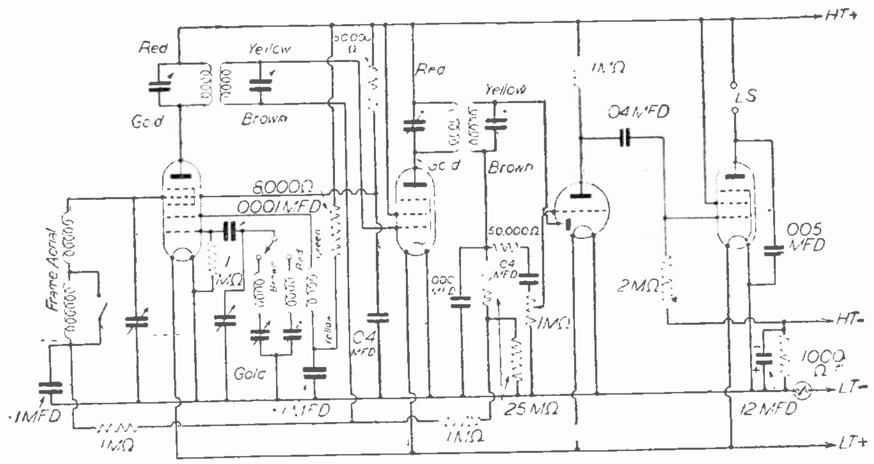
Only two additional connections are made to the switch. The tag, representing the moving arm of one of the free sections of the switch, is connected to the common negative-earth line, via the .1 mfd. fixed condenser, the leads "b" go to the frame. The connection between the end of the medium-wave and the commencement of the long-wave section "c," is then joined to the contact on the switch which links up with the moving arm mentioned above, *when* the switch is in the position which causes the moving arm of the *oscillator section* to make contact with the tag carrying the *brown* lead from the oscillator coil. In other words, the long-wave section of the frame must be short-circuited when medium-waves are being received, and remember that the brown lead of the oscillator coil represents the medium-wave winding of that coil.

### The Frame

The frame is mounted on the inside of the removable back of the cabinet. It is wound in two sections, and is connected to the receiver by the three leads "a," "b" and "c." The commencement of the medium-wave section, which is connected to the grid of the frequency-changer, one section of the two-gang condenser and the fixed vanes of the trimmer, is denoted by the lead "a." The junction formed by the end of the medium-wave and the start of the long-wave windings, is indicated by lead "c," whilst the finish of the latter section is joined to the moving arm of the switch one side of the 0.1 mfd. condenser, and the small resistance leads "b."



To carry the medium-wave winding, a simple rectangular wooden frame is constructed from strips of three-ply wood. The dimensions are 11¾in. by 8⅝in. by 1⅛in.



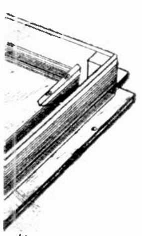

*Theoretical circuit diagram.*

# SUPERHET PORTABLE

## ...on of the Frame Aerial, ...eiver and Speaker in the ...n in This Article

It should be noted that the horizontal strips, i.e., those 11⅞in. in length, overlap at each end the vertical pieces, therefore the latter must be cut 8⅝in. *minus* twice the thickness of the ply-wood used. The frame is held in shape by the use of small wooden blocks, glued and pinned in each corner, their dimensions being 1¼in. by ½in. square. The winding consists of 13 turns of 26 s.w.g. enamelled wire, the turns being spaced so that the whole winding occupies the full 1⅞in. of width. It does not matter in which direction the winding is made, provided that the long-wave section is wound in the same direction. This is very important, therefore particular care should be taken when doing this part of the constructional work.

The wooden frame, when wound, is fastened to the inside of the back of the cabinet by a little dab of glue to each corner block and short panel-pins through the back. It should be noticed that it is not fixed in a central position, with respect to the back. It is placed so that the bottom horizontal strip is approximately ¼in. from the bottom edge of the back. At the top the distance between frame and edge is, roughly, ⅜in. The frame should not be fixed to the back until the long-wave section is wound as mentioned below.



*The construction of the frame can be clearly understood from this drawing and the text.*

### Supporting Brackets

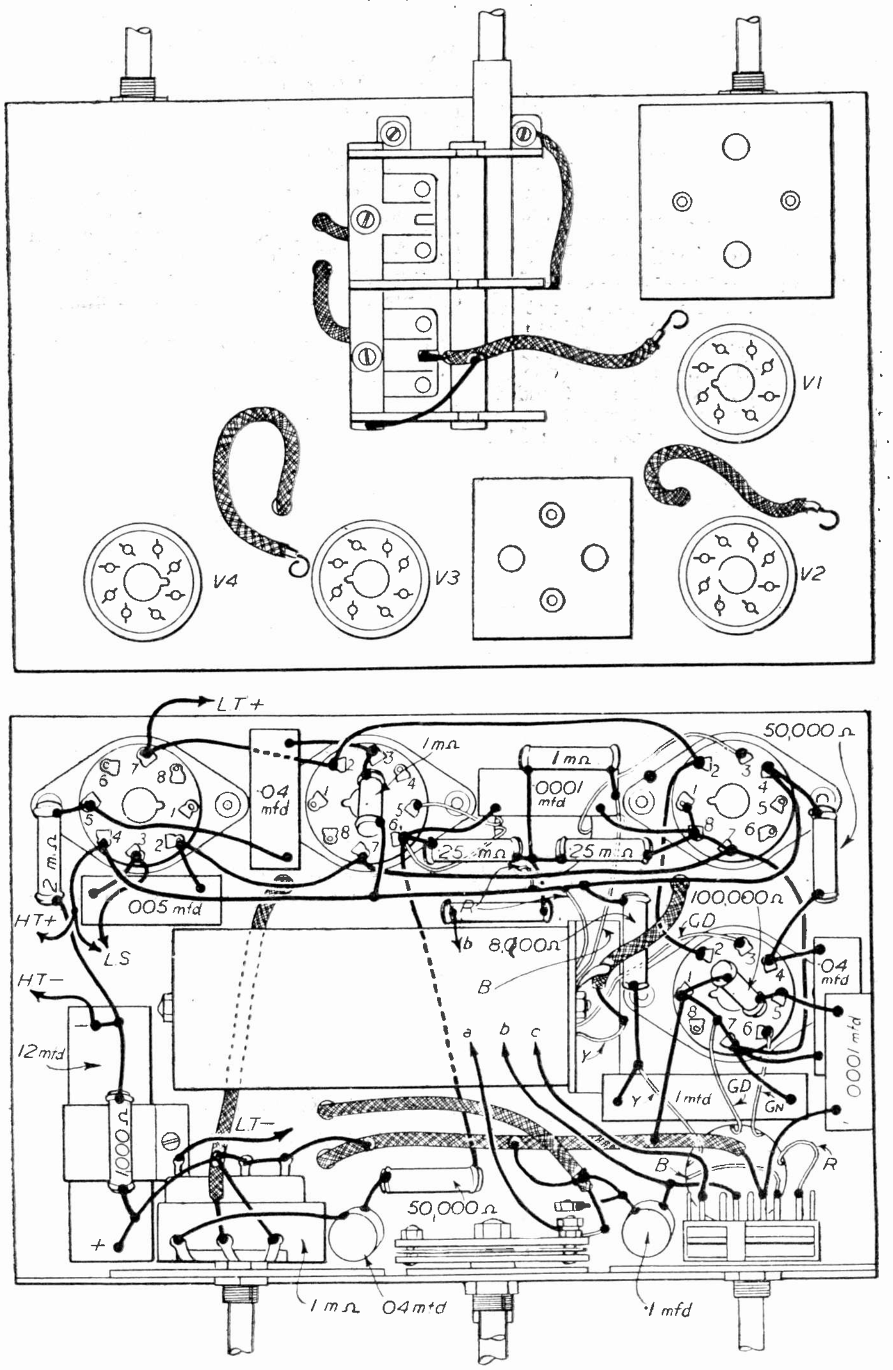
Four small wooden brackets—as shown in the inset—are cut from ¼in. or ⅜in. wood. These are fixed to the back, by the same method as adopted for the medium-wave frame. No wooden strips are necessary, the winding being solely supported and held in position by the brackets. While it is essential to keep the wire fairly taut when doing the winding, excessive tension should be avoided, otherwise it will be found that the wire will tend to stretch and eventually sag. Enamelled wire can also be used for this section, but owing to the number of turns, namely 40, the gauge must be reduced to 34 s.w.g. Small pins, driven into one of the brackets, can be used to anchor the ends of the winding. When this section is completed the medium-wave frame can be fixed in position, and the necessary connection between the finish of the medium-wave and the start of the long-wave windings made.

### The Dial

As explained last month, no dial is provided with the condenser specified. It is not a difficult matter, however, to make one from a stiff piece of Bristol-board, or any piece of card which has a hard, polished surface. Two semi-circular lines, having radii of 2¼in. and 1¾in., should be drawn in ink; these will form the scale lines on which can be marked the settings or names of medium- and long-wave stations. If the

(*Continued on page 235*)

## COMPLETE WIRING DIAGRAM FOR THE ALL-DRY SUPERHET PORTABLE




### LIST OF COMPONENTS

One Bulgin coil, type 72.
Two Bulgin I.F. transformers, type 73.
One 2-gang tuning condenser, J.B., .0005 mfd. Type 4301.
One J.B. .0002 mfd. Dilecon.
One wavechange switch, Bulgin, type S.204.
Four octal valveholders (Celestion-Amphenol).
*Fixed condensers* (Dubilier):
Two .1 mfd., type No. 4603 S; three .04 mfd., type 4601-S; two .0001 mfd. type 4601/S; one .005 mfd., type 4601 S; one 12 mfd., type 3016.
Cabinet. (Lockwood.)
*Resistances* (Erie), ½-watt type:
Two 1 megohm; two 50,000 ohms; one 100,000 ohms; one 8,000 ohms; two .25 megohms; one 2 megohms; one 1,000 ohms; one potentiometer with 3-point switch, one megohm.
One four-pin plug. Bulgin. P.104.
Three top cap connectors, Bulgin, type P.96.
Four Cossor valves, Types I.A.7.V.G., I.N.5.V.G., I.H.5.G., I.C.5.G.
One H.T. and L.T. dry battery, type H. 1157 (Exide).
One W.B. speaker. Midget.

# Wireless Terms and Nomenclature

## *How a Number of Different Terms and Abbreviations are Often Used in Reference to the Same Object or Property*

PROBABLY in part because radio—or wireless—has grown so rapidly, a variety of terms have been introduced which are not strictly correct. Additionally, terms used in the U.S.A. have often varied from those employed in this country. As a result of the variations confusion sometimes arises, especially in the mind of the beginner.

It is scarcely necessary to point out the obvious inaccuracy in the term "wireless," but on the other hand, what exactly does "radio" mean? Presumably the word was coined especially for the purpose, and it has the advantage of being completely international. Then most readers know that in America what we refer to as valves are described as tubes. It is true that the word "valve" is not strictly correct as applied to the articles in question and when the older meaning of the word in the engineer's vocabulary is borne in mind. But a tube can be almost anything from a length of rubber pipe to a ship's funnel.

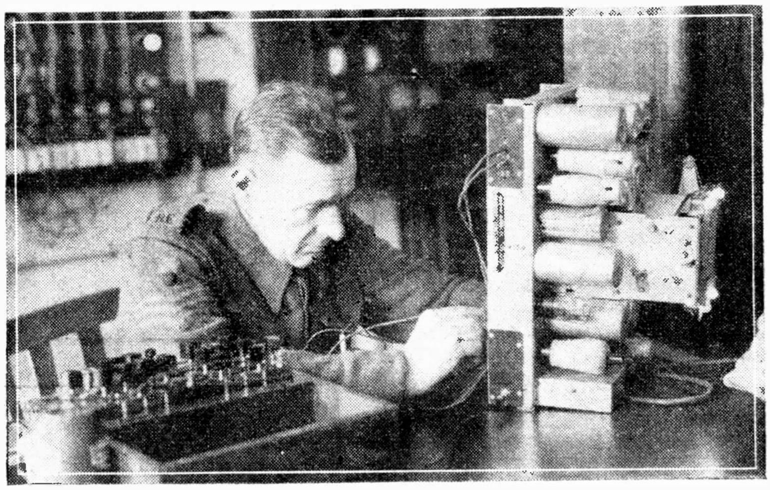
### Frequency Denominations

The terms referred to above are straightforward enough, and whether or not we like them we know perfectly well what they mean. On the other hand, a number of experimenters who have joined one or other of the Services have not found it easy to recognise in the terms S.F. (or S.F), R.F. and A.F. the expressions I.F., H.F. and L.F., with which they were previously familiar. S.F. means supersonic frequency, which is to all practical intents the same as intermediate frequency. Actually, the term S.F. is probably better than I.F., because although the frequency on which the so-called intermediate-frequency amplifier works is equal to the difference between the signal and oscillator frequencies, it can scarcely be said to be intermediate. For example, we might produce an I.F. of 465 kc/s by having the first detector and oscillator tuned to, say, 1,000 and 1,465 kc/s respectively. Obviously, 465 kc/s is not intermediate between these two.

### Radio and Audio Frequencies

Supersonic means above audibility, and therefore a supersonic frequency is one which cannot be heard; above about 20,000 cycles per second, roughly. This brings us to the question of H.F., R.F., L.F. and A.F. The first two abbreviations mean high frequency and radio frequency, while the second pair stand for low frequency and audio frequency. Which shall we use? It does not matter very much as long as we know the meaning of all four, but "high" and "low" are clearly very general, especially when we remember that we refer to both high and low low-frequencies, or notes, as well as to high, medium and low radio frequencies!

A radio frequency is essentially a frequency above audibility, and is in that respect the same as a supersonic frequency. But it is more usual to apply the term to a frequency within the range used for radio transmission. In practice that is from about 50 kc/s to 60,000 kc/s, or 6 mc/s. Let it be made quite clear, however, that this range could be extended very appreciably if we were to include "possible" wavelengths or frequencies in addition to those which are fairly commonly in use.



*One, well past the scope of this article, undergoing further training, in common with many other members of the Services, at a London Technical Institute.*

Low frequencies or audio frequencies can be defined rather more easily, because they are those which produce sounds audible to the unaided human ear. They can generally be said to range from zero to 20,000 cycles, although the average person could probably not hear sounds of frequency as high as the maximum figure mentioned. On the other hand, a few people and many insects and animals can hear sounds of appreciably higher frequency. Anyhow, it is now clear that the term A.F. is more descriptive than is L.F.; we can take our choice.

### Telegraphy and Telephony

While dealing with abbreviations it is of interest to refer to the expressions W/T and R/T, which are widely used in commercial radio and in the signals branches of the Services. The former means wireless telegraphy (which you may prefer as morse or C.W.), and the latter to radio *telephony*.

Another term which has a different meaning in commercial radio practice than in what might be called domestic practice, is "broadcast." Every reader knows one meaning of it, but there is another more restricted meaning. If one transmitting station calls another, the operator does not say that he is broadcasting a message although in fact he is, because his signal could be picked up on any receiver within range. He considers that he is broadcasting when he calls all stations or when he calls all stations in a certain group. Thus, the operator of a coastal station might call all ships in a certain area, giving warning of the presence of an enemy submarine, or of the suspected presence of enemy mines.

### Technical Abbreviations

Technical terms often cause confusion, not because their meaning is not understood, but because they are expressed in different forms. Thus, the simple word milliampere is abbreviated in at least four different ways: ma., m.a., MA, mA. The last is the only correct one, for we express the electrical unit by a capital letter, and any fraction or multiple of it by a lower-case letter. We may, therefore, abbreviate microfarad as mF., but it is usual to indicate it as mfd. Another method of writing it is $\mu$F, the Greek letter $\mu$ being used to represent the prefix micro-, meaning a millionth-part-of. When dealing with inductance the question is similar, for we can write either mH or $\mu$H for micro-henry. In all cases the use of the Greek letter is to be preferred, since a small "m" is often used as an abbreviation for milli-, which is one-thousandth, as in mA.

In giving frequencies some would indicate 1,000 kilocycles per second as 1,000 kcs., others as 1,000 k cs, and others as 1,000 kc/s. The last-mentioned is the only one which can be considered as correct, since the oblique stroke is customarily used to represent the three-letter word "per." On the other hand, in setting down 3,000 cycles per second, many would write 3,000 c.p.s., and could scarcely be said to be wrong. Nevertheless, it is better to follow the standard laid down above and give the expression as 3,000 c/s.

### Ohms and Megohms

The abbreviated form of the word megohm is very often shown incorrectly—in many cases by people who should be better informed. It may not be so bad to express a resistance of 2 megohms as 2 meg., because nobody would be likely to misunderstand it. On the other hand, if it is written as 2$\Omega$ (figure two followed by the Greek letter omega) the correct interpretation is 2 ohms. When using this correct symbol for ohms it should be prefixed by a capital M when megohms or millions of ohms is intended. That is, a value of 2 megohms should be expressed as 2M$\Omega$.

We get on to rather difficult ground when we introduce the terms resistance, resistor, resistivity, capacity, capacitor, condenser, and capacitance; but that is only because these words have been so badly misused in the past that their real meanings have been in danger of being lost. Resistance is the property possessed by a body or wire of resisting or obstructing the passage of an electrical current through it. It is not, therefore, correct to refer to the object as a resistance, but as a resistor. Thus, one could state that the resistance in a circuit is, say, 25 ohms, but the particular component causing that resistance is a resistor.

# ROUND THE WORLD OF WIRELESS

## Ships Must Listen to B.B.C. News

THE Admiralty recently made an order that all British ships of less than 1,600 tons must not go to sea unless equipped with radio able to receive the B.B.C.'s home or overseas news in English. They must maintain a wireless watch to ensure that the news bulletins are received.

## "Vest-pocket" Radio

IT is reported from Tokio that a Japanese amateur, Jiro Taniuchi, has just completed a "vest-pocket" radio set claimed to be the smallest in the world after seven years of experiments. Reception is stated to be excellent.

## Portable Radio for U.S. Police

IN a drive to make the Atlantic City, N.J., police department the most efficient in the nation, every officer in the force is being equipped with a tiny portable radio by means of which he will be in constant touch with headquarters. The illustration on this page shows a motor-cycle officer carrying his radio, which is attached to his belt in a small leather case. The earphone is held in place by a head clamp that fits underneath the uniform cap. The radio weighs 29oz., measures 3½in. by 3½in. by 1½in., and costs about £7.

## Radio "Ghost"

AN amusing incident was recently reported from Lusaka, capital of Northern Nigeria. A special broadcast was given from that town, for recruiting purposes, at a chief's village a hundred miles away.

A midget called Jeki, only three feet tall, arrived at the studio and insisted upon broadcasting, as he had accompanied a battalion of the Northern Rhodesia Regiment to Somaliland as cook.

He shouted up into the microphone greetings in the native tongue to his relations and friends at the meeting. His parents were present and heard his voice with consternation. They believed he had been killed.

They thought it was "his ghost speaking from a magic box," but the recruiting officer explained and calmed their fears.

## Radio Amateurs Tap Nazi Code

IT is reported that British amateurs are at work during the night taking down morse code messages which fill the air after dark. In the hands of code experts some of these transmissions might produce a message of vital importance to our Intelligence service. These listeners are drawn from the radio amateurs who operated their own short-wave transmitters before the war.

## Indian Broadcasts

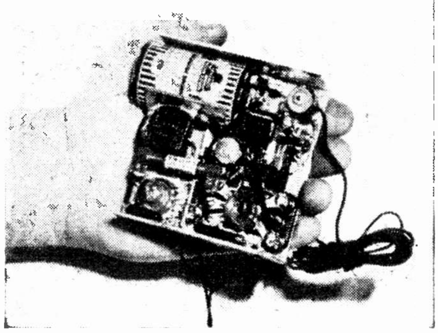
INDIA is to have a new broadcasting station, which, it is expected, will be audible in all parts of the world, and will be used for broadcasts to Europe, Africa and the Far and Middle East, Reuter reports.

An order has been placed in England for a 100-kilowatt transmitter. This will be one of the most powerful in the world; and will be installed at Delhi.

## Hunting Radio Spies

ACCORDING to a recent report, hunting in the ether for spies is the new job the war has brought the seven radio monitor stations of the Federal Communications Commission in the United States.

These stations have directional gear used for tracing all kinds of wireless transmissions. A foreign agent wirelessing the departure of a ship from a U.S. port to a warship at sea would stand a good chance of being tracked down. The monitor service can actually trace a transmitter which is being operated from a fast-moving car.



*American policemen, when on patrol work, carry miniature portable radio sets, as shown in the illustration.*

## Loudspeaker Vans for Emergencies

THE G.P.O. has announced that should enemy action affect the postal, telegraph and telephone services of a district loudspeaker vans will inform the public about the emergency arrangements.

Announcements will be made in conversational style, and will not contain too much detail. In addition, posters will be exhibited.

## B.I.R.E. Merger

WE are informed that the Council of the British Institution of Radio Engineers has agreed in principle to fusion with the Institute of Wireless Technology. At a recent B.I.R.E. council meeting it was provisionally agreed that the combined body is to be known as the "British Institution of Radio Engineers, incorporating the Institute of Wireless Technology." Members will be able to transfer to the combined body with the same grade as they now hold.

## New York's Ten Stations

IN New York there are ten radio stations which broadcast news throughout the day and night. During a normal 24 hours recently these stations sent out 66 separate news broadcasts, and 34 separate news commentaries.

## Valve Output in U.S.A.

IT is interesting to note, particularly at the present time, that valves are being turned out, by the industry in America, at the rate of 400,000 daily.

## U.S. Navy's New Transmitter

IT is reported that the U.S. Navy Department has purchased 359 acres of land in Oahu Island, T.H., for the site of a new radio station which is to cost one million dollars.

## America's Tallest Mast

A MAST, 878ft. high, has been made taller by the addition of a four-element array for FM transmissions. The station, WSM, has been granted a 20kW. FM licence for an area covering 16,000 square miles.

## World's Radio Listeners

ACCORDING to figures obtained by the U.I.R., there were at the end of 1939 nearly ninety million receivers in use throughout the world. To this total Europe and North America each contribute approximately 40,000,000.

## Boy W/O.s for R.A.F.

WE understand that boys who have taken the course at the civil wireless schools licensed by the G.P.O. and municipal technical colleges will in future be accepted, if suitable, by the Royal Air Force as wireless operators from the age of seventeen and a half. A reimbursement for tuition fees up to £25 can be claimed by the entrant.

## R.S.G.B. Progress

IT is interesting to note that despite the war, the Radio Society of Great Britain made remarkable progress during 1940. No fewer than 300 new members entered the Society, and over 50 per cent. of them are in the Services.

## Official Statement on Jamming

IT was recently stated in the House of Commons that the jamming of the B.B.C. Forces programme on 373 metres is of Italian origin and is aimed at the B.B.C.'s transmissions in foreign languages, which are radiated on this wavelength at certain times during the evening. We do our best to counteract it by jamming enemy transmissions within the limits of our resources.

## News from Athens

NEWS of the situation in the Balkans, and the war in Albania, can be heard each evening in an English bulletin broadcast from Athens. It is radiated by the courtesy of Cable and Wireless from the company's transmitter on a frequency of 9.935 mc/s (30.196 metres) beamed on Great Britain.

The transmission, which is from 8.40 to 9 p.m., B.S.T., opens with Greek National Anthem, which is followed by the British National Anthem. The news begins at 8.45 p.m.

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

## Dead Spots

MEMBER 6,740 raises a very interesting point in a recent letter, and although the matter has been dealt with in past issues, we feel that the subject is one of general interest, and will give other members an opportunity of passing on any information they have compiled as a result of their own experiences and experiments. The writer of the letter says, "As a member of the B.L.D.L.C. I would like sound advice from any member who cares to offer it on a subject which verily has whiskers on it. The subject is 'dead spots' on short waves, or, in other words, failure to obtain reaction over certain frequency bands mainly below fifty metres. As far as I know, I have tried every device, dodge and gadget possible, but still I get these very annoying spots, which is most aggravating, as my chief attraction on short waves is morse. To obtain the advice I require, it will be necessary for those who wish to offer it to know something of the circuit I am using. It is an 0-v-2, both stages R.C.C. My aerial is an ordinary inverted-L type, about 30ft. high. H.T. is supplied by an eliminator, whilst the L.T. is always up to the mark as I charge my accumulators myself.

"In the aerial lead I have five condensers, varying from .0001 mfd. to .000025 mfd., thus allowing me to select a wide range of capacities. I can vary the detector plate voltage, and have tried numerous values for the reaction condenser. The valves are quite good, and changing them makes no difference. I have used an old heavy metal chassis connected to earth on which to place my feet whilst operating. I tried this to see what effect it would have on 'body capacity,' but the only effect was to vary the reaction without eliminating any of the trouble. I have also tried a resistance in the reaction circuit between anode and reaction coil, the controlling condenser being on the earth potential side of the winding.

"Generally speaking, I get reaction after some fiddling with the aerial coupling up to about half of the frequencies each coil covers, but this does not apply in every case. Can any member give me the cure after noting these details? I would add that I cannot use a by-pass condenser between detector plate and earth, as if I do I cannot get reaction under any circumstances.

"I expect by now I have given the impression that my receiver is a perfect washout, but far from it. In the year prior to the war I logged over 2,000 stations, all amateurs, in 103 countries, and had various QSLs, including ZLs and VKs, and 75 per cent. were heard on C.W.

"Perhaps I am greedy, and want an ideal circuit; well, to be candid, I want as much as I can get from the apparatus available, and why not? I have heard British hams say they have not heard a Welshman for two years, whilst I have heard quite a number in half that time. What I really want is some good DX work when we all start off once more under peace-time conditions.

"After all this, I shall be pleased to get any advice, either through P.W. or by letter, from any member willing and able to solve my problem. Thanking you in appreciation of the facilities your paper gives."

Well, now, here's a chance for the short-wave enthusiasts to pass on some good advice, and this can be done direct to the member in trouble, his address being 248, Kenmore Avenue, Belmont, Harrow, Middlesex, or through these columns.

## In Khaki

THE illustration on this page was sent us by Member 6,186, now a corporal in the Royal Corps of Signals. According

*Member 6,186, now in khaki, and his friend, G3HW.*

to his letter, he is wearing kid gloves, and his friend is Les Deymond, G3HW. He continues: "I am also enclosing a few lines which may be of interest to other readers, and I would like to mention that 'Wireless Transmission for Amateurs' which I always keep by me, has been very useful to some of the boys in their trade tests, as it explains things in a more simple manner than the Army textbooks. If any readers would like to write to me, I will gladly answer their letters, but they had best write to me c/o 15, Meadow Road, Salisbury, Wilts." About the opportunities open to wireless enthusiasts in the Army, Member 6,186 says: "Now that new classes are going to be called up, it may interest some readers to know what unit in the Army offers the best scope for their knowledge of wireless or electricity. For Hams or S.W.L.s. one of the best units is the Royal Corps of Signals. There is plenty of scope for wireless operators, for wireless engineers, instrument mechanics, linemen, telephone switchboard operators, and teleprinter operators, but I expect most readers will be chiefly interested in the wireless side. The Service offers fine opportunities for keen wireless operators, and many amateurs will thus get their chance to rattle away on the key again. One snag that has come to my notice is that if you wait until you are called up you might not have the same opportunity of selecting the unit which you would like to join, but if you join up a month or so before your time, there is every possibility that you will get posted to the unit of your own choice. If you pass all the preliminary details satisfactorily, and join the Royal Signals, you will, of course, go to a training unit first. If your morse has got rusty, and you are not very fast, don't worry; you will get plenty of practice, and your speed will soon come up to anything from 15 to 28 words a minute. After this initial training you will get a trade test, and, if you pass this, you will get tradesman's pay and be posted to a unit. Those who have selected the wireless branch will go on to a mobile or stationary wireless station and have plenty to do with both telegraphy and telephony. The prospects of promotion are good, and as an example of this I would mention that out of the twelve who joined, or re-joined with me in September, 1939, one has been promoted to commissioned rank, two have received sergeant's stripes, whilst seven have been made lance-corporals."

## Contacts Required

A NEW Service member, Number 6,892, now serving in India, would welcome correspondence from those experienced in S.W. reception and transmission. Letters should be sent to us for forwarding to this member.

Another newcomer, living at 84, Windwill Terrace, St. Thomas, Swansea, Member 6,899, would also like to make contact with others interested in short-wave reception.

Member 6,883 (fourteen years of age), of 199, Seamer Road, Scarborough, Yorks, would like to contact others around his own age.

Member 6,887, of 29, Albion Street, Wall Heath, Brierley Hill, Staffs, whose name has recently been added to the ever-growing list of members, is anxious to get in touch with other short-wave enthusiasts in his area.

Brompton-on-Swale. Any members in this district should note that Member 6,870, of Catterick Bridge Burseries, Brompton-on-Swale, nr. Richmond, Yorks, would like to get in touch with them.

**Dwindling Stocks**

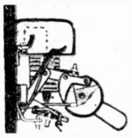
# ELECTRADIX BARGAINS

**Cannot be Repeated**

## AUTOMATIC CIRCUIT BREAKERS

**Magnetically tripped Switches that operate instantaneously**

We offer, at a reduced price, Circuit Breakers of first-class make, metal cover. Made in single, double, and triple pole. Prices are very low, and **type marked with a star have thermal trip delay.** Illustration shows S.P. with cover removed.



**SINGLE POLE, HEAVY IRON CASE**
250/400 Volt

| Rating | Type | Price |
|---|---|---|
| 6 amps. | S 11/1G | 11/6 |
| 6 .. | S 11/1Z* | 13/6 |
| 10 .. | S 11/1G | 16/- |
| 15 .. | S 11/1G | 18/- |

**4in. x 5½in. DOUBLE POLE, IRON CASED 300/500 Volt**

| Rating | Type | Price | Rating | Type | Price |
|---|---|---|---|---|---|
| 1 amp. | S 11/2Z* | 18/6 | 5 amps. | S 11/2Z* | 25/6 |
| 1½ .. | S 11/2Z* | 19/- | 6 .. | S 11/2Z* | 26/- |
| 2 .. | S 11/2Z* | 20/- | 6 .. | S 11/2 | 23/- |
| 2½ .. | S 11/2Z* | 21/- | 10 .. | S 11/2Z* | 32/- |
| 3 .. | S 11/2Z* | 22/- | 10 .. | S 11/2 | 30/- |
| 4 .. | S 11/2 | 22/- | 12 .. | S 11/2Z* | 36/- |
| 4 .. | S 11/2Z* | 25/- | 15 .. | S 11/2Z | 34/- |

| 22 TRIPLE POLE, 3 TRIPS Light Iron Case 300/500 Volt | | | TRIPLE POLE, 3 TRIPS Heavy Iron Case 300/500 Volt | | |
|---|---|---|---|---|---|
| Rating | Type | Price | Rating | Type | Price |
| 800 m.a. | S 11/3Z* | 25/- | 500 m/a. | S 11/3Z* | 26/- |
| 3 amps. | S 11/3 | 21/- | 800 .. | S 11/3Z* | 27/- |
| 3 .. | S 11/3Z* | 24/- | 1 amp. | S 11/3Z* | 24/- |
| 4 .. | S 11/3 | 21/- | 2 .. | S 11/3Z | 22/- |
| 6 .. | S 11/3 | 32/- | 2 .. | S 11/3Z* | 26/- |
| 10 .. | S 11/3 | 38/- | 3 .. | S 11/3Z* | 28/- |
| 15 .. | S 11/3Z* | 45/- | 4 .. | S 11/3 | 23/- |
| | | | 4 .. | S 11/3Z* | 30/- |
| | | | 6 .. | S 11/3 | 36/- |

## ROTARY SWITCHES

Instrument type Rotary Back-panel Voltage Switches, with 40 sector contacts. Ideal for home-made multi-range meter sets, multi-tap chokes, power potentiometers or faders. Brand new, limited number, surplus on a contract. Finely made with front panel plate and knob. Type L40. Pre-tax Sale Price, 7/6.

**CURRENT ROTARY SWITCHES.** 20 contacts, carry up to 10 amps., multi-blade brush. Back of panel type, as above. Type 11. Few only at 8/- each.

**15-DAY TIME SWITCHES.** Venner 5 amps., 100 amps., 200 amps. In stock.

**THERMOMETERS.** Panel 2½in. dial, 5ft. ether tube, for distant indicating, reading 0 to 100 deg. Cent., 7/6. Cambridge, 10/6. FOURNIER THERMOMETERS by Cambridge Instrument Co., 4in. dial, 10-110 deg. Cent. Fitted adjustable electric contacts, 45/-.

## OTHER SWITCHES

Small 7-stud on ebonite with plug, 1/9. Yaxley, wave-change, 2-gang, one hole, 1/2. Reyrolle Power Plugs, 15 amps., shrouded panel wall, two pairs on box, unused, 10/-. SNAP Indicating on-off and change-over Switches, carry 250 volts, 5 amps., 1/2 ; 10 amps., 1/6. Single-pole Change-over 10 amp. Switches, porcelain, 2/6. Double-pole ditto, 3/6. R.A.F. 80B Series Parallel Barrel Switches, 5 amps., 2/-.

## VOICE RECORDING

**VOICE - RECORDING MACHINE.** Illuminated pedestal type, fitted automatic, motor, disc recording gear and amplifier, by the Amusement Equipment Co., Ltd. Put 6d. in the slot and 125 words are recorded on 5in. disc, plays back to earphones. For voice letters to friends and relations, an acquisition to a canteen or entertainment depot ; earns good fun fair money, only £22. Cost £90.

## DOMESTIC BARGAIN

**AEROFRIGE DOMESTIC REFRIGERATOR.** Cabinet size, 46in. high x 22in. x 20in., 3½ cu. capacity, white enamelled, New condition, £14.

## ELECTRIC GEARS

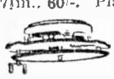
¼ h.p. Morse Chain and Wheels, 5/- set. **Skewgear** Boxes, ¼ h.p., 10/-. Gear Boxes, 2-1 for ⅛h.p., 4/6. **Electric** Governors, 7/6. **Bowden R.A.F.** Remote Controls, 18 points, 7/6.

**200 TRUE-TWIN CAMERASCOPES,** 2 lens viewers, 1/- post free.

**COMPRESSORS ONLY.** For Refrigerators or Tyre Pumping, £3. Brass Unions, 1/-. Stop Valves for refrigerators, 2/6.

**ELECTRIC GOVERNORS.** Centrifugal control, 1,500 r.p.m. contacts, brushes, slip rings for auto speed regulation, 7/6.

**COMPASSES.** Mariner's 6in. Binnacle Boat Compass, portable, gimbal bases, etc., 45/-. Kelvin Ship Compass, pattern 14, liquid type. Mahogany case 10in. x 10½ in. x 7½in., 60/-. Plain 1in. Pocket Compass, 1/3.



**SMALL RHEOS.** Back of panel, one hole, front knob, 10 watts, 40 ohms, 2½ amps., 2/6 ; 6 ohms, 1.7 amps, 2/6 ; 10 ohms, 1 amp., 2/- ; 20 ohms, ½amp., 2/- ; 30 ohms, .3 amp., 1/6 ; 30,000 ohms Volume Controls, 1/6.

**Resistors,** on mica, 8 ohms, 1½ amps., 9d.

**LARGE IMMERSION HEATERS** for tank or bath, 1,000 watts, 25/-.

**The ROLLS-ROYCE of BUZZERS is the CAMBRIDGE-TOWNSEND. Tiny and Shrill.**

Perfect for Wavemeters, ideal for signals. High note model "T" Diaphragm blade. Platinum Contacts. The smallest Buzzer possible. **10/-**

**BUZZERS,** small type, with cover, 1/6. **Power Buzzers,** with screw contact and adjustable armature, 2/6. **Heavy Buzzers,** in Bakelite case, 3/6. **Siemens Morse Line Transmitters,** with key and brass-cased Power Buzzer, 17/6. Magneto Exploders, 25/-.

**H.T. BATTERY SUPERSEDERS.** 85 v. at 6 m.a. for H.T. from your 2-volt battery no H.T. batteries. 7in. x 4½in. x 3in. Bakelite finish. Vibrator and Metal Rectifier, by S. G. Brown. Sale 37/6. Full guarantee. VIBRATORS, 6/12 volt car type, 4 amp., 10/-


## TRAINING AIDS FOR NAVY, ARMY AND R.A.F.

**L.R. SOLO PHONES.** For buzzer morse. Single Earpiece, 40 ohms, with cord, 1/3. Ditto, D.3, 60 ohms, with cord, 1/6. W.E., 1,000 ohms, with cord, 2/-. 2,000 ohms Earpiece, with cord, 2/6.


**L.R. DOUBLE HEAD-PHONES.** Pilot Signallers 120 ohms Phones. All leather headbands with slide adjustment chin strap and 4ft. cord, 4/6. Sullivan 120 ohms, Aluminium Headbands, 4/9. Cords, 1/6.

**RADIO PHONES.** Browns, "A" ReedPhone, aluminium headband, 4,000 ohms 35/6. 1,500 ohms, 21/6. 120 ohms, 17/6. Cords, 1/6. **Various Makes :** Second-hand Headphones in good order, 2,000 ohms and 4,000 ohms, 4/6 and 6/6, with cords. Western Electric, 2,000 ohms, 4/6.

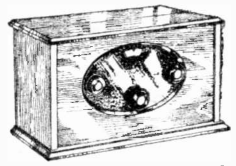
**TAPPER KEYS** for Morse Signal Transmission. Service Silent Practice Keys, 3/-. T.X. Practice Key, front contact, on black moulded base, a good small key, 3/6. Long bar Type Practice Key, T.X.2, with cranked bar, 5/6. Superior Model B2, with back contact, a well finished key on polished wood base, 7/6. Operators' P.F. plated pivot bar and terminals, mahogany base, 9/6. Type I.V. Superior ditto, nickel-plated pivot bar and fittings, on polished base, 10/6. Panel Keys to fold up flat, 6/6. Fullerphone double acting Morse Key, solid brass on heavy base 7/6. Three-colour light Switch Box, with morse key for code signals, 4/6. S.G. Brown totally enclosed type, 42/-.

**PORTABLE FIELD PHONES FOR H.G. LISTENING POSTS AND A.R.P.** Leather cased W.D. Type 135. Service Field Phones are difficult to get. Soiled but serviceable, have morse keys, mike and phone.

**EXCHANGES,** Plug type, 5-line and 20-line. Wire and cables cheap.

**TELEPHONES** for all purposes. House, Shelter, and Office.

## TUDOR OAK CABINET



13½in. by 7in. by 7in. Fitted variable .0005 S.M. condenser and a microdenser, 3-wave switch, valve-holders, wiring, three condensers and 10 terminal panel. **14/-**

**HORIZONTAL BRASS-CASED GALVOS,** 7/6.

**CELL TESTERS.** Megger 3-0-3 moving coil. Aluminium case, 25/-.

**ELLIOTT BATTERY TESTERS.** Government model 108. Moving Coil Ammeter and graded rheostat, 37/6.

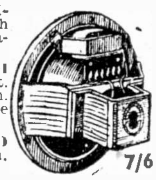
**MOTORS.** We still have a good stock of fractional H.P. motors, A.C. and D.C., as well as large machines of all sizes and types.

**SWITCHBOARD, PANEL AND PORTABLE METERS.** We can supply 8in., 6in., 3in. and 2in. meters in certain ranges still at low prices.

**AMPERE HOUR METERS,** D.C., Ferranti, 1,000 amp., 200 amp. ditto ; C. and H. 50 amps, 60 amps, 100 amps, and 150 amps.

**METER MOVEMENTS,** with magnets, switchboard size, with moving coil on jewelled pivot. For home-made relays or meters, 6/- each to clear. Movements from A.C. Unit Recorders, induction motor, magnet brake, gear to 5 dials to 10,000, 5/6.

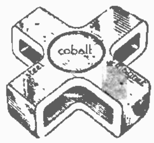
## SPEAKER BARGAINS



**MAINS ENERGISED SPEAKERS,** 6in. Rola, 1,200 ohms, with speech transformer, 7/6. Magnavox, 6in. type, 12/6.

**A.C. MAINS SPEAKERS, WITH RECTIFIERS.** Jensen, 220 volt, 7in. cone and transformer, 25/- ; 7in. cone, 20/- ; 100 volt A.C., 8in. cone with transformer, 21/-.

**BATTERY ENERGISED SPEAKERS,** K.B., 6 volt, 8in. cone, 8/6. **7/6**

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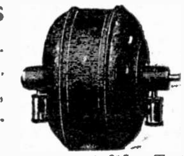

110-volt, .8 amp. D.C. ball bearing, semi-enclosed, 1,850 revs., 15lb. 6in. x 5in., cheap. This month only. **10/6.**

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**STATIC CONVERTERS.** A.C. to D.C. 40 watts output, steel-cased. Input 230 volts A.C. 50 cycles, output 440 volts, 60/100 m.a. D.C., with valve, 45/-.

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Adhesive Tape, new, for joints, ½in., 6d. per roll.

**ARC LAMPS.** Scissors type, one movement, hand feed, 5 to 20 amps., 25/6. Superior model, ditto, semi-automatic, magnet feed, 35/-.

**SOLENOIDS.** 6 volts and 12 volts, lifts 1 oz. ½in., 3/6. Heavy Type, 110 volts 2lb. model, lifts 7 lbs. 220 volt Type lifts 12 lbs., 4/6.

**ALUMINIUM FOIL,** 12in. by 12in., 9d. sheet.

**HOME RECORDERS. Electrical Home Recording** requires Tracking Gear for Grooving, Traverse, etc., 25/-.

**CUTTER** needles, sapphire, 3/6. Real Diamond, 7/6. Rotary Needle Sharpeners, 1/6. Wood Needles, round or triangle 1/- doz.

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# Outline of Musical History—18

## By Our Music Critic, MAURICE REEVE

THE present conflict has brought about a situation very similar to that created by the Great War—1914-1918. Practically all musical activities are suspended, creative as well as executive. In England things are probably much worse than they were then, whereas on the Continent they would seem to be better. Here, for example, the blitzkrieg has killed both the concert and theatrical worlds. Such few activites as the National Gallery and Sunday afternoon concerts can scarcely be even called "keeping the ball rolling." But in the last conflict the Promenade Concerts never ceased for one night, and there was a fair amount of individual activity, and theatreland veritably flourished.

On the Continent there is a different situation entirely. The activities of the R.A.F. have not affected the civil population to anything like the same extent as have the depredations of the German Luftwaffe here. A music lover has not got to ask himself, before leaving home, whether a performance of some favourite work is worth his sacrificing his life or coming away from it mutilated. But even more important than that, as an influence making for the peaceful and uninterrupted performance of music, is the fact that there is no warfare going on anywhere in Europe—except Greece—and that so much of Europe is now under one sovereignty. There is, in fact, much music on the Continent, as one can hear from the many broadcasts from the German occupied countries, as well as from Germany itself.

### When Peace Comes

Doubtless, when the bells ring out again and the joyful news that the war is over is spread across the land, the position will be exactly as it was last time. Concert halls will be packed beyond capacity by totally uncritical audiences, so great will be the thirst to hear real music again. Some of the scenes witnessed after the last conflict were, with a few honourable exceptions, ludicrous in their naïveté and trusting simplicity.

In theatreland, however, the position is indeed sad. Nowhere is this reflected more clearly than in the complete and abysmal dearth of marching songs and concert numbers. Just think back and recall the series of magnificent tunes which such shows as the Bing Boys, the Co-optimists, and "The Maid of the Mountains," as well as "Chu Chin Chow" and many others, gave us! In addition, the music-halls were flourishing. To-day, "Roll Out the Barrel" and "Hang Up Your Washing on the Siegfried Line" are the depths to which we have had to descend!

### Lack of Popular Melodies

Furthermore, the ballad concert was at the zenith of its popularity, and at these delightful occasions popular singers gave us such charming numbers as "Roses of Picardy," "Little Grey Home in the West," and "The Great Big World Keeps Turning," all on everyone's lips and lightening their burdens during those terrible years. To-day, owing to the complete absence of any source of supply, there is absolutely nothing! The loss is enormous to all concerned, but to none more than the weary plodder who is left to carry the full weight of his pack unaided.

The position in the creative world of art is, of course, much the most serious aspect of the situation. It has long been giving its friends and devotees cause for grave anxiety which the war has only served to accentuate. War hits music hardest of all the arts; it is the very antithesis of all it stands for and symbolises. It is the most difficult emotion to express in terms of sound and the most difficult art form to listen to when the mind is beset by the worries and tragedies of modern combat. And it is very expensive to produce, and is therefore unprofitable correspondingly.

But above all, perhaps, stands the well-nigh impossibility of adjusting the mind to the creation of music in the atmosphere which war engenders. It is a barren and sterile soil in which to sow harmonies and melodies. Even a giant like Elgar wrote little during the last war, when there were more opportunities for getting one's work produced than there are now. And I think the same applies to Sibelius.

### Music in Germany

This naturally has a most baleful effect on the future of music, and nowhere more so than in Germany. For two hundred years, from the advent of Bach and Handel to the zenith of Strauss's creative genius, Germany reigned supreme in the realm of music. Come who might in other countries, there was always a giant across the Rhine, who would inevitably be succeeded by another. And the same applied to all branches of music, executive artists, teachers, theorists and pedagogues in general. To study music meant a sojourn in Leipzig or Vienna, as surely as the day follows the night.

But somehow or other this great empire came crashing down and little now remains of the former dynasty. Scarcely a first-class work has come out of the country for thirty years, its teachers are barren of any new or original ideas, whilst its pedagogues and researchers render the night hideous with their quarter tones and their unrelated dissonances.

Why all this, whilst "unmusical" England, for instance, has in the same period poured forth much splendid music and rich ideas? The materialism of the present age can only partially be held responsible, because materialism has been rampant everywhere, including England. The preparation for wars, which have filled the minds of all classes of the German people from the dawn of the present century, has had a much more vicious influence.

Though always war-like and truculent, the Germans have also always been a speculative, philosophical and contemplative people with a vast capacity for work and study. A few callings require harder work or more intense concentration than the writing of great musical compositions. The Germans, in the quiet burgher life that they led right up to recent times, would seem to have been marked out as the "chosen race," musically. It was an atmosphere in which great music was bound to thrive and flourish; up a point it couldn't help itself. The Olympian pronunciamentos of Beethoven, the romantic and racial imaginings of Wagner, the hard logic of Brahms, the religious and mathematical genius of Bach, the sweet romanticism of Schubert, the more neurotic and passionate Schumann; all these and a host of lesser but worthy lights were the product of the mother earth that bred them and reared them.

All is now changed, and the picture presented us by modern Germany is too horrible to contemplate even if we had the time or the inclination to do so.

### Music's Future in England

In England, on the contrary, we can look forward to the future with supreme confidence and thanks, at least, in part, to the liberal outlook of our people, and their freedom from regimentation and soul-destroying influences. We abound in original ideas both in the creative as well as the executive sides of the art, which are bound to bear rich fruit.

# The B.B.C. Overseas Service

IMPORTANT developments in the B.B.C.'s Overseas Service came into force recently. The schedule of broadcasts has been completely revised, and the services have been increased from four to six, operating for a total of 54¼ hours daily—an increase in the transmitting time of nearly twenty-five per cent. This new grouping will give a World Service in English for 21 hours daily; a second World Service in other languages of the Empire—such as Hindustani, Afrikaans, Burmese, Maltese—for two hours daily; a Main European Service in German, French, Italian, Dutch, Flemish and the languages of Central Europe for twenty hours daily; a second European Service of five hours daily for broadcasts to Spain, Portugal, the Scandinavian countries and the Balkans; a Latin-American Service, four hours daily, for broadcasts in Spanish and Portuguese; and the Near East Service, 2¼ hours daily, for broadcasts in Arabic, Persian and Turkish.

Overseas English News bulletins may be heard at the following times (B.S.T.):

7.15 a.m. (W): 31.55, 31.32, 31.25, 25.53, 19.66 m.
9.0 a.m. (W): 31.55, 25.53, 19.82, 19.66; 19.60, 16.84 m.
9.0 a.m. (E): 49.59, 30.96 m.
12.0 noon (W): 31.25, 25.53, 19.82, 16.86, 13.97, 13.92 m.
2.0 p.m. (W): 25.53, 19.82, 16.86, 16.84, 13.97, 13.92 m.
2.15 p.m. (E): 49.59, 25.38, 25.29 m.
5.0 p.m. (W): 31.75, 31.55, 25.53, 16.84, 13.93, 13.92 m.
5.15 p.m. (E): 49.59, 25.38, 25.29 m.
7.0 p.m. (W): 41.96, 31.25, 25.53, 19.82, 19.66 m.
9.45 p.m. (W): 31.25, 25.53, 25.38, 25.29, 19.82 m.
11.0 p.m. (E): 373.1, 285.7, 261.1, 49.59, 30.96 m.
11.45 p.m., 1.0 a.m., 2.45 a.m., 5.30 a.m. } (W): 49.10, 31.32, 31.25, 25.53 m.

(E) means European Service; (W), World Service.

# Impressions on the Wax

## A REVIEW OF THE LATEST GRAMOPHONE RECORDS

### Variety

THERE are some particularly lovely numbers this month, especially "Good-night Again" and "Ferry-boat Serenade," both recorded by Ambrose and His Orchestra on *Decca F* 7673. The former title is a very beautiful melody and has a pleasing lyric. It is performed to perfection on this record. Mantovani's Orchestra has two film-hit numbers—"Our Love Affair," from "Strike up the Band," and "Only Forever," from "Rhythm on the River"—*Decca F* 7675. "Our Love Affair" has an arrangement that is different, the opening theme of violins and rhythm being very unusual and used with effect at intervals throughout the record.

On *Rex* Billy Cotton has recorded "Good-night Again," in which he introduces vocalists and choir with very pleasing effect—certainly Cotton's best record this month. The coupling is excellent, too—"Our Love Affair"—*Rex* 9898. There are two other records by Billy Cotton's Band, both very good, from which you can take your choice—*Rex* 9896—"Trade Winds" and "Blueberry Hill"—*Rex* 9897 "Maybe" and "Ferryboat Serenade."

A record of topical interest is a revival of the old song, "Yes, We Have No Bananas." The number gives the Arthur Young Swingtet an opportunity to go to town and the boys obviously enjoy themselves. The other side is a happy version of "All Over the Place." The teamwork and general spirit of happiness which pervades it make this one of the brightest records of the month—*Decca F* 7687.

### New Comedy Number

A NEW comedy number particularly apt just now is "Oh, What a Surprise for the Duce." It has an Italian air with an anti-Italian lyric! This will certainly be sung at all camp concerts with gusto, and the lyrics will not always be as printed. Ambrose has recorded it for *Decca F* 7691, and on *Rex* 9904 Elsie Carlisle puts all she has into it, and obviously enjoys doing so. Bertha Willmott is also an ideal artist for this song and she has recorded it on *Decca F* 7692, coupled with another popular song with the troops, "Bless 'Em All."

A new combination on Decca make a very good start with "Tuxedo Junction" and "Six Lessons from Madame La Zonga" *Decca F* 7672. They are the Sid Phillips Quintet. This is a "commercial" swing, and will appeal not only to the swing fan but to the ordinary person who likes a record with a snap.

Charlie Kunz, the pianist who plays with such simplicity and yet introduces a terrific rhythm into all his records, has an especially good selection of titles this month on *Decca F* 7680. It includes "All the Things You Are," "Until you Fall in Love," "I'm Nobody's Baby," "Sierra Sue," etc. This record is not only soothing to the ear, but excellent for dancing. There is a rhythm accompaniment which maintains a perfect tempo.

### Old Favourites

ALFRED PICCAVER sings two grand old favourites, "I Hear You Calling Me" and "Homing," on *Decca F* 7688. From ballads we come to songs of to-day, and Bing Crosby sings two of the numbers from his latest film, "Rhythm on the River"—"Only Forever" and "When the Moon Comes over Madison Square"—*Brunswick* 03087. The first number is a typical Crosby "ballad fox-trot," and will undoubtedly prove a hit, whilst the second is in hill-billy tempo and is a very happy contrast. Adelaide Hall has made two new records this month—"Our Love Affair" and "So Do I"—on *Decca F* 7681, and "Good-night Again" and "Trade Winds" on *Decca F* 7678. "Trade Winds" is one of the best records this artist has made recently, and an instrumental accompaniment with the novachord adds charm to the record.

### Swing Music

SWING on strings was introduced a few years ago by a group of French boys. Foremost among them were Django Reinhardt, French gypsy guitarist, and Stephane Grappelly, whose violin style has revolutionised swing. These two were the leaders of a combination called the Quintet of the Hot Club de France. Then came the war and the unique quintet was broken up. Grappelly came to London and played for a time with Arthur Young's Swingtet. More recently, he has been playing on his own at London's Lansdowne House. This month he has made a new record called "Stephane's Tune." It is played by Stephane and His Musicians, and promises to be one of the hits of the season. The other side contains an old favourite, "After You've Gone"—(*Decca F* 7570). Incidentally, there is also a record in the new Decca lists by the original Quintet with both Grappelly and Reinhardt. One of the last to be made by the pre-war group, it should have a definite collector's interest for the swing fans. It is "Tea for Two" and "Billets Doux" on *Decca F* 7568.

# Operating the Receiving Station

## *This Article Explains the Best Procedure to Adopt, How to Carry Out Worth-while Experiments, and the Real Value of Co-operation Between All Amateurs*

By L. O. SPARKS

WHAT constitutes the correct operating procedure at a receiving station appears to be a very debatable point; it will suffice if we assume that there are three schools of thought, those whose chief concern is to log as many transmissions as possible, those who use D.X. stations to verify the effective efficiency of their installation during experimental work and, finally, the more serious amateur, who compiles exhaustive data concerning reception conditions.

Space does not permit the analysis of the merits or demerits of each group. However, knowing the three widely varying views, we can formulate a plan which, if adopted, would lead to better work all round and greater co-operative effort between all amateurs.

The lone-station operator can do some very useful work, but unless exceptional circumstances force such conditions, it is not to be recommended. Apart from fostering the vital spirit of the amateur movement, namely, comradeship and co-operation, a group of amateurs can always get more interest, more pleasure, and usually better results than the lone man. There are, of course, exceptions to every rule, but this article is concerned with the majority, not with the idea of freezing the lone man out, but rather to show him how, by joining in with the vast army of fellow enthusiasts, he can become an active contributor to its progress.

### Preparatory Work

Before any serious listening can be undertaken, it is essential to see that the receiving installation is capable of giving maximum results. It does not matter what type of receiver is in use: preliminary experimental work is the only means of proving to the operator that he is getting the last ounce out of the complete installation. Such work, therefore, covers not only the receiver but the aerial and earth systems, power supplies, headphones and speakers, all external wiring and switching and, of course, the ability of the operator.

It is not possible to deal with all types of receiver, but this will not prove detrimental to the advice given below as it is equally applicable to one type as another. For example, the first requirement is to check up on the receiver's performance. As reception conditions of any one transmission can vary over a very wide range during remarkably short periods, it is essential for all actual receiving tests, for comparative purposes, to be undertaken in such a manner that the total time taken will not exceed the period during which one might expect reasonably consistent field strengths from the transmitter being used as the source of test signals. As much as possible should, therefore, be done to the receiver off the aerial. To be more explicit, all valve operating conditions should be subjected to a thorough check, reference being made to the maker's recommendations and data. If several tuned circuits are incorporated in the receiver, they can be lined up by using an external oscillator or, failing this, the reception of a "local" station whose field strength is consistent in the area concerned. The L.F. portion of the circuit, headphones and loudspeaker, can be tested by applying a modulated signal, i.e., L.F. oscillator or pick-up, to the input of that section of the circuit. Coils, contacts, switches and power supplies can also receive their share of attention. The aerial and earth systems have not been mentioned as coming within this part of the preliminary work, as it is assumed that they are reasonably efficient and, provided they are not altered during the comparative tests, they will not affect such results one way or another.

Once the operator is fully satisfied that everything is in tip-top order, the actual aerial tests can commence, and it is during these that the set will be put through its paces and, incidentally, the operator, as much will depend on his skill and ability to handle the receiver.

*A wireless section at work with a portable transmitting and receiving set during tank exercises, somewhere in the Eastern Command.*

### Comparative Tests

It must be appreciated that these tests are not intended to follow laboratory practice; the average amateur is without the facilities or equipment for such work, therefore, no mention has been made of using a high-grade external H.F. generator plus a calibrated output meter for checking purposes. It is a great pity that so many S.W.L.s have to rely on their ears to determine any variation in output of their receivers. The use of a reliable "R" meter is certainly a great assistance during these tests, but there again, unless they are incorporated in a well-designed balanced circuit arrangement, they can be very misleading and produce readings which are not always truly indicative of the actual state of affairs. There is, however, one simple method which the writer has used with reasonable success, but unless it is calibrated against some known sound level, it can only claim to be of use for comparative methods. It consists of an ordinary L.F. oscillator, such as is used for Morse code practice, having an output transformer connected in place of the usual 'phones. The secondary of this transformer is connected via a .5 megohm potentiometer to the P.U. terminals, or their equivalent, of the receiver under test. With the potentiometer at its minimum setting, a transmission is tuned-in until maximum results are obtained. The L.F. oscillator control is then turned up until the note is of the same intensity as the signal. A little practice and care are needed to adjust matters to a nicety, but if, for example, modifications are made to the installation, or another transmission received, one is able to get a good idea whether the new signal is greater or less than the original by noting whether the L.F. potentiometer has to be turned up or down to produce intensity balance.

When undertaking aerial tests, working to one known transmission, it is rather difficult to judge variations by ear alone, but one can have the satisfaction of knowing that any gain in audible output usually represents an appreciable gain in some part of the receiver or input.

During these checks it is advisable to hold the one transmission for at least five minutes before any modifications are made. This period will usually cover the time taken for the signal to reach its maximum and minimum strength if fading is experienced, and also allow time for notes to be made of the actual reception and the operating conditions. If the operator has in mind trying several experiments to see if efficiency can be improved, he should remember that the most accurate indication of the value of such modifications can best be secured by carrying out only one item at a time. If two or three alterations are made at the same time it does not follow that all contribute to the gain or loss obtained, thus misleading deductions are likely to be arrived at.

## Aerial and Earth Systems

Experiments with these vital items should not be undertaken until one is satisfied, by the methods mentioned above, that the receiver is at its peak. Any proposed alterations should be thought out and planned beforehand, so that once one starts on any outside work one is able to proceed without any loss of time trying to make up one's mind what to do and how to do it. For comparative tests of modifications made to the aerial and earth systems, it is essential to prolong them over several days, to allow for good and bad reception periods, otherwise the results will not necessarily be a true indication. For the same reason, it is really useless trying to carry out D.X. tests if one or two trial loggings prove that conditions are hopeless. It is far better to wait for more favourable times; there is generally something to do about the station during such periods of enforced inactivity.

Apart from undertaking experiments to improve the efficiency of any given aerial system, particular attention should be paid to the erection, design and operation of "directional" aerials. This can prove a most interesting subject, as it combines opportunities for the exercise of theoretical, constructional and even mechanical skill. When making comparative tests with aerials of this type, it is, of course, essential to bear in mind that one must consider the power radiated by the stations used for the observations. For example, if one is trying out a system directed, say, west, and during the experiments a transmission is received from S.S.W., one cannot judge the directional properties of the aerial by comparing the intensity of signal strength from the two stations, *unless* one takes into account the power radiated by each transmitter.

## General Procedure

Bearing in mind the three classes of S.W.L. mentioned at the beginning of this article, experience proves that the real amateur is the one who adopts an operating procedure which might be termed the happy medium between the three widely varying types.

To devote a station to the sole process of just logging stations, during which a transmission might only be held long enough to receive its call sign, is not to be encouraged. Such operators do very little to further their own knowledge and often far less to help other enthusiasts. The desire to log D.X. transmissions is, in itself, quite natural and essential, but it should be combined with genuine experimental work, the compiling of reasonable records and the desire to improve one's skill and knowledge. The question of records needs careful consideration: it is not necessary to write down pages of notes about things which do not directly affect general results, but it is necessary to keep an informative record in the log book of all stations received. Such details should cover the transmitter's call sign, frequency, its location, power in the aerial, quality of signal, time of day, date, and a reasonable indication of the state of the weather. If experiments are under way, notes should also be made concerning the apparatus in use, and any general observations which are likely to be useful in the future.

## Prize Problems

### PROBLEM No. 418

HAWKINGS had a battery-operated three-valve receiver. The L.F. stage was coupled by a parallel-fed transformer. Results were most satisfactory until one day, when signals became very weak and distorted. On testing the H.T. consumption, he found that it had risen well above normal value. During his investigations he happened to connect a fixed condenser between anode of detector and the grid of the output valve. Signals improved in strength considerably, but distortion was still present. Where was the fault?

Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem 418 in top left-hand corner and be posted to reach this office not later than the first post on Monday, March 17th, 1941.

### Solution to Problem No. 417

The power-valve consumed more anode current than the pentode, and likewise produced a greater voltage drop in the eliminator, thus reducing the effective voltage to all valves, thereby affecting their efficiency. The deeper tone was due to unsatisfactory matching between power-valve and speaker and the presence of the pentode tone corrector.

The following three readers successfully solved Problem No. 416, and books have accordingly been forwarded to them: A. J. B. Towell, 36, Emerson Avenue, Linthorpe, Middlesbrough; S. E. James, 72, Kimberley Road, Croydon, Surrey; G. H. Moss, Highlands, Marldon Road, Shipbay, Torquay.

# A New Crystal Calibrator

THE General Electric Co. Ltd. have recently introduced an addition to their range of H.F. measuring instruments in the form of a crystal calibrator for radio frequency measurements on oscillators, receivers, transmitters and similar apparatus.

The instrument comprises essentially a crystal oscillator followed by a mixing stage and listening post, the principle being illustrated in the diagram, Fig. 2.

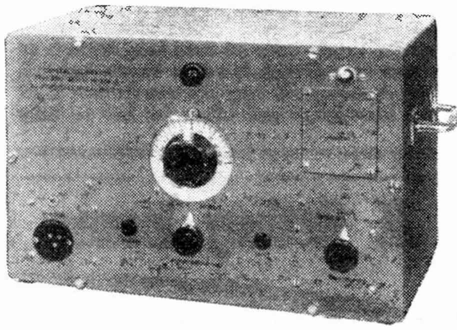


*Fig. 1.—The new crystal calibrator.*

In addition, a synchronising oscillator is incorporated which enables very high frequencies to be determined.

The crystal oscillator comprises a circuit whereby crystals operating at a frequency of 100 kc/s, 1 mc/s or 5 mc/s may be selected by means of a convenient panel switch. When this switch is operated the associated circuit components are also changed over.

The crystals used are made at the company's crystal works from the finest quality quartz, and the special apparatus used ensures the optimum cut for each particular frequency, thus ensuring an extremely low temperature coefficient, precise accuracy, and freedom from oscillation in spurious modes.

## Heterodyne Detection

The instrument employs the heterodyne method of detection when the apparatus requiring calibration produces an output voltage. The unknown signal is fed to the mixer valve grid, while the oscillation voltage is fed into an independent circuit which is arranged to accentuate the harmonics of the oscillator. The two frequencies mix, and as the unknown source is varied an audio-frequency beat note will be heard which can be reduced to zero when the precise frequency is obtained. The beat note is amplified by a detector following conventional lines, the output of which is fed into high resistance headphones.

When operated at very high frequencies the higher harmonics of the 5 mc/s oscillator is used, and confusion may arise in differentiating, for example, the 30th or 31st harmonic. In order to avoid this difficulty, an additional synchronising oscillator is employed, using an acorn triode. This oscillator is capable of being switched to either 25 or 50 mc/s which can be brought into tune with the corresponding harmonic of the 5 mc/s crystal oscillator by means of a trimmer adjustment on the panel of the instrument. Thus a "milestone" is provided, making it impossible for errors to be made.

In order that receivers, wavemeters, and similar apparatus can be calibrated, a socket is provided whereby an output voltage from the crystal oscillator is made available. By taking a feed from this point, apparatus can be calibrated using the receiver output meter or the wavemeter indicator as a detecting device. All the controls are conveniently placed on a grey lacquered panel which is engraved to show the functions of each control (Fig. 1).

The instrument is mains operated, rectifiers and smoothing equipment being incorporated to enable it to be operated from alternating current mains, 230 volts 50 cycles. It is mounted in a polished walnut case which has been selected on account of its attractive and durable finish. The outside dimensions are 17½in. by 9½in. by 10in. over projections, and it weighs approximately 35lbs.

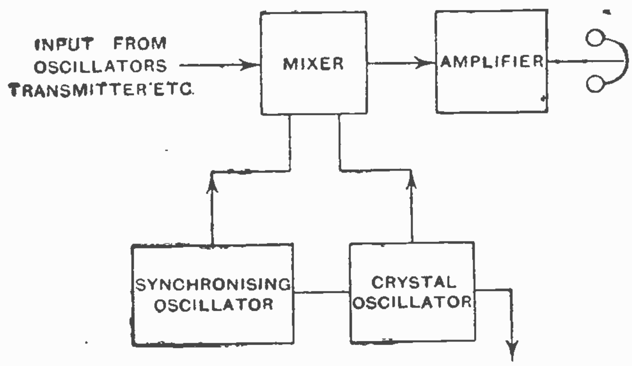



*Fig. 2.—Schematic diagram of the principle of the calibrator.*

## PERSONAL PARAGRAPHS

**Mr. H. O'Halloran** has been appointed Director of Postal Services, General Post Office, and a member of the Post Office Board in succession to Colonel F. C. G. Twinn, who has been appointed Regional Director, South Western Region, Bristol. Mr. O'Halloran spent many years on the Postal Surveying Staff, from which he was seconded in 1925 to take up the post of Controller of Posts and Telegraphs in the Sudan. In 1934 he reorganised the Newfoundland Post Office when the Government of that Dominion was put in Commission. On his return, he became Deputy Controller of the Money Order Department. From there he went to the Ministry of Home Security where he was Chief Regional Officer, A.R.P. Department.

**Mr. D. P. Dunne,** late of Southport, died suddenly on January 31st at a Manchester hotel. He had been ill since November and was making good progress, but recently his illness had taken a graver turn. Mr. Dunne joined the Chloride Electrical Storage Co., Ltd. of Clifton Junction, near Manchester, as secretary in 1902, and played an important part in the growth and development of the company. He became a director in 1922, and for a number of years has been managing director. He was 65 years of age.

# 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).

## A Well-equipped Den

SIR,—Having noticed in recent issues of PRACTICAL WIRELESS photographs of readers' radio dens, it occurred to me that the enclosed photograph of my experimental room may be of general interest. In it will be seen the remote control apparatus in use, as described in your issue of June 15th last. This instrument is actually controlling, from various rooms in the house, the other apparatus shown, including a morse recorder on the right, a communication receiver below it, a steel wire speech and music recorder on the operator's right, and behind this a photo-electric appliance. On the extreme left of the writer can be seen an oscilloscope, and on the right-hand shelves a home-made world time clock, capacity and resistance bridge, as well as valve tester, megger, output meter, micro-ammeter, etc.

At the back are the familiar QSL cards, relics of pre-war days, before the transmitter was removed by the G.P.O. Behind the steel wire recorder is seen a home-made electric clock and almanac, constructed chiefly from a mains clock movement, and this shows at any moment the time in continental style, day or night, day of the week, date of the month, year and moon changes. There is also a disc recorder, not seen in the photograph.—CECIL H. L. ANDREW, A.M.I.R.E. (Wellington, Somerset).

## Address Wanted

SIR,—Will the reader of PRACTICAL WIRELESS from Easingwold, nr. York, who asked for correspondents some time between August and November last year, please let me have his address ?—T. GOTT, 3, Gladstone Terrace, Huntington Road (Rural), York.

## The Trade and Amateurs

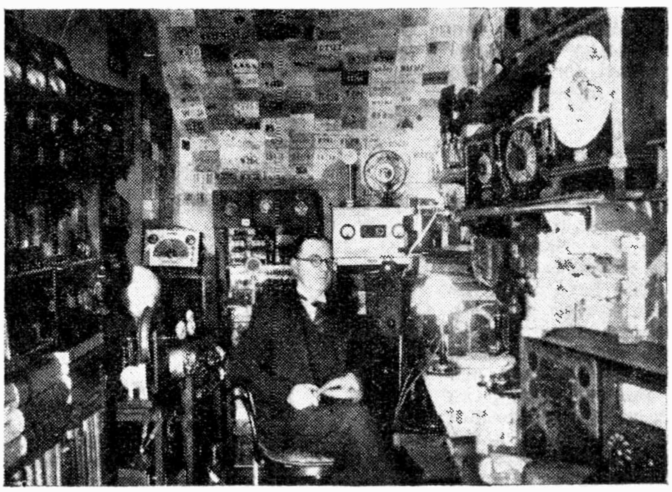
SIR,—We in the trade have long ago lost contact with the amateur constructor except for one or two odd callers inquiring for bits and pieces, which, incidentally, we often manage to supply, much to the surprise of the caller.

When I come across a struggling but intelligent amateur. I sometimes go out of my way to assist him, as I believe that amateur experiments and receiver construction do no tangible harm to the retail receiver trade. Alas, I am afraid some of my confrères think otherwise. So you may be pleased to hear that there are a few readers of long standing who do not write to you, but still have a deal of sympathy with your cause, and have nothing but praise for the manner in which your publications have managed to carry on for such a long time, and under the present adverse conditions.

As I know you welcome criticism, may I offer some ? You give in the March issue what appears to be a thoroughly sound design for an all-dry receiver. May I point out that the 1A7 valve is, to the best of my knowledge, unobtainable to the trade, and in only limited numbers to set makers. Can you give your readers an assurance that this and the other valves can be obtained retail in sufficient numbers to enable construction to proceed without delay ?

Incidentally, I am going to disagree with battery-makers' contentions that the L.T. and H.T. cells are designed to dissipate at approximately the same time. I have had so many arguments with buyers of commercial instruments which have suffered from premature failure of batteries (as you know, they have no kick coming under guarantees) that I decline to recommend them. I do, therefore, suggest that the L.T. and H.T. are kept separate. May I also suggest that there are still plenty of larger capacity single dry cells about, and that they could be utilised ?

Now, on the question of the automatic tuning unit which you describe and which uses the Strowger co-ordinate switch (correctly described as a uni-selector switch) I would like to mention that I owned a provisional patent in 1931 (now lapsed) for an identical system, but I am very pleased to find some comprehensive details given to the public, as I feel confident the system would prove extremely popular once it gets known and constructed in numbers.



*Mr. Cecil H. L. Andrew, of Wellington, Somerset, in his well-equipped radio den.*

I must, however, point out that a fully itemised and covered complete patent specification is on record, and which goes much further than your article for obvious reasons. I need hardly remind your readers that a copy of this specification which gives detailed drawings and methods is obtainable for a shilling from the Patent Office. This patent was owned by two persons, and may have expired by now.—R. M. STAUNTON-LAMBERT (J. and F. Stone (Lighting and Radio) Ltd., Kilburn).

[*It is rather beyond our powers to give an assurance to our readers that there will be no delay in securing components or valves during these abnormal times. Such a great deal depends on the manufacturers and distribution, but we do take every precaution to determine the actual position regarding stocks, etc., before we specify any item. So far as we know, any delay which might be experienced in obtaining the valve in question is purely temporary, and is not more pronounced with that particular type than any other. There is no infringement of patent by publication.*—ED.]

## "Practical Wireless" Helps R.A.F. Entrants

SIR,—I was interested to see that one of your readers ("J. G. P.," of Chatham) was able to pass as wireless mechanic R.A.F. on account of knowledge gained from your articles.

I also passed as radio mechanic, and can also thank you for a great part of my radio knowledge, although I have not yet taken PRACTICAL WIRELESS for a full year. I also have the "Radio Training Manual," which has proved very helpful.—C. L. REDSHAW (Swingate, Kent).

## "Practical Wireless" in Palestine

SIR,—Apropos your statement that you would be pleased to hear from readers on Active Service, I take this opportunity of again writing to you. From France I wrote, expressing my appreciation of the "Radio Training Manual," which I received in that country, and conveying my views of the desirability of publishing in book form the "Radio Engineers'" series. On returning to England, and finding that this had indeed been put into effect, I lost no time in acquiring a copy. It was extremely fortunate for me that this series was available, as owing to the evacuation from France I lost three months' issue of PRACTICAL WIRELESS—to my intense annoyance.

Once again I am away from home, and, as formerly, have requested that PRACTICAL WIRELESS be sent out to me with the greatest despatch. Mail from England takes at least two months, so I must possess my soul in patience for some time yet before the first copy arrives. Having seen the R.A.F. appeal for radio mechanics, I applied for the rank in France, and again in England, but have heard nothing further.

Thanks are due to you for keeping alive the spirit of amateur radio, which you have done admirably in times of peace, and continued under the present trying conditions. Carry on with the good work, for you have plenty of support, which I am sure will manifest itself still more strongly when the day arrives that amateurs now in exile return to active participation in this fascinating hobby.—W. G. WEBB (Somewhere in Palestine).

## Correspondents Wanted

C. F. PADGHAM, c/o Mr. R. Williamson, Crescent House, Alton, Hants, is anxious to get in touch with any other young beginner interested in short-wave radio.

J. Parkin (Junior), 18, Rowley Grove, Cottingham Road, Hull, Yorkshire, would welcome letters from readers on short-wave listening.

# Electrical Musical Instruments

## With Particulars of a Small Home-constructed Keyboard Organ

THERE are two kinds of electrical instruments in use to-day, truly electrical instruments, such as the electronic organ, and instruments which produce a note mechanically and amplify it electrically. These latter are far more common, ranging from the single string electric guitar to the modern Hammond cinema organ. They all employ a magnetic pick-up similar to a gramophone pick-up, but adapted for its particular job. In the stringed instruments the strings are of metal, and vibrate between the poles of a permanent magnet with a coil wound on just as in a pick-up. This is amplified by an ordinary amplifier and fed, in the case of a large instrument, to a speaker, or in the case of a small instrument the pick-up is connected directly to a small speaker unit mounted on the instrument itself.

The first commercial keyboard instrument on this principle was an electrical piano brought out late in the last century; this had two magnets for each string, one for the fundamental frequency and low harmonics, and one for the upper harmonics, thus permitting a certain amount of tone variation. The great advantage of this instrument was the absence of heavy strings and sounding board, for a modern grand piano may have a strain of several tons on its frame.

### Hammond Organ

The Hammond organ is on a somewhat different principle, depending for the production of its notes on constant-speed motor driving shafts on which are mounted metal discs. These discs have teeth cut in their rims and rotate so that the teeth pass between the poles of a magnetic pick-up. There are eight of these shafts, each carrying a disc for every note, so that each note has eight discs, the first having the same number of teeth as the fundamental frequency of the note (assuming that the shaft is rotating at one revolution per second), the second disc twice that number (the second harmonic), and so on. Each shaft has a separate volume control which has eight positions, so that a particular tone variation might have the fundamental frequency full on, the second harmonic shaft set to half volume, no third harmonic, the fourth harmonic at three-eighths full volume, and so on. Thus there are 88 possible combinations, or sixteen million variations of tone. Not all of these are practicable or pleasant, but practically all instruments, other than those employing plucked or struck strings, can be imitated on this organ, which is the basis of all cinema organs. Certain combinations of tone are provided with stops to correspond to the stops of an ordinary organ, and for imitating musical instruments, and there are usually three or sometimes more keyboards, each of which can be set to a different tone, so that it would seem that the organ had boundless possibilities. There is, however, one serious drawback: a cinema organ always sounds like a cinema organ. This is because it has the natural tone of the speaker underlying its music, and because the characteristics of the amplifying circuit will be impressed upon the output. The circuit can be brought as near to perfection as matters, but the speaker difficulty is very hard to overcome, as no speaker has yet been designed to have an even response over a frequency range from 50 cycles to 50,000 cycles as is necessary to reproduce accurately the full tone of the musical instrument.

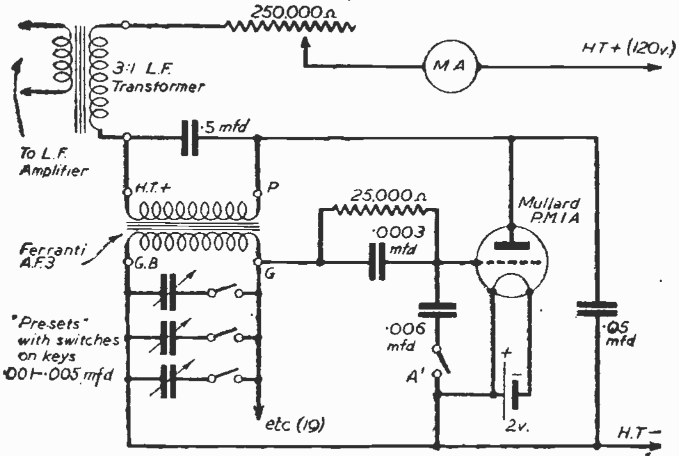
### Electronic Instruments

The other type of electrical instrument is the electronic instrument which employs an oscillating valve, and a tuned circuit of variable inductance. The chief objection is that a valve can only be induced to operate at one frequency at a time, so that a valve is required for every note, and a separate set for each harmonic brought in. At this rate an electronic organ having a range of a Hammond would have about 800 valves. These would all have to be kept in tune which would be very difficult, as changes of temperature and humidity affect the frequency of the tuned circuits. A Hammond, of course, can never be out of tune as the notes will always be in their correct relationship, even if the motor is running a little faster or slower than it should.

Some years ago many freak instruments were brought out, utilising a single-valve oscillator. In most of these the capacity of the circuit was altered by moving the hand over a steel plate or between two loops of wire. These had as their object not the production of a practical musical instrument, but the presentation of a novelty to music-hall audiences who were amazed to hear a melody played by a performer who merely moved his hand in empty air. I know of no keyboard instrument working on the single-valve principle, the difficulty being, of course, that no chords can be played on it.

### A Small Keyboard Organ

I have built a small keyboard organ on this principle, using the standard L.F. oscillator circuit with preset condensers connected across the secondary of an L.F. transformer connected between grid and earth, the plate current flowing through the primary as shown in the accompanying illustration. The chief difficulty was to get the note low enough without employing a B.F.O., which would have complicated the keyboard, but eventually by means of various by-pass condensers a reasonable range of frequencies was attained. Even then, no particular combination would give oscillation over the whole range, and certain additional condensers had to be switched in by different banks of notes. The organ is difficult to keep in tune owing to the poor quality of the only preset condensers obtainable during the war, but has quite a pleasant tone, although a trifle high-pitched.




*The oscillator circuit as adapted for the small keyboard organ described in the text*

The construction of the key-board presents some difficulty, the ideal being spring-loaded keys as used on accordions and cheaper harmoniums, as gravity-loaded keys give a rather slow return and tend to make notes overlap, which, of course, produces a lower note than either of the two depressed, as the two condensers in parallel are equivalent to one larger one.

The values given apply only to the particular transformer I used, and would vary with different transformers of the same model, as I have discovered to my cost. I am at the moment experimenting with combinations of neon tubes to produce oscillations with variations of tone, and hope to have the results of these experiments ready in a few months, but there is still a wide field of research for those interested in music as well as radio, one in particular being a harmonic organ where electrical relays produce a harmony in the bass while the melody is played on the keyboard, leaving one hand free for effects or runs on top of the tune.—J. E. L.

## F. J. CAMM'S ALL-DRY SUPERHET PORTABLE

*(Continued from page 223)*

board used is not too rigid it would be advisable to back it with a stiffer piece to prevent it from buckling when in use. Methods of fixing the dial to the set will, no doubt, be obvious to some constructors, but a secure fixing can be obtained by mounting a stiff piece of cardboard, or even a thin piece of plywood, to the condenser, with the aid of small bolts and a few washers, to secure the correct distancing, by making use of the two holes which will be found at the top of the front plate of the two-gang condenser. The proper dial can then be stuck on to the wood or cardboard, and the pointer located in the correct position on the driving spindle to enable it to travel over the scale—but just clear of its surface—in the proper manner.

### Fixing the Chassis

The cabinet is so designed that the chassis, when looking into the cabinet from the back, fits tight up against the right-hand side. It rests on the shelf provided, and it is anchored in position along its rear edge by two ½in. strips of metal of sufficient length to enable them to be bolted to the chassis and screwed to the wooden shelf. The specified cabinet has all the spindle holes drilled,

### The Speaker

There is very little to say about this item, as it is simply a matter of screwing the speaker frame over the fret already cut in the cabinet, taking care to select screws of the correct length to give good grip *without penetrating* the front face of the cabinet. The speaker is mounted so that its transformer is at the bottom i.e., near the shelf.

### Testing

It is very desirable that all tests should be carried out before the set is fixed into the cabinet. With a superhet circuit, one must avoid the temptation to fiddle about with the I.F. transformer trimmers if the results are not at first up to expectation. Tune in the Home Service transmission. The moving vanes of the two-gang condenser should be just over three-quarters closed and the small frame-aerial trimmer half open for correct setting. This, however, will be governed by the setting of the oscillator trimmer on that section of the ganged condensers and the rear one—when looking at the front of the set—in the oscillator coil can. The best procedure is to set the two-gang condenser in the position mentioned, then adjust the trimmer on the oscillator section and, finally, make careful adjustment of the trimmer in the oscillator coil. It is far better to assume that the makers of the I.F. transformers have sent the components out properly tuned to the correct frequency, and only make adjustments to them—and then with great care—after you are satisfied that the maximum results have been obtained by adjustment of the trimmers previously mentioned.

## LOUDSPEAKER—A CORRECTION.

In the list of components given in our issue for last month, the specified P.M. loudspeaker was unfortunately described as the W.B. Junior. This is incorrect, as the model we used is known as the W.B. Midget. We regret any inconvenience which may have been caused to our readers, and the makers of the speaker.

# SIMPLIFYING SUPERHET OSCILLATOR DESIGN

IN the design of receivers it is important to bear in mind that a reduction in the number of circuit components not only reduces the cost of production, in that fewer parts are required, but also the wiring of the circuit is rendered easier, and breakdowns due to faulty components are minimised.

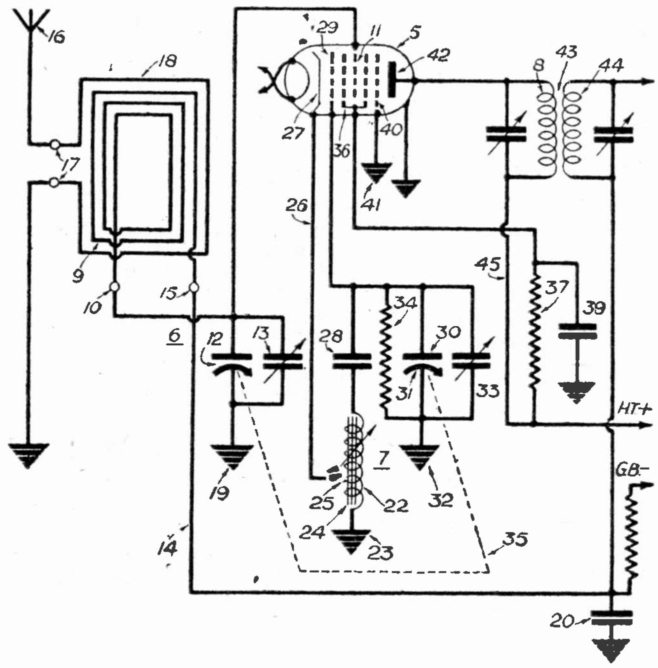
As an example of the simplification of a superhet-oscillator the following circuit developed by the R.C.A. will be of interest. In a normal receiver it is the practice to employ a tuning condenser in series with a tracking condenser, both shunting the tuning inductance, and the high potential end of the tuned circuit being connected to the oscillator valve grid through a grid condenser.

In the accompanying diagram is shown a circuit of the mixer stage of a superhet receiver in which one condenser serves the I.F. valve by means of a series resistance and filter condenser 20. The output I.F. transformer 43 is connected in the normal manner to the anode 42 of the mixer valve. The suppressor grid of the latter is earthed, and the screen grid is connected to the H.T. supply through the resistance 37 and decoupling condenser 39.

## Hartley-type Oscillator

The oscillator is of the Hartley type, the cathode of the valve being connected to a tap 25 on the coil 22 which is adjusted at the low-frequency end of the tuning band by the iron core 24.

The oscillator tuning condenser 31 is ganged with the aerial tuning condenser 12 and is connected between the oscillator grid and earth. It is shunted by the trimmer condenser 33 for adjusting the trimming at




*The simplified mixer circuit. Note that one condenser serves the dual purpose of tracking and grid condenser.*

dual function of tracking condenser and grid blocking condenser.

The mixer valve is of the R.C.A. 6SA7 type, and has its control grid connected to the frame aerial 9 and tuning condenser 12 which in conjunction with trimmer condenser 13 provides the tuned input circuit. An external aerial is coupled by means of loop 18 to the frame aerial to increase the signal pick-up. Automatic volume control potentials (—G.B.) are applied to the signal grid of the mixer valve, and to the the high-frequency end of the band, and also by the grid leak resistance 34. The grid blocking condenser 28 is connected between the oscillator grid of the valve and the high potential end of coil 22. Since it is in series with the tuning condenser 30 it serves also as a tracking condenser. In a practical circuit the value of condenser 28 may be 430 $\mu\mu$F, the grid leak 34 may be 33,000 ohms, and the variable condenser 31 may have a range of variation of 10 to 420 $\mu\mu$F.

# BOMBER CREWS AND THEIR DUTIES

BOMBER crews are a cause of some confusion to the layman. He reads of the navigator, the observer, and the bomb-aimer; and then he discovers that these are sometimes, but not always, the same man. He reads of an air gunner sending out wireless messages, and he wonders what has happened to the wireless telegraphist. The "second pilot" seems simple enough until he crops up elsewhere in the story as the navigator. And so on.

This confusion is partly due to the varying size of crew carried by the different types of bombers. The medium Blenheim bomber, for instance, carries three men and the heavy Wellington bomber carries six. Of the Wellington's three air gunners, only the rear gunner has no other duties, and even he is expected to observe what is happening to the target when his aircraft turns and leaves for home. The remaining two are wireless telegraphists, one being reserve if needed. In other types of bomber wireless telegraphist and air gunner are one and the same man. Hence the familiar abbreviation WT/AG.

The terms navigator and observer are really interchangeable. The man who navigates also observes, and he is nearly always the bomb-aimer as well. The principle is that all duties are duplicated.

# Books Received

**THE AMATEUR RADIO HANDBOOK.** Published by The Incorporated Radio Society of Great Britain. 328 pages. Price 3s. 6d. Overseas. 4s. 6d.

THE first edition of this most popular work appeared during the winter of 1938, and so wide has been its appeal. that —even during these difficult times—it was found necessary to produce a second edition. On examination of this, we find that a general revision has been made, and considerable new data included and two entirely new chapters have been added, covering Workshop Practice and Crystal Band-Pass Filters.

From Chapter 1, which deals with Radio Fundamentals, to Chapter 24, Charts and Abacs, the pages are packed with authentic information, diagrams, formulæ and tables which are of vital interest to the amateur experimenter or the professional radio engineer who wishes to acquire, and keep up to date, a sound knowledge of the subject. The high light of the manner in which the information is presented is, undoubtedly, the easy, yet comprehensive style in which it is written. The various contributors have shorn all their descriptions and explanations of unnecessary technicalities, thus allowing the reader to obtain a clear understanding of the various items without having his brain fogged or his patience exhausted by excessive, and so often absolutely unnecessary, advanced theoretical considerations. The Handbook is within everyone's reach, and all connected with the practical or theoretical side of radio should see that a copy is handy on their desk or bench.

**RADIO DESIGNER'S HANDBOOK.** By F. Langford Smith, B.Sc., B.E., etc. Published by Amalgamated Wireless (Australasia), Ltd., and distributed in Great Britain by Iliffe and Sons, Ltd. 352 pages. Price 7s. 6d. net.

THIS Handbook was originally prepared to provide a volume wherein could be found, with the minimum of trouble, all the data, formulæ and circuits so vital to the designer of radio receivers. This prime object has been satisfied in a most commendable manner, and although the professional designer will secure the maximum benefits from the carefully compiled information, the Handbook will also be found invaluable to all radio engineers, experimenters and service mechanics.

The book is divided into forty chapters, each of which deals with what can best be termed a section of a receiver circuit. Space prevents us from mentioning all the chapters, but we can say that they cover their particular subject or section in a most comprehensive manner. Here are a few taken at random. Chapter 1: Audio Frequency Voltage Amplifiers. Chapter 9: Tone Compensation and Tone Control. Chapter 15: Frequency Conversion. Chapter 27: Voltage and Current Regulators. The large number of diagrams used to illustrate the explanations and formulæ are of reasonable size and bold in print, thus making it easy to follow all details. The Radio Designer's Handbook is unique: all keen experimenters and those engaged in the designing, engineering and servicing sections of the radio industry will find it a great asset.

**UNDERSTANDING RADIO.** By H. M. Watson, H. E. Welch and G. S. Eby. Published by McGraw-Hill Publishing Company, Ltd. 603 pages. Price 20s.

THE writers of this book have succeeded in their object to produce a guide to practical operation and theory of radio. The style they have adopted is distinctly different from the usual run of radio text-books, as produced in this country, and we think that it will appeal to those who wish to acquire a sound general knowledge of radio right from Chapter 1, which deals with Radio Waves and Wave Travel. There are fourteen chapters, each profusely illustrated with diagrams, and to make sure that the reader has grasped the information, a set of questions are given at the end of each chapter.

The subject is covered in a most comprehensive manner, the following being some of the chapter headings. Principles of the Vacuum Tube, Tuning, Receiving Sets, 'Phones and Speakers, S.W. Sets, Oscillators and Transmitters, Aerials and Ultra-Short-wave Sets. In addition to the theoretical explanations, a considerable amount of practical information is given, thus allowing the reader to get a good idea of the working conditions and actual constructional details. The work is of American origin, and American terms are used in many descriptions and this may, at first, be a little confusing to the beginner in this country, but this does not in any way detract from the value of the information contained between the two covers.

## PURCHASE TAX

THE 33⅓ per cent. Purchase Tax on all wireless apparatus came into being on October 31st, 1940, but owing to the fact that there were large stocks in existence the consumer has not yet felt the fullest effect of the tax. Generally speaking, the tax will not actually come into operation on all goods until the middle of this year.

When it does, a 9-volt grid-bias battery, now costing 10d., will cost 1s. 0½d.; 120-volt H.T. battery now costing 6s., will cost 7s. 6d.; an all-dry battery, costing 10s., will cost 12s. 4d.; 120-volt H.T. battery, costing £1, will cost £1 4s. 8d.; a 7s. 6d. valve will cost 9s. 2d.; a 10s. valve 12s. 2d.; a 12s. 6d. valve 15s. 3d.; a 15s. valve 18s. 3d.; a 17s. 6d. valve £1 1s. 4d.; and a 25s. valve £1 10s. 5d.

**PATENTS AND TRADE MARKS**

**Any of our readers requiring information and advice respecting Patents, Trade Marks or Designs, should apply to Messrs. Rayner and Co., Patent Agents, of Bank Chambers, 29, Southampton Buildings, Chancery Lane, London, W.C.2, who will give free advice to readers mentioning this paper.**

# Replies to Queries

## Hum

**"I have been trying to put into commission an old A.C. mains type of commercial receiver which I have had by me for some time. I have made one or two modifications which have certainly improved its performance, and made it more suitable for present-day transmissions, but I am still troubled with an annoying hum. Do you think it is due to any defect in the valves, or would you suggest that the smoothing arrangements call for special attention?"—M. F. (St. Albans).**

BEARING in mind that it is an old receiver, although you do not give us any indication of how old, the trouble could be due to either or both of the items mentioned. If the valves have already given a long period of service, we would be inclined to suspect them, especially the detector. Faulty cathode insulation might be present or, if the valves are of the non-metallised type, the trouble could be due to interaction due to insufficient screening. On the smoothing side, an unsatisfactory L.F. choke, i.e., one having low inductance value when carrying the total current of the receiver, could be responsible for a poor degree of smoothing. The associated smoothing condensers might, if the set is very old, have too low capacity values; therefore, if the choke is as mentioned above, hum would probably be present. We would suggest that you check up on the valves; connect, say, an 8 mfd. condenser in parallel with each existing smoothing condenser then, if the trouble still persists, replace L.F. choke with a better component and, finally, look to the A.C. wiring of the receiver and any by-pass condensers, although we have assumed that you have already paid attention to such items.

## Soldered Contacts?

**"I have recently built a receiver which necessitated soldered connections, but as I am without a soldering iron, etc., and as I have not had any experience of such work, I used some patent stuff called cold solder. The connections appear to be all right, but so far I have not been able to get any results. Do you think the solder is responsible for this? I can just hear a sort of rushing crackling noise through the speaker, but no proper signals."—R. G. (Swindon).**

FROM the brief details provided, we are unable to determine what substance you have used, but there is a possibility that it is responsible for the trouble. You do not state whether you had to apply any heat or whether you simply applied the material to the wires, etc. We understand there is a solder which is supposed to melt and form a good joint with the aid of a match flame. Another type appears to have some chemical combination which allows it to set on being exposed to the air. It is possible that the substance you used was of such a nature that the joints formed by it resulted in a poor electrical contact, and if this is so, it could cause most unsatisfactory results. We can only suggest that you carry out a series of tests to determine if the valves are actually receiving their correct voltage and passing their desired current. It would also be advisable to examine all joints to see if it is possible to loosen or crack them; if it is, then they are obviously unsuitable for radio work.

## Pentode Results

**"When modifying my home-made three-valve receiver, I decided to replace the power valve with one of the pentode type. I did this, as I wished to get a little extra volume, but I am very disappointed to find that the increase is not as much as I had expected, and that the tone now seems to be on the high side and somewhat thin. Can you tell me where I have gone wrong? I enclose a rough sketch of the circuit."—C. I. G. (Sydenham).**

ON examination of the diagram, we find that it is fundamentally correct but, bearing in mind your remarks about the resultant tone, we would advise you to fit the simple pentode corrector which is really essential with this type of valve to eliminate the tone you mention. It consists of a .01 mfd. condenser in series with a resistance of, say, 10,000 ohms, and it should be connected between the pentode, anode, and earth, or across the primary of the speaker transformer. The values of the components are not critical, and if you require the low notes to be emphasised, a larger capacity condenser can be used. The failure to obtain the increase in volume anticipated might be due to the fact that the pentode is not correctly matched to the loudspeaker, and as you do not state whether you are using a different ratio output transformer to that employed with the power valve, we should imagine that this is responsible.

### 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.**

## Fading Signals

**"A peculiar fault has recently developed in my receiver, and it takes the form of a gradual fading away of the signal. I find, however, that if I switch off the mains and then switch on again the signals appear to be restored to their normal strength. I have replaced all valves, but this has not effected a cure. Can you make any suggestions as to the cause of the trouble?"—E. McK. (Dundee).**

WE are not sure whether, when replacing the valves, you included the rectifier, which we are assuming to be of the valve type. If this has not been tested, then the trouble might be due to some defect in the rectifier, the smoothing condensers, or one of the by-passing components. The best test would be to insert a milliammeter in the common negative line and note what variations in the total current consumption are produced when the fault develops. An extension of this test to include the milliammeter in the anode circuit of each valve in turn would also help you to localise the trouble. We would also suggest that you pay particular attention to the volume control and switching contacts.

## Using Headphones

**"I am using a battery-operated receiver which has two valves in push-pull in the output stage, and as I wish to add a pair of headphones for a person who is slightly deaf, I would welcome some advice on the best method of connecting them. I have already tried joining them through two 2 mfd. condensers to the anodes of the output valves, but the volume is very poor."—J. S. (Rossendale).**

THE poor results might be due to defective 'phones, or the fact that they are of unsuitable resistance value. By connecting them to the anodes of the output valves, i.e., in parallel with the primary of the output transformer, you may be unbalancing the matching. If the 'phones are of high resistance, you will no doubt find that ample volume will be obtained if you connect them to the anode circuit of the valve feeding the two in push-pull. Assuming that the primary of the push-pull input transformer is connected in series with the anode of this valve, we would suggest that you connect one side of the 'phones to the anode through a 2 mfd. condenser, and the other side to the common negative earth line.

## Superhet and Straight Condensers

**"Being a beginner at radio, I am rather puzzled when I come across the terms 'superhet' and 'straight' variable condensers. Could you explain what is the actual difference between such components, and is it essential to use whichever type is specified for a given circuit?"—K. B. (Birmingham).**

THERE is certainly a difference between these two types of condenser. In a straight gang condenser each section has an identical maximum and minimum capacity, and to enable it to "track" correctly, each section has to be so designed that at any setting of the dial the capacities of the individual sections are equal. It is possible, however, for the matching between sections to be upset by the circuit wiring; therefore, to overcome this and to compensate for any minute differences in the coils used, small trimmers—very small variable condensers—are connected in parallel with each section. In a superhet gang condenser, one section is used to tune the oscillator circuit, and owing to the fact that a constant difference has to be maintained between the oscillator and the other tuned circuits, the difference in frequency is known as the I.F. frequency, the vanes of the condenser have to be so designed that correct difference will be maintained. Such condensers are made for 110 kc/s. and 465 kc/s, intermediate frequencies, and it is essential for the correct type to be purchased according to the oscillator coil and I.F. transformers in use. It is possible to use a straight condenser in a superhet circuit, but additional small condensers have to be employed to provide the necessary trimming and padding of the oscillator circuit.

# Practical Wireless BLUEPRINT SERVICE

## PRACTICAL WIRELESS

### CRYSTAL SETS

| | Date of Issue | No. of Blueprint |
|---|---|---|
| **Blueprints, 6d. each.** | | |
| 1937 Crystal Receiver | — | PW71 |
| The "Junior" Crystal Set | 27.8.38 | PW94 |

### STRAIGHT SETS. Battery Operated.

| | | |
|---|---|---|
| **One-valve : Blueprints, 1s. each.** | | |
| All-Wave Unipen (Pentode) | — | PW31A |
| Beginners' One-valver | 19.2.38 | PW85 |
| The "Pyramid" One-valver (HF Pen) | 27.8.38 | PW93 |
| **Two-valve : Blueprint, 1s.** | | |
| The Signet Two (D & LF) | 24.9.38 | PW76 |
| **Three-valve : Blueprints, 1s. each.** | | |
| Selectone Battery Three (D, 2 LF (Trans)) | — | PW10 |
| 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, 2LF (RC)) | — | PW55 |
| The Monitor (HF Pen, D, Pen) | — | PW61 |
| The Tutor Three (HF Pen, D, Pen) | — | PW62 |
| The Centaur Three (SG, D, P) | — | 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) | — | 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 | — | PW59 |
| F. J. Camm's Universal £4 Superhet 4 | — | PW60 |
| "Qualitone" Universal Four | — | 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) | — | 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 |
| **Four-valve : Blueprints, 1s. 6d. each.** | | |
| 65s. Four (SG, D, RC, Trans) | — | AW370 |
| 2HF Four (2 SG, D, Pen) | — | AW421 |
| Self-contained Four (SG, D, LF, Class B) | Aug. '33 | WM331 |
| Lucerne Straight Four (SG, D, LF, Trans) | — | WM350 |
| £5 5s. Battery Four (HF, D, 2 LF) | Feb. '35 | WM381 |
| The H.K. Four (SG, SG, D, Pen) | — | WM384 |
| The Auto Straight Four (HF Pen, HF Pen, DDT, Pen) | Apr. '36 | WM404 |
| **Five-valve : Blueprints, 1s. 6d. each.** | | |
| Super-quality Five (2 HF, D, RC, Trans) | — | WM320 |
| Class B Quadradyne (2 SG, D, LF, Class B) | — | WM344 |
| New Class B Five (2 SG, D, LF, Class B) | — | WM340 |

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.

Practical Wireless (issues dated prior to June 1st, 1940). 4d. Post Paid
Issues dated June 1st to July 27th, 1940, 5d. Post Paid
(Issues dated September, 1940 and after) 7d. Post Paid
Amateur Wireless ... ... 4d. " "
Wireless Magazine ... ... 1/4 " "

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.

### Mains Operated.

| | | |
|---|---|---|
| **Two-valve : Blueprints, 1s. each.** | | |
| Consoelectric Two (D, Pen) A.C. | — | AW403 |
| Economy A.C. Two (D, Trans) A.C. | — | WM286 |
| Unicorn A.C.-D.C. Two (D, Pen) | — | WM394 |
| **Three-valve : Blueprints, 1s. each.** | | |
| Home Lover's New All-electric Three (SG, D, Trans) A.C. | — | AW383 |
| Mantovani A.C. Three (HF, Pen, D, Pen) | — | WM374 |
| £15 15s. 1936 A.C. Radiogram (HF, D, Pen) | Jan. '36 | WM401 |
| **Four-valve : Blueprints, 1s. 6d. each.** | | |
| All Metal Four (2 SG, D, Pen) | July '33 | WM329 |
| Harris' Jubilee Radiogram (HF, Pen D, LF, P) | May '35 | WM386 |

### SUPERHET.

| | | |
|---|---|---|
| **Battery Sets : Blueprints, 1s. 6d. each** | | |
| Modern Super Senior | — | WM375 |
| 'Varsity Four | Oct. '35 | WM395 |
| The Request All-Waver | June '36 | WM407 |
| 1935 Super-Five Battery (Superhet) | — | WM379 |
| **Mains Sets : Blueprints, 1s. each.** | | |
| Heptode Super Three A.C. | May '34 | WM359 |
| "W.M." Radiogram Super A.C. | — | WM366 |

# PUBLIC APPOINTMENTS

## WIRELESS TECHNICAL INSTRUCTORS REQUIRED IN ARMY UNITS

**Emoluments.**—Pay, 8s. 9d. per day (7 days a week). Clothing, rations and accommodation or, if this cannot be provided, allowances at authorised rates. If married and otherwise eligible, family allowance payable in respect of wife and children, subject to allotment from pay.

Candidates should preferably be under 35 and over 24 and—

(a) Hold one of the following qualifications:

Graduateship of the Institution of Electrical Engineers.

Final (Grade III) Certificate of City and Guilds of London Institute Examination in Radio Communication.

Higher National Certificate in Electrical Engineering.

Certificate of City and Guilds of London Institute in Radio Service Work.

OR

(b) Be able to pass an examination on the following syllabus:

Simple algebra, including quadratic equations; simple trigonometrical ratios and identities; vectors.

Properties of electrical currents; heating of conductors; magnetic fields; unit of current; Ohm's Law; resistance in series and parallel; potentiometers.

Magnetic effect of current; fields due to parallel wires; field due to a solenoid; electro-magnets.

Meters.

Induction; effect of rotating a coil in a magnetic field.

Mutual and self induction and inductance; effect of inductance on growth and delay of current.

Capacity; charging storage and discharge of condensers; through resistance and inductance.

Alternating currents; vector diagrams; effect of resistance variation; effects of L and C in A.C. circuit; phase difference of currents; resonance in a series circuit; parallel circuit of L and C; Q factor.

Elementary knowledge of valves; simple theory of amplifiers; oscillators and detectors; general principles of radio practice.

**Suitable Candidates** will be interviewed at local centres, and, if successful, will be enlisted and appointed Acting Sergeant Tradesmen. For those who are on the Schedule of Reserved Occupations, special arrangements will be made to enable them to be enlisted. In the event of any applicant found to be reserved under Schedule of Reserved Occupations special application will be made for relaxation of the Schedule. No guarantee can be given that this application will be successful.

**Application Forms,** obtainable by post card from the Under Secretary of State, The War Office (A.G.6c), "Poles," London, S.W.1, to be lodged by March 12th, 1941.

# Classified Advertisements

**ADVERTISEMENTS** are accepted for these columns at the rate of 2d. per word (minimum charge 2/- each paragraph). All advertisements must be prepaid.

**EACH** paragraph will commence with the first word printed in bold face capitals. Additional words in bold face capitals are charged at 4d. per word.

**ALL** communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, London, W.C.2.

## CABINETS

**A CABINET** for every radio purpose. Surplus cabinets (undrilled) from noted makers. We have hundreds in stock (no catalogues). Send measurements of chassis, etc., and say what kind of cabinet required. Stamp for reply. Inspection invited.
**H. L. SMITH AND CO., LTD.,** 289, Edgware Road, W.2. Tel.: Pad. 5891.

## COMPONENTS FOR SALE

**S.-W. CHOKES.** wire ended, single layer wound, 6d. each. Postage extra.—Crawshay, Highbridge Road, Burnham-on-Sea, Somerset.

## LOUDSPEAKER REPAIRS

**LOUDSPEAKER** repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

## MISCELLANEOUS

**U.S.A.** Radio Club writes: "Extremely well-written." Revolutionary Detection theory; circuits; practical experiments. 2/- post free.—D'Arcy Ford, Gandy Street, Exeter.

## MORSE EQUIPMENT

**FULL** range of Transmitting Keys, practice sets and other equipment for Morse training.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: GERrard 2089.

## MORSE TRAINING

**FREE.** "Book of Facts," tells you all about The Candler System of Code training. Courses for Beginners and Operators.—Write: Candler System Co. (LO), 121, Kingsway, London, W.C.2.

## NEW LOUDSPEAKERS

**3,000** Speakers, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

## RADIO CHASSIS

**ARMSTRONG CO.** regret, owing to the increasing difficulty in obtaining materials, they have been compelled, for the time being, to discontinue practically all models of Radio Chassis.

**ARMSTRONG CO.** still have a very small number of EXP48 chassis described in the November issue of PRACTICAL WIRELESS and also single models of other types at very economical prices. Particulars sent on request.—Armstrong Co., Warlters Road, Holloway, London, N.7.

## RADIO MAP AND GLOBE

**WEBB'S** Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6, post 6d. Limited supply on Linen, 10/6, post 6d. WEBB'S Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post Paid. 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

## READERS' BARGAINS

**A.C. ELIMINATORS,** as new, 20s.; with trickle charger, 30s.; carriage free.—12, Yewcroft Avenue, Newcastle-on-Tyne, 5.

**WANTED.** Varley DP6 or DP36 PP. transformer, or good substitute; particulars.—Innes, 13, Sunnyside Terrace, Holytown, Motherwell.

**VALVES,** condensers, etc., at give-away prices, stamp for list.—Matthews, 77, Holme-lacy Road, Hereford.

## RECEIVERS AND COMPONENTS

**COULPHONE** Radio, New Longton, Preston. Prompt personal service. Brand new goods only. Large stocks Tungsram valves at best prices. Guaranteed American valves, 5/9 to 6/9. Cosmocord Crystal Pickups, 23/6. Rola 10" P.M. speakers, 22/6. Goodmans 8" P.M., 17/6. Latest types with transformers. Dryshavers 110/250 A.C./D.C., 22/6. Electrolytic Condensers 8 mfd. 500v., 2/6; 8+8 mfd. 500 v., 4/3; 50 mfd. 50 v., 2/6. Dubilier and Erie 1 watt resistors, all values, 4/6 dozen. Centralab volume controls with switch, 3/6. 25 per cent. discount off latest 1941 receivers. Stamp for list.

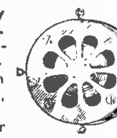
## RECEIVERS AND COMPONENTS

**SURPLUS** Stocks. Bargains in Electrical equipment, engineers' tools and materials. Stamp for list.—F. Busfield and Co., Waterhouse Yard, Scarborough.

## LONDON CENTRAL RADIO STORES

**Specialists in the disposal of miscellaneous surplus electrical gear. Send us your requirements and ask us to quote.**

**MICROPHONES : Heavy duty, double button type.** Chromium-plated case. Gold-plated electrodes. High output. Good Quality. With mounting clips and springs, **£1.15.0.**



**TRANSFORMERS** for above microphone, **7/6.**

**AUDAK PICK-UP HEADS.** High resistance coil, **6/6.**

**AUDAK CUTTING HEADS** (Heavy duty). 3-5 ohm coil. High quality instrument, **17/6.**

**SINGLE EARPIECES,** with flexible metal sheathing, chrome plated, **2/6.**

**ELECTRO-MAGNETIC COUNTERS,** Resistance 500 ohms, counting from 1 to 12,999, **9/6.** Smaller Type, 1 to 9,999, **5/6.** Useful for innumerable purposes.

**TELEPHONE HAND SETS.** Second-hand, in good order. Ideal for A.R.P., etc., **6/6.**

**WESTINGHOUSE RECTIFIERS.** Type H.T.8, slightly used. Guaranteed O.K., **8/6.**

**COMPLETE MOTOR-DRIVE TUNING ASSEMBLY.** Including 2-gang .0005 condenser, tuning motor with muting switch and homing commutator and station selector. With 8-button push-button switch, **25/-.** Full details supplied.

**SMALL REVERSIBLE A.C. MOTORS** (as used for motor tuning). 25-30 volts A.C. Built-in reduction gear spindle. Speed about 60 r.p.m. A first-class job with hundreds of applications, **8/6.**

**TAPPED MAINS RESISTANCES** for .2 amp. valves tapped 200, 230-250, **4/-.**

**SATOR** .5 meg. Volume Control and switch, 1" spindle, **1/9.**

**HEAVY TYPE MORSE KEYS, 6/3** each.

**PERMANENT CRYSTAL DETECTORS, 2/-** each.

**DECCA MICROPHONE TRANSFORMERS, 2/-** each.

**CERAMIC TRIMMERS, 140 x 2 mfd., 8d.** each.

**PILOT LAMP RESISTANCES,** 40 ohm, **6d.** each.

**T.C.C. TUBULAR CONDENSERS,** .5 mfd., 450 volt working, **9d.** each.

**MIXED RESISTANCES,** 1 watt, **1/6** doz.

**LONDON CENTRAL RADIO STORES**
**23, LISLE STREET, LONDON, W.C.2**
*'Phone: GERrard 2969.*

**CHALLENGER RADIO CORPORATION** announce their New Wartime Policy, **"One Super-Efficient Receiver a Year."** Send 2½d. stamp for handsomely illustrated brochure on this model. Also still available, valves at competitive prices, and P.A. Speakers.
**Challenger Radio Corporation, 31, Craven Terrace, London, W.2.**

**FREE ADVICE BUREAU**
## COUPON
This coupon is available until April 5th, 1941, and must accompany all Queries and Hints.
PRACTICAL WIRELESS, April, 1941.

## RECEIVERS AND COMPONENTS

**FRED'S RADIO CABIN**
**75, Newington Butts, S.E.11. 'Phone: Rodney 2180.**
**THE SPOT FOR KEEN BARGAINS**
**HERE WE ARE AGAIN WITH ANOTHER RANGE OF COMPONENTS AT THE RIGHT PRICE. "PRACTICAL WIRELESS" READERS HAVE BEEN PLEASED WITH THEIR BARGAINS AND SENT REPEAT ORDERS. THANK YOU !**

**T.C.C. BLOCK ELECTROLYTIC CONDENSERS.** Salvage stock at real bargain prices. Serve many useful purposes. Assorted, 8+8+2, 24+8+2, 12+8, and many other values. In some cases one section of the block is dead, but these have been cut out. **7/6** doz. (6 supplied for **4/-**). N.B. A special low price will be quoted for quantities.

**COIL-FORMERS.** Brand new stock, 4½" by 1¼" at **4d.** each. Also a line of 1" coil-formers in cardboard at **1/6** doz.

**ASSORTED COIL-FORMERS.** These are ideal for experimenters wishing to build up their own coils, **2/6** per dozen.

**TRANSFORMERS.** Another useful line for experimenters and handymen. These are burnt-out rejects and if stripped provide perfect laminations. 4" by 3¾" by 1". **1/6** each.

**RESISTANCES**; wire-end; all values, 12 assorted, **1/6.** Invaluable for servicemen and experimenters. Only a few to clear.

**RESISTANCES** and **CONDENSERS.** Ex. famous maker. Paxolin strip carrying approximately 8 resistances and 4 condensers; all useful values. Cannot repeat. **1/3** complete.

**BULGIN** Bulb-holders. Ex. important manufacturer. Neatly mounted on circular paxolin base, **2d.** each.

**MICROPHONE** Buttons. Absolutely first quality; no junk; to clear, **2/6** each.

**MICA** Condensers, small type; assorted; all useful values; ideal for servicemen, **1/6** per dozen.

**CONDENSERS.** Single-pole mounting, 50 mfd., 12 volt working. **1/-** each.

**T.C.C. CONDENSERS.** .25 mfd., 1,000 volt working; .1 mfd., 1,000 volt working. Special low price to clear remaining stocks, **6d.** each. State value required.

**TUBULAR** Condensers. Only a few remaining to be cleared. .1 mfd., 350 volt working: first-class condition. **2/6** per doz., or **3d.** each.

**VOLUME CONTROLS.** Previous stocks completely sold out. A new supply now available—rather better quality. We offer these with every confidence: 12 assorted, some with switches various values. Ideal for servicing, etc. Same price as before, although a better line. **3/-** per doz.

**MILLGATE** 2-speed geared dials in smart brown bakelite moulding. Listed at 3/-. In unopened boxes, brand new, our price, **1/3** each.

**BLACK** milled knobs, standard ¼" spindle, improves the appearance of your set, **6d.** each.

**WEGO** 1 mfd. condensers, 700 volt D.C. test in brown bakelite, baseboard fixing with metal terminals, **9d.** each, **7/6** doz.

**WIRE-END** tubular condensers. .5 mfd. Another good line at the right price. **8d.** each, **7/-** doz.

**SPECIAL** to clear. Six only, shop soiled Bulgin screened superhet H.F. chokes in original boxes. List No. H.F.10. Our price **3/-** each.

**KNOBS.** Black bakelite milled knobs, with ¼" spindle, **2/6** doz.

**VOLUME CONTROLS.** We are making a name for good volume controls at the right prices. Have supplied over 1,000 in last two months. Another line—2,000 and 20,000 ohms wire wound, without switch, **1/6** each.

**DUAL-RANGE** 6-pin coils in perfect condition, complete with circuit diagram. **1/9** each.

**MAINS CHOKES.** Only a few left to clear, 60 m.a., 350 ohms, at special clear-out price of **2/-** each. Also H.F. Filter chokes, twin mains, for smoothing, **1/9** each.

**REACTION CONDENSERS.** J. B. balanced differentials, shop soiled, in original boxes. List price is about 3/6. To clear, **1/6** each.

**LIMITED SUPPLY.** Burton 6" angle brackets, now unobtainable elsewhere. Solid stamping, polished finish. In boxes, listed 8d. pair. Our price, **6d.** pair.

**CRYSTAL** and catswhisker in tin box. Bargain line, to clear, **7d.** each. Very useful to experimenters. Also Lucerne permanent crystal detectors, **1/6** each.

**EX-ROLA** speaker transformers. For pentode output only. These have sold extremely well and have had many repeat orders. Definitely the last few, **1/9** each

**BULGIN** aerial insulator bracket, List No. L7. Brand new, but no purchase tax, **2/-** each. Also brand new Bulgin aerial lead-in insulator and arrester, List No. L1. **2/6** each.

**EKCO** mains dropping resistances. Total resistance 700 ohms. 3 tappings; 500, 100, and 100 ohms. Only a few remain to be cleared, specially reduced price. **2/6** each. Also a few "Truwind" mains dropping resistances. 2 tappings, 400 ohms. **2/6** each.

**DX AERIAL FILTERS.** Cut out noise and interference and improve the quality of your reception. Easily fitted in a few seconds. **1/3** each. Also Lincoln Stewart Aerial Eliminator at **1/3** each.

**ORMOND,** .0005 mfd. Slow-motion condensers, complete with knob, **2/-** each. This is indeed a bargain. Also 10/1 slow-motion gears—a cheap line at **1/3** each. 5-way battery cords—cheap to clear, **4d.** each. Rubber grummetts, **9d.** doz.

**IMPROVE THE APPEARANCE** of your receiver. Attractive chromium-plated speaker grills in modernistic design. You will like these. Overall size, 7" deep, 3½" wide, **1/6** each. Also chromium bars, 8½" long, ¼" wide, **6d.** each. And brass bars; many uses; 11¾" long, ¼" square, **8d.** length.

**Postage must be included with all orders.**
**Regret cannot accept C.O.D. orders.**
**FRED'S RADIO CABIN FOR BARGAINS,**
**75, Newington Butts, S.E.11. 'Phone: Rodney 2180.**

## RECEIVERS AND COMPONENTS

**GALPINS ELECTRICAL STORES**

**ELECTRIC LIGHT CHECK METERS,** small, late type, well-known makers, in good condition, electrically guaranteed to 200/250 volts 50 cy. 1 phase A.C. mains. 5 amp. type, 6/- ; 10 amp., 7/6 ; 20 amp., 9/- each. Post 1/- on all types.

**D.C. ELECTRIC LIGHT CHECK METERS,** 200/250 volts, 5 and 10 amps., 4/6 each, post 1/- (in new condition).

**PHILIPS HIGH VOLTAGE CONDENSERS.** Infd. at 4,000 volts working, 5/6 each, carriage 1/6.

**EX R.A.F. GLASS ACCUMULATOR TANKS,** 5 x 5 x 8in., new and unused, 3/6 each, post 1/-.

**EX R.A.F. SWITCH PANEL,** with case (new) fitted 6 small knife switches, leads, cords and cleats, complete in wood case, 2/6 each, post 6d.

**D.C. MOTOR BLOWERS,** 2in. inlet and outlet. Aluminium body, laminated field, ideal for dug-out ventilation. 100 volt, 25/-.

**HIGH-VOLTAGE TRANSFORMERS,** useful for all test work or television. Input 200/240 volts, output 5,000 and 7,000 volts, 7/6 each, post 1/-.

**VOLTAGE CHANGING TRANSFORMERS** (Auto-Wound), 100/110 to 200/240 v., or vice versa, fully guaranteed, 1,000 watts, 60/- ; 2,500 watts, 110/-.

**DUG-OUT LAMPS,** Ex R.A.F., solid brass construction, glass dome, complete with 12-volt bulb (any bulb can be fitted), wall fitting, 3/- each, post 6d. ; Ditto, wing type, as new, 2/6, post 6d.

**DUG-OUT LAMPS,** Ex. R.A.F., porthole type, or can be bracket fitted, glass dome, three colour fitting, white, red, or green, solid brass construction, 6in. dia., complete with bulb ; any size bulb can be fitted. Price 5/-, post 6d.

**1 kW. TRANSFORMER,** 100 v. input at 100 cycles, output 10,000 volts centre tapped, price 30/-, carriage forward.

**EX R.A.F. AUTOMATIC CHANGING CUT OUTS AND VOLTAGE REGULATORS,** to suit any dynamo up to 20 volts at 15 amps., fully adjustable, wiring instructions, complete in metal case. Price 3/6, post 9d.

**DYNAMOS,** all shunt wound and fully guaranteed, 50/75 v.–15 a., £6/10/– ; 50/75 v.–25 a., £8/10/–. All carriage forward.

**25-VOLT D.C. MOTOR,** maker "Crompton," ½ h.p., ball bearing, in perfect order, £3 carriage forward.

**110-VOLT D.C. MOTOR,** totally enclosed, rated at 8 amps., ball bearing, in new condition, make good slow-speed dynamo. £2/5/–, carriage forward.

**PHILLIPS TRANSFORMERS,** 220 v. input, output 2,000-0-2,000 volts, 200 m/a and 2 L.T.s., 40/-, carriage forward.

**STEEL CABINETS,** suitable for large amplifiers, etc., size 42in. by 24in. by 16in. Price 25/-, carriage forward.

**½ H.P. 110 v. D.C. MOTOR,** in good working order, 25/-, carriage forward.

**MILLIAMPMETERS,** 2in. dia. 0-30 m/a, 20/- ; 2½in. dia. 0-500 m/a, 20/-.

**FLOODLIGHTS,** 12in. dia., multi mirror type with 5in. dia. margin spot centre, any bulb can be fitted, 15/-. Carriage paid.

**AERO DYNAMOS,** output 12v.–12 amps., new, 15/- each. Carriage paid.

**GALPINS ELECTRICAL STORES,**
**21, WILLIAM STREET, SLOUGH, BUCKS.**
Terms Cash With Order or C.O.D.

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**SOUTHERN** Radio's Bargains.

**ALL** Guaranteed. Postage Extra.

5/- Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.

15/- Service Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tubular, Mica, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9" x 7" x 7", 15/- the Kit.

5/- 100 Wire-end Resistances, assorted capacities, ½ and 1 watt, 5/- per 100.

**ORMOND** Loud-speaker Units, 2/6. Crystal Sets, 5/6 ; Westectors Type W2, 2/6 ; Crystal Detectors 2/- ; Crystals, 6d. ; "P.O." Microphones on Stand, for use with any receiver, 5/- ; Telsen W349 Iron-core Midget D.R. Coils, 5/6 ; Morse Tapping Keys, 3/- ; Buzzers, 1/6.

2/- Tool or Instrument Carrying cases, ex. Government Stock. Wood 9" x 7" x 7", 2/-.

**SOUTHERN** Radio, 46, Lisle Street, London, W.C. Gerrard 6653.

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**S.T. 900,** first specified kit, assembled and aerial tested, including 5 valves and 8 coils. Bargain, £4/0/0, carriage paid.—Mr. Barker, Manager, Grange Lane, Scunthorpe.

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**BANKRUPT** Bargains, GENUINE OFFER. Brand new 1939-40 models, makers' sealed cartons, fully guaranteed, at 25 per cent. to 40 per cent. off present prices ; also portable midgets. Send 1½d. stamp lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

## RADIO CLEARANCE, Ltd.

**PLESSEY** 4 Waveband Coil Units, with switching, fully screened Pre H.F. stage, 465 kc/s oscillator 13 metres, 2,000 metres, 21/- each ; I.F. transformers, 2/6 each extra ; gang condensers for same, 2/11.

**LISSEN** 2v. Battery Pentodes, 4-pin, side terminals, P.T.2A., 4/11 each.

**LOW-LOSS** Ceramic Valve Holders, Lissen Hi-Q baseboard and chassis, 7-pin, 1/- each.

**LOW-LOSS** Short-wave Condensers, variable, ceramic insulation, brass vanes, Lissen Hi-Q, minimum capacity 5 microfarads, 20 mfd., list 5/6 each ; our price, 2/6 each.

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

**YAXLEY** type Switches, 4-pole, 3-way, 9d. each.

**YAXLEY** Switches, 4-bank, 2-pole, 4-way, 2/6 each.

**YAXLEY** Switches, 6-bank, 3/- each.

**YAXLEY** Switches, 9-bank, 3/6 each.

**AMERICAN** Line Cords, with fittings, 2-way, 3/- each.

**ROLA** P.M. Speakers, latest model, 7½in. cone, with power and pentode transformer, boxed, 17/6 each.

**CLOCK-FACED** Dials, 5in. x 5in., with printed scale, 4-wave, 2/6 each.

**STRAIGHT-LINE** 3-waveband Dials, 1/11 each.

**MAINS** Transformers, G.E.C., American windings, 350-0-350v. 65 m.a., 5v. 2 amps., 6.3v. 3 amps., suitable for replacements in G.E.C. models, 6/6 each.

**MAINS** Transformers.—Wearite R.C.1 250-0-250v. 80 m.a., 4v. 2.5 amps., 4v. 4 amps., 9/11 each ; R.C.3 350-0-350v. 150 m.a., 4v. 2.5 amps., 4v. 2 amps., 4v. 5 amps., 15/- each ; R.C.4 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.6 amps., 21/- each ; R.C.5 100-watt auto-transformers, 100-110v., 200-250v., reversible, 14/11 each ; all above transformers 200-250v. tapped primaries.

**QUANTITY** of Wearite Mains Transformers. New, but with dented covers. R.C.1, 5/6 ; R.C.3, 9/6 ; R.C.4, 14/6 each. Specification as above.

**CHASSIS** Mounting Valve Holders, American Octals, 6d. each.

**CHASSIS** Mounting Valve Holders, English Clix type, 4-5-7 pin, 3d. each ; Celestion valve holders, 5- and 7-pin chassis type, 4d. each ; baseboard type, 5-pin, 2d. each.

**CENTRALAB** Volume Controls, Midget type, 2,000, 5,000, 25,000, 50,000, 100,000, 500,000 ohms, less switch, 2/9 each ; 1,000, 25,000, with switch, 3/6 each.

**SPEAKER** Transformers, pentode output, 3/6 each.

**PRESS** Button Units, size of unit 6in. x 6in. x 2in., complete with 6 press buttons and capacitators, 4/11 each.

**PLESSEY** Motor Tuning Units, including fractional h.p. A.C. motor for 12v. continual running on 24v., intermittent running and 2-gang 0.0005 condensers, 8/6 each.

**12-WAY** Push-button Switches, 1/6 each ; 11-way push-button switches, 1/6 each ; 6-way push-button switches, 1/- each ; 7-way push-button switches, 1/- each.

**SPEAKER** Cabinets, suitable for 8in. speaker, 4/6 each.

**DROPPING** Resistances, for all purposes, total resistance 535 ohms, 5 taps in steps of 50 ohms, standard for Pye, Lissen, Ever Ready, etc., 3/- each.

**RESISTANCES,** 100 ohms, 10 watt, 1/- each.

**10FT.** Coils Connecting Wire, glazed, 4d. each.

**DUAL** Capacitators, 300 x 600, 4d. each.

**COILS** Kits, for superhet circuit, including 2-gang straight condensers, aerial coil assembly, oscillation coil assembly and 2,465 kc/s I.F. transformers, with circuit diagram, 8/11 each.

**PUSH-ON** Pilot Lampholders, 3d. each.

**PLESSEY** Single-gang 0.0005 Variable Condensers, 1/6 each.

**2-GANG** 0.0005 Variable Condensers, with Vernier control, 1/11 each.

**PERMUABILITY** Tuned Press Button Units, 2/6 each.

**B.I.** Wire-end Bias Electrolytics 50 mfd., 12v., 1/6 each.

**B.I.** Bias Condensers, 50 mfd., 50v., 2/11 each ; 25 mfd., 25v., 1/6 each.

**TUBULARS,** wire-end non-inductive paper condensers, all sizes up to 0.01, 5d. each ; 0.1, 7d. each.

B.I. 4 mfd. Tubulars, 1/9 each ; B.I. 8 mfd., cartons, 2/11 each.

T.C.C. 2 mfd. Electrolytic Condensers, 200v. working, 1/3.

**HUNTS** 8 x 8 mfd. Electrolytic Condensers, 700v. peak, 5/- each.

**All orders must include SUFFICIENT POSTAGE TO COVER. Hours of Business : Weekdays, 9-4. Saturdays, 9-1 p.m.**

**PLEASE WRITE YOUR NAME IN BLOCK LETTERS.**

**We cannot undertake to answer enquiries unless full postage included (2½d.).**

**RADIO CLEARANCE, Ltd., 95, HIGH HOLBORN, LONDON, W.C.1.**
'Phone : Holborn 4361.

## RECEIVERS AND COMPONENTS

**GEE GEE GEE GEE GEE GEE**
**15, LITTLE NEWPORT STREET, W.C.2.**

**METAL CHASSIS.** Well finished in battleship grey, 11in. x 7in. x 2½in., ex. famous set-maker in brand new condition. Fitted with seven valveholders. Four 7-pin and two 5-pin. Suitable for all kinds of adaptions. Limited supply. 4/- each.

**AMERICAN** & B.V.A. valves. All types in stock, from 4/- each. Send us your list and we will supply.

**SCREENED SLEEVING.** A good line of circular metal wrapped sleeving. Unrepeatable, 6d. a yard.

**RESISTORS.** Assorted ½ watt American Bradley Unit. A good line for servicemen, 1/- doz.

**CELESTION** P.M. Speakers. Absolutely brand new, latest type 6in., at special low price, 12/6 each.

**A.C. BATTERY CHARGERS.** Made by famous maker, ½ amp. 14/6 ; 1 amp., 50/-. 2, 6, and 12 volt.

**MAINS DROPPING RESISTANCES.** 150 ohm flat metal type, most suitable for midget receivers, 1/- each. We carry large stock of mains droppers, .2 amp. and .3 amp. tapped. Tell us your requirements.

**ALL-WAVE** Dials. Ivorine dials, stations named in three colours, red, black and green. Improves the appearance of every receiver. Size, 7in. x 4in., complete with fixing holes. 1/- each.

**EX-G.E.C.** Speaker transformers. Brand new for pentode output only. Not a junk line, but good-quality stuff in first-class condition, 2/9 each.

**SOLDER.** Very best quality resincore solder, 50 per cent. tin, 12 gauge, 6d. a length.

**EX-PHILCO** new American battery valves. Types: 1A4E, 1B4E, 2/6 each.

**VARIABLE CONDENSERS.** 3-gang .0005 mfd. A fine job with die-cast frame and solid aluminium vanes, 2/6 each.

**We hold large stocks of the above items, and will quote extremely low terms for large quantities. Postage extra.**

**GEE ELECTRIC, 15, LITTLE NEWPORT ST., W.C.2.**

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**VAUXHALL.** Rola 8" P.M. speakers, with transformers, 14/9. Electrolytic condensers, 8mfd. 500v., 3/- ; 8+8mfd. 500v., 4/3. Cosmocord pickups with volume control, 11/- and 18/9. Dubilier composition volume controls with switch, 25,000 and 50,000 ohm, 1/9. Vauxhall Utilities, 163a, Strand, London, W.C.2. Postage extra under 3/- ; send 1d. stamp for new valve and component list.

## SHORT-WAVE EQUIPMENT

**"H.A.C."** Short-wave Receivers.—Famous for over eight years. Improved one-valve model now available. Complete kit of precision components, accessories, full instructions, soldering absolutely unnecessary, only 16s., postage 6d. Immediate despatch. Illustrated catalogue free.—A. L. Bacchus, 109, Hartington Road, S.W.8.

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**YOUTHS,** aged 17-18, required for Audio Amplifier work. Knowledge of Radio and Electrical principles an advantage. Interesting work and excellent opportunities. Training for reserved occupation.—Box 208, c/o "Practical Wireless."

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**PRACTICAL** Postal Courses, radio, television, test equipment design, trade-test coaching for R.A.F. posts, I.P.R.E. and I.W.T. exams. ; booklet free.—Secretary, I.P.R.E., Bush House, Walton Avenue, Henley-on-Thames.

**WIRELESS.** Students of both sexes trained for important War-time Radio Appointments, also for peace-time careers in all branches of Radio and Television. Boarders accepted. Low inclusive fees. College in ideal peaceful surroundings. Prospectus Free.—Wireless College, Colwyn Bay.

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**WANTED,** Multirange Meter, good condition essential, 30/-.—Offers Phillips, "Warberry House," Culverden Down, Tunbridge Wells.

**WANTED,** PRACTICAL WIRELESS Nos. 414, 415, 416, 1/- each.—Woollhead, 51, Glanfield Road, Beckenham, Kent.

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**CONDENSERS,** 0.0005 twin, 1/3 each ; triple, 1/9 each.

**WESTON** Metres, 0.50 m.a. and 0.300 m.a., moving coil type, 25/- each.

**ROTHERMEL** Senior Crystal Pick-ups, 33/6 each.

**SMALL** Brown Knobs, 2d. each.

**1LB. REELS** 16 and 20 gauge Tinned Copper Wire, 2/6 reel.

**5" MIDGET** Energised Speakers, 600 ohms Field with Pentode Matching Transformer, 7/6 each.

**WE** have in Stock a Large Selection of High Voltage Paper Condensers, all capacities but too numerous to advertise. Advise interested clients to call.

**ALSO** Large Selection of High Voltage Transmitters and Chokes.

**RAYTHEON** Valves, first grade, largest stockists, all types stocked, including glass series, glass Octal series, metal series, bantam series, single-ended metal series and resistance tubes ; all at most competitive prices ; send for valve list.

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