CUTTING OUT STATICS!

POINTS ABOUT POWER UNITS

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Give your Set the power to bring in

MORE STATIONS

If you use a Screened Grid Receiver you can easily widen your choice of programmes by fitting a Cossor S.G. Valve.

Due to their unique construction (including the famous Mica Bridge) Cossor S.G. Valves are exceptionally efficient. They will definitely improve the performance of any well-designed Screened Grid Receiver (A.C. Mains or Battery operated) — increase its range and maintain a high degree of selectivity.

Your dealer will tell you the type you need.

Cossor
SCREENED GRID VALVES

NEW REDUCED PRICES

Cossor 2-volt Screened Grid Valves

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<tr>
<th>Type</th>
<th>Ratings</th>
<th>Anode Volts</th>
<th>Imped.</th>
<th>Amp. Factor</th>
<th>Plate Cond.</th>
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<tr>
<td>220 V.S.G.</td>
<td>15</td>
<td>120-150</td>
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Cossor A.C. Mains Screened Grid Valves

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<td>1,000</td>
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<tr>
<td>MSG-LA</td>
<td>Super M.F. Amp'</td>
<td>400,000</td>
<td>700</td>
<td>20</td>
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<td>Variable Mu</td>
<td>300,000</td>
<td>250</td>
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<td>MSG-LA</td>
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<td>H.F. Pentode</td>
<td>2-2</td>
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<td>17'6</td>
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These Mains Valves have Indirectly Heated Cathode, 1 Volt, 2 Amp.
* These Valves available with or without Metallised Bulb.
† Characteristics measured at 50 grid volts.
** Stocked with Metallised Bulb only.
Antifading Aerial Towers

RESULTS obtained with the specially designed aerial tower used by the Breslau high-power station having proved so satisfactory, the German Railways have decided to equip the Frankfurt-am-Main and Leipzig transmitters with one of the same type. Over a test lasting several months it has been found that the system employed greatly increases the range of the broadcasts, and that they have been subject to less fading than with aerials of a somewhat older construction.

Holland's New High-Power Station

MANY listeners have reported reception of tests recently made on 1,875 m. by a 50 kilowatt station situated at Kootwijk, near The Hague, and it was presumed that the transmitter was to be placed by the Dutch authorities at the disposal of whichever organization would be using the wavelength on July 1st. It is now stated that although negotiations are proceeding between the A.V.R.O., and the Administration of Posts and Telegraphs, so far no definite agreement has been concluded for the loan of the plant.

Experimental broadcasts from this station will also be carried out shortly on 296 m.; they will be made in the later evening hours at the conclusion of the day's programme.

Another Military Tattoo

THE sound portions of the Tattoo to be held at Tidworth on August 5th will be broadcast in the National programme. The display is on a large scale and only ranks second to that recently given at the Rushmoor Arena.

When Greek Meets Greek

APARENTLY, to-day, when two Greeks meet, the conversation soon turns to the necessity of a broadcasting system in that country. The Lucerne Plan provides for the construction of a somewhat older construction.

A Cafe Chantant Dance Band

DURING the period of the music festival, held annually at the Lucerne Hotel, the many well-known continental artists have been engaged. Mozart's Magic Flute is down for transmission on Saturday, August 5th (7.0 p.m.), and on the following evening listeners may hear Gluck's Orpheus and Euridice, for which many Continental stations will be needed in the Cork wavelength, as it is to be used for transmission on 217.1 m. (1,382 kilocycles). It is not expected that any alteration will be needed in the Cork wavelength, as it is anticipated that the separation, namely, 45 kilocycles, will be sufficient to prevent mutual interference.

A new transmitter will be erected a year ago by a group of amateurs at Salonica, but its broadcasts have not been of a regular nature. An attempt is now to be made to obtain from the authorities to provide capital for the installation of a 20 kilowatt transmitter in or near that city, or, alternatively, to grant a concession to a native or foreign company to erect and operate such a station. The actual power of 20 kilowatts is limited to that channel by the Lucerne conference.

SERVICE!

Every PRACTICAL WIRELESS RECEIVER is made only from parts which are available to the public. Only those parts actually used by our designers are specified—no alternatives!

Every PRACTICAL WIRELESS RECEIVER is Guaranteed to give the results we claim under a Free Advice Guarantee.

All readers' queries are accurately and helpfully answered FREE OF CHARGE, and without onerous restrictions!

Because of the unparalleled reader service we render, PRACTICAL WIRELESS has become the Leading Constructors' Weekly.

New Relay for Dublin Listeners

FOR the benefit of owners of crystal sets residing in the Dublin area, the old 1 kilowatt station has again been brought into operation. It relays throughout the day and evening the Athlone broadcasts on 217.1 m. (1,389 kilocycles). New subscribers may hear

Radio Svizzera Italiana

THE new transmitter on the Monte Ceneri, overlooking Lugano, is perhaps the most inaccessible station in the world for visitors. Not only is the broadcasting plant situated on the summit of a high mountain, but, in addition, it is located in a fortified zone to which entrance without special authority is strictly forbidden. The studios are in the neighbourhood of Lugano, on the borders of the lake of that name. After having tried various wavelengths, such as 680 and 760 metres, which unfortunately caused interference, the station has now temporarily settled on 1,143 metres.
Why Germans Give Up Licences

According to recent statistics published in Germany, although a number of new licences have been taken out there has been a falling off of subscribers during the past few months. As the Reichsfunk was anxious to ascertain the cause of these cancellations, a special investigating committee was appointed. It was found that of each 100 former licence holders, 4.9 per cent. were frankly dissatisfied with the programmes, 2.6 per cent. maintained that reception in their individual districts was poor, 0.7 per cent. claimed that outside interference marred the wireless entertainments, 41.1 per cent. had to give up listening through adverse financial conditions, and 50.7 per cent., or over one half the total number, put forward vague reasons for dismantling their wireless apparatus. Apparently, the present political character of the programmes does not suit all radio fans, and in view of stringent measures taken against dissentients, the majority was afraid to stat his real motives for which licences were not renewed.

Broadcasts from Dutch and Belgian Coasts

Notwithstanding rumours published in the continental press in regard to the closing down of the Ostend Kursaal, this famous place of entertainment will open again its doors and the Brussels station will run its concerts several times weekly. During the summer season, dance music will also be heard from the Knocke-Le Zoute Kursaal, situated somewhat higher up the coast. In the same way musical entertainments given at the Scheveningen Kurhaus, Holland, will be broadcast at regular intervals through the Huizen station on 1,875 metres.

Salvage Ship and Submarine Telegraphy

The salvage steamer Artiglio, which achieved fame through its recovery of 4,975,000 francs worth of gold ingots from the sunken s.s. Egypt, has now added submarine wireless telephony to its diving equipment. A specially constructed bell is lowered from the steamer and contains an observer, who by ordinary telephone and wireless apparatus can communicate simultaneously with both ship and divers at work.

This novel observation post is capable of giving valuable information and assists greatly in the search for the treasures. It is reported that an attempt will also be made to film the wreck through the massive glass portholes of the diving bell, in which powerful electric searchlights can be fitted.

The Future of Radio Luxembourg

At the Lucerne Conference five delegates fought hard to secure a longwave channel for the 200 kilowatt super-station, but they failed to secure this greatly coveted privilege. Although Luxembourgers refused to sign the agreement the transmitter, Jack and "Mrs. Bartholomew," is expected to give up the 1,191 metre wavelength and work on 240.2 (1,249 kilocycles) after January 15th, 1934. It is unfortunate that the power in that position of the wavelength should be limited to 60 kilowatts, as such a restriction completely hampers the organisations who were planning publicity broadcasts throughout Europe.

Solve His!

**Problem No. 44.**

Samuels rebuilt his receiver, using components which had already been in use and which were undoubtedly good. When the new receiver was completed one of the variable condensers was found to be of no use at all. It made no difference to signals when rotated through the complete scale, and yet, from the circuit, it should have been quite critical in its tuning. As already mentioned, all components were in order. What was the cause of the trouble?

Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, 19, Southampton Street, Strand, London, W.C.2., and mark your envelopes Problem No. 44. Last date for entry July 24th.

**SOLUTION TO PROBLEM No. 43.**

Gibson had worked out all the figures correctly, but he had overlooked the transformer losses. The resistance should therefore have been slightly smaller than that which he chose, and consequently there would have been a smaller voltage drop across the primary. The following three readers received books in connection with Problem No. 43: Mr. H. S. Francis, 179, Nelson Street, Norwich; Mr. D. W. Frith, Hillsborough, Marlborough; Mr. Theo. Dutton, 7, Brookfield Park, N.W.5.

Germany's Music Censorship

As only non-Jewish composers of strictly Aryan origin are permitted to figure in the broadcast programmes, the authorities have decided that these regulations must also apply to all musicians, whether dead or alive. Acting on this principle the broadcasting studios have been forbidden to transmit even excerpts from the works of Offenbach.

The Hilversum-Huizen Change-Over

From July 1st, broadcasts from the Hilversum studios are being carried out on 1,875 metres, and from Huizen on the lower wavelength. This change-over of the transmitters will last until the end of September, 1933.

France and the Lucerne Plan

The only longwave channel given to France is that of 1,796 metres, which will be used by Radio Paris, now included in the State broadcasting net. French listeners are not satisfied with this allocation, inasmuch as their high power broadcasts will only be possible from those of the Moscow 800 kilowatt station by 8 kilocycles. In the medium waveband all transmitters foreseen by the Ferrié Plan have been allotted fairly favourable positions, namely, Lyons PTT (436 m.); Paris (PTT) 431.7 m.; Marseille 400.5 m.; Toulouse PTT (386.6 m.); Limoges 328.6 m. Grenoble, 309.0 m.; Renne PTT, 288.6 m.; Bordeaux PTT, 278.6 m.; Nîmes-La Broque, 233.2 m.; Lille, 247.3 m.; and Montpellier, 224 m. All stations except the last named, of which broadcasting is limited to 30 kilowatts, may transmit with an energy not exceeding 60 kilowatts.

Manchester Airport

Similar to Croydon and Heston, Manchester now has its own airport from which wireless telephony transmissions may be heard. The call letters are Gem, and the wavelength is 870 m. (345 kc/s). Morse transmissions are carried out on 900 m. (333 kc/s).

American Amusement Tax

In view of present economic conditions in the United States, the American theatre industry has put forward a proposal to the effect that radio receivers should be taxed to the same extent as seats in the theatres. Managers contend that it would be fair to enforce an amusement tax on broadcast entertainments.

Wireless for the Blind

Further orders have been placed with Messrs. Boeing Radio, 366, Borough High Street, London, S.E.1, for wireless sets for the use of the blind. These comprise single valve, two-valve headphone, two-valve screened grid, and three-valve screened grid sets.
AUTOMATIC TONE COMPENSATION

A Method of Counteracting the Distortion Normally Introduced by the Use of Reaction: Full Theoretical and Practical Details are Given in This Article.

By FRANK PRESTON, F.R.A.

Fig. 1.—Curves which show the response of a receiver to various audio-frequencies; they are fully explained in the text.

Fig. 2.—This circuit shows the basic idea of a tone-compensating device, where a variable condenser is used to reduce high-note emphasis produced by using reaction.

Fig. 5.—This diagram shows the practical wiring details for the arrangement shown in Fig. 4.

Fig. 6.—This sketch shows how the moving vanes of an air-dielectric reaction condenser can be made to short-circuit with one set of fixed vanes when the condenser is set to its zero position.

Fig. 7.—A method of short-circuiting one set of fixed vanes when the condenser is set to its zero position.
Automatic Compensation

Automatic tone compensation, or tone balance, to which reference was previously made, aims at simplifying the latter scheme so that the correct degree of compensation is automatically provided by the reaction condenser without the necessity for any further control. For its proper functioning the device depends upon the use of a special Tone Compensating Transformer which has lately been put on the market by Messrs. Varley. This transformer is specially designed for this purpose most satisfactorily.

The Basic Idea

The only "trick" is that the reproduction of a set using the transformer would become high-pitched when reaction was switched off. But we know that high-tone response can be reduced by connecting a condenser in parallel with the transformer primary, and it is obvious, therefore, that if a variable condenser be interposed in a parallel with the primary winding and so arranged that the capacity was increased as reaction is reduced we should have a fully self-compensating arrangement. This basic idea is shown in the circuit of Fig. 2 where separate variable condensers are used for reaction and tone-control. If these were ganged together so that the capacity of one was increased at the same time as that of the other were reduced we should obtain exactly the desired effect. On reflection it can be seen that instead of connecting the tone-control condenser directly across the transformer primary it could be joined between one transformer terminal and earth as shown by broken lines. The condenser can then be in parallel with the transformer since the second connection would be completed through the high tension battery.

The Final Circuit

In the circuit of Fig. 3, then, we have a system of automatic tone compensation, and, provided that the capacities on the two halves of the differential condenser were suitably chosen, the tone would be perfectly satisfactory. Unfortunately, though, the capacities are always equal in practice and, whereas, about .0005 mfd. is required for reaction control, it is quite insufficient to reduce the high-note response of the special transformer when reaction was switched off. The capacity actually required being about .01 mfd. A further modification is therefore necessary and, in consequence of this the .01 mfd. condenser is inserted in series with the fixed vanes B of the differential condenser and earth, whilst the differential condenser is made to short-circuit when in the "full-off" position. In consequence of this the .01 mfd. condenser is put in parallel with the transformer primary when the reaction is reduced to "minimum" setting.

Having arrived at the final and satisfactory circuit we can consider its application to our sets. As a matter of fact, it can be used with any type of receiver by making very few alterations, and the practical wiring connections are clearly shown in the sketch of Fig. 5. To obtain full benefit from the scheme it is necessary to employ one of the special tone compensating transformers mentioned above. The idea is not by any means useless, however, even when an ordinary transformer is used, but then the fixed condenser should have a value not in excess of .005 mfd. The maximum capacity will depend upon the actual transformer in use, and so it will be advisable to experiment a little in this respect.

Differential Condenser Modifications

It was stated before that the moving vanes of the differential condenser make contact with one set of fixed ones when they are fully meshed with them. Although it is possible to buy some specially designed for this purpose most readers will wish to use existing ones, so a few notes in respect to the necessary alteration will be helpful. When the condenser is of the air dielectric type it is only necessary to bend the corner of one fixed vane as shown in Fig. 6, but with bakelite dielectric components a different method must be employed. The exact alteration will depend very largely upon the construction of the particular condenser in use, but the method illustrated in the sketch of Fig. 7 will apply in most cases. A length of 18 gauge flattened copper wire is flattened out at one end by striking it with a hammer and wedged between the two halves of a pair of fixed vanes. The other end of the wire is attached to the terminal corresponding with the vane to which the short-circuit is required. The wire must be inserted so that the moving vanes do not make contact with it until they are almost fully meshed. It is very important that the short-circuit be made to the proper set of vanes because otherwise the H.T. battery will be shorted; the terminal indications in Figs. 4, 5 and 6 will make this point quite clear.

Operation of A.T.C.

Very little remains to be said in regard to the operation of a receiver incorporating the reaction-tone compensating scheme described, since it will be exactly "as you were." The differential condenser provides reaction in the usual manner and tone-balancing is perfectly automatic; as reaction is increased the transformer gives additional amplification to the high notes due to the capacity across its primary winding being reduced.

When a pick-up is connected in the grid circuit of the detector valve a certain amount of tone control can be obtained by means of the reaction condenser, but, in general, it is found that best results are given with the condenser in the "full out" position. That is when the moving and set of fixed vanes are short-circuited.

The Ferric Plan

The French parliament has adopted the plan for the reorganization of the broadcasting system; it was devised by the late General Ferrie. By this scheme, France will possess at least six high-power transmitters, namely, Paris (120 kw.); Toulouse (120 kw.); Lyons (90 kw.); Nice (60 kw.); Marseille (60 kw.); Rennes (120 kw.) and Lille (60 kw.).

Ostar Ganz Valves**: Change of Address

As and from June 24th all communications for Mr. Edouard Perrier, Sales Distributor for the "Ostar Ganz High Voltage Mains Valves" and Rectifiers should be addressed to: 289, Southampton Street, London, W.1.
A FEW years ago when a valve set was a luxury and the majority of listeners took it for granted, outside interference was practically limited to atmospherics, unless you were unfortunate enough to be situated close to a noisy automobile, car, or motor or flashing lights. Nowadays, using the modern super-sensitive valve set, interference picked up from outside sources has increased tremendously. Quite apart from atmospherics, with their terrific crashes or low grumblings, according to the time of the year, some listeners are continuously receiving crackles, bangs, fryings, and a multitude of other unwanted noises.

The first search for the cause of, course, should always be made in the set, for a loose wire or a bad connection, or even a broken-down transformer or loud-speaker.

Ware Fractured Wires

Fig. 1.—Aerial and lead-in running close to gutter and rainspout.

Digressing for a moment, it is remarkable to find that many listeners fall to locate the source of frying noises or crackles in a broken-down transformer or loud-speaker because they take it for granted that if they can still hear signals at all, there is a fault in the receiver and not in the aerial. Actually, this is often not the case, as signals can often be heard when wires are broken or disconnected, although probably at a much lower volume. Another source of crackles that are often mistaken for atmospherics because the trouble disappears when the aerial is disconnected, is a fractured wire in a stranded wire aerial. This is likely to be more troublesome if the aerial is insulated with enamel.

PRACTICAL WIRELESS

Cutting Out Statics

Precautions to Take Effectively to Cure the Trouble.

By R. P. COLE

If you are unfortunate enough to live near trams or electric trains you are almost certain to have a series of crackles each time a tram or train passes that you cannot entirely get rid of. In some districts the trouble becomes so bad as to make walking or standing near the railway dangerous. Noises from trams or trains can sometimes be considerably

lessened by running the aerial at right angles to the wires or lines. Always remember that a large amount of pick-up of R.F. energy comes from objects in close proximity to the aerial.

Aerial and Lead-in Hints

Three or four years ago it was the recognized practice to make the aerial as long as possible within the prescribed limit of 100 feet, including the lead-in. Now, however, in order to attain greater selectivity the length is seldom more than 60 or 60 feet, and very often considerably shorter than that. Yet connecting these short aerials with their comparatively long leads, in the same care is not always taken as previously. The result is that long leads-in run close beside metal pipes and aerials often extend over metal roofs or alongside gutters, as shown in Figs. 1 and 2, and the pick-up from these causes of disturbing H.F. currents, which produce the crackles, is greatly increased. The lead-in should therefore be kept as short as possible consistent with a high aerial.

Faulty Electric Light Fittings

It sometimes happens that a persistent crackle or frying noise will be heard at definite periods, while at other times reception is free from interference. After making certain that the trouble is not due to a loose wire or faulty component in the set, the search for the source of the interference must be continued outside. When there is a loose contact somewhere in the mains circuit, a small spark keeps jumping across the loose points: This sets up a series of damped oscillations very near to the aerial, which produce the crackles, is greatly increased. The lead-in should therefore be kept as short as possible consistent with a high aerial.

Fig. 2.—An aerial arranged close to a lead roof and guttering.

For example, you may find that when the lamp is then very loose or not made up, the lamp may, be alight to momentarily drop the light may apparently be burning with perfect steadiness. The spring-loaded contact pins in a lampholder are apt to become stuck up, and the connection with the lamp is then very loose or not made up, the lamp may, be alight to momentarily drop across the loose points: This sets up a series of damped oscillations very near to the aerial, which produce the crackles, is greatly increased. The lead-in should therefore be kept as short as possible consistent with a high aerial.

Pin Jammed

Fig. 3.—A jammed contact pin causes bad contact.

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Another source of interference due to loose connections is to be found in the fuse-box, although this is not so common as the faulty switch or lamp contact. The wire used for fuses is made to "blow" when a certain current is reached, for instance, 5 amps or 10 amps. Actually, it burns away, due to the heat set up in it by the excessive current. However, when lower currents are passed through the fuse wire it stands for a moment, the wire will warm up. With the increase in temperature the wire expands and, under the terminals, its shape is distorted and flattened because the expansion can only take place outwards. The opposite action takes place when the current is switched off and the wire cools again. The wire contracts but does not regain its original shape under the binding terminals (Fig. 6). When this procedure has taken place a number of times the wire becomes loose under its terminals, and the result is a loose contact where slight sparking will sometimes take place. The remedy is obvious, and is simply to tighten the terminals that hold the fuse-wire. You will possibly find that each terminal will allow of half a turn, whereas they were previously tight when the fuses were first fitted. Should the contact become very bad through corrosion or for other reasons, a variable resistance is produced and when a light is switched on the sudden rise in current will cause any other lamps that may be a slight to momentarily drop in brilliance.

(Continued overleaf)
Eliminator Hum

When an eliminator is used the mains often give rise to hum that is difficult to get rid of. In many sets the eliminator is placed directly beneath the set itself, which is mounted on a wooden baseboard. It is a good plan to place an earthed sheet of copper foil underneath the set to screen it from the eliminator. Another simple expedient which sometimes works is to turn the mains transformer round, or even move its position altogether. This has been known to completely cure hum trouble. With positive side earthed D.C. mains it is often very difficult to entirely eliminate hum, but by a thorough system of screening (i.e., the coils, valves and eliminator) can work wonders. Above all, make certain that you are not trying to get more out of the eliminator than it is designed to supply. This would certainly produce a hum.

Apart from mains interference caused by hum, a large amount of H.F. interference is induced into the set via the mains. It has been estimated that this is as high as 90 per cent. of the total H.F. interference. The smoothing equipment of the eliminator, will in many cases be sufficiently efficient to prevent these currents from reaching the set, and will effectively short them to earth. It is extremely important, therefore, to have as efficient an earth as possible.

Fig. 3.—A loose wire in a fuse-holder.

The earth lead should be of heavy gauge wire, insulated for preference, and wherever possible soldered to a buried earth. The wire should be kept short.

By paying careful attention to the efficiency of the earth much of the H.F. interference can be kept from the set.

If the trouble is still excessive it may be necessary to insert an interference filter in the mains. In some houses the metal conduits are not properly earthed, or not earthed at all.

In these cases it is essential to prevent the H.F. currents reaching the wiring system of the house at all and in order to accomplish this the interference filter should be inserted in the mains immediately after the electricity company's meter. As the fuses used will in this case have to carry the entire current the wire used in the house, they must be made of heavy wire.

No hard and fast values can be set down for the construction of the filter. The constructor will have to decide the best values in each individual case by trial and error method. The following details will give some ideas to work on.

For the fuses wind 30 or 90 turns of No. 20 gauge enamelled copper wire on 2½ in. diameter paxolin formers. The fixed condensers must be of the non-inductive type, and to commence with try a capacity of 2 mfd, but again the best results may be attained with condensers of considerably less or even twice this capacity. (See Fig. 6).

Finally, prevention of interference at the source is better and usually simpler than attempted cure in the set. If you can trace from whence your interference emanates, the Post Office will be only too pleased to give advice regarding its prevention. Always be suspicious of such electrical equipment as motors, lifts, illuminated advertising signs and in fact anything that makes and breaks the circuit during its operation. The Post Office automatic telephone dials have even been the cause of trouble.

**IRON-CORED COILS**

A Brief Explanation of the Differences Between the Cores Used in the Coils Which Have So Far Been Produced.

By W. J. DELANEY.

The material used in the Wearite coil is known as Nucleon, and this material has already been described in our pages. (See page 251 of PRACTICAL WIRELESS dated May 6th, 1933.)

**Nucleon**

The material used in the Wearite coil is known as Nucleon, and this material has already been described in our pages. (See page 251 of PRACTICAL WIRELESS dated May 6th, 1933.)

The new Wearite Nucleon iron-core tuning coil.

**Varley Nicore**

In the Varley Nicore, the manufacturers have developed their own material, which differs from Ferrocort and is independent of that invention; quite naturally each manufacturer has ideas of his own which are included either to simplify the process or to enable a different degree of permeability to be obtained.

It is not desirable, at the present stage, to give full details concerning the individual processes, as complete patent protection has not yet been obtained in the majority of cases, but it has been thought worth while to give the above brief descriptions in order that any confusion which might exist regarding the similarity, or otherwise, of the various cores may be removed.
FOR LIGHT RAY EXPERIMENTS:

MAKING A Selenium Cell

By J. R. FENNESSY and H. WELTON

NEXT WEEK: USING SELENIUM CELLS

TO be able to close doors, to open windows and to ring bells by the agency of a ray of light seems to savour of magic; nevertheless the amateur can do all these "stunts" and perform countless more apparent miracles when aided by a selenium cell.

The construction of such a cell is well within the capability of any amateur radio enthusiast; moreover, when he has grasped the idea of its working there is no doubt that he will be encouraged to design and make special types in an attempt to secure maximum sensitivity.

The Chemistry of Selenium

Selenium is, of course, an element, and lies midway between sulphur and tellurium in the classification of elements according to the periodic system. On account of its position in this group we can assume that it is "almost a metal" and that it has properties similar to those of sulphur. On investigation we find our assumption to be correct. We perceive, for instance, that selenium in common with its low neighbour sulphur, may occur in a variety of allotropic modifications. The most familiar form is that of the grey semi-metallic selenium obtained by slow cooling of the heated element. This is insoluble in carbon disulphide and exhibits light sensitive properties. Sharply contrasting with it is red precipitated selenium—a variety insensitive to light and freely soluble in carbon disulphide.

On heating, selenium melts and then boils. Its vapour has a characteristic, unpleasant odour which resembles rotting vegetation.

Readers who have read articles on chemistry will remember that a mixture of iron filings and sulphur heated together form a ferrous sulphide which in turn liberates sulphuric acid gas on treatment with hydrochloric acid. Selenium behaves in an identical manner forming first ferrous selenide and then reacting with acid to yield an evil smelling poisonous gas—hydrogen selenide.

Red precipitated selenium is made by dissolving selenium in warm nitric acid, cooling the mixture and then passing sulphur dioxide gas through it. Red amorphous selenium is thrown out as a fine powder.

At this point we may leave the chemical aspect of the substance and turn to a consideration of its light sensitive properties.

To add to the fascination of selenium as a source of fascination, the selenium rod has two main uses, one for its remarkable attribute of holding a charge in the dark while the other is dependent on the manner in which the cell is wound.

Light Sensitivity

Many years ago an engineer engaged in development work at a cable station discovered quite accidentally that the selenium rods he was using as high resistance devices in the cable system showed large variations in total resistance when light fell upon them. It is claimed that the discoverer was Willoughby Smith. There can be no question that Smith was well informed on the subject as we find him experimenting with selenium in the year or two which followed. The effect of the discovery and subsequent investigations was to prove that light was capable of producing an electrical effect of far reaching possibilities. In view of more recent knowledge regarding selenium and its limitations it is evident that the early hopes of its future applications have in many instances proved unjustified for reasons shortly to be discussed.

How to Make a Selenium Cell

A selenium cell is easily made and requires little outlay, in fact with the exception of the selenium which must be purchased, the remainder of the kit will be found in any amateur's junk box. Obtain a little selenium from a chemist. It is preferable in the form of black powder although either the stick or crystalline form may be used. The next step is to cut a rectangular piece of thin slate about 1 in. by 1 in. with a smooth surface. The two longer sides are notched throughout their length to a depth of about 1/32 in. with a three-cornered file, as many notches as possible being cut, the number being the same on each side. It is a good plan to mark off the slate panel first with a needle and ruler as this will ensure the notches being in line and equal in number on each edge. The panel is now wound from end to end with two wires always running parallel but at no point coming into contact with each other. The purpose of the notches is to facilitate the winding process and to prevent a short circuit between the two wires (or more technically—the electrodcs). Fig. 1 shows a cell ready for coating and Fig. 2 the parallel winding.

The best wire to use is either gold or platinum but as the price of these is prohibitive, copper must suffice for the modest amateur. The thickness is not critical—between 40 and 40 s.w.g., and the surface must be clean and bright. Two terminals are attached to one end of the cell and these are connected to each end of winding. The two loose ends of the winding at the opposite side of the cell should not be left free but should be secured by means of wax or some similar non-conducting substance.

It now remains to apply a coating of selenium to the article, and as the successful operation of the cell depends on the manner in which this is carried out, the following instructions must be carefully followed. The selenium, placed in a porcelain basin, is gently heated over a bunsen flame until it becomes a molten red mass. At this stage the flame is lowered and the heating continued very gently indeed until the consistency of the selenium is such that it may be spread thinly and evenly with a glass spatula over the wires on one side of the cell. A thick, patchy surface is useless and, if this is the result on the first attempt, the best course is to rewind the cell and coat it afresh. A good surface having been spread, the cell must be annealed. This is accomplished by Fig. 4.—An assembly of (Ctd. on page 594)
A Simple Method, for which no Instruments are Necessary, of Quickly Ascertaining the Cause of Faults in a Receiver

By W. J. DELANEY

As, no doubt, the majority of our readers are by now aware, one of the principal features of our great reader service is the free servicing of our guaranteed receivers, where it has been found impossible for the reader to get the receiver into working condition after correspondence with the Queries Department. By far the greater proportion of such receivers as I have tested have suffered from a short-circuit or partial or complete break in one of the components, and substitution of the faulty component has rendered the set workable. In many cases the reader could have ascertained this fact by carrying out one or two simple tests, but I do not want it to appear that I am finding fault with the reader for not doing this, as I fully appreciate that in the majority of cases the builder of a receiver is only, possibly, just constructing his first receiver and a complete working knowledge of wireless is not one of his strong points. We all have to begin some time, and I know how exasperating it is to complete the wiring of a receiver, exactly according to plan, and then find that either no signals at all can be received, or such signals as are received are only equivalent to those previously heard on a much smaller receiver. In most cases the builder then carefully spends hours checking connections, and probably writes several letters to us asking what is wrong, when the fault rests with one of the components. It is, unfortunately, nearly always assumed by the man-in-the-street that components which have been produced by a firm of repute are above suspicion—but experience proves that this is not always so. Transit, careless handling by the many people through whose hands the component passes before reaching the set-builder, and other factors all tend to introduce damage to a delicate component, and therefore one of the first things that should be done (where possible) before building a receiver is to test each part. I fully appreciate that delicate measuring instruments are not to be found in every house, but there are simple tests which will often save hours of worry and much waste of energy, and will also make the hobby of wireless receiver building even more interesting.

Continuity Tests

Electrical knowledge is not necessary, but is very useful when testing components, but from articles which have already appeared in these pages it should by now be obvious that a condenser, for instance, cannot be tested for continuity by any very simple means. Resistances, choke, inductances, transformers, coils, etc., should all show up when tested by such simple means as a battery and pair of 'phones in series, and this point has already been mentioned. If a contact is made a click will be heard in the 'phones. If the resistance of the component under test is very high the click will be faint, and a low resistance will result in a loud click. The arrangement is illustrated in Fig. 4. Unfortunately, this method of testing will not show whether the component is short-circuited inside its case or whether there is a much greater resistance than there should be, and therefore a receiver may be built up from components which have all passed this test and yet fail to perform satisfactorily.

How to Test the Receiver

In order to illustrate this method of testing, I will assume that the Beta Universal Four recently described (April 15th issue), but the method is applicable to practically any receiver, battery, mains-connected. It is obvious that if no signals of any kind are heard, a check on the mains is indicated, and therefore if the component in question is short-circuited some sort of sound will be heard, although it may be much weaker than it should be owing to the component in question having been removed from the circuit. Similarly, if a component is only partially connected, resulting in a much higher resistance than is required, short-circuiting it will result in a louder signal being heard, although a sound may be caused by the resistance due to the short-circuits, signals will not be of the strength which will be obtainable when the correct resistance is included in circuit. Starting from the aerial circuit, we have the tuning coil (or coils) and tuning condenser. In the circuit we are examining, as in most present-day circuits, the coil is of the dual-range type, and a common fault which arises in these coils is the failure of the switch to operate when changing from one Wave Band, and the terminals connected to the switch contacts shorted.

Fig. 1.—Circuit diagram of the Beta Universal Four, which is the short-circuit method of testing.

Fig. 2.—An ordinary pen-knife may be used as a temporary short-circuiting device.

(Continued on page 594)
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July 22nd, 1933

Making a Selenium Cell

(Continued from page 591)

by baking it over a bunsen flame in a metal box or even for not less than two to three hours during which time the temperature of the work must lie between 180° and 200° C., but at no time must the cell be allowed to cool down with the naked flame. After this baking the work must lie between 180° and 200° C., but at no time must the cell come in contact with the naked flame. After this baking the cell coating will now appear grey and metallic and is preferably enclosed in a glass fronted box or oven for not less than two to three hours. Fig. 3 illustrates the coil-shorting test. If weak signals, or a complete absence of signals, is obtainable when the terminals are not shorted, and they are heard when the short-circuit is introduced, it is obvious that the cell switching is faulty. In some cases, the variable condenser plates get bent, with the result that at some point in the setting a short-circuit is introduced. The effect of this is usually a click in the speaker. Oscillation sometimes produces an exactly similar effect, and, therefore, our short-circuit tests between these two causes. Rotate the dial until the click is heard. Now with the piece of wire or the pen-knife short-circuit the two sections of the variable condenser (or each separate portion of it if a ganged condenser is in use). To do this simply attach one end of the wire (or one blade of the knife) to the chassis of the condenser, and with the other end touch the moving and fixed plates in turn. If no difference in the sound emitted from the anode circuit is heard when the short-circuit is introduced, then the condenser is faulty. If a weak signal or the sound of a click be heard, then the condenser is in order, and in the possibility of a complete disconnection, a noise may be obtained in most cases from the loud-speaker when the faulty winding is shorted. Signals will not, in most cases, be obtained by this method, but the character of the sound which will be heard from the speaker will enable even the beginner to decide whether or not the winding is disconnected. The short-circuit need only be applied for a few seconds, and in general a click will be heard from the speaker which is a sufficient indication that the winding is sound and not faulty. In the latter case, the shorting of the choke will result in maximum signals being received if the component is defective. Shortening the primary and secondary windings of the transformer will remove crackling noises in the event of a partial breakdown, and in the possibility of a complete disconnection, a noise may be obtained in most cases from the loud-speaker when the faulty winding is shorted. Signals will not, in most cases, be obtained by this method, but the character of the sound which will be heard from the speaker will enable even the beginner to decide whether or not the winding is disconnected. The short-circuit need only be applied for a few seconds, and in general a click will be heard from the speaker which is a sufficient indication that the winding is sound and not faulty. In the latter case, the shorting of the choke will result in maximum signals being received if the component is defective. Shortening the primary and secondary windings of the transformer will remove crackling noises in the event of a partial breakdown, and in the possibility of a complete disconnection, a noise may be obtained in most cases from the loud-speaker when the faulty winding is shorted. Signals will not, in most cases, be obtained by this method, but the character of the sound which will be heard from the speaker will enable even the beginner to decide whether

it would not be right to complete this article without giving a word of warning as to those components which must, on no account, be short-circuited. Roughly these may be summarized as follows:—
Decoupling condensers.
Grid-bias batteries and resistances.

Grid-bias batteries and resistances.

To enlarge upon the above list it may safely be taken that no fixed condenser in a receiver should be shorted, even momentarily. Further, no short should be made between H.T. positive and H.T. negative, and a short examination of the circuit will soon enable a doubtful point to be decided in this respect. Although only a few of the components in a complete receiver have been touched upon in this article, sufficient has no doubt been said to enable even the newcomer to wireless to ascertain a faulty part, and to enable one of our receivers to be built up to give a performance similar to that obtained on the original design.

MAKING A SELENIUM CELL

(Continued from page 591)

Fig. 5.-Testing components for continuity

Fig. 4.-Testing components for continuity

Fig. 5.-Condensers may be tested for short-circuit by bridging fixed and moving vane by means of a piece of wire whilst tuned to the short (or medium) wave-band.

Fig. 6.-The H.F. Chokes and a broken connection here will result in no signals being received, whilst a short-circuit between pig-tail (or pig-tail screening) and the case will result in a similar effect. For the latter cause a close inspection is all that is necessary with most makes of aerial circuit choke, and the tests will show to which two terminals the switch contacts are joined. When on medium wave difficulty is experienced in obtaining good signals. An examination of the path of coupling in the aerial circuit choke, and the results of testing the two blades of the knife being quickly adjusted to the necessary width,Fig. 3 illustrates the coil-shorting test. If weak signals, or a complete absence of signals, is obtainable when the terminals are not shorted, and they are heard when the short-circuit is introduced, it is obvious that the coil switching is faulty. In some cases, the variable condenser plates get bent, with the result that at some point in the setting a short-circuit is introduced. The effect of this is usually a click in the speaker. Oscillation sometimes produces an exactly similar effect, and, therefore, our short-circuit tests between these two causes. Rotate the dial until the click is heard. Now with the piece of wire or the pen-knife short-circuit the two sections of the variable condenser (or each separate portion of it if a ganged condenser is in use). To do this simply attach one end of the wire (or one blade of the knife) to the chassis of the condenser, and with the other end touch the moving and fixed plates in turn. If no difference in the sound emitted from the anode circuit is heard when the short-circuit is introduced, then the condenser is faulty. If a weak signal or the sound of a click be heard, then the condenser is in order, and in the possibility of a complete disconnection, a noise may be obtained in most cases from the loud-speaker when the faulty winding is shorted. Signals will not, in most cases, be obtained by this method, but the character of the sound which will be heard from the speaker will enable even the beginner to decide whether or not the winding is disconnected. The short-circuit need only be applied for a few seconds, and in general a click will be heard from the speaker which is a sufficient indication that the winding is sound and not faulty. In the latter case, the shorting of the choke will result in maximum signals being received if the component is defective. Shortening the primary and secondary windings of the transformer will remove crackling noises in the event of a partial breakdown, and in the possibility of a complete disconnection, a noise may be obtained in most cases from the loud-speaker when the faulty winding is shorted. Signals will not, in most cases, be obtained by this method, but the character of the sound which will be heard from the speaker will enable even the beginner to decide whether or not the winding is disconnected. The short-circuit need only be applied for a few seconds, and in general a click will be heard from the speaker which is a sufficient indication that the winding is sound and not faulty. In the latter case, the shorting of the choke will result in maximum signals being received if the component is defective. Shortening the primary and secondary windings of the transformer will remove crackling noises in the event of a partial breakdown, and in the possibility of a complete disconnection, a noise may be obtained in most cases from the loud-speaker when the faulty winding is shorted. Signals will not, in most cases, be obtained by this method, but the character of the sound which will be heard from the speaker will enable even the beginner to decide whether
Mounting S.G. Valve Holder

When converting a straight set to one embodying a screened-grid H.F. stage, and wishing to effect all possible economy, one little dodge can be adopted, as shown in the accompanying sketch, which will help in this direction. Using an old panel-mounting valve holder for this purpose, and wishing to effect all possible economy, one little dodge can be adopted, as shown in the accompanying sketch, which will help in this direction. Using an old panel-mounting valve holder for this purpose,

THAT DODGE OF YOURS!

Every reader of "Practical Wireless" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay half-a-guinea. Turn this idea on your to account by sending it in to us addressed to the Editor: "Practical Wireless." George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every

Automatic Paralleling Device for Reaction Circuit

It is often found when using a .0003 mfd. condenser in the reaction circuit that for the higher long-wave stations it is impossible to supply sufficient reaction. This occurred in my set, and I found it necessary to employ a paralleling switch to add a .0002 mfd. condenser. Finally, means of a bush. This terminal was connected to the reaction winding of the aerial coil: a .0002 mfd. condenser was placed across one side of the .0003 mfd. differential condenser, thus giving .0005 mfd. when this side was in circuit. The position of the contact arm would decide whether the .0002 mfd. or the .0003 mfd. side were placed in the reaction circuit, a diagram of which is given in Fig. 3.

An Aerial Hint

A SATISFACTORY way of getting an aerial up to the top of the post again when the pulley has carried away, is as follows:

Stretch a spring coil tightly round the...
An improved method of mounting a radiogram turntable.

A radiogram switch. This switch protrudes underneath the motor board and has a lever soldered on to it. Then I made a bracket out of sheet brass to hold a toggle mains switch, the handle of which is filed to form a groove, which is made as deep as possible. The lever engages in this groove, as shown in the diagram. Thus all one has to do is lift the pick-up arm off its rest and move it towards the turntable. After playing, just put the pick-up arm on its rest, and the motor is automatically switched off again.—Ernest Silson (Leece).

An Improved Motor Board

Many radiogram enthusiasts depend on the clockwork motor to propel the turntable, and have to take the motor out periodically, to fit new springs, and for oiling. This means no end of time and trouble spent on disconnecting the pick-up, volume control, and various gadgets, before you can get properly at the motor.

The turntable arrangement shown in the accompanying sketch I have fitted on my own set, and only a small section of the motor board needs to be removed. Measure approximately 1 in. towards the centre of the turntable, opposite the side of the cabinet where the winding handle is situated; this gives the position of the bearer (A). Then measure 6 in. along the bearer (A) where the position of the turntable is to be; this gives the positions of the centres of cross bearers B C. The next step is to cut a piece of wood 6 in. square, and mount the motor on it, and when in position no joins can be seen as the turntable covers them. A good dodge is to place the needle cup directly under the turntable and the motor board.

Switchboard arrangement for protecting an electric soldering iron.

This requires a slight alteration. The extra 15-watt being used in place of the usual thermal-delay switch in cases where 4 volts winding of a transformer is not available to work a small switch. The apparatus required is a Thermo-Blink No. 00, used for small flashing signs, which can be purchased for 9s. 4d. This requires a slight alteration. The heater should be taken off the terminal that is connected to the contact screw and brought to another terminal, which can be set in the hole provided in the porcelain base. The accompanying diagram shows the connections. This switch can also be used in place of the usual thermal-delay switch for small apparatus, necessitating A.C. or D.C. The object of the device is to fit suit particular requirements. The greater the wattage, the cooler the iron will keep and conversely.—A. J. (Kent).
Operating the D.C. A.C.E.

By H. J. BARTON CHAPPLE,

When tuned in to the local station the full value of the input volume control (our potentiometer-aerial feed) will be found. It is particularly smooth in operation and a method of tuning will be tried to be appreciated. Then again on your local you can see for yourself how valuable it is to have a tone-control functioning in conjunction with the transformer. This is the knob in the bottom right-hand corner. The component in question has been dealt with very fully before in this journal, but for the uninitiated let me say briefly that adjusting the knob position of the potentiometer enables a correction to be effected which will overcome defects in quality due to lack of treble or bass in a loud-speaker.

It brings about a more natural tone, and permits the listener to suit his own tastes in reproduction according to the nature of the item which is being listened to at any one time.

Searching for stations follows quite normal practice and is the same both on medium and long waves. The input volume-control is set at maximum, and starting with the tuning condenser at zero, the dial is moved round slowly (coarse tuning knob—that is, the large centre one) while the set is kept in its most sensitive condition (near oscillation point) with the other hand on the reaction-control. If preferred, the set can be made to oscillate and the familiar “tweet” listened for. As soon as this is heard, turn back the reaction control slightly and make any readjustments on the tuning through the medium of the fine tuning control (small centre one). These adjustments according to taste will soon come to you, and in any case when you hear your first station you cannot fail to be impressed with the complete absence of hum (generally a “prominent” feature in D.C. mains sets) and the first-class quality of reproduction.

COMPONENTS FOR THE D.C. ACE.

One 50,000 ohm L.F. Choke (special type, see last week’s issue) (Losco).
Two 10,000 ohm L.F. Chokes (special type, see last week’s issue) (Losco).
One 250 ohm 50 watt variable resistance (Rotor Electric).
One 4 megohms graded potentiometer (Multistone).
One General Purpose L.F. Choke (Losco).
One Hypercore smoothing and output choke (R.I.), One 1 henry 1 amp L.F. Choke (special type, see last week’s issue) (Losco).
One Bulgin Screened Grid H.F. Choke.
One Wearite H.F. Choke Type HPPA.
Four Type B Belling Lee Screened marked aerial, earth, input, and output.
Two Belling Lee Terminal Mounts.
One Colvern KTF Coil.
One Colvern Kill Cut.
One Multistone L.F. Transformer.
One Panel Mounting moving coil Ferranti ammeter 0-25 A range.
Three (W.S.B.) Sub baseboard valve-holders.
Two Belling Lee S.G. anode connectors.
One Colvern Mounting moving coil Ferranti ammeter O.D. 0-7 A range.
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In the course of my daily round, it falls to my lot to deal with large numbers of queries from users of mains-units, and some to these queries are frequently repeated.

The most common of these queries is that regarding the correct switching sequence. The answer is, when switching on, L.T. first, and then H.T. When switching off, reverse the procedure, H.T. first, and then L.T. The reason for this is that if the H.T. current is switched on before the L.T., the valve filaments are cold, and there is no actual H.T. circuit, the result being that the voltage soars up in the condensers in the unit. Thus abnormally high-peak voltages occur which are likely to cause premature failure of the condensers, and, furthermore, the momentary surge of current released from the condensers when the L.T. is switched on is not good for the valves. Actually, this point is much more important in the case of an A.C. unit than a D.C. unit, as in the latter case the voltage cannot build up to more than the mains input voltage, but even so, it is not wise to leave the unit connected to the mains for long periods with the L.T. switched off.

Another point regarding D.C. units is that, upon connecting the unit to the set, the metal parts of the set often become "live" to the touch. This is merely due to the fact that the supply to the house in which the unit is used happens to be on the positive-earthed side of the D.C. three-wire system, the consequence being that the negative side of the set is at a potential above earth. Thus abnormally high-peak voltages occur which are likely to cause premature failure of the condensers, and, furthermore, the momentary surge of current released from the condensers when the L.T. is switched on is not good for the valves. Actually, this point is much more important in the case of an A.C. unit than a D.C. unit, as in the latter case the voltage cannot build up to more than the mains input voltage, but even so, it is not wise to leave the unit connected to the mains for long periods with the L.T. switched off.

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Increasing Output from an A.C. Unit

The next point on which there appears to be much misconception is the question of increasing output from an A.C. unit. Quite a number of people are under the impression that this job entails the removal of a resistance. Unfortunatly, this is not so, and to increase the output is usually quite an expensive proposition. The maximum output is dependent entirely upon the type of metal-rectifier used, and of course, the secondary of the mains transformer is wound to match the rectifier used. Therefore to increase the D.C. output it is necessary to use a larger rectifier, and also to re-wind or replace the transformer with one to suit the larger rectifier. In addition, it may also be necessary to replace the smoothing choke with a larger component which will handle the increased D.C. current without saturating. Therefore, to get a few more milliamps the transformer, rectifier and choke have to be replaced, which is hardly an economical proposition. There are two ways out of the difficulty, first, to use a dry battery in conjunction with the unit, and, secondly, to use another small unit in addition to the existing unit.

Suppose the unit is rated to give 15 milliamps, and the output valve required about this current, then the entire output from the unit can be fed to the power valve, using a dry battery to feed the S.G. and detector valves. As these two valves will not require more than, say, 5 milliamps, a super-capacity battery is not necessary, and owing to the light load, the battery will give a very long service. The connections are shown in Fig. 1.

On the other hand, if the receiver has three or four valves before the output valve, as in the case of a superhet, these valves may require between them nearly as much as the last valve, in which case it is better to use another small unit for supplying that H.T. current. It is merely necessary to connect the negative sockets together and use the positive tappings as required. The connections are exactly the same as those in Fig. 1, except of course, that a unit is used in place of the dry battery. The two flex leads to the mains can be taken to one adaptor for the sake of convenience—on A.C. it does not matter which way round the leads are connected.

Increasing Output of a D.C. Unit

In the ease of a D.C. unit it is often possible to increase the output quite easily and cheaply, as in most cases the maximum output is limited by a resistance, usually in the negative lead. By decreasing the value of this resistance, the maximum output is automatically increased. For example, in a 20 milliamp unit, this resistance may have a value of some 2,500 ohms, but by reducing this value to 2,000 ohms, the output would be increased to 30 milliamps.

If, when using the first arrangement, instability becomes evident, this is really due to insufficient decoupling in the receiver, but a 2 mfd. condenser connected directly across negative and positive of the battery usually has the desired result.

Fig. 1.—Connecting unit and battery in parallel.

Fig. 2a.—Theoretical circuit of Fig. 2.

Fig. 3.—Variable "free" grid.
It's About Units

The actual resistance required is arrived at by dividing the surplus voltage by the required current. For example, assume the mains input to be 230 volts and an output of 150 volts at 30 milliamps is required, the resistance is calculated as follows:

\[ R = \frac{V_{\text{mains}} - V_{\text{output}}}{I_{\text{required}}} = \frac{230 - 150}{0.03} = 2,666.67 \text{ ohms} \]

One is to return the choke to the manufacturer, who will replace the transformer and charge accordingly, and the other is to investigate a voltage absorbing resistance in one side of the mains, so that although the mains are 230 volts, the actual input to the unit remains at the original 100 or 200 volts. It is simple to work out the resistance required, where the supply is direct current, but where the supply is A.C. the matter is not quite so simple. However, the method given here will provide a sufficiently accurate value for all normal purposes.

The first step is to find the total wattage of the secondary windings. Take, for example, the case of a unit employing valve rectification, having a D.C. output of 20 milliamps at 150 volts. The wattage is the product of voltage and amperage, and therefore the wattage of the filament circuit is 4 volts x 1 amp., which is, of course, 4 watts. The H.T. circuit will be 150 volts x 1 amp., which is three watts, giving a total load of 7 watts. The power socket can be split up into three fixed and one variable tapping, where the connections are shown in Fig. 4; two additional tappings are shown, one fixed and one variable. The condensers should be at least 2 mfd. each.

Many of the units now on the market incorporate trickle-chargers for charging L.T. accumulators from the mains. If the accumulator is allowed to become completely discharged, the trickle-charger cannot be expected to charge it up again in a few hours. The usual trickle-charger rate is .5 amp., and it will be obvious that in the case of a discharged 30 actual-amp-hour accumulator, the trickle-charger will take 60 hours to charge it up, or allowing for losses in the accumulator, about 80 hours. The trickle-charger is not intended to be used in this way. The accumulator should first of all be fully charged from some external source. The result of a test which I recently took on several representatives of units, revealed the average current consumption of a 20 milliamp A.C. unit to be five watts, a 20 milliamp D.C. unit four watts, and a .5 amp. trickle-charger twelve watts. As there are one thousand watts to a unit of electricity, obviously, the A.C. unit would give about 170 hours for one unit, at an average cost of, say, 4d.
IT is an undoubted fact that the super-

heterodyne receiver is daily increasing in 
popularity, and with the increasing 

chaos in the ether, this is the only type 
of receiver which can be relied upon to 

" perfect " reception of stations at any 
time of the day or night. The time 

has now gone when the quality claims 
of the superhet could be questioned. 

Provided the design is correct the old-fashio-

ned whistles all round the dial can also be 

completely eliminated. In fact, in 

handling a really well-designed, modern 

receiver of this type, it should be im-

possible to tell whether or not an 

ordinary " straight " receiver is being 

used. The latest receiver of this type 
to be placed on the market is shown 

on this page, and we have had the 

pleasure of examining models of this 

circuit design of this set it is essential 

that every refinement has been included, 

and that, provided no revolutionary new 
developments come along, he has a receiver 

which will take some time to go out of 

date. The circuit consists of an S.G. 

combined first detector and oscillator, 

variable-mu I.F. stage, linear grid rectifier, 

and Pentode output stage. A gramophone 

pick-up may be left permanently con-

nected to the receiver, and the operation 

of the mains selector switch will enable 

record music to be produced when desired 

without the necessity of making extra 

connections. The input circuit is of the 

band-pass type, which ensures the almost 

a signal. In any case, the ordinary listener 
inadequate L.F. filtering. The L.F. coupling 

and combined volume-control, acting on either radio or gramophone. Mains 

energized loud-speaker. Second-

channel whistles reduced to an absolute 

minimum. Stroking off every wave-band, 
each separately illuminated, enabling any tone to be produced 

that " forwardness " which is associated with the receivers produced 

by the H.M.V. factory. In spite of all 

the above good points, there is still 

one other which will interest every 

reader, and that is the price. Fifteen 

guineas is that which is asked for this 

complete receiver, and when it is 

remembered that less than a year 

ago a battery receiver, of batteries cost 
such as much, it will be appreciated that the manufacturers 
have endeavoured to interest and please in producing a receiver which will 
find a most ready market.

For those who may care to examine this chassis is also obtainable in a 

radio-gram cabinet, and the pick-up and other 

gramophone apparatus is also obtainable and connected in circuit. Details concerning 

this radio-gram will be given on this page in due course. The performance is, 

of course, of the same order as is obtained 

with this particular receiver.

H.M.V. SUPERHET SELECTIVE FIVE 
(Model 438 A.C.)

H.M.V. SUPERHET SELECTIVE FIVE 
RECEIVER: Model (438 A.C.)

MAKERS: The Gramophone Company, 
Ltd.

SPECIFICATION: Four valve Super-
heterodyne : Single tuned variable-mu 
combined detector-oscillator; variable-mu 
I.F.Stage; linear grid detector and Pentode 
output stage. Adjustable tone control, 
and combined volume-control, acting on either radio or gramophone. Mains 
energized loud-speaker. Second-

channel whistles reduced to an absolute 

minimum. Stroking off every wave-band, 
each separately illuminated.

TEST REPORT: Reception of dozens of stations, 
with the greatest facility, on either wave-band and gramophone, and practically any worthwhile station at night. Quality 

is of the highest; the manufactures 

is just suit any requirement 

characterized by " forwardness 

complete absence of resonances. A 

PRICE: 15 guineas.
Neutrodyne Circuit
A receiving circuit designed to neutralise the inter-electrode capacity of high-frequency valves and so prevent H.F. leakage out in the valve itself by internal screening. See INTER-ELECTRODE CAPACITY.

Nickel Iron
An alloy of iron used for making the cores of transformers and chokes, etc. It derives its name from the fact that its constituents are chiefly iron and a small proportion of nickel.

THE BEGINNER’S ABC OF WIRELESS TERMS (Continued)

Non-Inductive Condenser
A condenser with negligible inductance. Fixed condensers made of flat metal plates or foil are non-inductive, but those made by rolling up two strips of tin foil separated by waxed paper are inductive unless each turn of the protruding foil at each end is connected to the terminals. If only one connection is taken from each strip, then the rolled-up strip acts like a tuning-coil or inductance. This may impair the efficiency of the condenser at certain frequencies. Fig. 1 shows how the ends of the foil in a non-inductive paper condenser are soldered together.

Non-Inductive Resistance
A resistance with negligible inductance. Composition resistances come under this heading, but all wire resistances wound in the form of a coil are inductive to a greater or lesser degree. There are, however, special non-inductive wire-wound resistances in which the wire is wound back on itself so that the inductance of one turn neutralizes that of the next. The total inductance is thus negligible. (See Fig. 2.)

Ohm’s Law
A knowledge of this law is essential for the working out of a great number of the simple wireless calculations.

The practical unit of resistance.

Ohm’s Law
A knowledge of this law is essential for the working out of a great number of the simple wireless calculations.

It is usually stated in the following form: \( I = \frac{E}{R} \) where \( I = \) current, \( E = \) R.M.F. or voltage, and \( R = \) the resistance of the circuit in question. It follows that where two of the quantities are known, the third is easily determined.

For example, if it is desired to find out the current passing through the filament of a valve when the voltage across it is 2 volts and when the resistance of the filament is 10 ohms, then we apply Ohm’s Law thus: \( I = \frac{E}{R} \). That is, \( I = \frac{f}{10} \), that is .2 amp. This is an example where the current in the circuit is the unknown quantity. If it is desired to determine the resistance, then the law may be expressed thus: \( R = \frac{E}{I} \), or again, if the voltage is the unknown quantity, the expression becomes \( E = IR \).
receiver acts as a miniature transmitting station.

This is why a receiver which is oscillating violently will cause interference with neighbouring sets. The squeals and howls produced when the tuning dial is turned are caused by the waves which are being produced by the set combining with or heterodyning those radiated by the various transmitting stations "on the air" at the time. Due care should always be exercised in the handling of the reaction control so that this sort of thing does not occur. It is quite a mistaken idea that louder signals or greater range will be obtained by turning the control "full on," since there is no increase in selectivity beyond the point where the self oscillation begins to take place, only the introduction of frightening distortion. It is usually easy to tell when the danger line is being approached by the fact that as the reaction control is advanced and the signals built up in volume, a point is reached where a slight rushing noise manifests itself. With some sets, however, there is scarcely any warning beyond a sudden "plop." This is due to poor design or the fitting of unsuitable valves or batteries. See also REACTION.

Oscillator Valve

The valve in a superheterodyne receiver which is used to produce the local oscillations necessary with this type of receiver.

Oscillograph

An instrument for recording the shape of alternating current impulses or waves, and particularly those of high-frequency current.

Pan Cake Coil

A flat type of tuning coil or inductance now practically obsolete.

Parallel Connections

When connecting two or more pieces of apparatus, such as lamps, valves, resistances, condensers, etc., to one source of electrical supply they may either be joined together in the form of a chain and then the two ends connected to the supply or they can be connected each one separately to the supply. The former system is known as connection in series, the latter as connected in parallel. The difference between the two arrangements is illustrated in Fig. 3. Here electric lamps are the pieces of apparatus which are to be supplied with a battery the source of supply. It is also possible to combine the two methods. This is called series parallel connection. Fig. 3 illustrates the difference between series and parallel connections.

In the case of the parallel arrangement the total current is shared between each of the lamps according to their respective resistances. Thus, a low resistance lamp would pass more current than another of higher resistance. With the series arrangement on the other hand, the current through each lamp is the same, but the voltage across each one depends on its resistance and the number of lamps in circuit.

Pentagrid

A valve having five grids.

Pentode

A valve with a total of five electrodes, namely, filament, plate and three grids. It is remarkable for its amplifying properties, and it is used in connection with low frequency valves.

Permeability

This may be described as the magnetic conductivity of a material. A substance with a high permeability has the property that magnetic lines of force is said to have a high permeability. Substances such as air, glass, paper, and the majority of metals have a permeability of unity, whereas ferrous substances have a higher value. The highest values are found in certain special iron and steel alloys, such as the nickel iron which is used for the cores of transformers. So much easier it is for the lines of force to pass through the iron core of a transformer that practically none is radiated out into the space beyond the core. High permeability is one of the desirable properties of the core of a low frequency transformer or choke.

Phosphor Bronze

An alloy of copper, tin and phosphorus. It has greater tensile strength than pure copper, but is equally good regarding electrical conductivity, and thus makes a very suitable material for aerial wire.

Photo Electric Cell

A device which alters its resistance according to the amount of light falling upon it. In appearance it is somewhat like an electric bulb, and its chief use is in connection with television and telephones.

Pick-Up

See GRAMOPHONE PICK-UP.

Plate

Another name for the anode of a valve. In a receiving valve it is usually a small box-shaped or cylindrical structure. In the centre is placed the filament or cathode and between the two is the grid or grids consisting usually of wire mesh. Fig. 5 shows a typical plate in a receiving valve.

In the ordinary type of valve the plate is enclosed in a glass bulb which is exhausted of all air, but in the new Cathkin type of valve the plate itself forms the envelope of the valve.

Plate Circuit

That part of the circuit of a wireless set between the plate or anode of a valve and the H.T. supply.

Plate Voltage

The voltage applied to the anode or plate of a valve in order to make it positive in respect to the filament or cathode. The plate voltage is derived from the H.T. battery or mains unit. It is not necessarily the full voltage of the battery or unit since some drop in voltage occurs due to internal impedence in the anode circuit, such as a parallel of a transformer, or other component.

Permendur

An alloy of iron and nickel, having a permeability about 1000 times that of iron.

Phosphor Bronze

An alloy of copper, tin and phosphorus, with greater tensile strength than pure copper, but equal if the least good regarding electrical conductivity.
Converting a Short-Wave Receiver

By D. P. TAYLOR

It is well known that for reception on the short, and more particularly ultra-short, waves, the super-regenerative type of receiver offers several distinct advantages over the more orthodox type.

For example, by the use of the super-regenerative principle it is possible to make "direct" the idea of a receiver with enormous amplification, and consequently great sensitivity.

The super-regenerative type of receiver is not as selective as the more usual type, but this is not necessarily a disadvantage at the present state of short-wave work, where it provides an effective resistance in searching for stations in the very large frequency bands involved. Before dealing with the practical details of converting short-wave receivers to this principle, let us consider the super-regenerative principle from a theoretical point of view.

The Super-regenerative Principle.

As the retro-action control on a normal detector valve is increased, the negative resistance injected into the grid circuit tends to neutralise the positive resistance present.

If a point is reached where the positive resistance present is equal to the negative resistance injected into the circuit by the feed back, the effective resultant resistance in searching for stations in the very large frequency bands involved. Before dealing with the practical details of converting short-wave receivers to this principle, let us consider the super-regenerative principle from a theoretical point of view.

The Super-regenerative Principle.

As the retro-action control on a normal detector valve is increased, the negative resistance injected into the grid circuit tends to neutralise the positive resistance present.

If a point is reached where the positive resistance present is equal to the negative resistance injected into the circuit by the feed back, the effective resultant resistance will be zero.

If the retro-action be increased above this point, the resultant resistance would be negative. If a signal be applied to the tuned grid circuit when the resultant resistance is positive, this signal will be damped due to energy loss in the positive resistance.

If signals were applied at the point where the resultant resistance of the circuit were negative, the signals would build up to a maximum value limited only by the characteristics of the valve, but due to the fact that the resultant resistance is negative these oscillations will continue after the applied signal has ceased, and this is a condition of self-oscillation and will be familiar to anyone who has handled an oscillating receiver, being a condition in which it is impossible to satisfactorily receive signals.

Suppose now the signal were applied at the point where the positive and negative resistance are equal, giving an effective resistance of zero, we should then have a receiver of remarkable high-frequency properties, as any signal, no matter how small, would cause oscillations to build up to a limit dependant upon the characteristics of the valve, and yet at the same time the effective resistance is zero, the oscillations should follow the original wave form.

This receiver would suffer from the disadvantages that any atmospheric or electrical change in the circuit would also cause oscillations to build up to the maximum amplitude.

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If signals were applied at the point where the resultant resistance of the circuit were negative, the signals would build up to a maximum value limited only by the characteristics of the valve, but due to the fact that the resultant resistance is negative these oscillations will continue after the applied signal has ceased, and this is a condition of self-oscillation and will be familiar to anyone who has handled an oscillating receiver, being a condition in which it is impossible to satisfactorily receive signals.

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This receiver would suffer from the disadvantages that any atmospheric or electrical change in the circuit would also cause oscillations to build up to the maximum amplitude.

It was arranged that the mean value of the grid circuit damping resistance was such that the circuit was prevented from falling into self-oscillation, and yet at the same time allowing the signal to build up to a large value in the intervals when the effective resistance is negative.

It is possible to arrange for the detector valve to perform the dual purpose of detector and supersonic oscillator, but in doing so a certain amount of efficiency is sacrificed, and we will consider at the present time the method described in (1) above.

The circuit diagram is shown in Fig. 1, all the apparatus shown enclosed in the dotted lines being the super-sonic oscillator. The inductances used are two coils each of 1.000 turns, the grid coil being shunted by a .004 microfarad fixed condenser.

The coils can be conveniently wound between plywood discs mounted on a rod, with suitable spacers, the end of the centre rod being fixed in the chuck of a drill for the purpose of winding.

It will be seen that the end of the grid coil, instead of being returned directly to the low-tension circuit is tapped on the grid coil of the receiver.

A variable resistance is inserted in the high-tension feed lead of the super-sonic oscillator for the purpose of varying the amplitude of the oscillations which is used in practice for the purpose of effecting a compromise between signal strength and noise level. We will now consider the method shown in (2) above, for converting a receiver to the super-regenerative principle.

(Continued overleaf)
That Cheap Commercial Set!

How is it done? The answer is that although manufacturers use components which are just as good as those which you and I buy, instead of being enclosed in prettily coloured bakelite cases and having nice nickel-plated terminals, they are left as "bare-bones" without any fancy trimmings and with soldering tag contacts. I am now wondering why the makers of components do not offer these bare-bone "manufacturers' models" to us. I am quite sure that we should not object to the appearance as long as we knew the parts were good—neither would most of us mind unscrewing the soldering iron again, if by so doing we could save money. It appears that if all components could be sold in this way their price could be reduced by quite 20 per cent. In most cases.

"Standard" and "Manufacturers" Models

If might be added that one firm of transformers manufacturers at least do sell their products in two types—"Standard" and "Manufacturers". The latter are a good deal cheaper as you can tell from the following specification taken at random.

"Mains Transformer, giving outputs of 200-250 volts, 60 m.s. and 4 volts at 1 a.m.p. Price, Standard Model, 26s.; Manufacturers Model, 22s. 6d." Both models have identical characteristics, but whilst the first mentioned is fitted with terminals, the second has wire connections.

Again, there is a certain make of fixed condenser which can be obtained with either terminals or soldering tags. A .0005 mfd. component costs 1a. 3d. and 9d. respectively in the two types. Surely it is worth while to use soldered connections!

To Solder or Not to Solder

Personally, we are in favour of soldering, for after very little practice it is both easier and quicker to wire up a set in this way, and the trouble associated with subsequent loose connections is practically obviated.

The "Westector"

Have you tried the new "Westector" yet? For automatic volume control they are ideal, especially in a superhet. Due to their irrefutable capacity they put a fairly heavy load on the tuning circuit at wavelengths below 300 metres or so, but at 2,000 metres (the approximate wavelength at which the second detector of a superhet operates) their damping effect is negligible. Even on the medium waveband, however, the rectifier does not appear to reduce selectivity to a very great extent if it is connected to a fairly low tapping on the preceding coil.

One interesting use for the half-wave "Westector" is as combined detector-automatic volume control in a 2 V.-M. four-valve set. The rectifier after the second tuned-grid coil, and converting the valve detector for use as L.F. amplifier, results were almost as good as before (despite the loss of reaction) and with the added advantage of A.V.C. Due to the small size of the rectifier it was an easy matter to fit it in the set without the need for any alteration to lay-out, and, by using R.C.C. coupling between it and the valve that previously functioned as detector, very little space was required for the few additional components.

CONVERTING A SHORT-WAVE RECEIVER

(Continued from page 603)

The Supersonic Oscillator

As will be seen from Fig. 2 the super-sonic oscillator is inserted in the anode feed to the detector valve causing the anode potential of this valve to be varied at a supersonic frequency. The oscillator in this case is identical to the one previously described, with the exception that in this case the anode coil is tuned by the .004 condenser instead of the grid coil.

When testing these super-regenerative adaptors the first thing is to determine if the oscillator valve is oscillating satisfactorily, this is best done by inserting a milliammeter in the anode circuit of this valve and noting if a large increase of anode current takes place on short-circuiting the anode or grid coil.

If it is found that the oscillator valve is not oscillating properly, it is advisable to reverse the connections to one of the coils to ensure that they are coupled in the correct sense, also it is often worth while trying the effect of a change in valves.

When the oscillator is working satisfactorily the circuit should be connected up as shown in Fig. 1 or 2 and, with the filament circuit of the oscillator broken, a station should be tuned in on a low wavelength with the normal reaction control at the maximum at which it is possible to receive satisfactorily.

If the oscillator valve is now switched on an immediate increase of signal strength is noted and it will be found that the detector reaction control can be increased still more without self-oscillation taking place.

If the amplification be pushed too far it will be found that background noise becomes excessive, and a compromise can be effected by the adjustment of the detector reaction control or by the resistance in the oscillator circuit or, in the case of the Circuit shown in Fig. 1, by the adjustment of the tapping of the receiver grid coil.

We will be following up, in a practice that whilst the noise level may be high when not tuned to a station the receiver becomes quieter when tuned to a short wave.

In practice, the super-regenerative effect becomes more effective the greater the difference between the quenching frequency and the signal frequency due to the fact that the signal has a larger time to build up in the intervals whilst the resistance is negative, therefore the types of receivers described are very effective on the ultra-short waves.

In conclusion it might be said there is a very large scope for experiment in receivers of this type, which should appeal to many amateurs, as the apparatus required is inexpensive and should be of particular interest in connection with the British Broadcasting Company's ultra-short wave transmitters.

Super-Power Transmitters

It is about time that some restriction was placed on the maximum permissible power, and this alone would go a long way towards the solution of our present difficulties. We have recently tasted the delights (?) of high power by listening to the test of the new Moskow station, which has been working on 500 kilowatts somewhere near the top of the long-wave band. We say "somewhere near" because we have been unable to locate the exact wavelength, due to the fact that the station could be heard over a band of something like 100 metres, even with a fairly selective set.

Another station which has caused not a little trouble of late is Radio Luxembourg. Although working with fair regularity on 1,250 metres and with a power of 200 kilowatts, this "giant" has, so far as I am aware, no authority from the U.L.R. to do so. He has caused no end of trouble on the long-wave band, even in this country, so he must have been much more than a nuisance in Central Europe. As a matter of fact it is entirely apparent that the whole idea of colossal power can do no more than defeat its own objects. To enable us to cut out the interference caused by super-power stations we are obliged to build ultra-selective receivers having numerous valves, so that if the powers were reduced we should still receive as many programmes with better quality and less interference.

July 22nd, 1933
PRACTICAL WIRELESS
POSTAL RADIO BARGAINS

SAVE MONEY...ORDER DIRECT ORDER WITH CONFIDENCE.

PEARL & PEARL
SUPER RADIO BARGAINS

All guaranteed and carriage paid.

CONDENSERS
Zetavox 4-pkg .0005 mfd condensers, specially made for the famous Zetavox Receivers.
Utility brand new, unopened .0005 mfd. 7/4 pkg condensers, all with trimmers, without screen (also supplied with trimmer, 7/6).
Edison Bell fixed condensers supplied in 1 doz. lots assorted capacities.

FAMOUS SLEKTUN SCREENED COILS
Slektun Dual Range screened Aerial coil, as recommended and used by famed designers. Usual price 6/6.

BARGAIN OFFERS OF POPULAR LOUDSPEAKERS

Cash or C.O.D. Carriage Paid.

AMPLION
The famous Amplion model A.C.6, face oak cabinet speaker, suitable for all receivers. Usually sold at 25/-.
Cash or C.O.D. Carriage Paid.

AMPLION
Model A.B.6. Fine speaker in handsome polished walnut cabinet. Usual price 5/-.
Cash or C.O.D. Carriage Paid.

AMPLION
Another famous Amplion Speaker housed in a fine Walnut Cabinet. List price 10/-.

LIMITED NUMBER OF SLEKTUN SPEAKERS

LISTEN TONE LOUDSPEAKER UNITS.
Marketable value.

PYE CHOKE
Fully guaranteed Pye choke as received from the makers. 20 H.F. Chokes, usually 12/6.
Cash or C.O.D., carriage paid on all orders. Send now to avoid disappointment—limited stock only. These bargains can also be obtained by personal shoppers at branches shown below.

PEARL & PEARL
190, Bishopsgate, London, E.C.2

Branches:
11, Liverpool St., E.C.2, 100/101, Houndsditch, E.C.2
276, Pentonville Rd., Kings Cross.

REMARKABLE OFFER!
LAMPLUGH SILVER GHOST SPEAKER
The junior model is famous for its massive magnet giving perfect balance of treble and bass. Amazing bargain, as genuine 1933 production. List price 29/6. Special offer whilst stock lasts. Cash or C.O.D. Carriage Paid. PEARL & PEARL, 190, BISHOPSGATE, LONDON, E.C.2

SOVEREIGN JUPITER AT BARGAIN PRICE

EASY TERMS
Everything Wireless supplied on lowest terms. Prompt delivery guaranteed.

NEW BLUE SPOT 99 PERMANENT MAGNET MOVING-COIL UNIT.
Cash Price £2/18/6; £4/- with order and 11 monthly payments of 6/-.

CLASS "B" KIT, consisting of Multitone driver trans. and output matching, choke, and five 2-valve set. Suitable for Valves: 825, 255W. Ready for use, including Valve. Cash Price £2/18/6; £4/- with order and 11 monthly payments of 6/-.

NEW MULTITONE CLASS "B" UNIT.
Ready for use. Including Valve. Cash Price £2/18/6; £4/- with order and 11 monthly payments of 5/-.

ALL CARRIAGE PAID. QUOTATIONS BY RETURN.

To avoid delay, will customers kindly send first payment with order.

THE LONDON RADIO SUPPLY CO., 11, Oat Lane, Noble Street, London, E.G.2.

ELECTRIC CLOCK
TO YOUR SET!
NO MAINS NEEDED! KEEPS CORRECT TIME! NO WINDING!

Works off small battery lasting 12 months, or can be plugged into 0.5 battery without affecting reception. Does practically on current. Fits into hole 21/2 in. in easy wood or tin, thin. Easy to fit.

To avoid delay, will customers kindly send their orders direct to head office at Bishopsgate.

PACKED COMPLETE WITH BATTERIES.

POSTAGE GD

The Plays That Have Thrilled Millions!

MILLIONS of wireless listeners who have been thrilled by such plays as "The Path of Clive" and "The Mary Celeste" can now read them in book form for the first time, Five radio thrillers, 350 pages.

RADIO PLAYS

BY L. DU GARDE PEACH

Obtainable at all Newsagents and Bookstalls, or by post, 29/6, from George Newnes, Ltd., 8-14, Southampton Street, Strand, London, W.C.2

UNIQUE PORTABLE BARGAIN

LISSEN 2v.
PORTABLE TRANSPORTABLE
The finest portable 2-valve Pye 购物袋 portable is complete with Lisson 12v. H.T. Battery, Lisson Box, B.B.C. Transistor and Exide Battery. This remarkable transistor, self contained, has no moving parts and is complete with Exide W.H. High-Tension Accumulator. Ideal Portable for both home and car use. A lovely gift. Only £5. Very few left.

PEARL & PEARL
12-19-6
190, BISHOPSGATE, LONDON, E.C.2
NOW that the summer months are here portable sets are very popular. Most portables have the frame aerial combined in the case for reasons of compactness, although some prefer to have the frame aerial separate, as it gives one more room inside the case for the other components, and in some cases it is more efficient.

The frame aerial here described may be constructed quite easily, and will be useful for those making portable sets besides enabling one to convert a transportable type of set into a portable.

**Constructional Details**

The frame is constructed from 1in. by 1in. section hardwood, readily obtained from any fretwood store. Two pieces 9in. long and one 1ft. 10in. long are required. The cross pieces are fixed 15in. apart on the main piece by means of glue and small nails. The joints are made as shown in Fig. 1.

Six pieces of fibre (or ebonite), *in. thick, are then cut to the shape shown in Fig. 2, and glued in position for holding the wire. It will be necessary to cut a slot 3in. wide by 3in. long at the foot of the frame to take the bottom piece of fibre. A base of 4in. hardwood, 4in. square is then fixed to complete the frame.

Two triangular brackets of wood are glued and nailed in place to steady the upright. If preferred, metal brackets can be used, as in Fig. 3. A coat of varnish stain will improve the appearance of the completed frame.

---

**Fig. 1.** View of the complete frame ready for winding.

**Fig. 2.** Method of fixing fibre pieces for holding the wire.

**Fig. 3.** Alternative method of fixing base.

**Fig. 4.** Details of winding.

**Fig. 5.** Detail of terminal strip.
A REVIEW OF THE LATEST DISCS

By E. REID-WARR

For You, Rio Rita and I Want Nothing But Your Love, on H.M.V. B6345. South Americans can stuff by Marek Weber's Orchestra, grandly played. The first, a paso doble, is packed with infectious gaiety. The very thing for the summer evenings.

One from the classics to end this section, on no account miss Columbia DB1133, on which Gennaro Gersana's Concerto Quartet play a transcription of Bach's Air From the Suite in D and the finale of the Quartet in D Major (Antonoff). I listen the choral music we heard as were as lovely as these (especially the first) there would be no more caustic postcards to the B.B.C. Hear it; I think you will agree.

Nestly Ballads

Poetical fancy flies high in the first of Lawrence Tibbett's pair on H.M.V. D1933. These are And Love Was Born and The Song Is You. The first is a charming little song, and the way in which it is sung is a model to imitate (if one could!). Tibbett is a magnificent singer, especially in this sort of song. How many times Border Ballad has been done, I know not, but there is a satisfactory version by Irving Naismith on Decca F3478. He is a good baritone, and this is happily done with a nice Lowland dialect. Fairings backs it, but he is not quite at home with it.

Here is one for the votaries of the open road. Sit and listen to Harold Williams singing My Sheep Dog and I, and then continue to tramp With A Song on Columbia DB1134. Neither is original in theme or music, but for the same or a caravan they will fit the occasion to a nicety. By the way, another which might also be taken along for a sing-song is The Bacteriologist's Daughter and Botany Bay, by the Victorian Quartette, on Regal MR945. These absurd, attractive mixtures of barios and pathos always seem to come up as fresh as ever.

For those who like the modern pseudo sentimental song, Morton Downey fills a sentimental gap in the list of Columbia DB1132. His song is a model to imitate (if one could!). But for the camp or caravan they will not get wise to the best in radio you hear. It has a hump on at all times. He has a hump on at all times. He has the hump!

The CAMEL has the hump

He has a hump on at all times. If you do not get wise to the best in radio you will get like the camel and have the hump! Insist on Graham Farish components and you get the best in radio. They are precision made instruments, incorporated in any set and they provide Efficient Selectivity, High Tonal Quality, and Reliability.

OHMITE Resistances

The most popular and efficient type of fixed resistance for all general purposes, " Better than wire-wound." All values up to 0005 mfd. in tuning circuits required use the selection of Bach's Air From the Suite in D and the finale of the Quartet in D Major (Antonoff). I listen the choral music we heard as were as lovely as these (especially the first) there would be no more caustic postcards to the B.B.C. Hear it; I think you will agree.

Nestly Ballads

Poetical fancy flies high in the first of Lawrence Tibbett's pair on H.M.V. D1933. These are And Love Was Born and The Song Is You. The first is a charming little song, and the way in which it is sung is a model to imitate (if one could!). Tibbett is a magnificent singer, especially in this sort of song. How many times Border Ballad has been done, I know not, but there is a satisfactory version by Irving Naismith on Decca F3478. He is a good baritone, and this is happily done with a nice Lowland dialect. Fairings backs it, but he is not quite at home with it.

Here is one for the votaries of the open road. Sit and listen to Harold Williams singing My Sheep Dog and I, and then continue to tramp With A Song on Columbia DB1134. Neither is original in theme or music, but for the same or a caravan they will fit the occasion to a nicety. By the way, another which might also be taken along for a sing-song is The Bacteriologist's Daughter and Botany Bay, by the Victorian Quartette, on Regal MR945. These absurd, attractive mixtures of barios and pathos always seem to come up as fresh as ever.

For those who like the modern pseudo sentimental song, Morton Downey fills a sentimental gap in the list of Columbia DB1132. His song is a model to imitate (if one could!). But for the camp or caravan they will not get wise to the best in radio you hear. It has a hump on at all times. He has a hump on at all times. He has the hump!

The CAMEL has the hump

He has a hump on at all times. If you do not get wise to the best in radio you will get like the camel and have the hump! Insist on Graham Farish components and you get the best in radio. They are precision made instruments, incorporated in any set and they provide Efficient Selectivity, High Tonal Quality, and Reliability.

LIT-LOS

Condensers

Compact and efficient. Accurately gauged bakelite dielectrics and solid brass piping connection to moving vanes. All capacities up to 0005 mfd. in tuning straight-line capacity and differential types. 2/- Each.

L.M.S Twin Screen H.F. Choke

To H.F. signals where ultra selectivity is such a necessity you cannot do better than to fit L.M.S. Chokes. These chokes have been specially developed for long, medium and short wave reception. 2/6 Each.

Graham Farish Components

Graham Farish Ltd., Basens Hill, Bromley, Kent.

Exw orce Office: 11/12 Fenchurch St., E.C.3.
separately.
The holes are arranged so that vertical or horizontal mounting is possible, and by means of the slots and of 10 to 25 per cent. is assured by using two of these claims that an increase of efficiency in D.C. mairts' sets is produced a most interesting farm of H.F. choke for makers of the well-known .." Goltone with, this rem, of supply. - This is especially the case in the field of variable condensers.

Illustration below gives some idea of the neatness and design of this new line. It may confidently be recommended.

The peculiar characteristic of the "Regular" H.T. battery is the most important feature which has to be considered, and with the prong popular Class B type, of receiver the battery must stand up to heavy rates of discharge over a fairly long period, without showing any signs of distress, and has been in operation for some weeks with every satisfaction. Although not primarily designed for this heavy type of work, it is in every way satisfactory, and may be purchased with confidence.

One of the difficulties in the field of variable condensers is the easy. The new British Radiophone gang condenser. This has been developed with three objectives in view: (1) To overcome the drawbacks of fading which occurs on many stations, particularly at night-time. (2) To simplify tuning by permitting reception of large numbers of stations without switching of very strong degrees of strength on the aerial at equal distances, the level of which can be manually adjusted to suit individual requirements. The "Regular" M.H.D. consists of the usual double diode and triode electron stream system, surrounded by a common cathode. The great advantage of this form of valve from the observer's point of view is that the strength of signal which can be handled by the diode without overload is tremendously great, and also that the triode element is operating as a true L.F. condenser with negative feedback in series with a part-rectifier, phono-amplifier, as in a triode detector. This makes for distortion and greater sensitivity at the same time.

(Continued on page 610)
Practical Wireless

Practical Letters from Readers

The Editor does not necessarily agree with opinions expressed by his correspondents.

Standardized Representation for Dust-Core Coils

Sir,—The universal application of dust-core, radio-frequency inductances seems to call for a standardized representation. In the development of Nuclear tuning coils I have found it convenient to utilize a symbol consisting of a broken or dotted line instead of the usual full line normally used for an iron-core coil.

I am suggesting that this convention be adopted, and I believe a number of radio workers are already utilizing my suggestion. The use of a broken line is actually symbolical of the exact nature of the coil, and it therefore appears to be a very appropriate symbol. As inductances with ordinary iron cores are frequently shunted by variable or fixed condensers, and as both dust core and air-core coils are used together, the need for differentiation seems to be very desirable. It is to be hoped that the suggested symbol will be recognized by the standardization committees to whom the suggestion is being communicated.—E. D. Tyers (Watford).

[We see no reason for adopting this suggestion. Other confusion is not to be more confused than it is at present, such recommendations should be made by officially recognized bodies, not private individuals, otherwise the crop of signs will grow daily.—Ed.]

From the East Indies

Sir,—As a regular reader from the first issue, I should like to tender my thanks to Mr. Frank Preston for the good design throughout. I did not follow it out as far as you did, and I think I may safely say that it was not quite so much volume, as my room is small, so I followed the first tuning and detector stage, then I put in the first L.F. transformer connecting on to a switch so that I can use it as a two-valve set. Then I made the third valve resistance coupling. I have an L.F. and two Mfd. condensers for filter output across speaker terminals.—D. B. Smedley (Ilkeston).

Volume No. 1: A Suggestion

Sir,—I wish to second Mr. H. A. Okley’s suggestion, that he has made in the 8th inst. with reference to the layout of your paper. I think it is a common sense suggestion, and because Vol. 1 is on the bulky side, and would be more handy to be used if the advertisements were deleted. As he rightly says, “about 50 per cent. of the advertisements are out of date in six months,” and I wish to keep my volume for years. I have given up all other wireless weekly papers since your first number came out, and if Mr. Okley’s suggestion was carried out it would make it a perfect reference book on wireless matters. I have, your articles on short-wave work and receiver construction, I have your Encyclopaedia, the latter especially is a wonder.

G. Sourn (Walsham Abbey).

DO YOU KNOW?

THAT over 5 watts undistorted output is obtainable with certain triodes.

THAT the average battery triode only delivers an output of the order of 500 milliwatts.

THAT high-sensitivity triodes are being made even smaller and yet still retain a fairly straight response curve.

THAT an energized field type of loud-speaker is, generally speaking, more sensitive than one of the permanent magnet type.

THAT a straight-line tuning dial offers many advantages, the chief of which is the ability to rapidly select a given tuning point.

THAT a wooden baseboard may now be obtained for an average of 7/- each.

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THAT the efficiency of the permanent magnet type is, generally speaking, more sensitive than one of the permanent magnet type.

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THAT a homemade transformer is not the subject of letters patent.

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The Selecten Battery Three

Sir,—I have been a reader of Practical Wireless ever since I got a copy of January 14th, 1933, issue. I have been interested in wireless receiver construction for years, and I have built several sets a good many times, but the Selecten Battery Three that was published in that copy of Practical Wireless is the best and neatest one I have ever constructed. The circuit is a very good one, and I should like to tender my thanks to Mr. Frank Preston for the good design throughout. I did not follow it out as far as you did, and I am sure you didn’t quite so much volume, as my room is small, so I followed the first tuning and detector stage, then I put in the first L.F. transformer connecting on to a switch so that I can use it as a two-valve set. Then I made the third valve resistance coupling. I have an L.F. and two Mfd. condensers for filter output across speaker terminals.—D. B. Smedley (Ilkeston).

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FACTS AND FIGURES
(Continued from page 608)

The advantages of the Osman M.F.B.4 double diode triode system are extended when forward bias is used, and the diode rectifier system alone or the diodes, in conjunction with the "variable mu" the double diode triodes would have and a limited field of usefulness: without last the double-diode triod the full advantages of the "variable mu" are not utilized. In two valves we have a combination full of interesting possibilities to the set designer and constitute a marked step forward towards greater simplicity in operation.

PETO-SOCT METALLISED CHASSIS

The all-metal chassis has become the rule for all mains receivers, and even for the battery set, it possesses many advantages. The chief of these is, of course, the saving which is afforded between above and below-surface components, but in addition it is of great use in making earth leads etc. These are simply taken down to any convenient as close to the metal covering and wire. In this manner as with the popular metalised valves, and offer an extremely limited field of usefulness. "variable mu" the double diode triode would have and introduce a new phase to set designs.

MAKING A FRAME AERIAL

(Continued from page 606)

The peak fibre pieces to take the medium-wave winding. Starting on the left-hand side a space of about 1 in. is left and a second space of about 1 in. is left, and at the same time, restrictive laws; but undue liberty is always abused, and the abuse which eventually produces legislation in this direction is probably due in no small measure to the lack of bureaucrats. It will, in this aspect it is probably the reader the rapidity with which you could tour the ether with the Fury Four, and which would indicate also its liveliness, sensitivity, and power. I could think of no better word than that which typifies the fastest military aircraft in the world—The Hawker Fury. The incidence of this accident the Fury was designed by my brother.

Red Flag Days.

I don't suppose many readers of PRACTICAL WIRELESS remember the plethora of restrictions which have been the pioneers of the automobile industry. Certainly today the motorist is annoyed by oppressive legislation and a long list of technicalities. In this connection when we remember that the speed limit was once, five miles an hour, and that every automobile had to be preceded by a man with a white sheet or a red flag, we can only imagine the difficulties which the only industry which has not had to wage the dual fight of breaking down public antipathy and, at the same time, restrictive laws; but undue liberty is always abused, and the abuse which eventually produces legislation in this direction is probably due in no small measure to the lack of bureaucrats. We have, in this aspect it is probably the reader the rapidity with which you could tour the ether with the Fury Four, and which would indicate also its liveliness, sensitivity, and power. I could think of no better word than that which typifies the fastest military aircraft in the world—The Hawker Fury. The incidence of this accident the Fury was designed by my brother.

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TEMPERATURE OF RESISTANCES

A spaghetti type of resistance should not be operated at such a temperature. Generally speaking this type of resistance is only operated when small currents have to be carried, and in such cases the resistance is quite hot to the touch. If you find that the speaker is giving off noises, you should keep the needle steady as I can trace this was used for the mains smoothing choke and I appreciate that there was a voltage drop across it. Incorrect matching of the anode circuits will also lead to a continued jumping of the needle, either upwards or downwards according to whether the output load is inductive or resistive. This is not quite critical in the ease of push-pull valves.

Thus the klicking may not be due to any form of distortion, but may simply be due to the fact that you have tube biasing resistances which are overheating the valves, with the result that you are operating the valves at the breakdown point. Whilst this would give distortion-free reproduction, the anode current would vary with the received signal, and therefore you should try the effect of a smaller resistance (unless you are used to inductive coupling). If this does not make any difference to the resistance as it is if there is audible distortion incorrect matching of the and circuits will also lead to a continued jumping of the needle, either upwards or downwards according to whether the output load is inductive or resistive. This is not quite critical in the ease of push-pull valves.

In increasing the wattage by connecting the speaker, or what is more probable, especially if you have a permanent magnet speaker standing idle, and the makers of the set are now no longer in the market, I should like to try the experiment."-S. H., (Exeter).

As far as the substitution of the field winding is concerned, this was used for the mains smoothing choke and I appreciate that there was a voltage drop across it. Incorrect matching of the anode circuits will also lead to a continued jumping of the needle, either upwards or downwards according to whether the output load is inductive or resistive. This is not quite critical in the case of push-pull valves.


data sheet no. 44

REACTANCE OF A CONDENSER AT RADIO FREQUENCIES

<table>
<thead>
<tr>
<th>Condenser</th>
<th>Reactance in ohms</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.003</td>
<td>1500</td>
<td>200 metres</td>
</tr>
<tr>
<td>0.006</td>
<td>700</td>
<td>250 metres</td>
</tr>
<tr>
<td>0.01</td>
<td>600</td>
<td>300</td>
</tr>
<tr>
<td>0.015</td>
<td>330</td>
<td>350</td>
</tr>
<tr>
<td>0.018</td>
<td>270</td>
<td>400</td>
</tr>
<tr>
<td>0.02</td>
<td>225</td>
<td>500</td>
</tr>
<tr>
<td>0.025</td>
<td>180</td>
<td>600</td>
</tr>
<tr>
<td>0.03</td>
<td>150</td>
<td>700</td>
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<td>0.035</td>
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<td>800</td>
</tr>
<tr>
<td>0.04</td>
<td>100</td>
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</tr>
<tr>
<td>0.045</td>
<td>80</td>
<td>1000</td>
</tr>
<tr>
<td>0.05</td>
<td>60</td>
<td>1250</td>
</tr>
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<td>30</td>
<td>2000</td>
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<tr>
<td>0.065</td>
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<td>2500</td>
</tr>
<tr>
<td>0.07</td>
<td>18</td>
<td>3000</td>
</tr>
<tr>
<td>0.075</td>
<td>15</td>
<td>4000</td>
</tr>
<tr>
<td>0.08</td>
<td>12.5</td>
<td>5000</td>
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<tr>
<td>0.085</td>
<td>10</td>
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<td>8000</td>
</tr>
<tr>
<td>0.1</td>
<td>5</td>
<td>9000</td>
</tr>
<tr>
<td>0.11</td>
<td>4</td>
<td>10000</td>
</tr>
</tbody>
</table>

It will be seen from the above table that the reactance of different condensers at different frequencies differ considerably, and other values can therefore easily be worked out.

SUBSTITUTE FOR SPEAKER FIELD

"My commercial receiver, which has been working for some time, has now broken down, and after examining it I find that the speaker is the cause. Unfortunately, the makers of the set are now no longer in the market, and I wish to replace the speaker with a new one. I have a permanent magnet speaker standing idle, and I should like to try the experiment."-S. T. (Scarborough).

I have tried to connect my own speaker in place of the original one, but I have had the set working properly. I should like to try this in an efficient valve, and as we finished by taking on a new one I tried to let you know the correct answer to this problem."-T. B. (Dalston, N.1).

We regret that we cannot, for obvious reasons-"E. T. (Bristol)."

Passing on for a few minutes, one of the spaghetti resistances was quite hot to the touch. This is also indicated by the fact that when I have tried to connect my own speaker in place of the original one, I have not noticed it before, but found it out accidentally when testing the connections. I do not know how these things operate and do not want to buy another unnecessarily."-(T. H. S. D., Aldeishot).

I have in my junk box several sets of complete multi-valve receivers. I cannot by any reduction in signal strength increase the wattage by connecting the speaker, or what is more probable, especially if you have a permanent magnet speaker standing idle, and the makers of the set are now no longer in the market, I should like to try the experiment."-S. H., (Exeter).

RESISTANCES CONNECTED IN SERIES WILL

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PRACTICAL WIRELESS
July 22nd, 1933

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