# Practical Wireless

3D

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 2.—No. 33.
MAY 6th, 1933.
Registered at the G.P.O. as a Newspaper.

## Building the FEATHERWEIGHT PORTABLE FOUR

FULL SIZE BLUEPRINT Free Inside

# Practical Wireless

EDITOR:
Vol. II. No. 33 || F. J. CAMM || May 6th, 1933
Technical Staff:
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.
W. J. Delaney, Frank Preston, F.R.A., W. B. Richardson

# ROUND *the* WORLD *of* WIRELESS

### Roumania's Super Power Station

BLAJ, in Transylvania, where a 1-kilowatt experimental transmitter has been installed, will possibly prove the definite site of the super-power station for which a contract has already been placed by the Roumanian authorities. The site, however, is conditional on the transmitter being permitted to use the wavelength of 1,870 metres, a channel formerly allocated to the Bucarest Broadcasting Company. Should, however, a wavelength of roughly 1,200 metres be granted, it is proposed to erect the new plant in the neighbourhood of Brasov (formerly Kronstadt). The power of the station will be 150 kilowatts. The transmitter now in operation in the capital may be transferred to Jassy, Galatz or Braila.

### Vienna, Loud-speakers and Open Windows

THE police authorities at Vienna have warned all radio enthusiasts that during the spring and summer months, heavy fines will be inflicted in every case where loud-speakers are used in houses and flats whilst windows remain open. During the warmer evenings it is the habit of Austrians to take their meals on balconies overlooking the streets, and the noise caused by innumerable loud-speakers and gramophones has compelled the authorities to take precautionary measures.

### France's Wireless Bill

THERE is a strong possibility of the new wireless telephony bill being passed by the French Chamber of Deputies and Senate during the present session, as the Commission of Finance has adopted the clauses dealing with the taxes to be levied on wireless receivers and components. France, during the past six years, has made several attempts to raise money for the upkeep of the radio stations in this manner, but hitherto has not succeeded. It is even now expected that considerable opposition will be met before a bill can be passed which would authorise the State to monopolise the broadcasting services.

### More Czech Stations Advocated

NOTWITHSTANDING the fact that, excluding the Prague high-power transmitter, Czechoslovakia possesses four provincial stations, certain districts of the country are not adequately covered. A petition put forward by the Czech Radio Club for the installation of a further relay at Pilsen is being considered by the authorities. Pilsen, formerly in Bohemia, is the well-known "Lager" brewing centre.

### Italy Offers Radio Prizes

IN order to encourage the sale of licences the E.I.A.R. offers to all listeners a reward of 20 lire on proof that they have induced a friend to register his wireless receiver with the authorities. In addition, a radio lottery has been launched in which prizes of from 500 to 15,000 lire can be won. Tickets are also awarded to listeners who, in the same way, assist the development of the broadcasting system.

### When Oscillation is *Verboten*

SINCE the advent of the Hitler Government in Germany and its increased participation in the broadcast programmes, fines for interference of any description with reception have been greatly increased. In cases, however, where radio listeners are convicted of disturbance through oscillation *during a ministerial broadcast*, the unlucky culprit is not given any option, but is hauled off to prison.

### The Highest European Aerial Mast

RADIO-BUDAPEST, the new super-power station now under construction on the Island of Csepel in the Danube, will possess for its aerial system a mast 320 metres (1,056 feet) in height, or 20 metres higher than the Eiffel Tower. The actual weight of this steel tower will exceed 230 tons. It is hoped to have the station ready by next autumn.

### Tallinn's Alternative Channel

IN view of the fact that Tallinn's broadcasts on 298.9 metres are "sandwiched" between those of Hilversum and North National on much higher power, it is frequently easier to hear the Estonian programme through the Tartu relay on 585 metres, just under the shipping band. The difference in the distance of these two cities from London is only roughly twelve miles. The call from Tartu on (pre-war maps, *Dorpat*) when broadcasting from its own studio is: *Hallo! Hallo! Tartu lainelnelisada Kuuskümman wiijs* 585.7 *metrit*, and the interval signal a bell. When the Tallinn (Reval) programme is taken, you may hear: *Siin Tallinn ja Tartu*, and announcements will be given by a man or a woman. Estonia works to Eastern European time, and consequently her clocks are now only *one* hour ahead of B.S.T.

### The Naples Pipes of Pan

EITHER direct from Naples or through Rome when a relay of the former city is carried out, you will regularly hear a flute-like interval signal strongly reminiscent of the Pipes of Pan. It is a simple melody repeated in various keys. Naples, like most of the other Italian studios, possesses a woman announcer. The station broadcasts on 319 metres, and the call, as most programmes are S.B. with Rome, is usually *Radio Roma-Napoli*.

### A Giant Valve

AT the Marconi Osram Valve Co's. works at Hammersmith, some 250 different types of wireless valves are made, but recently this firm turned out what is stated to be the largest single-unit sealed-off transmitting valve in the world. This valve was a veritable giant for it weighed 75lbs., and stood nearly 4ft. high; it is designed for use in a 500 kW. transmitter.

## *IN THIS ISSUE:*

**BUILDING THE FEATHER-WEIGHT PORTABLE CLASS B FOUR** page 266

**CUT THE CRACKLE** page 261

**ALL ABOUT IRON-CORE TUNING COILS** page 251

**TONE VOLUME CONTROL** page 258

**THE PENTODE EXPLAINED** - page 274

**SHORT-WAVE SECTION** page 278

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

### Blimp *versus* Mast Aerial

TO study ways and means for the reduction of the fading effect in broadcast transmissions, the KDKA, East Pittsburgh, engineers are carrying out experiments with a small blimp as an aerial support. The airship is twenty-five feet long with a diameter of ten feet. It is floated at a height of roughly 1,500 feet above the station buildings and trails a five-hundred feet aerial. By this method it is hoped to extend the range of the transmitter and to counteract fading effects over a larger area.

### Reduced Advertising Programmes in Canada

THE Canadian broadcasting authorities have decreed that in the case of sponsored broadcasts by business or other concerns not more than five per cent. of the programme time must be devoted to actual microphone publicity. In some of the entertainments put out by the United States studios a longer period in the programme is allowed for advertising the wares of the firm responsible for the broadcast.

### New Interval Signal for Berlin

TO replace the metronome signal which the station has used for some considerable time, the Berlin studio has adopted, between items, the first bars of one of Germany's favourite military marches *Volk ans Gewehr* (People, to Arms). This, according to the Reichsrundfunk, better expresses Germany's nationalist movement. The long-wave Königs Wusterhausen (Deutschlandsender) transmitter will continue to use the first notes of the Potsdam Church carillon for the same purpose.

### The New Radio Toulouse Station

PENDING official authority—which is expected daily—to bring the new 80 kilowatt St. Agnan transmitter into regular service, this station will continue to carry out experimental broadcasts between B.S.T. 9.0 and midday and again between 12.30 and 1.30 a.m.

### Morocco and Radio Pirates

THE *Office Chérifien* with a view to the suppression of radio pirates in Morocco, has decreed that all dealers when effecting any sale of wireless components, must report the names and addresses of clients to the local Post Office. The P.T.T. authorities exercise full control over broadcasting and other transmitters, and have decided to wage war against unlicensed possessors of wireless apparatus.

### Radio Licences on the Increase

DURING the month of March the Postmaster-General issued approximately 450,000 listening licences, which shows on the total number of 5,498,700 in force, a net increase of some 71,000 new wireless fans.

### B.B.C and Opera Relays

THE B.B.C. will mark the opening of the Grand Opera season at Covent Garden on May 1st by relaying Act Three of *Der Rosenkavalier* (Richard Strauss) to National listeners. On the following evening the Regional stations will broadcast the whole of Wagner's *Rheingold*. The third act of the *Valkyrie* will be transmitted in the National programme on May 3rd. Relays of Covent Garden performances, on either National or Regional wavelengths, will be given frequently throughout the season.

### WIRELESS FOR POLICE.

*The above illustration shows a motor-cycle combination for police work fitted with a Marconi six-valve single-control police receiver operating with a short rod aerial.*

## SOLVE THIS!

**Problem No. 33.**

Robins had an All-mains receiver, home-built. The circuit was the conventional Screen Grid, Detector and Pentode valve, and the mains section employed a U.10 rectifier, which delivered 250 volts at 60 mA. As he wished to use larger output valves he purchased a pair of Mazda PP5/400 valves and a new rectifier, a Cossor 460BU. This should (according to the catalogue) deliver 500 volts at 120 mA, but when the receiver was switched on results were worse than with the original arrangement. What had Robins overlooked? Three books will be awarded for the first three correct solutions opened. Address your solution to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, London, W.C.2, and mark your envelopes Problem No. 33. Do not enclose any other correspondence with your solution.

**SOLUTION TO PROBLEM No. 32**

The anti-microphonic valve-holder was causing the trouble, as it was very loosely sprung and the weight of the valve caused the contacts to drop sufficiently to touch the metal chassis. This of course, shorted the H.T.

The following three readers received books in connection with Problem No. 31.

A. Burman, 196 Canterbury Road, W. Croydon. W. Rowlands, 1 Crooklands Terrace, Dalton-in-Furness. H. Fraser, 68, St. Johns Road, Waterloo, Liverpool.

### A Japanese Programme

ON May 4th (National) and the 6th (Regional) the B.B.C. proposes to broadcast an adaptation of three of Japan's most famous No Plays which date from the 15th and 16th centuries. In Japan a performance of a No Play lasts six hours; on this occasion the three to be broadcast will occupy less than sixty minutes.

### America's Giant Transmitter

CINCINNATI'S new four-hundred-thousand dollar super station is to be erected at Mason (Ohio). Work on the 830 feet high steel tower which is to serve as an aerial has already begun. The structure itself will be "cigar" shaped and thirty-five feet in diameter at its widest point; it will be stayed by means of eight two-inch bridge cables, and when complete will weigh nearly 450 tons. It is hoped that this ultra modern aerial mast may be ready by June when, until the new station is built, it will be used by the present WLW, 50 kilowatt transmitter.

### The New French Wireless Bill

THE French Financial Commission has adopted certain paragraphs of the new Budget which calls for a listening tax on all wireless receivers in France, in addition to a surtax of 15 per cent. of the retail price of valves sold in that country.

### Interesting Radio Statistics

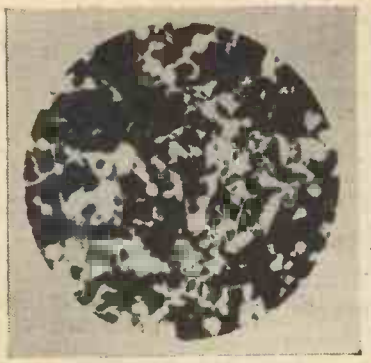
TO visualise the progress made in the broadcasting systems of the various European States it is necessary to compare the number of registered listeners with the general population. Some idea may be conveyed by the following figures which show the number of licences issued per thousand inhabitants: Denmark (150); Great Britain (149); Sweden (103); Austria (78); Germany (72); Switzerland (62); Belgium and Norway (48); Hungary (38); Czechoslovakia (35); Poland (10); Italy (7); Jugoslavia and Spain (4). Holland, where no tax is levied is estimated at 82 per 1,000.

### An Old Spanish Custom!

FOR some years Spain has endeavoured to reorganise her broadcasting system, and it has been the custom of her wireless Press to put forward new schemes at fairly regular intervals. Apparently, a perfected plan has been submitted for discussion at the next meeting of the Broadcasting Union at Lausanne. It calls for authority to build a 160 kilowatt station to operate on 1,450 m., one of 100 kilowatts on 413 m.; two of 50 kW. on a wavelength above 300 m., and two of 20 kW. on a channel higher than 259 metres. These wavelengths could be shared with transmitters operating in Estonia, Latvia and Finland, without causing mutual interference.

### Radio Tessin Testing

IT is reported from the continent that the third of the Swiss Regional stations (Monte Ceneri) has begun its experimental transmissions, and can now be heard on the air in the early hours of the day.



# IRON CORE TUNING COILS

## A Practical Article dealing with Iron Core Coils, Their Construction and Advantages

By PAUL D. TYERS

*Fig. 1—Photomicrograph of iron filings. Equal magnification.*

*Fig. 2—Photomicrograph of "Nuclean" dust. Equal magnification.*

I REMEMBER about ten years ago using an American receiver in which some of the high-frequency circuits contained iron cores, and it is only now that the universal application of the iron core tuning coil appears to be imminent.

It must not be imagined that there is anything new about an iron core tuning coil. The idea of using iron in comparatively high-frequency circuits is probably about thirty years old at least. The first application of dust cores was, I believe, in connection with telephone work where they were used as loading coils. The name of Pupin is familiar to everyone as a pioneer of dust core loading coils.

There are, no doubt, three questions which are of most interest to the wireless enthusiast, and it is these three which I will endeavour to answer. First, why use an iron core; secondly, what are its advantages; and, thirdly, what is it, and how is it made? The three questions are so intimately connected, that I think it will be best to deal with them as a whole.

The principle of the iron core coil is really very simple. When designing a coil, our aim is always to reduce the losses to a minimum, because obviously the greater the losses, the lower will be the efficiency. Sensitivity or magnification will decrease, and what is probably most important of all, the selectivity will go down, giving flat tuning, particularly if the losses are very high.

### Tuning Coil Losses

The losses in a tuning coil can be regarded as an equivalent resistance. I expect everyone is familiar with a resonance curve which indicates the sharpness of tuning of a coil at a particular frequency. The lower the losses, the sharper will be this curve. In other words, voltages are obtained across the tuned maximum circuit at the peak. If this is very wide and flat, quite a large voltage will still be obtained on either side of the tune point, with the result that quite strong signals will be obtained from adjacent transmissions.

Now the losses in a coil are made up of a number of different factors. Since the coil is wound with wire, the wire has an appreciable resistance, and the pure ohmic resistance of the winding is always one of the constituents of the total equivalent resistance of the coil. It is, in fact, one of the most important. For a coil of any given value or inductance, there is always a definite relation between diameter and length and gauge of wire, which will give the minimum effective resistance.

The inductance of a coil depends upon its length and diameter, and the number of turns, and also upon the nature of the material inside the coil. In an ordinary tuning coil, apart from the former on which it is wound, there is nothing but air. The material of which the former is made has no effect upon the inductance if it is non-metallic, but it may introduce what are known as dielectric losses. These losses vary considerably with different materials.

### Effect of Metal in a Coil

We know that in a transformer we always have a magnetic core. Now the effect of metal in a coil is to increase the inductance tremendously. The extent to which it is increased depends upon the material of which the core is composed. Magnetic materials such as iron have a property known as magnetic permeability. If the permeability is very great then the inductance is enormously increased. In fact, the inductance is a direct function of the permeability.

If, therefore, we have two coils, one having a permeability twice that of the other, we shall obtain double the inductance with the second core. Supposing we still want only our original value, we can remove a large number of turns and use the higher permeability core, thereby obtaining our original inductance. As we now have less wire, we have obviously removed quite a large proportion of undesirable ohmic resistance from the coil, and accordingly, we have decreased our losses very considerably. This is the fundamental principle of the iron core tuning coil.

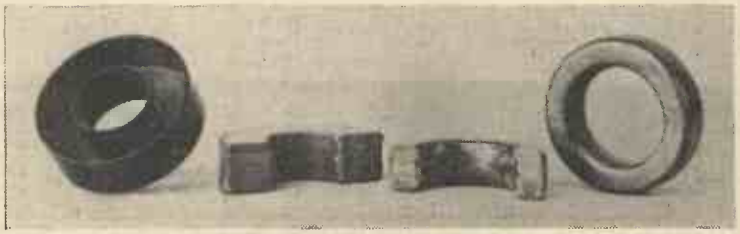


*Fig. 3—Iron Cores. Left to right: early type of Ferrocart ½ ring; high permeability ½ core (Standard Telephones); complete Standard Telephones ring core.*

### Hysteresis Losses

All this seems very simple, but as a matter of fact, there is quite a number of other considerations which complicate the problem enormously. Adding a magnetic core to a coil introduces other sources of losses which do not exist with a simple air core coil. These losses are due to hysteresis effects and eddy currents. Hysteresis losses in a core are controlled by the actual nature of the magnetic material or the alloy, and they vary considerably with different grades of material. The eddy current losses are controlled by the mechanical formation or construction of the core. If we consider for one moment an ordinary mains transformer or low-frequency transformer, we find that the core is composed of a large number of stampings or laminations. The core itself is not composed of ordinary iron, but consists of an alloy of iron with silicon, or iron combined with nickel.

Another property of an iron core is that its effective permeability varies with frequency. At mains frequencies, that is, of the order of 90 cycles per second, it is fairly constant, while the variation over the entire range of speech frequencies is not really very great.

When we are dealing with radio frequencies, however, a totally different state of affairs exist. If we simply take an ordinary iron alloy core and laminate it in the usual way, we shall obtain quite a good permeability, but the losses will be colossal. This difficulty can be overcome by splitting up our core into an extremely large number of particles. Accordingly, instead of laminating the core in the usual manner, we make the metal into the form of a dust or powder which is compressed into some form of solid block. This, one might consider, is the end of the dust core problem, but it is really at this point that it just commences.

### Dust Cores

The number of people who have investigated and developed various types of iron cores is really tremendous, and it is only exceeded by the number of patents which have been filed on the subject during the last thirty years or so. I think it can be definitely stated that it is only within the last few years that renewed attention has been directed to dust cores for really high radio frequencies, corresponding to those used for ordinary broadcast transmissions.

Dust core problems are partly electrical and partly metallurgical or chemical. In order to keep the losses down to a reasonable value, and at the same time obtain a useful permeability, it is necessary to employ an extremely small grain size. One

(*Continued overleaf.*)

(Continued from previous page.)

of the photographs (Fig. 1) is a photomicrograph of very fine iron filings. Compare this with the photomicrograph of a dust core material (Fig. 2), and the iron filings will look almost like large stones. When taking the photomicrographs, I employed equal magnification so that the comparison is a true one.

Several processes have been used for producing iron of minute grain size. Both mechanical and chemical methods have been employed, and, in some cases, the two have been combined. Some of the dust cores for radio frequencies are composed of fairly pure iron. When the iron is produced by chemical means, it is difficult to get anything but fairly pure iron because alloys cannot easily be produced by pure chemical reactions.

One of the most interesting processes which has been devised for obtaining very small iron dust is that known as the carbonyl process, the iron being deposited from iron carbonyl. The method is very similar to that used in the nickel carbonyl process. Haematite iron is also another source of supply, the iron being produced from haematite, which is one of the iron oxides, by a rather complicated process.

When mechanical means are used, the iron has to be ground into the form of a powder or almost impalpable dust. In such a case it is almost impossible to use a pure iron, because the iron would be soft, and it would tend to tear and drag. Accordingly, an alloy is generally employed which is of a more brittle nature. A hard brittle material can easily be ground down to a very fine powder. Quite apart from iron and other alloys, dust cores have been produced from partially magnetic materials, such as magnetic oxide of iron, and also certain magnetic pyrites.

An interesting point which arises in the use of a very fine powder is that of compressing it into a very small space. A very fine powder bulks tremendously because the particles have very little mass and lie very lightly upon each other. Accordingly, there is quite a large air space. If a quantity of powder is compressed, as soon as the pressure is released the particles tend to separate again. This difficulty, however, is easily overcome by adding a binding agent.

### Binding Agents

Wax, gums, resins, shellacs, celluloid, and cellulose compounds have all been used as binding agents. The iron dust is made into a paste and is allowed to set. According to the nature of the binding material and the quantity used, so the resulting core material has varying degrees of mechanical strength. It is obvious that if too much binding material is used, the quantity of iron which can be obtained in a given space is reduced, which means that the permeability will fall. Accordingly, every endeavour is made to keep it down to a minimum.

Some iron cores have been produced by moulding at extremely high pressures with bakelite powder. Some of the earliest experiments consisted in loading ordinary bakelite powder with iron, but, of course, the quantity of iron present was comparatively small. If the bakelite is reduced to a very small quantity, then the resultant core tends to become very brittle, and exceptionally high pressure is necessary in the moulding process. Brittleness is not altogether a defect, because it is not really practicable to wind the coil directly on the core for reasons which will be explained later. Accordingly, the core can be put into a small moulding which acts as a complete mechanical protection. Under these conditions the binding material can be reduced very considerably, with a resultant gain in the efficiency of the core.

*Fig. 4—German Ferrocart coils.*

### Insulating the Particles

Many attempts have been made to improve the insulation between the adjacent particles, and quite a number of patents have been filed for various methods. Insulation between the particles is similar in effect to laminating an ordinary core stamped from sheet steel. The binding agent added to the core tends to serve as an insulating material between the particles, but in the writer's opinion, the problem of insulating the particles, if such is considered necessary, is one of the most difficult. This is a point which may not be universally agreed, but it is based upon the writer's own investigation. Some idea of the difficulty of insulating the particles can be obtained when it is remembered that the grain size of the iron in a high-frequency core may be only of the order of a few thousandths of a millimetre in diameter. If we assumed a grain size of one five thousandth of a millimetre, and if we assumed that the grains were all circular, a representative small ring core would actually contain the amazing number of eighteen billion. When it is remembered that the grains are not all quite uniform in size, and that they pack in far more closely than they would if they were all in the form of uniform spheres, the quantity is probably about double.

The individual insulation of these grains is perhaps a rather more difficult problem than it appears to be at the outset. The insulating material between the particles must be small in quantity compared with that of the particles, as otherwise the permeability falls as already indicated. The best insulation is, no doubt, obtained by chemical methods in the form of a minute coating, but it is a matter of extreme difficulty to determine to what extent the particles of any core material are actually insulated. Microscopic examination even with high magnification does not yield much information.

### Core Materials

The comparison of photographs of some of the various core materials and coils is interesting. One very popular form of core is in the form of a small ring of square or rectangular cross section. These rings are usually about 1½in. in diameter, while the centre hole is about ¾in. in diameter. A core of this type at radio frequencies may have a permeability of the order of 10. Two examples of this are Atmalloy and Ferrocart. The former is a British commercial production which appears to be of the iron and binding agent type. The material is pressed into a small channel shaped ring moulding which can be clearly seen in the photograph. Ferrocart is a German production, and here the iron is deposited on thin paper, which is wound into the form of a ring, or alternatively, it is pressed into the form of sheets, which can be stamped into laminations.

A somewhat similar coil wound on a ring core is produced by Standard Telephones and Cables, Ltd. This has a permeability of the order of about 13, and accordingly, the cross section is smaller. When iron alone is used, the permeability depends very largely upon the proportion of iron to binding material, and the pressure which is applied.

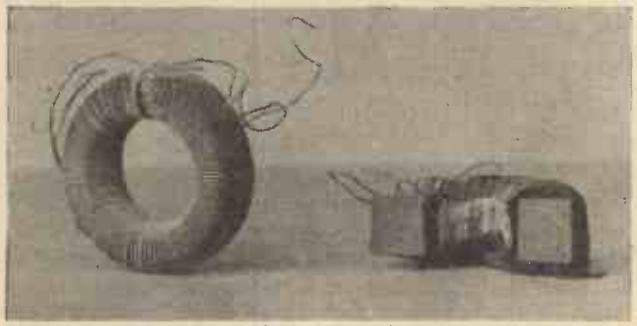


*Fig. 5—Experimental complete and half torroid coils. Note the spaced winding on the larger core.*

### Torroidal Winding

In order to take full advantage of the core material, it is general to use a closed core. This is done by winding the inductance either on a bobbin with a shell type core similar to an ordinary transformer, or utilising a torroid wind. A torroid wind consists of a coil which is doubled back on itself, so that the first and last turns are adjacent. Coils of this type have to be wound on a special machine, the wire being threaded round and round the ring as the winding proceeds.

A form of construction devised by the writer for torroid winding consists of splitting the core either into two or four sections, which are formed into a square. The four sections are wound separately on an ordinary machine, and the torroid is built up from the sections which are connected in series.

One of the difficulties in winding a torroidal coil lies in the accurate matching of a series. Slight irregularities are compensated for by moving the turns so that some are close together, and this has the effect of making a minute variation in the inductance. The turns are then subsequently fixed by some form of sealing compound.

(Continued on page 277.)

# MAINS TRANSFORMER CONNECTIONS—

## *How To Trace Them*

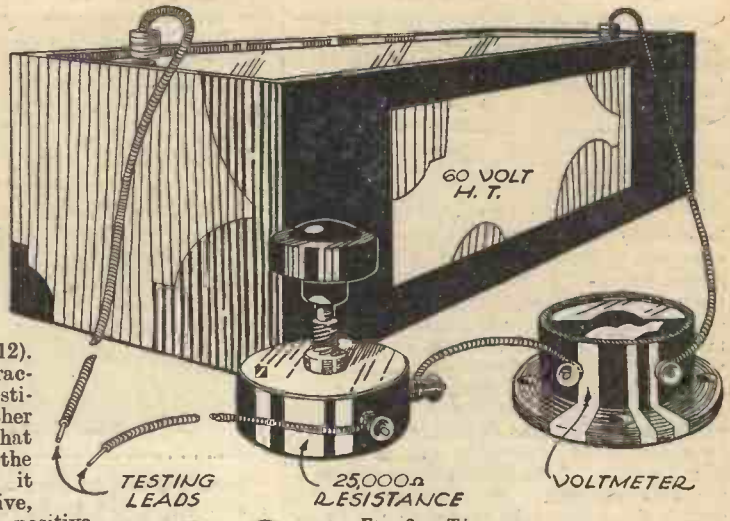



*Fig. 2.—The testing equipment.*

WHILE at a friend's house the other evening he complained to me that the transformer in his all-mains receiver had burnt out some time ago. He had returned the defective component to the makers and they had forwarded a new one to replace it, but when it was unpacked it was found to be devoid of any markings to indicate to which soldering tags on the transformer the leads from the set were to be taken. Having no testing equipment with me at the time I turned out my friend's junk box and discovered a D.C. voltmeter reading 0.6 volts, and an old 25,000 Ω resistance, the winding of which was luckily intact.

**Components Used For Testing**

Fig. 1 shows the transformer as sent from the makers (the lettering above and below the tap is mine), and Fig. 2 shows the voltmeter, resistance and a H.T. battery wired up to provide the means to apply tests. The reasons for the inclusion of the resistance are twofold, firstly to safeguard the windings of the voltmeter as every test is commenced with the resistance full in, and secondly, to obviate the necessity of constantly changing the wander-plug in the H.T. battery.

On inspecting the set it appeared as shown in Fig. 3. At the top left-hand corner you will notice a voltage selector marked 110, 120, and 220 volts, and these together with the return to the mains plug, through the mains switch, show us that four tappings on the transformer are required to accommodate the mains (wires 9, 10, 11 and 12). By diligently tracing out the destination of the other leads, I found that No. 4 was from the earth, therefore it was H.T. negative, No. 7 was H.T. positive, as it eventually fed the anodes of the valves, Nos. 6 and 8 were the filament wiring of the rectifier valve, and Nos. 3 and 5 were the plate connections of the same valve. A glance at Fig. 4 will give you the idea of the circuit, and from this you will see that on the transformer there are four windings, two of which are centre tapped, the mains winding having four connections to it, as mentioned above.

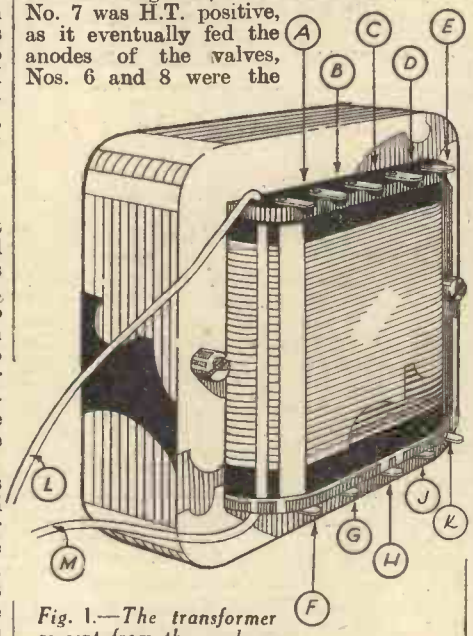



*Fig. 1.—The transformer as sent from the makers.*

**The Testing Apparatus**

The testing apparatus was then brought into play and somewhat indiscriminately testing between the taps on the transformer A, B, C and D were found to be connected in some way together as were also E, F, G; H, J, K; and L, and M. As the latter two leads were long flexible ones, and were the only long leads capable of reaching to the "hum-dinger" or centre-tapped resistance across the valve filaments in the set, these were assumed to be the A.C. supply to the filaments. Tags A, B, C and D were now tackled, and the readings on the voltmeter were carefully noted. Between A and B the reading was low; between B and C the reading was high comparatively, and between C and D the reading was again low, but slightly higher than in the case of A and B. From these tests it was evident that A is connected direct to one side of the mains, B is the 110-volt tapping, C is the 120-volt tapping, and D is the 220-volt tapping. An explanation of how I arrive at this may prove of interest. The difference between 0 and 110 volts is 110, the difference between 110 volts and 120 volts is 10, and the difference between 120 volts and 220 volts is 100. From this you will see that the resistance of A to B will be high, of B to C will be low, and of C to D will be also high, but on account of the slightly less amount of wire in this winding as compared with A to B (110 and 100) the reading on the voltmeter will be slightly higher.

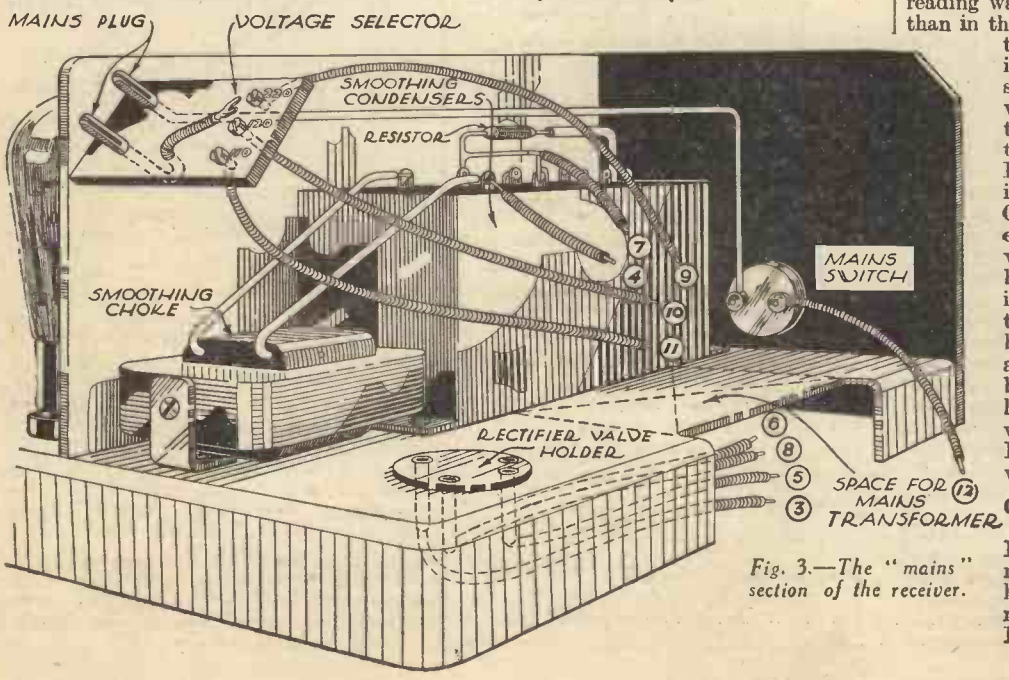



*Fig. 3.—The "mains" section of the receiver.*

**Continuing the Test**

I then dealt with winding E, F, G. The reading on the voltmeter was high, indicating a low-resistance winding, and the readings between E and G, and F and G were found to be equal,

(Continued on page 284.)

*COMPLETING—*

# SELECTONE A.C. RADIO-GRAM TWO

**Details of construction of the set itself were given last week, and the process of completing the radio-gramophone is now dealt with.**
**By FRANK PRESTON, F.R.A.**

THE first thing is to mount the electric turntable, and the motor-board of the cabinet is already drilled for this purpose when obtained. The turntable has single-hole mounting, so it is only necessary to pass the bush through the hole provided, and secure it on the underside with the ring-nut. Felt washers are supplied with the electric turntable, and these should be arranged on the mounting bush to insulate the motor-board from vibration. Next, the Q.M.B. switch must be attached to one corner of the motor-board and a 7-16in. hole will be required for this purpose. Connections to the switch should then be made, as shown in Fig. 4; it can be seen that one wire of the twin flex is broken and the two sides of the break are attached to the switch terminals. As the flex supplied is a good deal longer than necessary, it must be cut off to such a length that it will just reach the primary terminals of the mains transformer when the set is placed in position.

### Connecting the Pick-up

The pick-up can next be attached, its exact position being determined by means of the thick cardboard template supplied with it. As a matter of fact, the small hole in the right-hand corner of the motor-board almost exactly corresponds with the position for the centre of the pick-up base, so the connecting leads can be passed through this. It will be found that the pick-up lead is not long enough to reach the appropriate terminals on the set, and so it must be lengthened with a short piece of twin shielded wire. This is connected as shown in Fig. 5. There are three wires from the pick-up lead—two brown and one black—and the former two come from the pick-up proper, whilst the latter is connected to the metal parts and to the metal-braided shield; it is for "earthing" purposes only. The two brown wires are connected to the shielded wires and the black one is attached to the screening braid. These three connections are best made by soldering, and afterwards the joints should be covered with short lengths of insulating tape. At the "set" end of the pick-up lead a short wire is secured to the metal braiding and is joined, along with one of the ordinary pick-up wires, to that terminal which is connected to earth—this detail also is shown in Fig. 5.

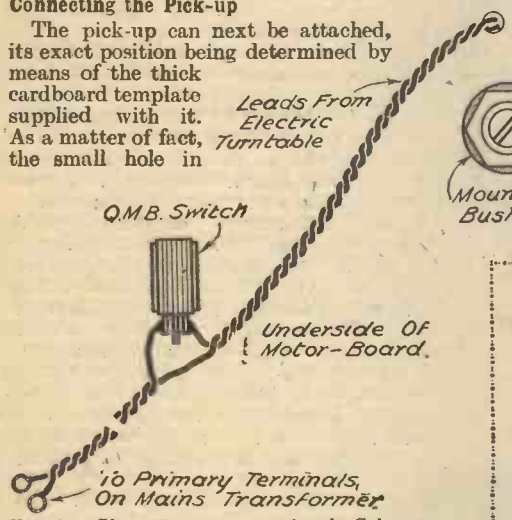



*Fig. 4.—Showing connections for the Selectone turntable.*

As the metal screening braid of the pick-up lead is earth-connected, care must be taken that it cannot come into contact with other parts of the receiver. For this reason it is best to take the lead along the underside of the motor-board and down the side of the cabinet, loosely fastening it in position by means of small staples or brass cup-hooks.

### LIST OF COMPONENTS

1 Polished Plywood Panel, 10in. by 7in. (supplied with Cabinet specified).
1 5-ply Baseboard, 15in. by 14½in. (supplied with Cabinet specified).
1 Utility "Mite" .0005 mfd. Condenser with disc drive.
1 "Wearite" 3-point Wavechange Switch (Type G.W.C.).
1 "Wearite" Changeover (Radiogram) Switch (Type G.C.O.).
1 "Wearite" 20,000 ohm volume control with combined Mains Switch.
2 Lotus 5-pin Valve Holders.
1 Colvern Type "T.D." Coil.
2 Dubilier .0001 mfd. Fixed Condensers.
1 Dubilier .0005 mfd. Fixed Condenser.
1 Graham Farish Ohmite 1 megohm Grid Leak.
1 Graham Farish Horizontal Grid Leak Holder.
1 "Wearite" Screened H.F. Choke (Type H.F.P.).
1 Lissen "Hypernik" L.F. Transformer.
1 Lissen "Tone Compensator."
3 Belling-Lee Terminal Mounts.
6 Belling-Lee Type "R" Terminals, 2 marked "Pick-Up" and 1 each marked "A," "E," L.S.+, L.S.—.
1 Heayberd Type W.25 Mains Transformer, giving outputs of 135 volts, 70 mA. and 2—0—2 volts, 4 amps.
1 Heayberd Type 751 Smoothing Choke.
1 Westinghouse Style H.T.7 metal Rectifier.
4 Dubilier (400 volts D.C. working) 4 mfd. Condensers.
1 Dubilier (400 volts D.C. working) 2 mfd. Condenser.
2 Dubilier (400 volts D.C. working) 1 mfd. Condensers.
1 Belling-Lee Fuseholder with .5 amp. fuse.
1 Graham Farish Ohmite 100,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 50,000 ohm 1 watt Resistance.
1 Graham Farish Ohmite 1,000 ohm, 1 watt Resistance.
1 Graham Farish Ohmite 250 ohm, 1 watt Resistance.
1 Heayberd Mains Flex with Lamp Adaptor.
2 Coils Glazite, screws, short length flex.
1 Mazda A.C.2 H.L. Valve, metallized.
1 Mazda A.C.P. Valve.
1 Simpsons Electrical Turntable.
1 Becker Q.M.B. On-Off Switch.
1 B.T.H. "Minor" Pick-up.
1 Celestion "Soundex" Speaker Chassis.
1 "Camco" Selectone-Tablegram Cabinet.

### Using the Gramophone

To set the gramophone into operation the radio-gram switch should first be pushed in, the set switched on in the normal way, and the gramophone turntable connected by means of its own switch. Since the driving mechanism of the turntable consists of a synchronous motor, it will not rotate until the turntable is given a flick with the finger. Let it run for a few seconds to attain its normal speed before putting the pick-up on to the record. The volume of gramophone reproduction is varied by means of a small lever projecting from the base of the pick-up track arm, and it will probably be found that this has to be set to very nearly its minimum position in order to reduce volume sufficiently to make it suitable for the average room. At the end of a record, the pick-up is lifted off and the turntable stopped by holding a finger against the rim (it is not necessary to switch off the current between different records).

### The Tone Control

The tone control operates just the same on gramophone music as on radio, and will be found very useful for cutting out needle scratch as well as for its normal purpose. It is not difficult to find a setting at which the scratch is almost entirely eliminated without producing any noticeable loss of higher musical frequencies. By making intelligent use of the tone control potentiometer, the greatest possible amount of enjoyment can be obtained from any record, and a slight adjustment for different kinds of music will prove very beneficial. As was pointed out last week, clockwise rotation of the knob increases the set's response to the higher notes (and to needle scratch, incidentally), whilst an anti-clockwise movement produces a greater response to the bass.

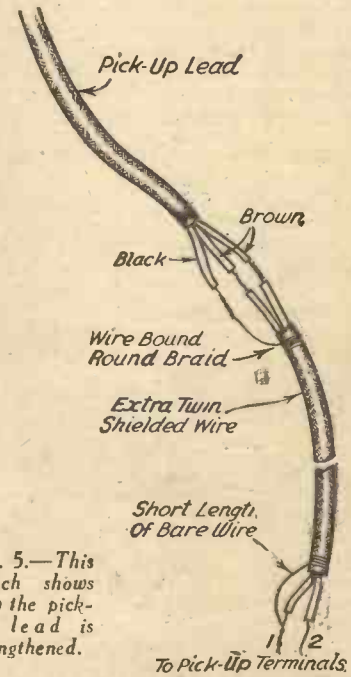


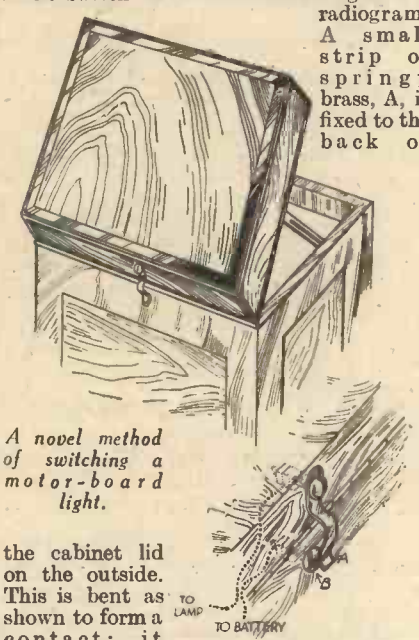

*Fig. 5.—This sketch shows how the pick-up lead is lengthened.*

THE HALF-GUINEA PAGE

# Radio Wrinkles FROM READERS

### Automatic Switch for Motor-board Light

THE accompanying sketches show a simple method of making an automatic switch for a motor-board light in a radiogram. A small strip of springy brass, A, is fixed to the back of

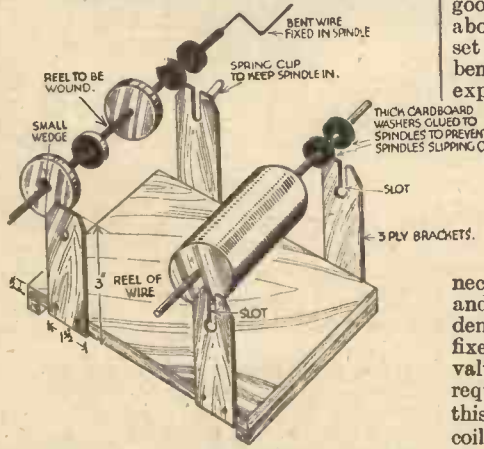



*A novel method of switching a motor-board light.*

the cabinet lid on the outside. This is bent as shown to form a contact; it should be drilled for a screw which holds it to the lid and clamps the connection. Immediately below it a large drawing-pin or flat head screw, B, should be placed, in such a position that when the lid is opened the strip rests on the head; the connection to this is merely placed under the head. The spring may be bent to make contact for any desired angle of the lid, which allows one actually to see the light extinguished before closing the lid tight; moreover, the switch does not disfigure the cabinet work since it is fixed at the back out of sight.—"LAMPLIGHTER" (Sunderland).

### Machine for Winding Chokes

A SIMPLE machine for winding chokes and coils can be made as shown in the accompanying illustration, which shows




*A simple machine for winding chokes and coils.*

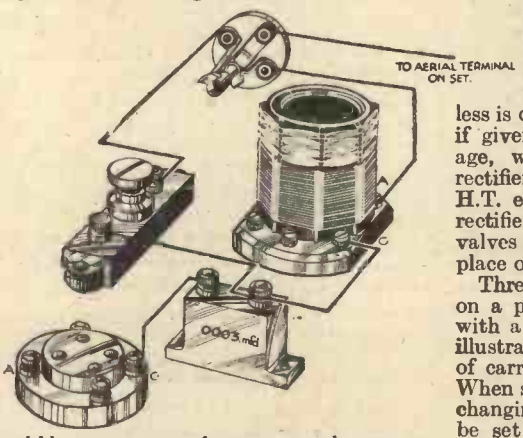
the details of construction quite clearly. The machine can be made to fit any size choke or coil. The former to be wound is wedged to spindle, but wire reel can be left loose to travel along the spindle with the movement of the winding. When in use the machine can be clamped to a table. —E. HILL (Brynamman).

### THAT DODGE OF YOURS!

**Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us, addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.**

### Improving Long-wave Reception

MANY listeners using a dual-wave coil receive only comparatively weak signals on the long-wave band, although

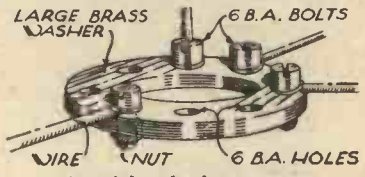



*Adding components for improving long-wave reception.*

reception of medium-wave stations is quite good. Here is a gadget which has brought about a marked improvement in my own set in this respect, and I pass it on for the benefit of other readers who may be experiencing the same trouble. Fix an old type three-point switch on the panel and take the aerial lead direct to the terminal of the switch which is in contact with the spindle, instead of to the dual-wave coil (see sketch). The terminal of the switch with the short tab should then be connected up with the aerial tapping of the coil, and that with the long tab to a pre-set condenser, and then through the usual .0003 fixed condenser to the grid of the detector valve. When medium-wave stations are required the switch is pulled out, and this has the effect of bringing the dual-wave coil into use. On pushing the switch in, the coil is cut out, and the result is a big increase in the volume of long-wave stations.—T. THORNTON (Doncaster).

### A Useful Connector

A VERY handy multiple connector, suitable for a variety of purposes where it is necessary to join several wires




*A useful multiple connector.*

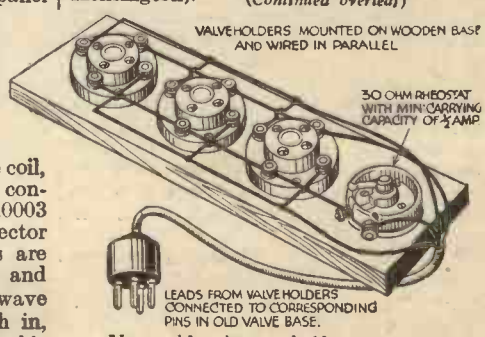
together at one common point, is shown in the accompanying sketch. This useful little gadget is made by simply drilling a ring of holes (to clear 6BA screws) in a brass washer of suitable diameter. Some 6BA. round or cheese-headed screws are slipped through the holes and, after looping the ends of the wires round them in the usual way, nuts are run on and tightened so as to grip the wires securely. Excellent connections result from this dodge.—NORMAN HURST (Wimbledon).

### A Use for Old Valves

MANY readers have, no doubt, a few valves that have lost their emission, and, as far as wireless is concerned, are useless. These valves, if given a slightly increased filament voltage, will serve quite well as half-wave rectifiers. For those readers who have H.T. eliminators of the half-wave, valve rectifier type two or three of these old valves in parallel will effectively take the place of the standard rectifier valve.

Three valve-holders should be mounted on a piece of board and wired in parallel with a suitable resistance as shown in the illustration. A 30-ohm resistance capable of carrying at least ½ amp is necessary. When switching on the attachment or when changing its valves the resistance should be set at zero. The resistance can then be carefully adjusted to the minimum position at which satisfactory results can be obtained. Once set, the resistance should not be altered unless results become poor when it may be advanced a little. It is important to see that the valves used have together a filament consumption of at least .2 amps.—J. HICKMOTT (West Kensington).

*(Continued overleaf)*



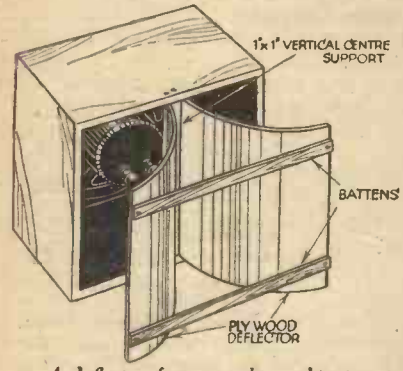

*Using old valves as half-wave rectifiers.*

## RADIO WRINKLES

*(Continued from previous page.)*

### Deflector for Speaker Cabinet

AS most listeners know, a loud-speaker cabinet should not be boxed in at the back, as this produces a hollow sound when speech is being reproduced. It is hardly enough, either, to bore a few holes in the back covering board, as it is sometimes done. Then the loud-speaker is generally placed with its back to the wall for convenience sake, and if it is too close




*A deflector for a speaker cabinet.*

some of the resonance effects of a built-in back will be noticed. The deflector boards here described, which can be fitted to any cabinet type of speaker, utilise to the full the vibrations emanating from the back of the cone, deflecting them side-ways and outwards, without producing resonance within the cabinet. The deflectors are made of thin plywood, which is screwed to each side of a central upright about ¾in. square. This upright is placed just inside the back of the cabinet, and screwed top and bottom. The plywood is curved outwards in two halves, and held in place by one or more thin battens, say of 1in. by ¾in., screwed across the backs. The curves of the boards should be somewhat as indicated in the diagrams. The increase in the total volume of sound from a cabinet to which this arrangement is fitted is very apparent to the ear. The device may be stained or polished to match the other part of the loud-speaker. For a cabinet 2ft. square, two pieces of plywood about 23in. by 17in. will be required, and the battens of the same length as the cabinet is wide.—MERVYN KNOTT (Reading).

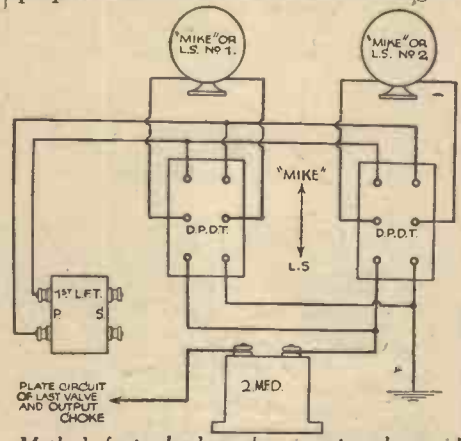
### Plywood Panel Brackets

NEAT panel brackets can be made very easily from five-ply wood. They are cut as shown in the sketch and attached to the panel and baseboard with screws. When one bracket has been made it can be used as a template for the other, and if the constructor possesses a treadle fretsaw he can cut out both together. The size and shape could, of course, be altered to suit individual requirements. They can be stained to match the panel, and answer the same purpose as the commercial metal brackets, take up less space, are more easily fixed, and cost practically nothing.—C. ENGLAND (Sheffield).

*A neat panel bracket made of plywood.*

### Using Loud-speakers as Microphones

HERE is an idea which might be of use to some readers, especially those who have the misfortune to have a relative ill in bed. I have my receiving-set and loud-speaker in the kitchen with an additional loud-speaker in a bedroom, and, naturally, these can be used in their proper capacity at the same time, but by throwing the switch attached to the additional speaker (No. 2) in the bedroom to the "mike" position that speaker becomes a microphone, and the sick person can transmit any message. By returning the switch to the ordinary position and then placing the switch of the kitchen loud-speaker (shown as No. 1) into the "mike" position that speaker becomes a microphone, and a reply can be given, and thus much saving of time and labour in climbing one or more flights of stairs is saved. By leaving the switch of No. 2 speaker in the "mike" position, No. 1 speaker can still be used to receive the broadcast programme, and any call made by the invalid will be heard above the received broadcast programme, provided, of course, that the latter is not being received too loudly—it should be toned down sufficiently. Reference to the sketch will show that the additional wires to the 1st L.F. transformer do not in any way affect reception when not switched in. There is a slight reduction in signal strength when No. 2 speaker is used as a mike at the same time as No. 1 is in use in its legitimate purpose. It should be noted that having

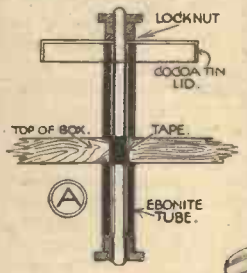


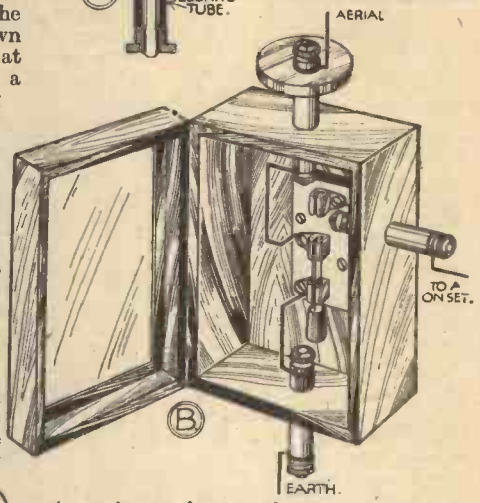

*Method of using loud-speakers as microphones.*

received a broadcast it will be necessary for that to be tuned out before No. 1 speaker is converted into a mike as otherwise the broadcast will be transferred to No. 2 speaker and the message might not be heard.—W. SULLIVAN (Merthyr Tydfil).

### Covered-in Aerial-earthing Switch

READERS who use an outside earthing switch may find the following hint useful, as it prevents corrosion of the contacts by weather and also any undue leakage caused by rain, soot, etc. Materials required are one old wooden electric light fuse box with a hinged glass lid, one single pole double-throw switch with porcelain base, three lead-in tubes about 4in. long, with nuts, and one cocoa-tin lid. Firstly, fill in the back of the box with a piece of ½in. wood to which the switch has been screwed, and then drill a ¾in. hole in the top, bottom and one side of the box. Take the lead-in tubes to pieces and cut off about ½in. of the ebonite tubing, and then cut the remainder in half. Bind some insulation tape around the centre of the brass rods to prevent it touching the sides of the hole, and re-assemble the lead-in tube after threading the rod through a hole in the box and tighten up the lock nuts each end so that the ebonite is tightly butted against the wood on each side, and the insulating tape is in the hole, as in sketch A. Treat all three lead-in tubes the same, with the exception of the top one, which has the cocoa-tin lid threaded on in addition under the



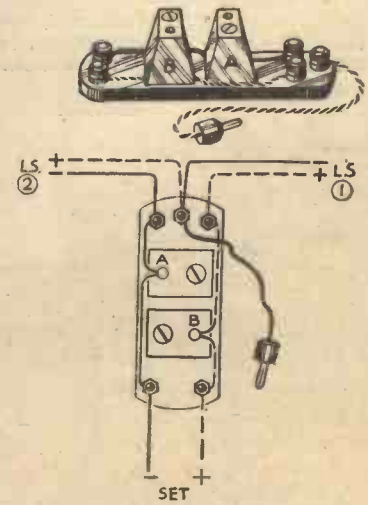




*A weatherproof casing for an aerial-earthing switch.*

lock nut, after having been drilled ¼in. in centre. This serves to throw off any rain which may settle at the base of the tube. Sketch B shows the completed gadget.—F. H. HOUGHTON (London, S.E.).

### Plug Switch for Loud-speakers

THE accompanying sketches show a switch for connecting two loud-speakers in series, made from a couple of coil bases and five terminals. The pins were taken out of the coil bases, the holes being used for screwing to a wood base 4in. long by 1½in. wide. One pin is converted into a wander plug. The wiring connections are shown in the sketches.—ERNEST TAYLOR (Bristol).




*Plug-in switching arrangement for two loud-speakers.*

# SAFETY FIRST!

Further Suggestions for Protecting the Receiver and its Accessories from Damage. (Concluded from page 218, April 29th issue)

**Preventing Reaction Condenser "Shorts"**

REACTION condensers are always connected across the high tension supply, through the H.T. choke and reaction winding, so that a short-circuit might have disastrous results. The danger of a short is fairly remote when using a condenser of the bakelite type, but with one of the air dielectric variety there is always some chance of the vanes touching and thus ruining the high tension battery. This possibility can easily and effectively be guarded against by connecting a fixed condenser in series with the reaction condenser (either plain or differential) as shown in Fig. 12. The extra condenser will have no effect on the normal working of the set so long as its capacity is high in proportion to that of the reaction condenser—any value from .002 mfd. upwards will serve perfectly well.

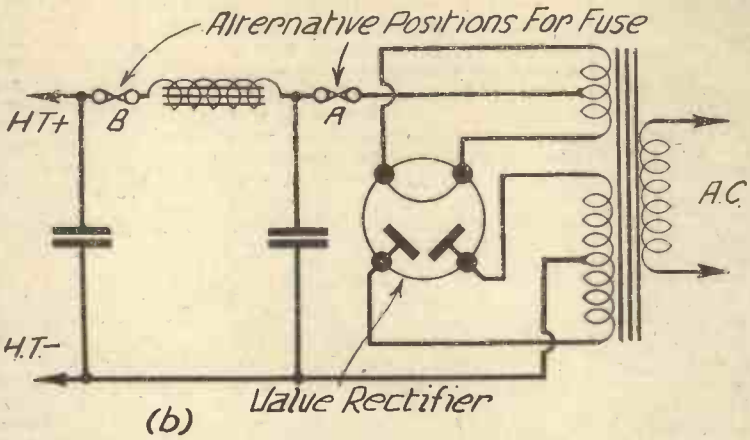



*Fig. 10.—Alternative positions for fuses in a mains receiver; position A is to be preferred.*

**Thermal Delay Switches**

To return to A.C. mains receivers for a moment. It is known that when first switching on, the high tension voltage rises to a very high peak value, often nearly twice that maintained under normal working conditions. The reason for this is that some little time elapses before the cathodes of indirectly-heated valves heat up to their proper temperature. Until that temperature is reached the valves pass little or no high tension current and therefore there is practically no "load" on the H.T. supply—hence its excessively high voltage. This high peak voltage is liable to cause the breakdown of smoothing condensers and even of valves, especially if it exceeds some 400 volts, so a "thermal delay" switch is often included in the H.T. circuit to prevent any such damage. The switch has four terminals and is connected up as illustrated in the sketch of Fig. 13; two terminals are joined to the heater terminals of the mains transformer and the other two are wired directly in the high tension negative lead from the rectifier. The latter pair of terminals are joined to the switch contacts and these are not "closed" until the switch attains a certain temperature, and since it is heated from the same source as the valve cathodes it heats up at about the same rate. Consequently the H.T. current is not applied to the valves until they reach their working temperature and thus the H.T. voltage cannot exceed its correct figure. A thermal delay switch is a particularly useful fitment for any A.C. receiver working on a high tension voltage of, say, 250 or more, and even for lower voltages it offers definite advantages from the "safety" point of view.

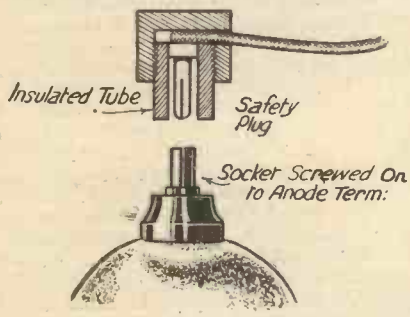



*Fig. 11.—A safety anode connector.*

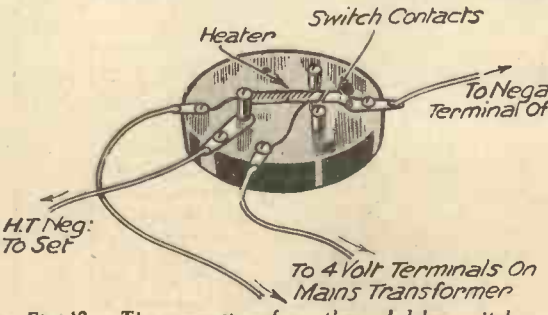



*Fig. 13.—The connections for a thermal delay switch.*

**"Safety First" In Receiver Operation**

So far we have considered the matter of safeguarding the receiver principally from what might be termed the constructional side, but there are a number of "safety first" rules which apply to the operation of our set. For instance, it is very unwise to make any alteration to grid bias voltages without first disconnecting the high tension supply, either by withdrawing the negative wander plug or by completely switching off. This rule is clearly stated on the instruction sheet accompanying every power valve, but is, nevertheless, frequently ignored because non-compliance does not necessarily result in any immediate perceptible harm. It certainly will lead to trouble sooner or later, since the anode current passed by a power or pentode valve jumps up to a very high value when grid bias is removed. As a consequence both the valve and the H.T. battery are subjected to a great strain.

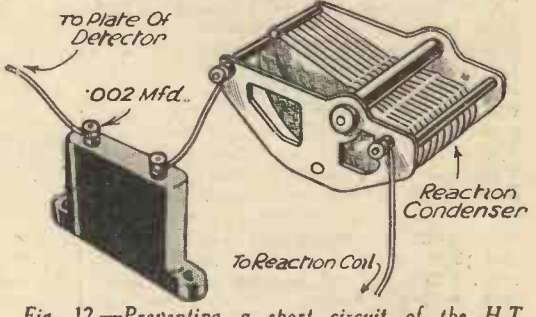



*Fig. 12.—Preventing a short circuit of the H.T. battery due to the vanes of a reaction condenser touching each other.*

Another important rule generally given on the instruction sheets of pentodes is that the anode circuit should never be broken whilst the priming grid is connected to the H.T. supply. The reason is that the sudden removal of the anode "load" causes a high "surge" voltage which can easily damage the valve. Interpreted into rather more simple language this rule really means that the loud-speaker should not be disconnected from a set using a pentode output valve without first switching off.

# TONE-VOLUME CONTROL

## A Cheap Combined Unit for Use with Loud-speakers and Radiograms

By A. C. BURNS, M.Sc., F.I.C.

VARIOUS tone-control circuits have been discussed from time to time in the radio press and some are available at any radio stores, though often by no means cheap. Generally speaking, the "tone control" incorporates some form of choke, condenser and variable resistance or potentiometer and, for really effective control, these components must be of critical inductance, capacity and resistance respectively. It is not always safe to specify fixed values, for much depends upon the characteristics of both receiver and loud-speaker circuits and upon the type of loud-speaker in use. The correct values are determined only by careful trial and most experimenters are not sufficiently fortunate to be able to borrow sets of condensers, chokes, etc., from the radio stores with a view to determining their precise requirements before purchasing.

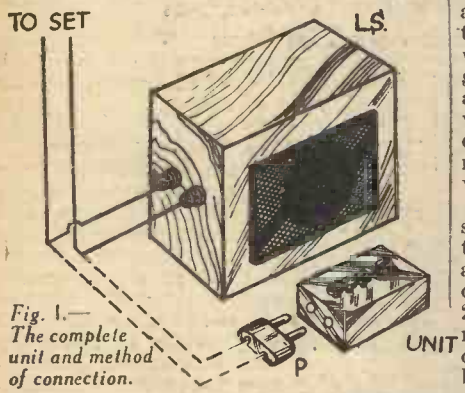



*Fig. 1.—The complete unit and method of connection.*

The writer has found the following components, if arranged as shown, to be effective when used with the "average" set. The unit is neat in appearance, conveniently small, and can be made up at a cost of 10s. 6d. The containing box may be constructed of quite thin wood, which, if dry, will demand no especial precautions by way of insulation. The only other items are :—One condenser, 0.1 mfd.; one choke, 0.3 henry (Wearite); three simplest form of push-pull switches; one variable resistance or potentiometer, 20,000 ohms; one simple form of jack and plug or one 2-pin plug and sockets. With the exception of the choke, these may well be taken from "spares" in your junk box. The choke is of rather unusual value, as regards inductance and capacity, and is especially designed by the manufacturers for use in tone-control circuits. A useful choke can be made up by winding 4,000 turns of No. 30 or 32 silk-covered copper wire round a 2in. former. About 1¼ lbs. of wire are required and the resulting inductance is about 0.8 henry. It may even be found that a winding of one or other of your disused transformers will have a suitable choke effect, *i.e.*, may cause a distinct cut-off or elimination of the lower notes when shunted directly across the loud-speaker terminals. In such case, the winding may be employed as a choke, provided that it does not introduce an undesirable drop in volume. Chokes of higher inductance and condensers of higher capacity may be substituted, if available, since the effect of these is ultimately controlled by means of the variable resistance in the unit. This latter, however, should preferably not exceed 50,000 ohms, otherwise the rotation of the potentiometer knob will cause too sudden a cut-off instead of a gradual repression of higher or lower notes, as the case may be. Even a 1,000 ohms variable resistance may suffice in some cases, particularly in conjunction with moving-coil speakers with speech-coils of very low resistance.

It will be noted that the control is shunted across (*i.e.* is in parallel with) the loud-speaker terminals and is simply attached (see diagram I) by means of 3ft. or 6ft. of twin-flex, provided with a suitable 2-pin plug. The unit may then be placed next to the speaker or may rest on the arm of a comfortable chair. Longer leads may be used, but are not always desirable, since long leads in themselves mean increased capacity, with possible losses in the higher frequency register.

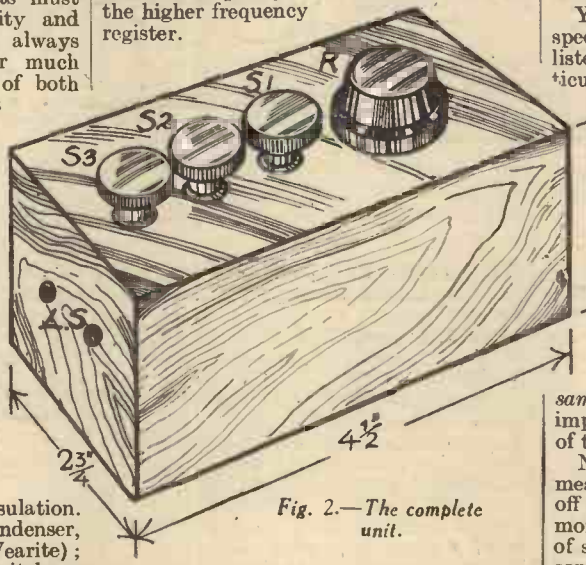



*Fig. 2.—The complete unit.*

### To Operate the Unit

For volume only, leave $S_3$ and $S_2$ depressed, withdraw $S_1$ and slowly rotate the resistance knob, R. This method of controlling volume is very useful when the set is in one room, the speaker and unit being in another—at any rate, as a temporary measure, for naturally the better method is to control volume from the actual receiver end.

To remove bass notes and boomy reproduction, the "by-pass" effect is increased through the choke, causing the notes of lower frequency to gradually fade out. Leave $S_1$ and $S_3$ depressed, withdraw $S_2$, and rotate resistance knob as before. Make a note of that point at which a more desirable "balance" is obtained in the reproduction, then depress $S_2$ and note the return to the original quality.

It will be observed that increased repression of the lower notes is accompanied by loss of volume. The more the knob is rotated, the less resistance there remains across the loud-speaker terminals and the more the choke comes into action. The resistance of the choke windings is comparatively low, hence the fall in volume of reproduction. With the type of choke specified and with the "average" modern receiver, the fall in volume is slight, but with some outfits it may be necessary to boost up the signal strength somewhat by adding a little reaction, in proportion as the choke is brought more and more into effect. Most sets of to-day, however, have a good margin of volume to spare and are not normally (particularly in the evenings) working "full-out." Any loss in volume due to the use of the tone-control choke, therefore, may be remedied by turning up the volume-control of the receiver itself.

This method of control is very useful in eliminating to some extent the excessive "boom" which is associated with some of the cheaper moving-coil speakers of to-day and with some of the dearer, but now obsolete, patterns. Certain gramophone recordings, too, are inclined to be boomy in reproduction and this may be improved by the use of the control choke. Usually, however, the fault with reproduction from records lies in the other direction, *i.e.* needle-scratch and associated high-frequency noises.

### Muffled Speech

You have doubtless, at times, found speech to be somewhat indistinct when listening-in to Daventry National, particularly when using a good receiver and speaker of up-to-date design. The effect is sometimes so pronounced as to render a radio play from this station too difficult to listen to with comfort. The fault is not at the receiving end and will doubtless disappear when the new transmitter is erected. As an experiment, note the quality of the announcer's voice during the 6 p.m. News Bulletin transmission from Daventry National. Then switch over to Midland Regional, or, better still, to Northern Regional to hear the *same* transmission. Note the difference and improvement in the quality of reproduction of the same voice from these latter stations.

Now return to Daventry National and, by means of the tone-control, gradually cut off the lower notes until the speech becomes more crisp and "definite." Quite a number of so-called good moving-coil speakers give somewhat poor reproduction of speech, and, therefore, benefit by tone-control. On the other hand, the better-class balanced-armature cones usually give an attractive crispness to speech, simply owing to their failure adequately to produce notes below a certain frequency.

(*Continued on page 260.*)

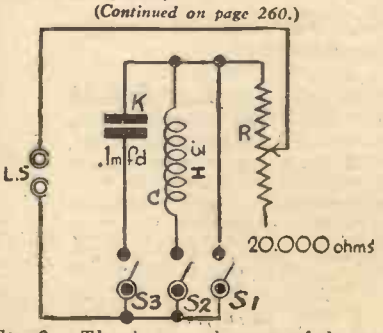
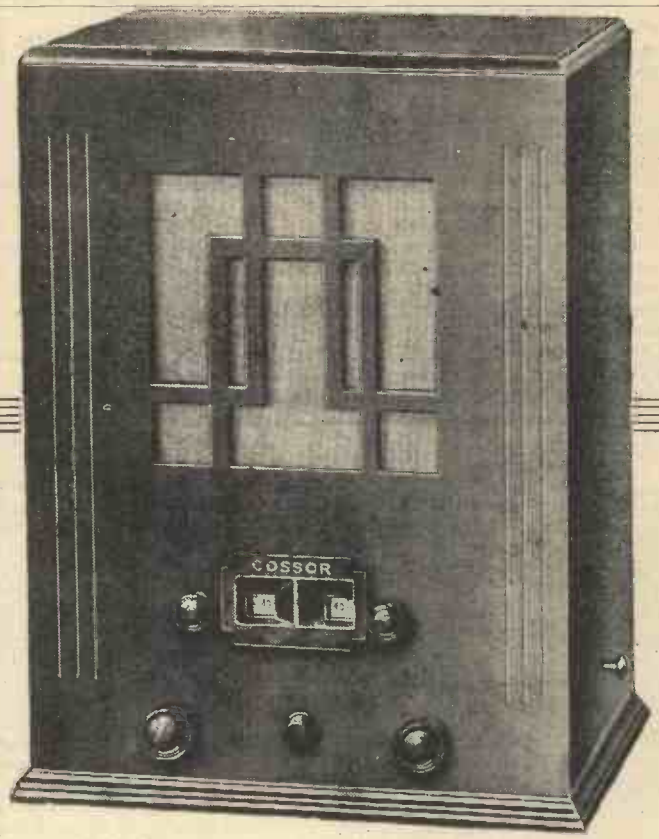



*Fig. 3.—The theoretical circuit of the unit.*

KINGS OF THE AIR




"I am more than delighted with the Melody Maker. Its **TONE** and **SELECTIVITY** surpass anything I have yet tried ...**VOLUME**...more than required when on full"

And that is what a delighted Cossor user thinks about his new Melody Maker. You too can enjoy such praiseworthy radio performance at a price lower than ever before. And when you realise that the Cossor Melody Maker incorporates a Cossor Variable-Mu Valve .... individually shielded coils .... graded volume control, in fact every up-to-date feature in radio design, you will readily appreciate why the Cossor Melody Maker represents the greatest possible value-for-money in Screened Grid Radio. The coupon will bring you full details.

# COSSOR MELODY MAKER

*Prices do not apply in I.F.S.*

### BATTERY MODEL 335

With Self-Contained Loud Speaker

Kit of Parts includes 3 Cossor Valves (220 V.S.G. Variable-Mu Metallised Screened Grid, 210 H.L. Metallised Detector and 220 P. Output); Individually Shielded Coils. All-metal Chassis and all parts for assembling the Receiver as illustrated; handsome cabinet 18½ in. x 13½ in. x 10½ in. and 10 in. Balanced-Armature Loud Speaker. Provision is made for fitting Gramophone Pick-up Socket and Plug. Price **£6.17.6**

*Hire Purchase Terms: 17/6 deposit and 9 monthly payments of 15/-*

### BATTERY MODEL 334

Kit of Parts, similar to Model 335 except that no loud speaker is supplied. Handsome cabinet 9½ in. x 13½ in. x 10½ in. Price **£5.15.0**

*Hire Purchase Terms: 15/- deposit and 9 monthly payments of 12/6*

### BATTERY MODEL 333

Kit of Parts, complete with Valves for building Cossor Melody Maker Chassis for fitting to your own cabinet. Specification as Model 335 but without loud speaker or cabinet. Price **£4.19.6**

*Hire Purchase Terms: 15/- deposit and 9 monthly payments of 10/6*

### ALL-ELECTRIC MODEL 337

With Self-Contained Loud Speaker

Kit of Parts for All-Electric Melody Maker Model 337 similar to Model 335 (as illustrated) but for all-electric operation, including Cossor Valves, handsomely finished Cabinet, 18½ in. x 17½ in. x 10½ in., Loud Speaker and all parts. For A.C. Mains only 100-125 or 200-250 volts (adjustable), 40-100 cycles. Price **£8.10.0**

*Hire Purchase Terms: 20/- deposit and 9 monthly payments of 18/6*

### ALL-ELECTRIC MODEL 336

Kit of Parts, similar to All-Electric Model 337 except that no loud speaker is supplied. Handsome cabinet 10½ in. x 17½ in. x 10½ in. Price **£7.10.0**

*Hire Purchase Terms: 21/- deposit and 9 monthly payments of 16/-*

### ALL-ELECTRIC MODEL 338

Kit of Parts for All-Electric Melody Maker Model 338 Chassis. Identical with Model 336 except that no cabinet is supplied. Escutcheon and template for drilling your own cabinet is included. Price **£6.15.0**

*Hire Purchase Terms: 28/6 deposit and 6 monthly payments of 20/-*

Models 336 and 338 are available for use on A.C. Mains only, 200 to 250 volts (adjustable), 40-100 cycles.

♡ 2787

To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5
Please send me free of charge a full size Constructional Chart that tells me how to build the Cossor *All Electric / *Battery Melody Maker.
(*Strike out type not required).

*Name* .....
*Address* .....
.....
PRAC. 6/5/33.

*My usual Retailer is* .....
*Address* .....
.....
.....

(*Continued from page 258.*)

**To Restrict the Higher Notes: Control of Gramophone-Needle Scratch and Heterodyne Whistles**

Depress $S_1$ and $S_2$, and withdraw $S_3$. Rotate R and note gradual suppression of the higher notes with "apparent" introduction of more and more bass. Actually, of course, the bass notes cannot be produced by the control unit, but only appear to be increasing in proportion as the higher notes are eliminated. This form of control is not usually required in conjunction with moving-coil speakers, as it would only serve to introduce boominess. It is, however, useful with several types of balanced-armature cones and similar speakers, also with certain horns, with their over-dominant high-pitched notes.

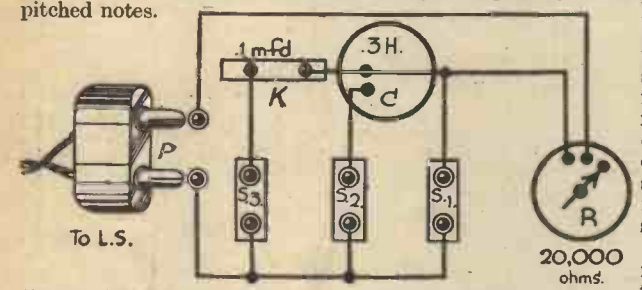



*Fig. 4.—The switches, choke etc., connected in semi-pictorial form.*

Certain forms of heterodyne whistle and, in some cases, other interference noises of a high-frequency character, can be partly depressed by means of the condenser (K) controlled by the variable resistance (R). Complete removal of these whistles, etc., would, in many cases, mean an undesirable depression of the higher notes of the musical scale. The adequate removal of heterodyne whistles requires more critical values of choke, condenser and resistance than is available in this tone unit, and careful tuning to a particular band of frequencies is necessary.

**Radiogram Control**

A certain degree of tone-control is useful in radiogram operation. The scratch-level of some makes of record is unpleasantly prominent, and will permit of a certain amount of reduction without serious loss of "brilliancy." Needle-scratch is associated also with mechanical resonances in the pick-up itself, but this aspect of the subject does not call for discussion here. The ideal operation of radiograms, especially where these are housed in too lightly-made cabinets, is to have the receiver and turn-table in one room, the speaker in another. The radiogram, naturally, has its own volume and tone-control, but the above-described unit, being alongside the speaker in the other room, naturally allows of some further control.

The "Beginner" in radio matters commonly fails to appreciate why there should be such differences in the quality of reproduction from different makes and types of loud-speakers (not forgetting, too, differences in receiver circuits), which are yet reproducing one and the same transmission. A few experiments with this type of tone control will quickly reveal the even drastic effects of introducing further capacity, inductance and resistance to either loud-speaker or receiver circuits. After all, both receiver and speaker are made up of components of varying degrees of capacity, inductance, and impedance. Tone-controls essentially improve the "balance" of reproduction by removal of undesired or over-stressed frequencies—they cannot add anything that is not already present or which the receiver itself cannot pass on to the speaker. Do not, therefore, expect significant results when operating the control choke ($S_2$) in conjunction with some types of balanced-armature cone speakers, though there will be a distinct effect with speakers working on the inductor principle. Most older pattern cone and horn units do not adequately reproduce the bass notes at the lower end of the scale, so that there is little or nothing for the tone-control to cut out. If you find this to apply to your speaker, then obviously you ought to instal a new one with a much wider frequency response.

Furthermore, bear in mind that a good loud-speaker does not necessarily improve a bad receiver—indeed, it will more probably reveal defects which the older speaker was incapable of reproducing. In this respect it obviously follows that the failure of a speaker adequately to respond to manipulation of the tone-control unit may be due actually to deficiencies in the receiver itself and not in the loud-speaker. Such deficiencies may be traced to the incorporation in the receiver circuit of obsolete forms of chokes, transformers, condensers, etc.

In conclusion, units of the type above-described are most efficient when the loud-speaker windings are choke or transformer-coupled to the output valve, thereby preventing saturation of the choke.

## H.T. FUSE LOCATION

IT is not always appreciated that the positioning of a fuse in a wireless set, although in itself a simple matter, is liable to cause trouble unless certain points are watched. This fact was demonstrated quite forcibly when some routine tests were being undertaken on a powerful five-valve wireless receiver fed from H.T. batteries and an accumulator. After all the connections had been made, the set was switched on *via* the appropriate control, but no signals could be heard in the loud-speaker. It was confirmed that the valve filaments were operative, but the set still appeared "dead," so a few quick tests were made with a voltmeter in order to locate the fault.

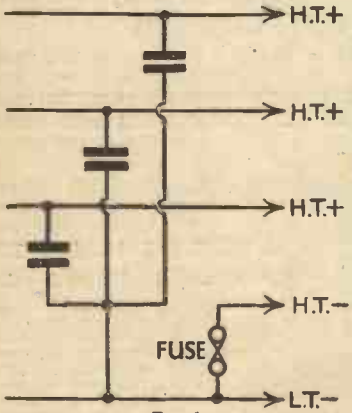



*Fig. 1.*

It was soon found that an H.T. fuse, in this case a low consumption bulb filament rated at 60 milliamperes, located between the H.T. — and L.T. — terminal connections, was burnt out. A replacement was effected immediately and the set switched on once more. Still nothing happened, and on re-examining the fuse it was noticed that the bulb filament had burnt out again.

**A Charging Current**

Attention was therefore turned to the set itself and although everything appeared in perfect order it was noticed that the 2 mfd. fixed condensers were shunted between the H.T. + and L.T. — tappings as indicated in Fig. 1. If it happened that any of these condensers had developed a short circuit, obviously this would cause a short circuit between the H.T. + tappings and the H.T. —, since H.T. — was joined to L.T. — through the fuse and in consequence the lamp was in circuit.

The abnormal current under these conditions would naturally be sufficient to blow the fuse lamp filament and each condenser was therefore tested separately but found to be in perfect condition. Another solution had to be found, and since it was known that when a large capacity fixed condenser is charged initially, there is a momentary heavy current rush, it was felt that this in itself may have been sufficient to cause the burn out.

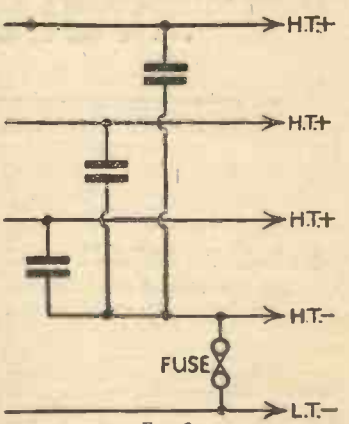



*Fig. 2.*

To safeguard the fuse from this, therefore, the common ends of the existing 2 mfd. condensers were joined to H.T. — instead of to L.T. — as shown in Fig. 2. The fuse was in this way removed from the "charging current" circuit and on switching on the receiver again all went well. Just bear this little point in mind when a similar thing happens in your own case.

**Something Secret**

THE conversation in suburban trains covers a wide range of topics, of which radio holds its own. I could not help overhearing an argument the other morning on the relative qualities of two receivers. One radio fan said he had a receiver "*with a wavelength capable of picking up the programmes from the most distant stations.*" In the ordinary course of events this remark would not have been noticeable for any trace of particular interest. My brain must have been extremely active, for it appeared to me he must have trained the wavelength to go out and bring back the goods. Not knowing how much programmes weigh, I wonder whether this is a feat of strength or not, but anyway, it's a good stunt to have such a receiver.—L.K.


A Talk About Eliminating Noisy Reception.

By BEAT HEAVYCHURCH

THE ills to which radio sets are heir may be divided into three main classes; the total failure of the set to reproduce signals, distortion of the programme and the development of noises not included in the broadcast. The first two types of trouble from their very nature are comparatively easy to detect, the one by finding by a process of substitution the faulty component or connection, and the other by investigating operating conditions, checking anode and bias voltages, component values and the like. But unwanted noises are often due to quite obscure causes, and the defects

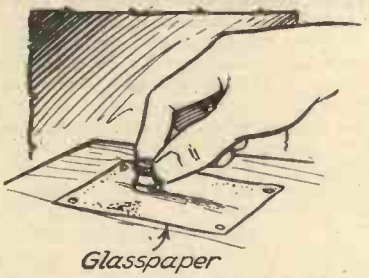



*Fig. 1.—Getting a flat and clean surface on a terminal.*

are far more difficult to trace, and when found, usually require far more skill in curing. Noises may, in their turn, be subdivided into two classes, those due to external influences, and commonly known as "interference," and those due to defects mainly within the receiving apparatus.

**Symptoms, Causes and Cures**

Interference has recently been treated exhaustively in PRACTICAL WIRELESS, so this article will be devoted almost exclusively to a survey of the symptoms, causes and cures of these noises—scratchings, crackles, pops, howls and hums which may be generated within the set itself. The main causes of noisy reception are, first, poor contacts and partial disconnections; second, partial or intermittent short circuits; third, the effects of accumulations of dust and damp; fourth, poor condition of batteries and other components; and fifth, mechanical causes.

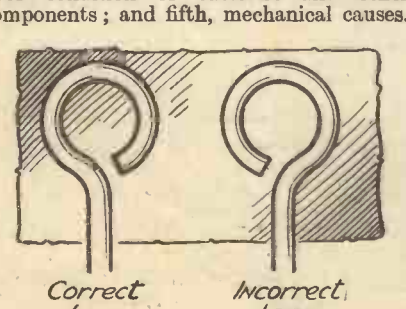



*Fig. 2.—The correct method of making a loop to avoid looseness.*

**Poor Connections**

The operation of a radio receiver depends upon the passage of electric currents of various sorts—radio frequency, audio frequency and direct current, through circuits consisting of many different pieces of apparatus—coils, condensers, chokes, valves, resistances and transformers. Each of these components has to be connected into the circuit by wires, and the number of different joints and connections in even the simplest set amounts to several dozens, and even more if the permanent connections within the components are taken into consideration. Each of these many joints is liable, if incorrectly made, to be a source of noise, and there is also a risk of wires breaking.

The actual noise generated by such a fault may range from a scratching or breathing sound to violent crackles, depending

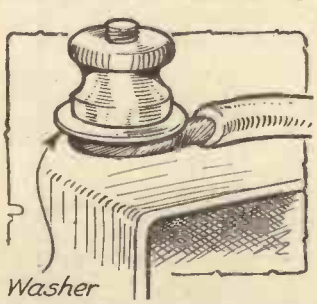



*Fig. 3.—A washer used to clamp flexible wires tightly.*

upon the part of the circuit affected, and the nature of the current flowing in it. The most common locations of loose contacts are loose terminal screws. Although I am a great believer in soldered joints, I realise that a good screwed joint is far better than a poor soldered connection. There are some people who just cannot solder, easy though the job is when rightly tackled, and for them, I say, make screwed joints. But do see that the nuts are tightly screwed up, and that they and the wires they secure are scraped or sand-papered clean and bright. (Fig. 1).

Oxydised surfaces never make good and permanent joints, and sooner or later crackles will develop. When binding wires under a nut, make a loop in the wire in a clockwise direction, that is, from left to right (Fig. 2). Then it will not work loose. Do not try to screw a flexible lead under a nut. One or more strands are bound to work loose and jam the screw thread, and you will never tighten it down. In this case, place a washer between the flex and the nut (Fig. 3). The same precaution is recommended if more than one wire is to go under one nut.

**Corrosion**

Low-tension battery connections are very liable to produce partial disconnections due to corrosion, either at the terminals or in the wires due to the creeping

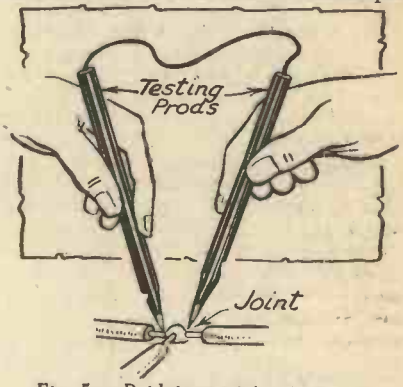



*Fig. 5.—Bridging a joint to test a soldered connection.*

of acid or fumes (Fig. 4). The terminals should be sand-papered bright each time the connections are made, and the wires should be well protected by good rubber insulation. High resistance contacts in the low-tension wiring give rise to most annoying disturbances. A frequent culprit is the battery switch, the spring contacts of which, by long use, become bent outwards and fail to make good connection. The remedy, a pair of pliers, is obvious, but the operation requires a little care.

Another very frequent cause of poor connections is the "dry" soldered joint—a joint in which the junction is mechanically strong, but which, because of dirt, which causes the formation of a kind of non-conducting slag, is of high electrical resistance. Dry joints are extremely difficult to detect. If a dry joint is suspected

(Continued overleaf.)

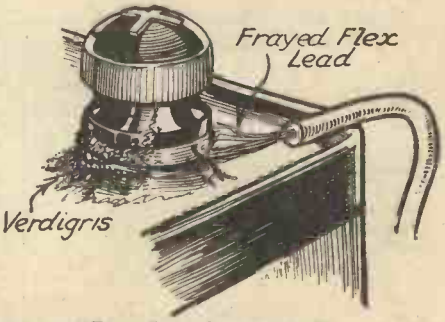



*Fig. 4.—The effect of acid splashes and fumes on flexible wires.*

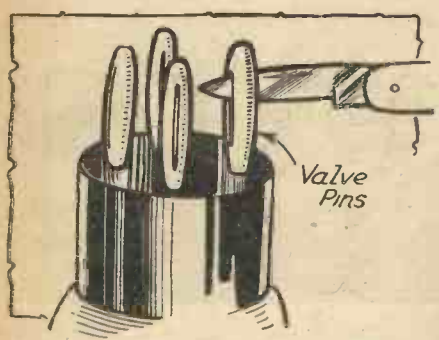



*Fig. 6.—The old type valve legs should be opened to ensure a tight fit in the socket.*

(*Continued from previous page.*)

in any set being tested, go over all the joints with a good hot iron and a *spot* of Fluxite—but a less drastic method is to bridge each joint in turn with a temporary connection, such as the testing prods (Fig. 5) which every amateur should possess.

Poor contacts often occur at valve holders. Sometimes the trouble lies in the valve pins, which require gently opening out with a small penknife (Fig. 6) or, if the pins are of the solid type, the sockets of the valve holder may require similar attention. A vulnerable point in many valve holders is the spot where a riveted joint is made between the socket and the metal part which forms the terminal. It is best to avoid holders with riveted joints if possible, and to select those where all the metal for any one terminal is in one piece.

**Partial and Intermittent Connections**

Closely allied to bad joints are partial disconnections and intermittent connections. These are almost always the result of broken wires inside some sealed component. The primary windings of intervalve transformers are a fruitful field for reaping this form of trouble—secondary windings are not so liable, because they do not carry current, and are, moreover, isolated from the high tension battery. High-frequency chokes, connected in the anode circuits of high-frequency and detector valves, are also susceptible to break-down in this way, and these two types of component should be among the first to be tested if a broken connection is suspected. What often happens is that a wire breaks off short in the winding at the point where it is connected to the terminal of the component, and makes partial or intermittent contact. This can usually be detected by tapping or shaking the component, when the scraping together of the two disconnected parts will cause a great increase in the crackle.

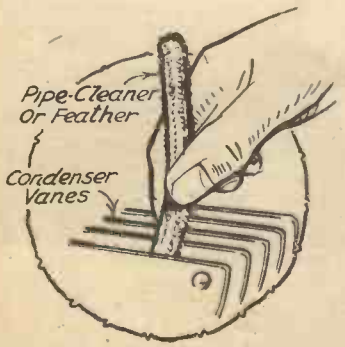



*Fig. 8.—Dust in between condenser vanes gives rise to grating noises when tuning.*

An intermittent or poor earth connection (Fig. 7) will often produce both loss of volume and a greatly increased tendency to oscillation. If your trouble is general instability of the receiver, look first to your earth.

Most distressing noises are produced by partial or intermittent short circuits on the high-frequency side. Often the trouble can be traced to an aerial or down lead which, in windy weather, chafes against a gutter, a tree branch or other body. Gradually the insulation is rubbed off, and then, every time the swinging wire touches the object, there is a momentary earth connection. A general tightening up, and perhaps a hold-off insulator will put matters right.

A partial or intermittent short circuit can also easily occur in variable condensers, due to one or more of the vanes being bent so that a moving vane touches a fixed plate. In the case of tuning condensers a harsh, grating noise will result, but in the case of reaction condensers, the noise will be much louder and even alarming, due to the fact that high tension current is being made and broken at the short circuit. This trouble can be tracked down by switching off the set and gently turning each condenser dial, when a grating contact will be heard and


*Fig. 7.—Make sure the earth connection is sound.*

felt. Re-adjustment of the condenser plates is rather a delicate operation, but if the fouling is not very severe, a repair is well worth trying. A partial short is sometimes found in reaction condensers on metal panels due to the breakdown or careless fitting of insulating bushes.

**Dust and Damp**

It is really extraordinary how much dust and dirt can enter the best designed radio cabinet, while if the case is properly constructed, or open at the back, as so frequently happens in radiograms, or if the set is used without a cabinet—a favourite trick of ardent constructors, its condition after a week or two will be deplorable. Dust, and even insects between condenser plates is a frequent cause of crackling. The only remedy is to dismount the condenser and carefully clean it with a bent pipe cleaner or feather (Fig. 8). A layer of dust, especially damp dust, will greatly alter the value of a grid leak, render a fixed condenser leaky, and cause considerable fluctuations in the resistance of fixed resistors. All these effects may produce noisy reception. Periodically every set should be examined and cleaned up. If a vacuum cleaner is available, a few minutes attention with this machine will work wonders (Fig. 9), and a small pair of bellows is not to be despised. High tension batteries should also be wiped over occasionally, as accumulations of damp and dirt cause high-tension leakage and more noise.

Another large class of "noise faults" are those due to deterioration of certain essential components and accessories. Failing low tension is apt to be noisy, because the filament current varies and "modulates" the anode current. Similarly, a worn out high tension battery develops varying resistance and thus varying high tension current, the changes in value being passed on from valve to valve as the unwanted modulation. The worst possible case, of course, is where a high resistance fault develops in a part of the equipment which is common to the circuits of several valves. The normal variations in anode current of one valve cause a varying voltage drop across the high resistance fault, and this is reflected in the anode circuits of all other valves. Low frequency instability is thus set up, and its effects may range from a gentle "ticking" to the "pop-pop-pop-pop" reminiscent of a motor boat, while in really bad cases unbearable howling is generated. The cure, of course, is to maintain batteries in efficient condition, and to guard against motor boating by decoupling the anode circuits of the various valves.

**Microphony**

Cracklings in moving-coil speakers are often due to loose connections to the moving coil; scratchings and scrapings may be due to the coil being out of centre—good speakers have provision for adjusting the centering — or even to vibration of the tinsel commonly placed behind the fret.

Two other causes of unpleasant noise need mention. First, microphony—that building up of a whistle, shriek or groan due to the vibration of valve electrodes under the influence of a powerful loud speaker. The vibration may be conveyed from the speaker to the valve *via* the chassis, or through the air. Mounting the valve holder on a sorbo pad, and damping bulb vibration with plasticene stuck on the valve are partial remedies, but usually a badly microphonic valve needs changing for one of a newer non-microphonic construction. If possible, the loud-speaker should not be situated close to the high frequency or detector valves, but where this is unavoidable, the precautions mentioned above are still more essential.

Mains hum is most objectionable. A well designed A.C. mains set should be perfectly hum free. It is impossible, in the space at command, to give complete instructions for curing hum, but a potentiometer for obtaining the true electrical centre of the filament transformer secondary, overhaul of the smoothing circuit, attention to earthing and the spacing out of A.C. leads are the first points to be attended to. In particular, A.C. leads, whether mains leads or low tension wiring, should be kept as far as possible from the H.F. and all grid wires. Ample smoothing, decoupling of anode and grid circuits, including automatic bias devices, may all be necessary to cure really bad cases.

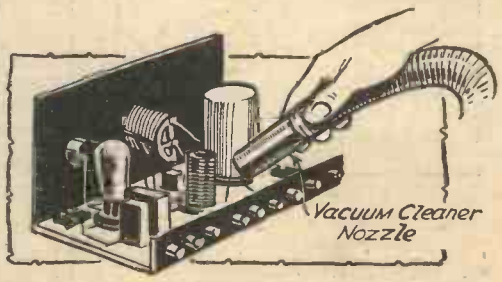
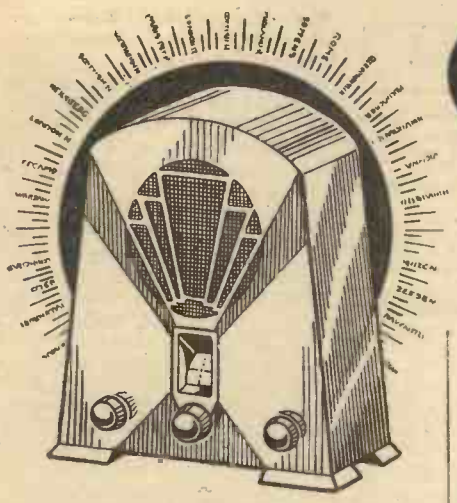



*Fig. 9.—A vacuum cleaner will remove the greatest of all troubles—dust.*



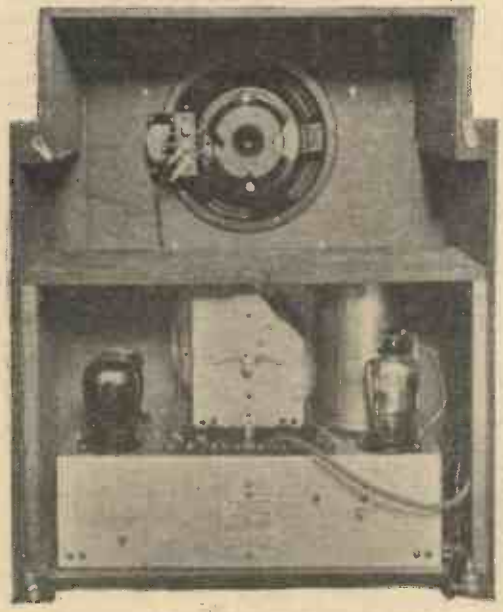
# OUR VIEWS ON RECEIVERS

## SIX-SIXTY TYPE 3-32 CHASSISET

IN this receiver we have several most ingenious and novel features, and it certainly represents a radical departure from normal set design. Starting with the cabinet it will be seen that this does not follow the orthodox arrangement of a small loud-speaker grille situated above or below the tuning controls, but it is cut out to form a pleasing design all over the front, and attractive silk backing is employed to set off the design. The baffle for the speaker is a separate board fitted behind this silk, and this prevents the rather obvious lay-out which characterizes the ordinary set. Situated in the centre of the front is a most elaborate tuning dial, and this is unlike any other which we have so far seen. Two ivorine scales are arranged round the tuning knob, and these scales are graduated in stations, wavelengths and kilocycles. The principal European stations are marked, and, therefore, it is most simple to tune to a station by using the name, the wavelength or the frequency reading appropriate to the station. In place of the customary pointer a beam of light is employed for tuning, and this is brought into operation by pushing the tuning knob in towards the cabinet. When this is pushed a short way a contact is made and a small pilot lamp enclosed in a narrow metal box is illuminated, and the carrier for the lamp is turned with the control knob. This is situated behind the ivorine scales and is quite close to the scale and, therefore, a very narrow beam of light is seen to travel round the scale as the knob is turned. When the required setting is obtained, the knob is pulled slightly outwards and the lamp is extinguished, thus saving an unnecessary drain on the accumulator.

### The Circuit

The other details will be mentioned as they are met in the examination of the circuit, which follows the more or less standard arrangement of screen grid, detector and pentode valves. Special Six-Sixty valves are employed, the output being a S.S. 220 Pen, which operates with a very small grid-bias, but gives quite a large output. The small grid-bias required is obtained by means of a resistance in the common negative circuit, and thus the necessity for a grid-bias battery is avoided. Capacity reaction is employed, and the condenser which is employed for the purpose is mechanically linked to a variable resistance which is connected between aerial and earth. Thus selectivity is slightly improved as the reaction is advanced, as the input to the grid circuit of the S.G. valve is reduced and the signals in the detector circuit are increased. This forms a very valuable feature in tuning and greatly assists in receiving a distant station clear of interference. The remainder of the circuit is more or less standard, but all values appear to have been chosen so as to obtain not only the maximum signal strength from each stage, but also to ensure stability and obviate risk of breakdown.



*The neat interior of the Six-Sixty Chassiset.*

### The Controls

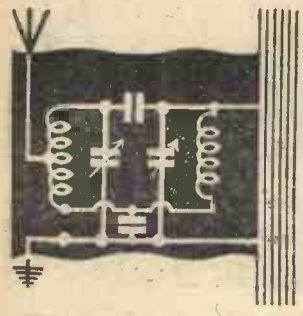
The front of the cabinet, as has already been stated, is occupied principally with the loud-speaker grille design and the main tuning control, and, in addition to this, there are two small knobs situated on the right and left, and slightly below, the main tuning knob. The left-hand control is the main selector switch, and this is provided with four separate positions. When upright, the medium waves are in use, and when turned one-quarter of a revolution to the right the long waves are brought into action. A further rotation of a quarter of a circle brings the gramophone pick-up connections into circuit, and the final quarter of a revolution switches the receiver off. The right-hand control is the reaction device, which has already been mentioned. At the back, all that can be seen of the receiver is the rear portion of the metal chassis, on which is a small adjusting screw for the aerial trimmer, and this obviously only requires adjusting when the receiver is first put into commission and thereafter may be ignored. The H.T. negative lead is provided with a fuse-plug.

*Front view of the 3-32 Chassiset.*

### Results

The performance set up by this receiver was very good indeed, and the H.F. stage certainly pulled its weight. Upwards of a dozen stations were easily tuned in with no difficulty at all, the dial being simply set to the requisite reading. With a very poor indoor aerial six or seven stations could be received with quite good volume, and there is no need to carry out any difficult manipulation of selectivity and reaction control in order to obtain stations free from interference—due to the very efficient band-pass aerial circuit which precedes the S.G. valve. On the long waves, all the principal stations are easily tuned in.

**RECEIVER:** Type 3-32 Chassiset.
**MAKERS:** Six-Sixty Radio Co., Ltd.
**CIRCUIT:** S.G., Detector and Pentode Valves. Band-Pass Aerial Tuning; Combined Reaction Condenser and Aerial Resistance; Automatic Bias for Pentode Stage; Fused Battery Leads; Illuminated Selector Dial Calibrated in Stations, Wavelengths and Frequency; Balanced Armature Loud-speaker.
**RESULTS:** Outstanding simplicity in handling and high standard of performance from the point of view of selectivity, quality and range.
**PRICE:** £10 - 10 - 0.



# RADIO RAMBLINGS

By JACE

*Jottings from my Notebook*

### The Mains Aerial

WE have previously mentioned in these notes that a "mains" aerial is often almost as good as the usual extended outside wire. The conventional way of using the mains as a source of pick-up is merely to connect a fixed condenser of .0001 mfd. to .001 mfd. between one supply lead and the aerial terminal. Unfortunately this system is not always satisfactory because any interference which happens to be superimposed on the supply is introduced into the receiver at its most sensitive point and is thus amplified just the same as are the legitimate signals. The natural result is that reception is far from pleasant.

### Eliminating Interference

JUST recently we happened to be trying out an A.C. set in a room where no aerial was available so we were obliged to use the mains. It was soon found that this was no use because everything was drowned by a loud "whine." The difficulty was soon overcome, however, by connecting *two* condensers in series across the mains and taking the "aerial" connection from their centre tap. At first a pair of .0005 mfd. fixed condensers were employed, but even then a small amount of hum was audible. On replacing one of them by a .001 mfd. pre-set condenser and adjusting this carefully, reception was all that could be desired. The idea underlying this scheme is that the aerial terminal must be connected to a "neutral" point, and if the two condensers are of exactly the same capacity any "ripple" or irregularity in the supply leads is cancelled out.

You might like to try this method so the connections are given in Fig. 1. There are just two points to watch: the first is to see that the pre-set condenser is of good quality, and the second is that it should be adjusted with an insulated screwdriver, or a piece of wood shaped off to an edge, to guard against the possibility of getting a shock by touching a "live" point. It is also a good "safety first" idea to connect the pre-set condenser to the "set" side of the fuse so that in case of a short-circuit no damage will be done.

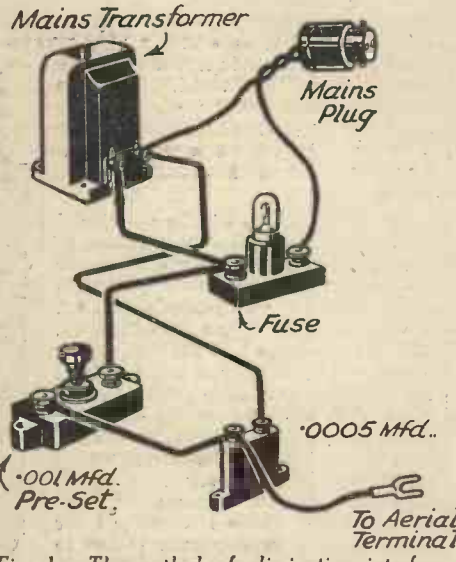



*Fig. 1.—The method of eliminating interference with a mains aerial.*

### A Universal Receiver with Standard Valves

WE were recently asked if it was possible to make a receiver to work from either A.C. or D.C. mains and using standard mains valves. It sounds rather a stiff problem, but after a little consideration the three-valve circuit shown in Fig. 2 was evolved. Our querist made up the set and has since reported excellent results on both kinds of supply.

A study of the circuit diagram shows that the arrangement follows very closely on that of an ordinary D.C. set, but a Westinghouse Style H.T. 8 metal rectifier is included in the positive H.T. supply lead. The valves are Mazda D.C. types, a DC2/SG being used in the screened grid stage, a DC3/HL for detector and a DC2/P in the power output stage. All these valves take .1 amp. of heater current and have voltage ratings of 20, 25 and 35 respectively. The heaters are all wired in series with each other and with a 1,700 ohm resistance which limits the supply voltage to 80. The resistance is tapped after 1,200 and 1,400 ohms so that it may be adjusted to suit mains voltages from 200 to 250 volts. This latter component can be bought ready-made from Messrs. Bulgin, or can easily be constructed at home by winding 71 yards of 38-gauge Eureka resistance wire on a glass tube and taking tappings after 50 and 58 yards. It will not become very hot in use, but should for preference be mounted in such a position that air can freely circulate around it. The remainder of the circuit is fairly straightforward and follows the usual S.G.-Det.-L.F. arrangement. When connected to A.C. mains the H.T. supply is rectified by the metal rectifier, but on D.C. the latter component acts merely as a limiting resistance.

Since the receiver is in direct contact with the supply mains (as are all "universal" receivers) it will always be "live," and therefore precautions must be taken to ensure against short-circuits or shocks. In this respect ample safety is secured by inserting condensers in both aerial and earth leads and by well sinking grub screws in the various control knobs. Incidentally it might be mentioned that sets very similar to that illustrated are extremely popular in America just now, and we can see no objection to their adoption in this country. They are not expensive to build and have a very modest current consumption—that described takes about 25 watts per hour.

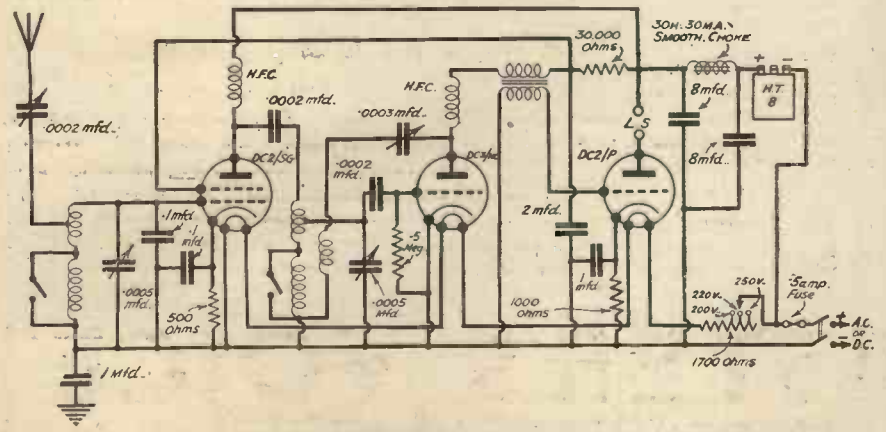



*Fig. 2.—The circuit of an S.G.-Det.-P. Universal (A.C. or D.C.) receiver using standard D.C. valves.*

### Class "B" and Tone Correction

THE Class "B" valve, like pentodes, has a tendency to give over-emphasis to the higher audio frequencies so that in most cases some form of tone-compensation is called for. When using pentodes the usual thing is to connect a fixed condenser and a resistance in series across the primary terminals of the output transformer, and although this same method could be applied to Class "B" it is open to a serious objection. It has been explained in these columns before that the H.T. current consumption of a Class "B" valve is proportional to the signal strength which the valve is called upon to give. Thus it would be wasteful to suppress any frequency band which had been amplified at the expense of high-tension current.

The most economical way of preventing shrillness is, therefore, to include the tone control arrangement in some part of the circuit preceding the output valve. A good place is across the primary winding of the "driver" transformer, but equally good correction can be obtained by the use of a tone-control transformer between the detector and "driver" valves. As a matter of fact either of the latter methods effects a distinct economy by cutting down the average Class "B" anode current by as much as 15 per cent.

# THE NEW "3 IN 1" INSTRUMENT


## 1 SUPERHET RADIO (7 VALVES)

## 2 ELECTRICALLY REPRODUCING GRAMOPHONE

## 3 IMPROVED AUTOMATIC RECORD-CHANGE

THIS complete "3 in 1" home entertainer gives you :

**FIRSTLY,** seven-valve radio employing a super-heterodyne circuit and variable mu valves, with the extended range, complete freedom from overlap and "background," and that extraordinarily high degree of selectivity this means.

**SECONDLY,** an electrical gramophone, as simple to turn on as electric light, and which reproduces your own records electrically.

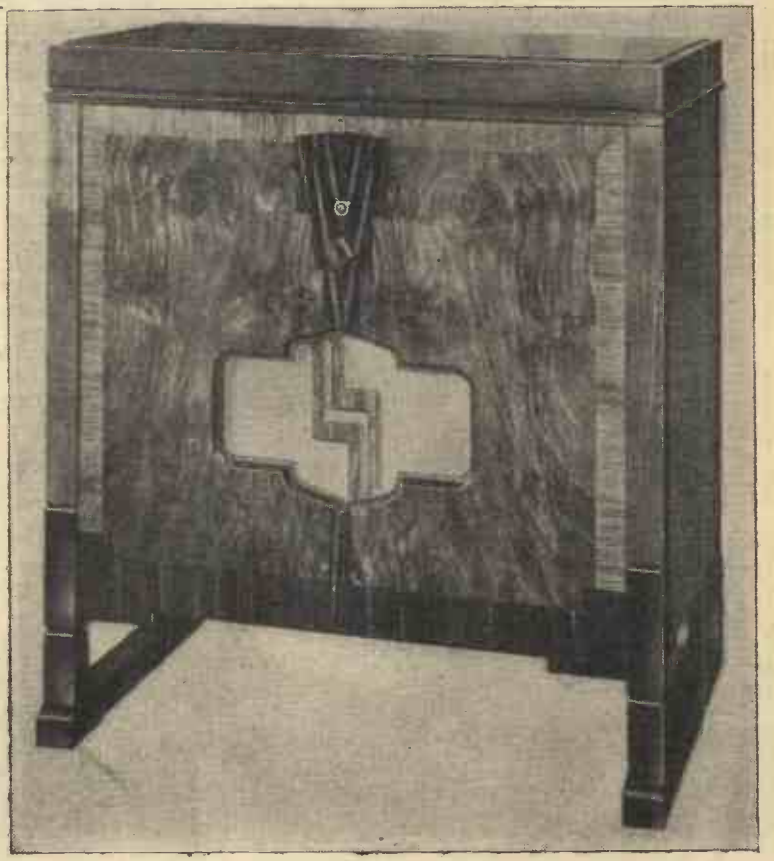
**THIRDLY,** the latest improved type of automatic mechanism to play eight records without any attention, or to repeat one record indefinitely.

Reproduction on both radio and gramophone is through an electromagnetic moving coil speaker giving a tone absolutely "true-to-life." There is nothing experimental about this model. Its thorough reliability has been proved over a period of many months before introduction.

The cabinet work is particularly noteworthy. It definitely acknowledges that radio is a new thing, and must be treated newly. In basic principles the design recognises the soundness of past craftsmanship, but new thought is apparent in the clean lines, the contrasting of exquisite grainings, and the absence of dust-catching mouldings. And because sound is influenced by cabinet design, this Auto-radiogram has combined much thought, scientific skill and art in achieving "true-to-life" tone quality —for after all, the sole object of the instrument is to please the ears.

This is but a brief description of "His Master's Voice" newest radio-gramophone. You will find below a more detailed specification. But to appreciate this model fully, you must see, examine, and hear it for yourself at any "His Master's Voice" dealers.

IN ONE SIMPLE INSTRUMENT *all for* **55** GNS.



### SPECIFICATION

**"His Master's Voice" Superhet Autoradiogram Seven, Model 524 :** *Circuit. Seven-valve superheterodyne; all mains. Three band-pass circuits employed. Variable mu valves.* ***Tuning*** *by specially compensated 4-gang condenser.* ***Brilliancy control*** *to adjust tone.* ***Three control knobs only :*** *tuning, volume and master switch.* ***Calibrated wavelength scale,*** *illuminated and giving the names of principal stations opposite their wavelengths.* ***Automatic record-changing mechanism,*** *giving continuous record programme of half-an-hour or more, with eight ten or twelve-inch records. No pre-setting necessary. Push button rejects any record at will. For A.C. or D.C.*

# "HIS MASTER'S VOICE"

*The Gramophone Co., Ltd., London.* *(Price does not apply in I.F.S.)*

*View showing the partly assembled receiver.*

# The "Featherweight" Portable

Class B Amplification, specially designed and covered by My Personal

AN inspection of the illustrations on these and the following page will reveal the ingenious system I adopted in the construction of the cabinet and the arrangement of the receiver portion of the Featherweight Portable Four. A circuit diagram was given last week, and I propose, therefore, to confine the first part of this article to a description of the cabinet.

**Accessibility**

From the point of view of accessibility the Featherweight Four easily scores over anything hitherto placed before the home constructor. Every part of the receiver can be got at during erection, and it also is a delightfully simple matter to adjust it afterwards. The fretted front carries a strip baseboard (if I may use the term), and the diagrams on the following page show how the various parts are assembled. Almost the entire structure forming the cabinet is made from walnut or oak 1in. wide by ¼in. thick. This section of wood is obtainable from any stores supplying fretwood, and you are therefore, by the expenditure of a few pence, relieved of the task of sawing and planing the wood to this section yourself.

**No Joints !**

Notice also that the cabinet is so designed that you merely require a saw in order to make it. I have entirely dispensed with the normal style of woodworking joint, realising that many of my readers would not be woodworkers. I have used the perforated strips which are obtainable, together with the perforated angle-brackets in the well-known constructional toy sold under the trade name of Trix, at 6d. a box. You do not even have to drill the strips, and once you have cut out the various lengths of wood it is merely a matter of minutes to screw the parts together after fretting out the grille to the shape shown. When completely assembled you will find that whilst the structure is entirely rigid it is practically featherweight. I have even saved you a considerable amount of work in the baseboard, for the spaces between the strips save a considerable amount of drilling and enable the sub-baseboard arrangement of the components to be carried out with a minimum of work.

**Assembling the Components**

Chassis mounting valve-holders are used, and these are fixed with their legs between the rearmost strips. The other components span the spaces provided by the three strips. The three strips themselves are merely nailed to the two end strips, the points of the nails being clinched over. Notice that the front strip of the baseboard is slotted at the ends to clear the frame aerial and in the

THE LIGHTEST YET!

THE MOST IN PORTABLE

FREE BLUEPRIN WITH THIS

*The completely assemb*

ORIGINA

# erweight" rtable Four

by F.J.CAMM

plete Constructional Details of my zing Light-weight Portable employing for "Practical Wireless" Readers free-advice Guarantee.

NGENIOUS EVER! NT GIVEN ISSUE!

led receiver.

LITY!

centre to clear the Rola speaker. The baseboard is screwed and glued from the outside to the front. The two tuning condensers (the extremes of the three top knobs), the reaction condenser (the central top knob), the wave-change switch (the left bottom knob), and the on-off switch (the right bottom knob) are next secured to the front and after the remainder of the components have been fitted to the baseboard wiring is commenced. Do not

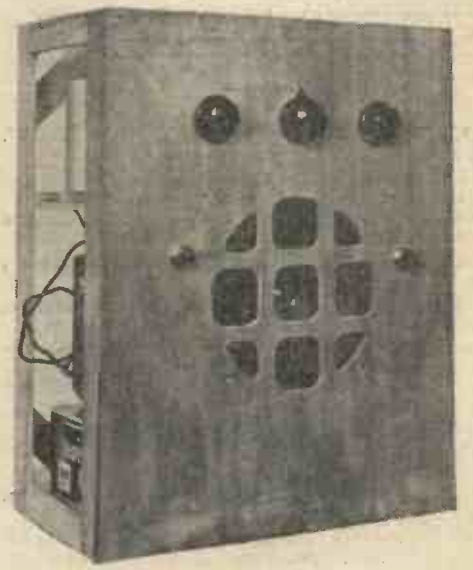
## SMALL IN SIZE!!

secure the front to the cabinet until wiring is complete, and leave the frame aerial winding until the last.

The full-size blueprint given with this issue should enable the wiring to be carried out without difficulty. An inspection of this will show that a surprisingly small number of wires only are required.

### Covering the Front

Before attaching the speaker, but after the remainder of the wiring is completed, the front should be covered with the particular leather cloth which the builder selects. You will require, if you purchase the 54in. wide variety, 1yd. only. It is obtainable at all prices from 4s. 11d. per yard upwards. That costing 6s. 11d. per yard is a particularly serviceable and stout brand, and it is also obtainable in a variety of colours. Cut a piece 1in. wider than the front and glue both the wood and the back of the leather cloth. Press it into even contact with the front and turn the edges over. Drawing pins may be partly pressed into the fabric until the glue has set.

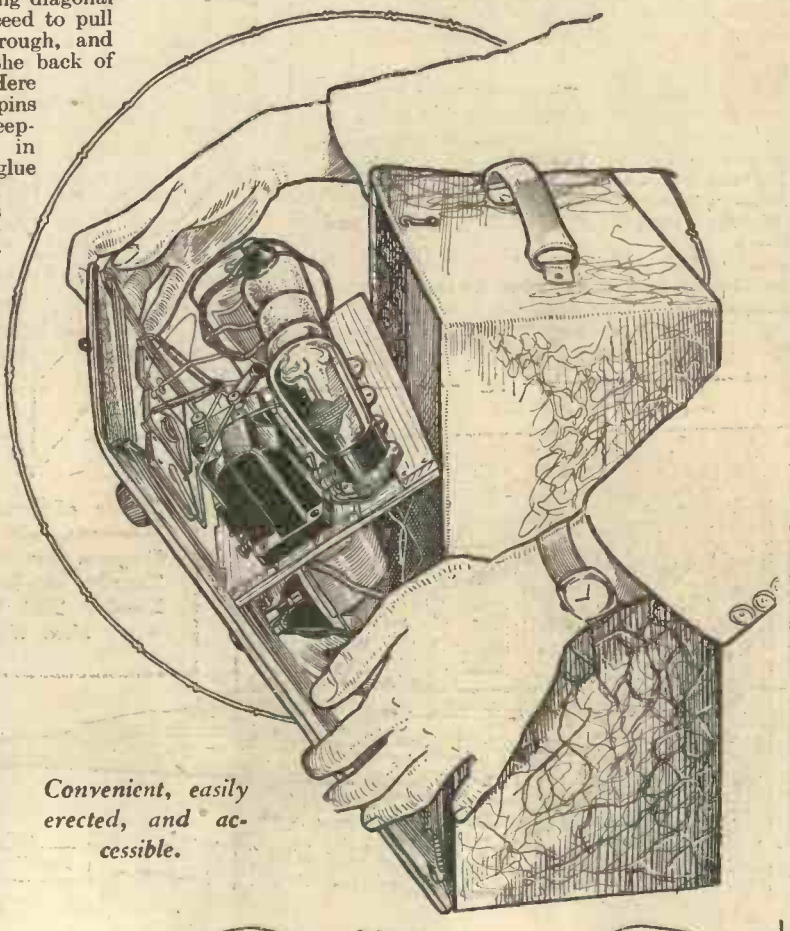


*The front before covering.*

### The Grille

Next, pierce the grille in the centre of each opening, making diagonal cuts, and proceed to pull these ends through, and glue them to the back of the grille. Here again drawing pins will assist in keeping the ends in place until the glue is dry. When the glue is thoroughly hard, glue over a piece of old gold gauze and finally attach the loud-speaker by means of the four nuts and bolts provided. Use bolts with plated heads, as these show on the front of the cabinet. Complete the wiring to the loud-speaker and then plant on the four notched frame aerial brackets in the positions shown in the photograph.

(*Contd. overleaf.*)



*Convenient, easily erected, and accessible.*

Presented Free with "Practical Wireless." May 6th, 1933.

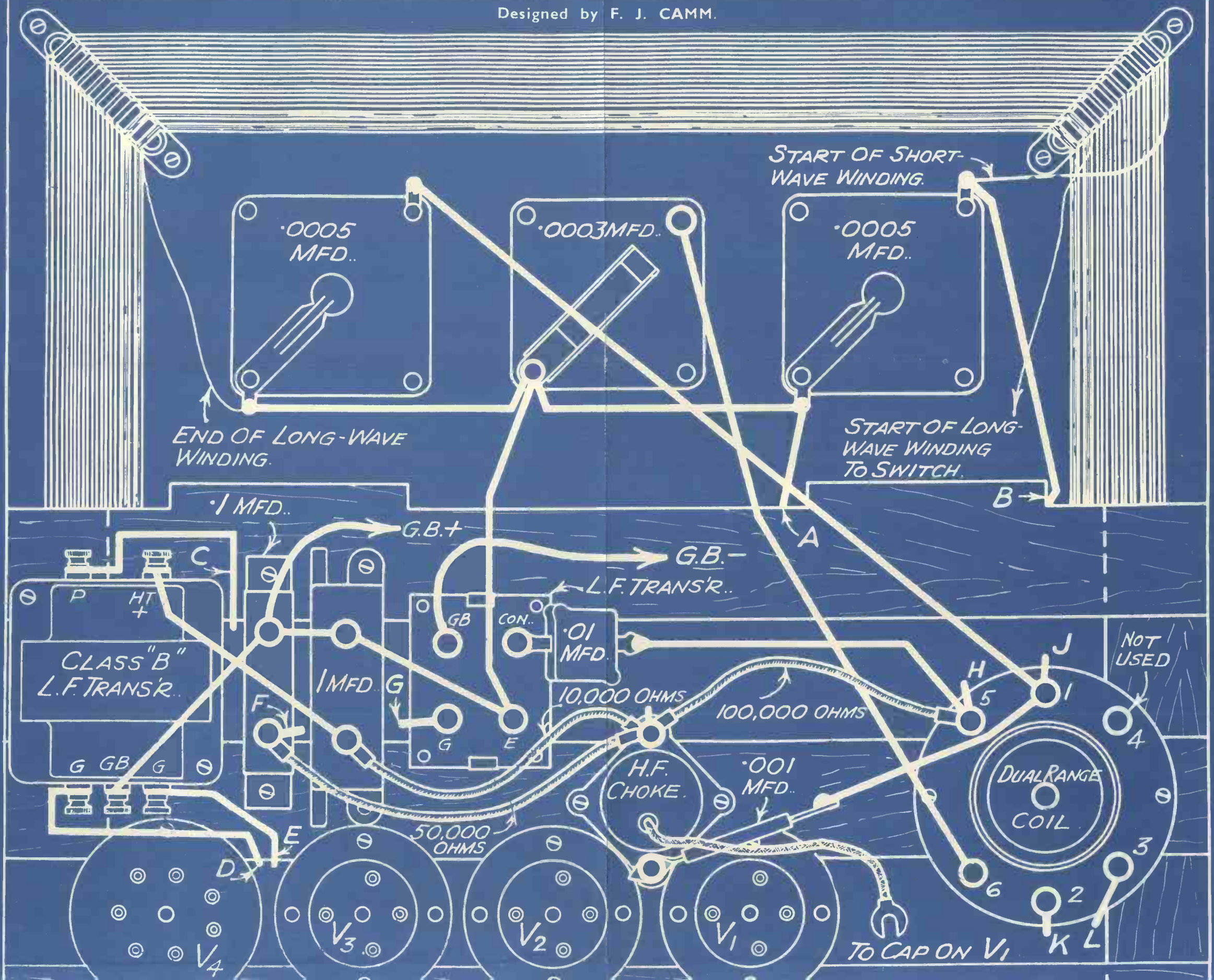
"PRACTICAL WIRELESS"
BLUEPRINT No. 12
PUBLISHED BY GEO. NEWNES LTD. 8-11 SOUTHAMPTON ST. STRAND. W.C.2.

# The "FEATHERWEIGHT" PORTABLE FOUR

PRICE 1/-

FULL CONSTRUCTIONAL DETAILS ARE GIVEN IN "PRACTICAL WIRELESS" May 6th, 1933.

Designed by F. J. CAMM.



TOP of BASEBOARD

BOTTOM of BASEBOARD

·002 MFD..

K

L

D

E

F

2 MEG..

G

CLASS "B" L.F. TRANS..

·1 MFD

1 MFD..

L.F. TRANS..

TO H.F. CHOKE

·0002 MFD..

H

J

C

A

B

START OF LONG WAVE WINDING

WAVE-CHANGE SWITCH

END OF SHORT WAVE WINDING

L.T. SWITCH

L.T. +

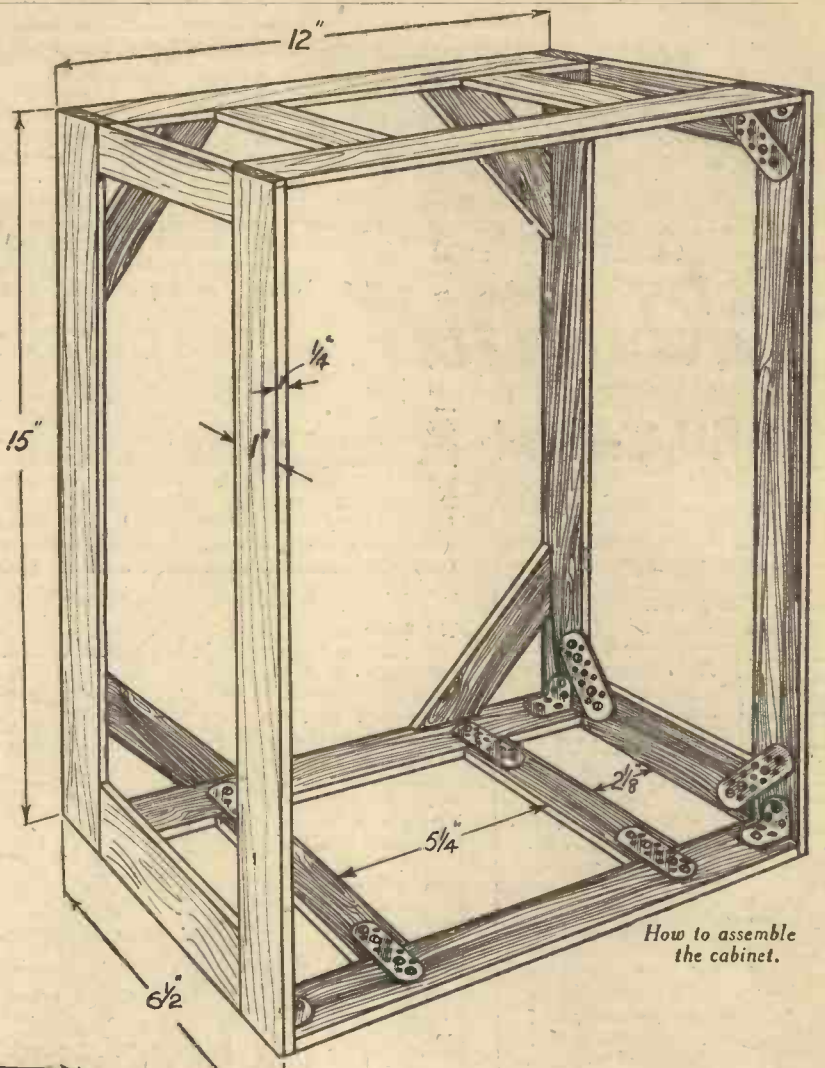
H.T. +

L.T. −

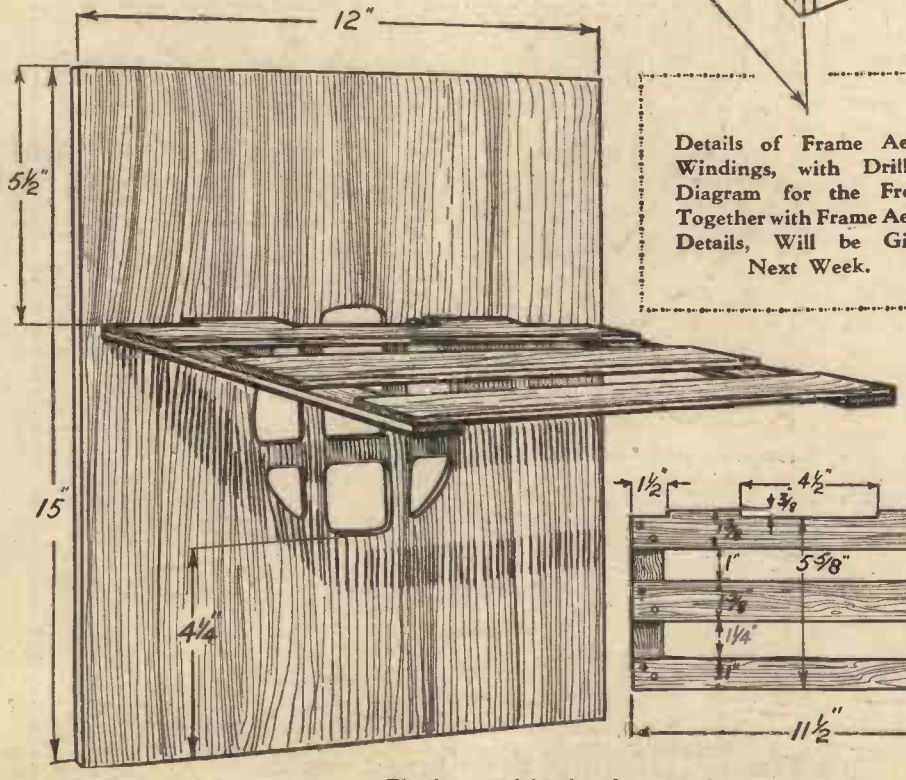
H.T. −

## SPECIFICATION OF FEATHER-WEIGHT PORTABLE.

Two Utility Bakelite Condeners, .0005 Type W. 297.
One Wearite H.F. Choke, Type H.F.P.A.
One Lissen Dual Range Shielded Coil.
One Graham Farish Litlos Condenser, .0003.
One Graham Farish Ohmite Spaghetti Resistance 10,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 50,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 100,000 ohms.
Three Clix 4-pin Chassis Type Valve-holders.
One Clix 7-pin Chassis Type Valve-holder.
One Bulgin On-Off Switch,Type, S.38.
One Bulgin Wave-Change Switch, Type S.36.
Four Bulgin Frame Aerial Spacers, Type I.12.
One Bulgin Senator Transformer, Type, L.F. 12.
One Lissen Class B Driver Transformer.
One 2 megohm Grid Leak, with wire ends, Lissen.
One T.C.C. .01 mfd. Fixed Condenser, Type M.
One T.C.C. .0002 mfd. Fixed Condenser, Type M.
One T.T.C. .002 mfd. Fixed Condenser, Type M.
One T.C.C. .1 mfd. Fixed Condenser, Type 50.
One T.C.C. 1 mfd. Fixed Condenser, Type 50.
One T.C.C. .001 mfd. Fixed Condenser, Type M.
One Cossor 220 S.G. (Metallized) Valve.
One Cossor 210 H.F. (Metallized) Valve.
One Cossor 215 P Valve.
One Cossor 240 B Valve.
One Rola Loud-speaker, Type F.5-PM-14-Class B.
2 ozs. 24 D.C.C. wire (medium-wave) and 2 ozs. 34 D.S.C. wire (long-wave) for frame.
One Ediswan 120 volt H.T. Battery, ref. 69706.
One Ediswan 9 volt Grid Bias Battery, ref. 69807.
One Ediswan 2 volt accumulator, E.L.M.2.
Four Wander Plugs, (H.T.+, H.T.—, G.B.+ and G.B.—).
Two Spades (L.T.+ and L.T.—).
One coil Glazite, flex, screws, wood for case, carrying handle, etc.




*How to assemble the cabinet.*




*The front and baseboard.*

**Details of Frame Aerial Windings, with Drilling Diagram for the Front, Together with Frame Aerial Details, Will be Given Next Week.**




*(Continued from previous page.)*

These have ten comb-like slots into which the long-wave windings and the short-wave windings are piled. For the long-wave winding use 46 turns; and for the short-wave winding 18 turns. Connections are taken from these to the three-point wavechange switch. Further to secure the frame aerial winding, sealing-wax or Chatterton's compound should be used to hold them in the slots.

The large slots are for the long-wave winding and are the innermost slots.

### Covering the Frame with Cardboard and Leather Cloth

Now put the set aside and proceed to cover the framework itself with thin cardboard. Damp this and leave it to dry when it will be found that the cardboard will have shrunk and considerably braced up the framework.

Next, attach the leather cloth, cutting the entire covering in one piece and leaving about 1in. margin all round to glue inside. But of this I shall have more to say next week.

# PICK YOUR BARGAIN

## KENWELL POWER PACK

Electrifies your present Battery Set. For A.C. Mains. With Matched Moving-Coil Speaker in Handsome Walnut Cabinet, as illustrated. Usual Price, £7/15/0. **Our Price, £4/0/0,** or 12 monthly payments of 7/4.

**LOEWE A.C. MAINS RECEIVER.** Complete 3-Valve Set, with Permanent Magnet Moving-coil Speaker. Ready to play. List Price, 9 Gns. **Our Price, £6/10/0.** or Deposit £1/0/0, balance in 11 monthly payments of 11/-.

**MARCONIPHONE RADIOGRAM,** A.C. only, Model 330. List Price, 32 Gns. **Our Price, 19 Gns.,** or 24 monthly payments of 18/7.

**ALL-ELECTRIC RADIOGRAM** with Garrard Automatic Record Changer, A.C. only, 3-valve S.G. Detector, and Pentode. Moving-Coil Speaker. **Our Price, 22 Gns.,** or Deposit £5/2/0 and 11 monthly payments of 36/-.

**ALL-ELECTRIC RADIOGRAM** with Electric Motor, A.C. only, 3-valve S.G., Detector and Power. Moving-Coil Speaker. **Our Price, 12 Gns.,** or 12 monthly payments of 22/3.

**KENWELL ALL-ELECTRIC 2-VALVE SET.** Detector and Pentode complete with Speaker, ready to play. For A.C. or D.C. Usual Price, £7/10/0. **Our Price, £4/0/0,** or 12 monthly payments of 7/4.

**KENWELL 2-VALVE DE LUXE A.S.2.** Detector and Pentode. Complete with P.M. Moving-Coil Speaker. Ready to play. Usual Price £9/15/0. **Our Price, £5/5/0.** or 12 monthly payments of 9/8.

Send **2/6** only

*Just pay a further 2/6 on delivery. Balance in 6 monthly payments of 2/6.*

**LOEWE CABINET SPEAKER** with 4-pole Balanced Armature Movement. **Our Price,** CASH or C.O.D. Carriage Paid **17/6**

**USUAL PRICE 39/6.**

**W.B. P.M.4 MOVING-COIL SPEAKER.** With input transformer. Cash or C.O.D. Carriage Paid, £2/2/0. Balance in 7 monthly payments of 5/9. Send **5/9** only

**NEW BLUE SPOT PERMANENT MAGNET MOVING-COIL SPEAKER 29 P.M.** With input transformer. Cash or C.O.D. Carriage Paid, £1/12/6. Balance in 6 monthly payments of 5/2. Send **5/2** only

**BLUE SPOT UNIT AND CHASSIS.** Type 99 P.M. including matched transformer. Cash Price, £2/19/6. Balance in 11 monthly payments of 5/6. Send **5/6** only

**ROLA PERMANENT MAGNET-MOVING-COIL SPEAKER F.6.** With Universal tapped input transformer. Cash Price, £2/9/6. Carriage Paid. Balance in 11 monthly payments of 4/6. Send **4/6** only

JUST RELEASED

## LISSEN ALL-ELECTRIC SKYSCRAPER 3

Complete with 4 valves and constructional chart in sealed Lissen carton. Cash or C.O.D. Carriage Paid, £7/19/6. Balance in 11 monthly payments of 14/8. Send **14/8** only

# PILOT AUTHOR KIT

## Exact to specification

# FEATHERWEIGHT PORTABLE

*As described in this week's issue.*

**KIT "A"** Author's Kit of first specified parts, less valves, cabinet, panel, baseboard and speaker, CASH or C.O.D. Carriage Paid, £3/1/3.

**Delivered, Carriage Paid on first payment of 5/8**

*Balance in 11 monthly payments of 5/8.*

**KIT "B"** As Kit "A" but with valves only. Delivered, carriage paid, on first payment of **9/10**

*Balance in 11 monthly payments of 9/10.* Cash or C.O.D. Carriage Paid. £5/7/6.

**KIT-BITS** Selected C.O.D. items. You pay the postman. We pay post charges on orders over 10/-.

| | | | |
|---|---|---|---|
| 1 Lissen Dual Range Shielded Coil | .. .. | 6 | 6 |
| 1 Bulgin Senator Transformer L.F.12 | .. | 6 | 9 |
| 1 Lissen Class "B" Driver Transformer | .. | 12 | 6 |
| 1 Set of 5 T.C.C. Condensers as specified | .. | 8 | 0 |
| Wire, Glazite, Flex, Screws and 4 Bulgin Frame Aerial Spacers | .. .. .. | 6 | 3 |
| 1 Set of Specified Valves | .. .. £2 | 6 | 3 |
| 1 Rola Class "B" Speaker | .. .. £1 | 12 | 6 |

# A.C. TWIN

**KIT "A"** Author's Kit of first specified parts, less valves, cabinet, panel, baseboard and speaker, CASH or C.O.D. Carriage Paid, £7/1/6.

**Delivered, Carriage Paid on first payment of 13/-**

*Balance in 11 monthly payments of 13/-.*

**KIT "B"** As Kit "A" but with valves only. Delivered, carriage paid, on first payment of **18/-**

*Balance in 11 monthly payments of 18/-.* Cash or C.O.D. Carriage Paid, £9/16/6.

**KIT "C"** with valves, cabinet, panel, and baseboard, but less speaker. Delivered, carriage paid, on first payment of **21/3**

*Balance in 11 monthly payments of 21/3.* Cash or C.O.D. Carriage Paid, £11/11/6.

# SUPERSONIC SIX

**KIT "A"** Author's Kit of first specified parts, including ready-drilled panel, but less valves, cabinet, and chassis. Cash or C.O.D. Carriage Paid, £6/16/6.

*Delivered Carr. Paid. on first payment of* **12/6**

*Balance in 11 M'thly Payments of 12/6*

*Set of 6 Specified Valves: £3-11-6 or add 6/7 to each monthly payment.*

**KIT-BITS** Selected C.O.D. Items. You pay the postman. We pay post charges on orders over 10/-.

| | | | |
|---|---|---|---|
| 1 Peto-Scott Paxolin Panel and Aluminium Baseboard drilled to specification | .. | 10 | 9 |
| 1 Set of 4 Wearite Coils as specified | .. £2 | 2 | 0 |
| 1 T.C.C. Special 8 mfd. Condenser Block | .. | 14 | 6 |
| 1 Lissen Hypernik L.F. Transformer, 3:1 | .. | 12 | 6 |
| 2 Polar .0005 mfd. Var. Condensers with S.M. Dials | .. .. .. .. | 13 | 0 |
| 1 Set of 6 Specified Valves | .. .. .. £3 | 11 | 6 |

# CASH, C.O.D. or EASIWAY


## PILOT GUARDIAN Q.P.P. 4-VALVE KIT

**KIT "A"** Complete Kit of Parts including ready-drilled panel, but less Valves and cabinet. CASH or C.O.D. Carriage Paid, £3/19/6. 7/6 Deposit and 11 monthly payments of 7/3. Send **7/6** only

**KIT "B"** As Kit "A" but with Valves *less* cabinet. CASH or C.O.D., Carriage Paid, £6/18/0. Delivered, Carriage Paid on First Payment of .. **12/6** Balance in 11 monthly payments of 12/6.

**KIT "C"** As Kit "A" but with Valves and Table Cabinet. CASH or C.O.D. Carriage Paid, £7/13/0. Delivered, Carriage Paid, on First Payment of .. **14/-** Balance in 11 monthly payments of 14/-.

**KIT "D"** As Kit "C" but with Consolette cabinet, less speaker. CASH or C.O.D., Carriage Paid, £8/3/0. Delivered Carriage Paid, on First Payment of **15/-** Balance in 11 monthly payments of 15/-.

*Send for Full Size Blue-Print and Constructional Chart. Usual price 1/-. Sent FREE to "Practical Wireless" readers.*

**IMPORTANT** Parts, Kits, Miscellaneous Components. Finished Receivers or Accessories for Cash, C.O.D., or H.P. on our own system of Easy Payments, send us a list of your wants. We will quote you by return. C.O.D. orders value over 10/- sent carriage and post charges paid.

**PETO-SCOTT CO. Ltd. 77, City Road, London, E.C.1.**

Telephone: Clerkenwell 9406-7.

West End Showrooms: 62, High Holborn, London, W.C.2. 'Phone: Holborn 3248.

Dear Sirs, Please send me CASH/C.O.D./H.P.....

for which I enclose £.....s.....d. CASH/H.P.....

NAME .....

ADDRESS .....

..... Pr. W. 6/5/33.

STRICT PRIVACY GUARANTEED—WE DEAL WITH YOU DIRECT

THE EASY ROAD TO RADIO

# The BEGINNER'S SUPPLEMENT

Conducted by F.J. CAMM

## Current Density

THE amount of current per each square inch of cross-sectional area which passes through a conductor. For instance, if a conductor has a cross-sectional area of 1 sq. in. and a current of 10 amperes is flowing through it, the density is 10.

With direct current the density is easy to calculate since the distribution of current through the conductor is uniform but when we come to alternating currents a peculiar state of affairs exists. The current tends to be densest near the surface of the conductor. In the case of a round wire, for example, there would be more current passing just under the surface of the wire than in the centre. This phenomena, which is known as the "skin effect" becomes more marked as the frequency of the current increases, that is to say, it is most noticeable with high-frequency currents. In the case of radio-frequency currents, the skin effect is so strong that with large conductors, as are used in transmitting, a solid wire may very well be replaced by a tube of the same external diameter without increasing the high-frequency resistance.

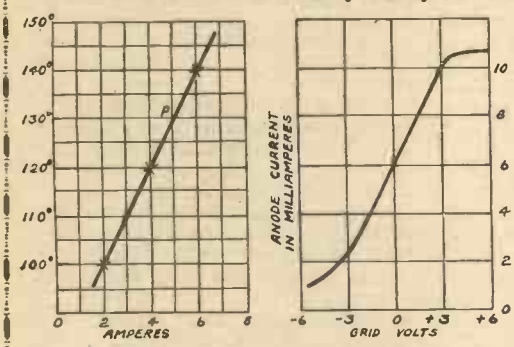



*Fig. 1.—Two examples of curves as applied to wireless.*

## Curve

A convenient way of finding out the characteristics or behaviour of wireless apparatus such as valves under certain conditions is to draw a graph or "curve." If the behaviour under one or two known sets of conditions is recorded graphically on squared paper and the points marked are joined by a line it is possible to tell by the shape of the line what behaviour to expect under intermediate unknown conditions.

A knowledge of the meaning of curves and how to plot them is very useful to the radio amateur. A simple example of how to plot a curve is given in Fig. 1. Suppose it was known that when a current of 2 amps. was passing through a certain conductor it would become hot, the temperature being 100 degs., and also that if the current were increased to 4 amps. the temperature would go up to 120 degs. Also again that a current of 6 amps. would mean a temperature of 140 degs. This might be useful as far as it went, but it might not be enough. We might want to know the temperature at 3 or 5 or 7 amps. A simple way to determine this without experiment would be to draw a curve as in Fig. 1. The paper is divided into squares and "amperes" marked at equal distances horizontally, while the temperature in degrees is marked vertically. To plot the curve a small cross or mark is made where the vertical line up from the point marked "2 amps." crosses the horizontal line corresponding to 100 degs. In the same way the position where the 4 amps. line crosses the 120 degs. line is also marked.

THE BEGINNERS' A B C OF WIRELESS TERMS
(Continued from April 29th issue, page 234.)

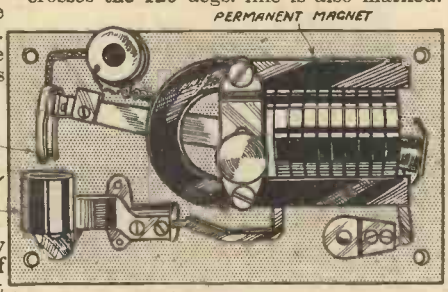



*Fig. 2.—Example of a cut-out.*

The last point to be plotted is where the vertical line from "6 amps." crosses the horizontal line representing 140 degs.

If these three points are joined up by a line we have a "curve" from which we can determine the current flowing at any temperature between 100 and 140 degrees. Likewise, we can find the temperature for any current between 2 and 6 amperes. Suppose we wanted to know the temperature at 5 amps. By following up vertically from the 5 amp. position on the base line we strike the curve at the point P. By following along horizontally we see that this point is opposite "130 degs." on the vertical scale. The temperature at 5 amps., therefore, is 130 degs.

Incidentally, this particular curve happens to be a straight line, but it is nevertheless still considered mathematically as a "curve." The other curve in Fig. 1 is, perhaps, more familiar in appearance, although not so simple as the one on the left. It records what happens to the current passed by a valve when the voltage applied to the grid is varied from —6 to +6. It shows, for instance, that at —3 volts the anode current is just over 2 milliamps., and that at 0 volts it has risen to 6 milliamps., and so on.

## Cut-off

The limits of frequency above which no reproduction takes place. For instance, a loud-speaker may reproduce all musical notes quite well until a certain high note is reached. Above this it will not produce any sound. In other words there is a "cut-off" above that particular note. Again, there may be some organ music transmitted which may come through clearly except that the very low notes are lost altogether. This would indicate cut-off below a certain frequency. Cut-off of this type is not so common as a general falling off in response. This is often met with, but should not, strictly speaking, be termed "cut-off." Cut-off implies complete absence of response above or below a certain frequency.

## Cut-outs

An automatic cut-out is an instrument used to break or make a circuit automatically according to some predetermined electrical circumstances. A well-known example is provided by the device used in some battery-charging circuits to prevent the batteries from discharging through the dynamo should the latter inadvertently stop for any reason. You can quite understand that the voltage of the batteries on charge may be quite high. Normally this is overcome by the voltage of the dynamo which is somewhat higher than that of the batteries, thus causing current to flow from the dynamo through the batteries. If, however, the voltage

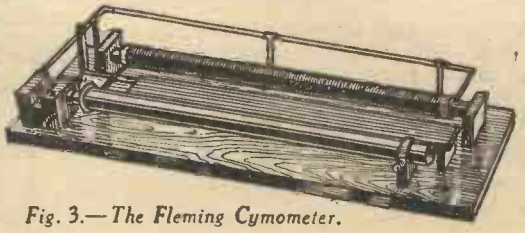


*Fig. 3.—The Fleming Cymometer.*

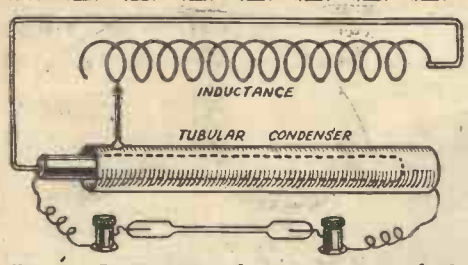



*Fig. 4.—Diagrammatical representation of the essential parts of a cymometer.*

of the dynamo falls below that of the batteries (through its slowing down due to a failing engine or for some other reason) then the batteries will discharge through the dynamo with possibly disastrous results such as ruining the batteries and burning out the windings of the dynamo.

In the cut-out shown in Fig. 2 a pivoted arm carries dippers which dip into metal cups containing mercury, thus completing the circuit. The dippers are held in this position so long as the dynamo is charging by reason of the current passing through a coil in the cut-out which attracts an iron armature attached to the arm. If the current reverses, as when the dynamo fails and the batteries start to "charge" the dynamo, then the armature is repelled and the dippers raised, so breaking the circuit. The reverse process takes place as soon as the dynamo commences again.

### Cymometer

A type of wavemeter invented by Dr. J. A. Fleming. It consists essentially of a long tubular condenser and a long small-diameter inductance so arranged that they can be both increased with one and the same control. The actual instrument is shown in Fig. 3, but the method of working it can be more easily understood from the diagrammatic drawing (Fig. 4). If the outside tube of the variable condenser is drawn to the right the capacity existing between the two concentric tubes becomes less. At the same time the slider attached to the outer tube and bearing on the bare wire turns of the inductance or tuning coil will slide along and reduce the number of turns in circuit, thus reducing its effective inductance. When the circuit composed of the condenser and inductance is in tune with the oscillating circuit near which it is brought the fact is indicated by flashes of light in the neon tube placed between the two terminals. The wavelength of the transmitter can then be determined by reading the scale mounted on the cymometer. This type of wavemeter is not used nowadays as it is replaced by more sensitive and accurate types.

### Cymoscope

An instrument used for detecting the presence of wireless waves by visible means. A very early form is shown in Fig. 5. It consists of a single metal loop cut at one point and having metal balls mounted on the ends. Short waves of sufficient intensity will cause a spark to jump between the points. Replacing the spark gap by a small lamp makes the instrument more sensitive, while increasing the number of turns of wire will make it respond to longer wavelengths. Such a device, but including a variable condenser for accurate tuning is also shown in Fig. 5.

### Cycle

Any sequence of events occurring at regular intervals of time. For alternating current cycle see "ALTERNATING CURRENT."

### Damped Waves

Wireless waves which occur in successive trains. The first waves of each train are large, but the successive ones gradually get smaller and finally die down altogether. Then follows another similar train starting at large amplitude and dying down again. This process goes on continuously. The rise and fall in amplitude gives a characteristic musical note to the transmissions, therefore this type of wave cannot be used for telephony purposes. It is confined solely to transmissions in the morse code. For telephony such as broadcasting *undamped* or *continuous* waves must be employed. The difference is illustrated in Fig. 6. (See also "CONTINUOUS WAVES.")

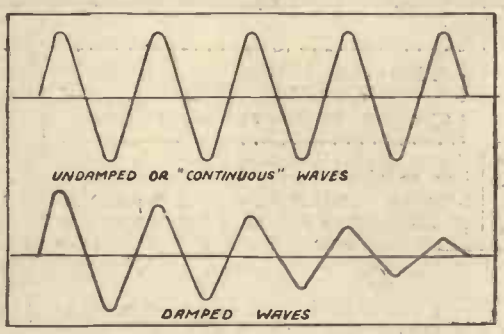



*Fig. 6.—Diagram showing the difference between damped and undamped waves.*

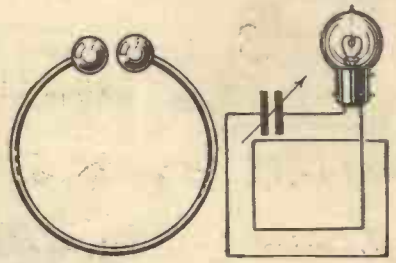


*Fig. 5.—Two forms of cymometer used for detecting the presence of wireless waves.*

### Damping

This is a term used to indicate the gradual falling off in amplitude of a periodic vibration or train of oscillations. It is applied to electrical waves. (See "DAMPED WAVES") and to such technical matters as the steadying or "damping down" of the vibrations of the pointer of a voltmeter or ammeter.

With most measuring instruments, unless some method is employed to slow down the vibrations of the pointer it will go on oscillating backwards and forwards a long time before coming to rest. A popular method of overcoming this with moving iron instruments is shown in Fig. 7. It consists of attaching a small aluminium vane to the lower end of the pointer. This vane moves in a sector-shaped aluminium box known as a "dashpot." The vane does not touch the inner sides of the dashpot, but moves very near to them so that the air in the dashpot has very little room to pass round the vane. In this way rapid swinging of the pointer is prevented since the air cannot get quickly past the vane every time it moves.

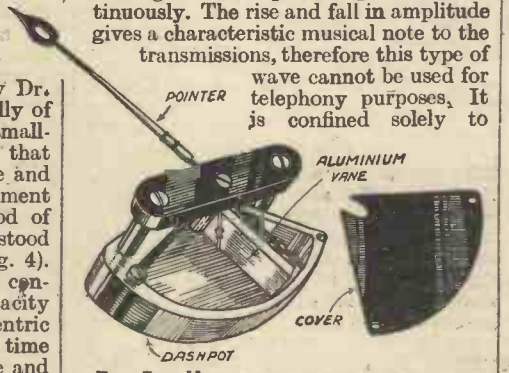


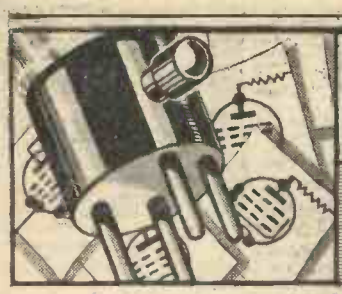

*Fig. 7.—How a moving iron type of instrument can be damped.*



## PRACTICAL WIRELESS BLUEPRINT SERVICE

In order to meet the requirements of readers who prefer to work from a full-size blueprint when building up any of the "Practical Wireless" Receivers, we can now supply full-size Blueprint Wiring Diagrams of all the "Practical Wireless" receivers for 1s. each, post free. When ordering, quote the number. Copies of the paper containing descriptions of the particular receiver cost 4d. each. Address orders to: The Publisher, George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

| Blueprint No. | Receiver. | Described in Issues dated 1932. |
|---|---|---|
| 1. | Dolphin Straight Three | Sept. 24th<br>Oct. 1st. |
| 2. | Long Range Express Three | Sept. 24th<br>Oct. 1st |
| 3. | Mains Express Three | Oct. 8th |
| 4. | Sonotone Four | Oct. 8th<br>Oct. 15th |
| 5. | Bijou Three | Oct. 29th |
| 6. | Argus Three | Nov. 5th.<br>Nov. 12th |
| 7. | Empire Short-Wave Three | Nov. 26th<br>Dec. 3rd |
| 8. | Solo Knob Three | Dec. 10th<br>Dec. 17th |
| 9. | Midget Two | Dec. 17th<br>1933. |
| 10. | Selectone Battery Three | Jan. 7th<br>Jan. 14th<br>Jan. 21st |
| 11. | Fury Four | Jan. 21st<br>Jan. 28th<br>Feb. 4th<br>Feb. 11th<br>Feb. 18th |
| | Fury Four (*continued*) | Feb. 25th<br>Mar. 4th |
| 12. | Featherweight Class B Four valver | Apr. 29th<br>May 6th |
| 13. | Q.P.-P. Three-Four | Feb. 25th<br>Mar. 4th<br>Mar. 11th<br>Mar. 18th |
| 14. | Alpha Q.P.-P. Three | Mar. 25th<br>Apr. 1st |
| 15. | Ferrocart Q.P.-P.Hi-Mag Three | Mar. 25th<br>Apr. 1st |
| 16. | Supersonic Six | Apr. 1st<br>Apr. 8th<br>Apr. 15th |
| 17. | Beta Universal Four | Apr. 8th<br>Apr. 15th<br>Apr. 22nd |
| 18. | A.C. Twin | Apr. 15th<br>Apr. 22nd<br>Apr. 29th |
| 19. | Selectone A.C. Radio-Gram Two | Apr. 22nd<br>Apr. 29th |
| 20. | A.C. Fury Four | Feb. 25th<br>Mar. 4th<br>Mar. 11th |



# FURTHER PRACTICAL NOTES — ON — PENTODES

(Continued from page 228, April 29th issue.) H. T. GODLEY, F.R.A.

THE purpose of the screening grid mentioned last week is to reduce the effective capacity between the control grid and the anode, literally pulling the electrons through the exceedingly fine mesh of the control-grid and neutralizing the screening effect of this grid. Thus, it is possible to obtain an amplification factor running into several hundreds.

Now the S.G. valve is, of course, essentially a high-frequency valve, and is therefore called upon to handle only very small signal oscillations, often merely the unamplified signals from the aerial. It is a fact, however, that when an attempt was made to use this valve in the output stage, where it was called upon to handle considerably larger oscillations, it was found that the velocity of the electrons was so great that a reverse electron flow, or secondary "emission," from the anode was set up, causing the electrons to return from the anode to the "screen" grid, thus reducing the effective anode-current and rendering the valve useless as an output valve.

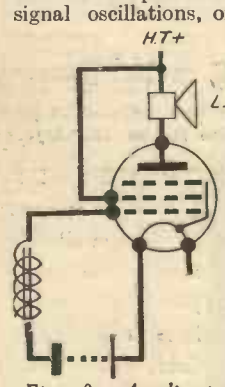



*Fig. 2.—A direct anode connection.*

To overcome this secondary emission, yet another grid was interposed, this time between the "screen" grid and the anode, and by connecting this "suppressor" grid to the filament the effect of the secondary emission was reduced sufficiently to enable a very high amplification factor to be retained when handling large grid-swings. In short, therefore, the pentode is really a S.G. valve modified by the addition of the "suppressor" grid, enabling it to be used as an output valve.

### Fitting a Pentode

Many people have written to me from time to time, asking whether, by fitting a pentode, greater volume will result! This is a question that cannot be answered without some knowledge of the circuit of the receiver. Although the later pentodes are designed to handle fairly large grid-swings, yet they are still overloaded much more easily than an equivalent triode.

Suppose that the required undistorted output were 500 milliwatts, *i.e.*, half a watt, then a super-power valve capable of giving such an output would require a total grid-swing of some 36 volts, which would certainly not be available from the detector. Therefore, we would have to use between the detector and the super-power valve an L.F. valve with a fairly high magnification factor, applying it to the grid-swing of some 8 or 9 volts from the detector stage, which, after being amplified by the valve and stepped up through the intervalve transformer, would result in the 36 volt grid-swing required by the super-power valve, thus enabling it to deliver the required half a watt for the loud-speaker.

Now the average battery pentode will handle a total grid-swing of only 15 volts or so, but for this small input will deliver the required half a watt. It will be obvious, therefore, that if we were to use a pentode in place of the super-power valve, we should not get any more volume, but we should certainly get severe distortion due to the pentode being badly overloaded by the output from the first L.F. valve. On the other hand, if the pentode were used in place of the first L.F. valve, the signal input to which is only 8 or 9 volts, the pentode would not be overloaded, and we could dispense with the other stage. By coupling the pentode to the detector with a 7 : 1 instead of a 3 : 1 transformer, the signal input to the pentode would just be sufficient to "load" it nicely, enabling it to deliver its maximum output of half a watt.

In such a case, therefore, the use of a pentode does not result in greater volume, but it does enable you to simplify the receiver and to economise in battery costs while still retaining the same volume as was originally obtained from two L.F. stages.

If, on the other hand, the existing set has only one L.F. stage, the use of a pentode in this stage will definitely result in greater volume, due, of course, to the fact that for a given input from the detector the pentode will give a much greater output than would the triode.

### Increasing Efficiency

There is nothing difficult in fitting a pentode, as no wiring has to be altered, it being merely necessary to connect the auxiliary grid to H.T. positive. The suppressor grid is connected internally to the filament, and is thus automatically earthed. There are, however, several modifications which can be made, all of which are worth while, as they will result in increased efficiency and better quality of reproduction. In the first place, it is usual to couple the pentode to the detector by means of a transformer and not by a resistance-capacity coupling, and in order to obtain a sufficiently large grid-swing to load the pentode, the transformer should be one of the special pentode types in which the step-up ratio is higher than usual. The average ratio for a triode transformer is about three-to-one, whereas, in the case of a pentode, a ratio of seven-to-one can be employed with advantage.

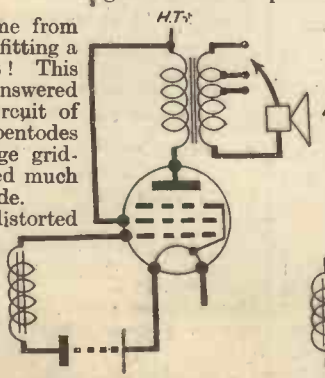



*Fig. 3.—A pentode output transformer.*

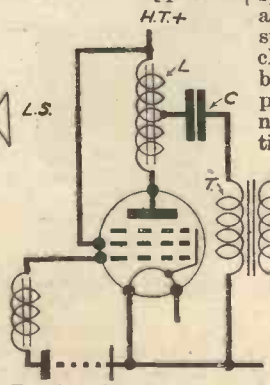



*Fig. 5.—A combination of choke and transformer coupling.*

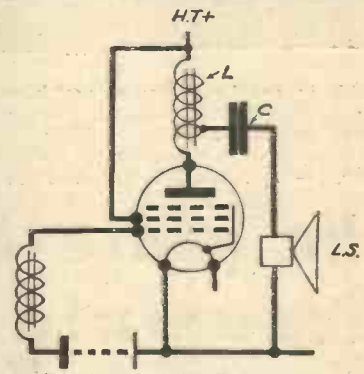



*Fig. 4.—A choke filter output.*

The next point to consider is the coupling of the pentode to the loud-speaker. If in your present set the loud-speaker is wired directly between the positive end of the H.T. battery and the anode of the last valve, as in Fig. 2, you should, upon fitting a pentode, incorporate in the circuit some arrangement which will divert the H.T current from the loud-speaker and which will also allow the maximum transfer of signal energy from the valve to the speaker (impedance-matching). There are two or three suitable arrangements, such as an output transformer (Fig. 3), choke-capacity-filter (Fig. 4) or a combination of the two (Fig. 5). The impedance of the valve will almost certainly not be just right for use with your particular loud-speaker, and if this state of affairs is not corrected, only a fraction of the signal energy available from the valve will reach the loud-speaker, the result being distortion and poor volume.

By using an output transformer having the correct ratio, the impedance values can be accurately matched and thus full benefit is derived from the pentode.

(Continued on page 275.)

(*Continued from page 274.*)

**Matching Impedances**

The necessity for accurately matching the impedances assumes particular importance in the case of a pentode valve, the reason being that, in a triode, the power output increases with anode impedance up to a point, but having reached this point, remains fairly constant regardless of any further increase of anode impedance. In the pentode this is not so—the power output continues to increase so long as the impedance in the anode circuit increases, and there is no point where the power output becomes constant as in the triode. The audible result of this characteristic is rather high-pitched and shrill "pentode-tone" which, if not corrected, is so unpleasant to the ear. It is a simple matter to overcome this high-pitched tone, as will be explained later—for the moment we must revert to the output transformer.

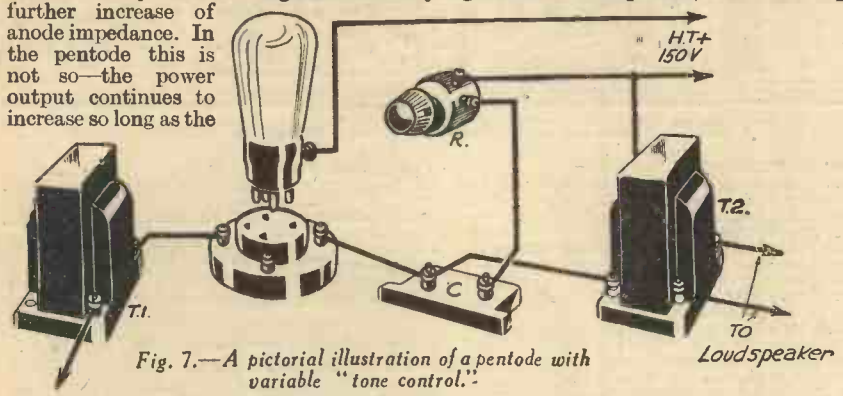



*Fig. 7.—A pictorial illustration of a pentode with variable "tone control."*

There are many pentode output transformers on the market, the secondary windings of which are tapped at three points, and by trying each tap in turn and using that which gives best results, the impedances are more or less accurately matched. This method is, however, a trifle haphazard, and probably some of my readers would prefer to know *exactly* what ratio they should use.

In the case of a triode output valve, the "load" impedance is assumed to be twice its actual impedance, but in the case of a pentode the matter has to be treated a little differently, as, owing to its high impedance under working conditions, it is not advisable to take twice the impedance as being a suitable "load" impedance. For all practical purposes, a satisfactory compromise is arrived at by assuming the "load" impedance to be 8,000 ohms—this value is correct for most of the standard battery pentodes on the market. The required transformer ratio is found by using the formula $\sqrt{\frac{R}{S}}$ where r is the required ratio, R the "load" impedance, and S the average loud-speaker impedance. Assume that a low-impedance moving-coil loud-speaker has to be matched to a pentode, the average impedance of the speaker being 20 ohms, then the formula becomes $\sqrt{\frac{8000}{20}}$ which, boiled down, comes to 20, the correct transformer ratio being 20 : 1.

**Output Filter**

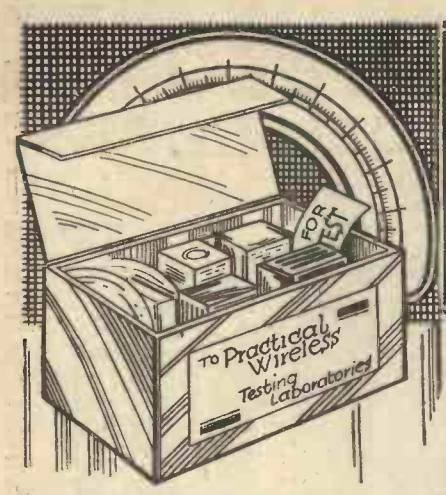
If it is decided to use the choke-capacity-filter as in Fig. 4, which is, perhaps, somewhat cheaper than the output transformer arrangement, it is necessary to use a special pentode choke as these are designed to have sufficient inductance when carrying the full anode current, and moreover, are tapped for impedance-matching purposes. It will be seen that one side of the loud-speaker is connected to earth, the other side being connected to the centre-tap on the choke through a fixed condenser. This condenser must not be too small, as if anything less than two microfarads is used, the tendency will be for the quality to be lacking in bass-note response. The smaller the condenser the less bass notes. Furthermore, this condenser must be a good-class component, as the speech voltages generated by the valve may be very high, and if the condenser is a "cheap" one, it may soon break down. In the case of large power pentodes, these peak voltages may be as much as two or three thousand volts, and therefore the insulation of every component in the output stage must be capable of withstanding these surges.

Particularly in the case of these large pentodes, the loud-speaker must never be disconnected from the set while the set is "on," the reason being that by so disconnecting the speaker, a considerable increase in anode impedance is caused and the extremely high peak voltage thus caused may be sufficient to break down the insulation of one of the components, however good they may be, or may even crack the base of the valve itself. Assuming the circuit to be as in Fig. 2, it will be clear that by disconnecting the loud-speaker, the connection between the battery and the anode of the valve is broken, but the connection between the battery and the auxiliary grid is not. Under these conditions, the anode is dead while the auxiliary grid is still at high potential, and this will probably damage the valve. If an output transformer or choke is used, as recommended, then, of course, disconnection of the speaker does not break the anode circuit, and, therefore, the point is not of such importance.

**Tone Control**

Now to go back to the question of the characteristic "pentode-tone," it is a fact that a pentode reproduces the treble frequencies much more vigorously than the middle and bass frequencies with the result that the reproduction sounds high-pitched and shrill. Fortunately, it is a simple matter to overcome this effect, it merely being necessary to connect a small fixed condenser in series with a resistance across the loud-speaker itself, or if one is fitted across the primary of the output transformer. By using a variable resistance as shown in Fig. 7, the impedance of the tone-control becomes variable, thus permitting gradual control of the high-note attenuation to suit individual tastes.

In the majority of cases, it will be found that a variable resistance of 50,000 ohms used in conjunction with a mica-dielectric condenser of .01 mfd. will be suitable.




# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF.

### ATLAS PENTODE CHOKE

THE question of coupling the loud-speaker to the anode circuit of a pentode valve is not a simple one. There are quite a number of points to be watched, not the least of which is the question of impedance matching. The choke illustrated on the right is manufactured by the well-known firm of H. M. Clarke of Manchester, and is a most substantial component. It is approximately 6in. long, and about as tall, and as may be seen in the illustration, it is fitted with six terminals. The ends of the actual winding are joined to the two outside terminals, and the remaining four terminals are connected to tappings so that it is possible to obtain ratios of 1 : 1, 1.23 : 1, 1.5 : 1, 1.6 : 1, 1.9 : 1, 2.1 : 1, 2.7 : 1, 3 : 1 and 5 : 1. It is therefore possible to match practically any make of pentode with any type of speaker. The winding is very substantial, having a D.C. resistance of only 385 ohms, but with an inductance of 48 to 50 henries. It is wound with heavy gauge wire, and will carry currents up to about 100 mA., but the maximum recommended current, in order to obtain a satisfactory inductance value, is 60 mA., at which the inductance is about 35 henries. This is a very high-class component, and will be found admirable for high-quality mains receivers. The price of the model illustrated is 21s., and it is also obtainable in an unshrouded form at 17s. 6d.

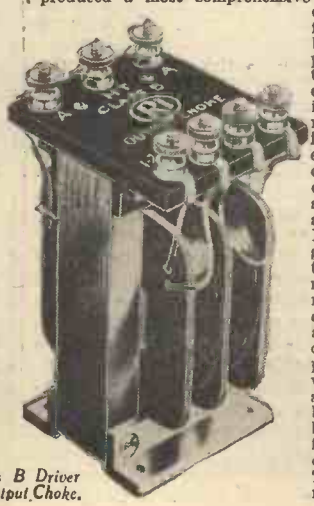
*Emicol pocket and panel meters.*

### EMICOL INSTRUMENTS

THE two instruments illustrated on the left are two popular models manufactured by the Electrical Measuring Instruments Co., Ltd., and are respectively a pocket meter, Type 4-104, and a panel instrument, Type 4-14. Both of these are of the moving-iron type, and are fitted with a dead-beat movement. Although cheap they are very good instruments, and have an accuracy which is sufficient for all normal purposes. The pocket instrument is available in two types — voltmeters and ammeters. There are six separate ranges in the voltmeter type, and in addition, two double-reading meters. The single-reading meters cost 5s., and 5s. 6d., according to the range, and the double-reading meters cost 6s. for a 0-6volts and 0-120 volts, and 6s. 2d. for a 0-6 volts and 0-150 volts. The panel instruments are available as voltmeters, ammeters and milliammeters, and a special type of high-resistance voltmeter is also available with a reading of 200 ohms per volt. These cost 11s., whilst the ordinary types are only 6s. The cases of both of these types of instrument are finished in black crystalline, and measure only 2in. in diameter. They are therefore highly suitable for the ordinary listener who only desires to keep check on his battery voltages or the operation of his valves, although, owing to their good movements, they may be found equally suitable for the enthusiastic experimenter who desires to carry out accurate measurements and undertake serious experimental work.

### R.I. CLASS B COMPONENTS

RADIO INSTRUMENTS have now produced their range of Class B components, and these are divided into two classes—driver transformers and output choke. There is only one output choke, but this is tapped to provide ratios of 1 : 1, 1.2 : 1, 1.5 : 1 and 1.8 : 1. The driver transformers, however, are of four separate types, DY.37, DY.38, DY.39 and DY.41. The two latter cost 11s., and the other transformers 15s., whilst the output choke costs 12s. 6d. The DY.37 and DY.38 are of the double-ratio type of transformer, and the two other transformers are of the single-ratio type, so that it is possible to use practically any driver valve with any of the existing or shortly-to-be-produced Class B valves. It may justly be said, therefore, that Messrs. Radio Instruments have produced a most comprehensive range of Class B components so that full advantage may be taken of the principle with any type of valve. The electrical characteristics of the components are very good indeed, the power efficiency of the drivers being in no case lower than sixty-five per cent., and in the case of the DY.38. arranged to give a 2.5 : 1 ratio, the efficiency is ninety per cent. The makers of these components supply a very complete data sheet with all particulars of the windings, load, etc., and it is thus possible to choose the best type of transformer for individual requirements. They may be highly recommended.

*Radio Instruments' Class B Driver Transformer & Output Choke.*

### W.B. CLASS B SPEAKERS

WE have already commented upon the new Mansfield loud-speakers made by the Whiteley Electrical Radio Co. Ltd., and this firm is now able to supply this particular model with input transformers suitable for either Q.P.-P. amplifiers or the new Class B valves. This is, of course, only a centre-tapped transformer of the push-pull type, but the question of matching must be fully studied if the speaker is to give of its best, and the W.B. speakers certainly stand up well to test. On our Class B Unit and with the Q.P.-P. Amplifier these new models gave splendid results, and were fully up to the original model using an ordinary matching transformer. We have already commented on the sensitivity of this particular type of loud-speaker, and with a Class B stage, fully loaded, the output from the P.M.4 is ample for the ordinary living-room, and, in fact, many would say that it was too loud. The brilliance of the Class B stage is fully reproduced and the effect of this full reproduction of harmonics and other top notes gives to music a "forwardness" which lends a new rendering to the term "reproduction." The price remains at 42s. for the P.M.4. and at 27s. 6d. for the P.M.5.


*The Atlas Pentode Choke.*

### McDANIEL CLASS B TRANSFORMER

AN interesting small type of driver transformer has been received from Messrs. McDaniel and Co. of Romford. This is of the unshrouded type, having a core clamped in a metal skeleton casing, and the windings are only protected by Empire Tape. A small paxolin square is eyeletted to the top and carries the terminals. These are rather on the small side, but as the whole component is so small no exception can be taken to this as it enables the transformer to be incorporated in an existing receiver with ease. The primary winding has a D.C. resistance of approximately 500 ohms, and the total resistance of the secondary is also in this neighbourhood. The ratio is therefore 1 : 1, and it is thus suitable for the Cossor 240.B valve. As this is the only Class B valve at present available (other than the 362 valve which possesses similar characteristics) it is quite suitable for present-day requirements. The price is 8s. 6d., and it therefore compares favourably with other driver transformers at present on the market.

*McDaniel Class B Driver Transformer.*

## IRON CORE TUNING COILS

(*Continued from page 252.*)

In the writer's built-up torroid system, matching is effected by slight displacement of one of the members, so that the mutual inductance is varied by an appreciable amount, while gap leakage is also affected, so that in this way matching becomes extremely easy. When a bobbin wound on a shell core is used, the inductance is usually matched by varying the air gap.

There is one fundamental difference between a coil wound on an ordinary laminated core working at audio frequencies, and one wound on a dust core. If we place two coils on a closed ring core, the coupling is substantially the same irrespective of the distance between the coils. In the case of a dust core, this is not the case, and the side limbs of a shell core are only partially effective. Accordingly, from the point of view of economy in design, it appears to be best to concentrate as much core into the actual field as possible, and it is for this reason that the torroid appears to be most popular. The leakage is also probably smaller.

The fact that a dust core coil has a magnetically closed core means that the stray field or leakage is quite small. This is another point in favour of the dust core coil, because it enables a screen to be placed very close to it without introducing any appreciable losses, and much space is thereby saved.

In conclusion mention must be made of two factors which are probably of more interest to designers than users. As there is a mass of metal inside the core, the coil and the core act as two elements forming a condenser, and the self-capacity of a coil of this type tends to become greater than that of an air coil with a corresponding inductance. It is necessary, therefore, to space the turns reasonably well away from the core, as otherwise the self-capacity becomes too high, and this in turn tends to reduce the tuning range.

Another interesting point is that the inductance varies appreciably with frequency. This is due to the permeability changing slightly with frequency, and it has already been pointed out that change in permeability produces a corresponding change in inductance. By suitable design, however, it is possible to produce an extremely efficient coil which will tune over the usual broadcast wavelengths. The coil can be made extremely small, and it can be fitted with an equally small screen. The resulting coil has an efficiency of the same order as that of a large coil wound with heavy Litz wire. Probably only those who have conducted research on dust core materials have any real appreciation of the tremendous possibilities. It is interesting to see, however, that already iron core coils are appearing on the British radio market.

# OUR SHORT WAVE SECTION

## IDENTIFYING THE SHORT-WAVE TELEPHONY STATIONS

**In this Article the Writer explains how Short-Wave Commercial and Ship to Shore Telephony Stations can easily be identified**

By ALF. W. MANN

THERE is unfortunately a mistaken impression amongst those with but a vague idea on short-wave matters, that the only transmissions, apart from amateur telephony and code stations, are confined to broadcasting. The number of commercial stations which it is possible to receive during the day is a little surprising to the new hand. Owing to the many different languages used, identification is difficult, and, in addition to this, information and data concerning these stations are very difficult to obtain. The purpose of this article is to assist readers who are short-wave listeners to identify a number of commercial stations now on the air.

A number of foreign commercial telephony organizations welcome reports upon the reception of their transmissions, but so far as the writer is aware, British transmitters neither ask for nor desire them, and readers are warned that there is a clause printed on their receiving licence concerning the unintentional reception of transmissions not intended for general reception. The regulations relative to this matter should be rigidly adhered to in every detail. When searching for S.W. broadcast transmissions, one cannot avoid tuning in those transmissions, and whilst the matter heard is of little, if any, interest, good use can be made of them if identification is at all possible.

As an example, let us take Station WOO, of Deal, U.S.A. This transmits on a wavelength of 17.52 metres, and other wavelengths. The writer assumes that the majority of short-wave enthusiasts have an approximate idea as to the tuning range of their coils, and in his case receives 17.52 metres at about 20° on the dial, using a four-turn aerial coil, with a tuning range of 16 to 29 metres. Well, there at least is one calibration point at the bottom of the dial, and the entry in the log is WOO—20° 17.52 metres. As WOO uses crystal control of wave-length or frequency, and the majority of commercial transmitters use identical apparatus or Marconi Franklin drive, the listener's data will be very accurate. Further explanation is unnecessary, and I intend to comment in the following paragraphs upon commercial transmitters located in South America, U.S.A., France, Germany, Java, and various other countries, and also to give details and data concerning the ship-to-shore telephony services.

### Argentina

Station LSM, 14.19 metres, Buenos Aires, South America. This station works with a number of European stations irregularly, and will be heard at intervals just before noon and sometimes during early morning.

The call letters in Spanish are as follows: L—ai'ley. S—ai'sey. M—ai'mey.

Another station of the South American group is LSG, which has been heard transmitting on 15.07 metres. This wavelength, however, is sometimes used by station LSY. A definite schedule seems to be the rule, and these stations should be received from 3 p.m. daily, according to the amount of traffic to be dealt with.

The call by which this transmission may be recognized is phonetically:—

Hillo Parie (Hello Paris)

the station with which telephony is worked being Ste. Assise, which is located near Paris.

### France

The French transmitter located at St. Assise, FTM, will often be heard on 15.5 metres from 3 p.m. onwards, calling LSG Buenos Aires; the latter, replying on 15 metres:—

ai'ley tay ai'sey,

### Java

Station PLE, which is the better known of the Java group, still continues commercial telephony transmissions, although the famous Tuesday afternoon broadcasts have been long discontinued. The wavelength used by PLE is 15.93 metres, and is sometimes heard working PCK Holland around about 11 a.m. one or two mornings during the week. Another station working PCK is PMB on 14.55 metres.

### Rio de Janeiro

A correspondent informs me that he has heard several commercial 'phones, the transmitters of which are located in Rio de Janeiro, PSK on 36.6 metres, and PSH on 29.35 metres, which, I understand, work with LSN, the latter being on 14.27 metres, according to my log.

### Australia

Station VK2ME is well known to old hands, and is one of the Amalgamated Wireless group located in Sydney, N.S.W., Australia. This station carries out telephony with Java and England and, at intervals, certain American stations; the wavelengths used being 15.5 metres, 28.5 metres, 30.75 metres, 37.7 metres. On the 28.5 metres wavelength, VK2ME may sometimes be heard calling GBX; the latter transmits on 27.5 metres.

### Ship to Shore Telephony

The wavelengths assigned to ship and shore telephony are 17.05 metres, 22.68 metres, 33.95 metres, and 71.82 metres. The number of ships fitted with telephony apparatus is steadily increasing, and among those to be heard at intervals are the:—

s.s. *Majestic* (call G.F.W.V.),
s.s. *Olympic* (call G.L.S.Q.),
s.s. *Leviathan* (call W.S.B.N.),
s.s. *Empress of Britain* (call G.M.B.J.),
s.s. *Belgenland* (call G.L.J.Q.).

## OUR SHORT WAVE SECTION

*(Continued from previous page.)*

The following land stations carry on telephony with the aforementioned and other stations: GBA—14.7 metres; the American WOO, which was incidentally one of the first to work this service, transmits on a number of different wavelengths, one being 17.52 metres. GBB and GBC used to work ships, but the former station is most frequently heard calling SUZ, Cairo, the Egyptian commercial telephony station. GBC has been heard on a wavelength of 22.06 metres.

CGA—62.70 metres, was the Canadian station of Drummondville, which worked with ships at intervals, but has not been heard recently.

### German Ships

A number of German liners are now fitted with wireless telephony apparatus, three of the most famous being:—

s.s. *Berlin* (D.D.B.R.),
s.s. *Albert Ballin* (D.D.N.Y.),
s.s. *Europa* (D.D.A.C.),

and may be heard on the usual ship wavelengths.

### Italian Ships

It is reported that a number of Italian ships are to be heard testing on ship to shore telephony. The writer, however, has only heard the s.s. *Conte Rossa*, whilst in some foreign dock with an almost unpronounceable name. The wavelength used was approximately 16.5 metres, and the station calling, Coltano, in Tuscany, Italy. The *Conte Rossa* later changed over to 17.18 metres.

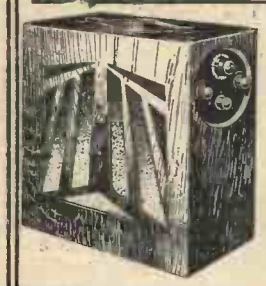
Coltano is the Italian naval short-wave transmitting station, and it is claimed that communication with any Italian ship at sea will soon be possible.

A lady correspondent in Ceylon informs me that the *Conte Rossa* was in Colombo harbour some months ago, and the music provided by the ship's orchestra was broadcast by the Colombo medium-wave broadcasting station. As this, and a number of other ships, cruise around the world at intervals, during which telephony tests are carried out, the owner of the most humble receiver may get a surprise as to the reaching-out propensities of his receiver, if fortunate enough to tune in these ship transmissions.

# PRACTICAL WIRELESS POSTAL RADIO BARGAINS

## SAVE MONEY...ORDER DIRECT ORDER WITH CONFIDENCE.

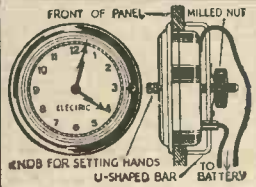
## UNIQUE PORTABLE BARGAIN



**LISSEN 2v. Pentode TRANSPORTABLE**

This famous Lissen 2-valve Pentode portable is complete with Lissen 120v. H.T. Battery, Lissen 9v. G.B. Battery, Lissen 2v. Accumulator and Lissen valves; incorporates balanced armature speaker. Indeal Portable for holidays, in the car, or on picnic. Special purchase enables us to offer them at this remarkable price. Stocks limited; get yours to-day.

**PEARL & PEARL** £2-19-6 Carr. Paid.
190, BISHOPSGATE, LONDON, E.C.2




## FIT THIS 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 G.B. battery without affecting reception. Uses practically no current. Fits into hole 3⅛in. dia. in any panel up to ¼in. thick. Easy to fix—no screws required. Only ⅛in. from front of panel to back of case. Swiss movement. Hands set from front. Nickel-plated bezel. Useful addition to any set.

**12/6** COMPLETE WITH BATTERY
POSTAGE 6D

**RIVERSIDE MFG. Co., Ltd.,** Dept. 21, Crisp Road, Hammersmith, W.6. Telephone: Riverside 6392.

## AMPLION

### LOUDSPEAKERS AT BARGAIN PRICES

| | | |
|---|---|---|
| A.C.6. | 25/- Oak Cabinet Speaker | 12/11 |
| A.B.4. | 59/6 Walnut Cabinet Speaker | 17/6 |
| A.B.6. | 90/- Walnut Cabinet Speaker | 25/- |

### MORE SPEAKER BARGAINS for "Practical Wireless" Readers

| | |
|---|---|
| G.E.C. 50/- "Stork" Oak Cabinet Speaker | 19/6 |
| Lamplugh "Silver Ghost" 42/- Permanent Magnet Moving coil Speaker | 29/6 |
| Lamplugh 34/- D.C. Moving Coil Speaker | 15/- |
| Lamplugh 34/- A.C. Moving Coil Speaker (using pot as choke) | 15/- |
| Celestion 27/6 M12 unit and chassis | 11/9 |
| Lincoln-Stewart 47/6 Permanent Magnet Moving Coil Speaker | 16/11 |
| Lissen Horn Units | 2/6 |

*Cash or C.O.D. Carriage Paid.*

## DO IT AT HOME and SAVE £ £ £

**1/6** Per Tube Post 3d.

Boot repairing with Rhino-Sole is simplicity itself; a plastic compound easily spread on with a knife, it can be moulded to any desired shape or thickness and hardens ready for wear in a few hours. "Rhino-Sole" repairs rubber as well as leather footwear and is ideal for worn tennis shoes, gum boots, goloshes, crepe and uskhide. Every tube is guaranteed and contains enough Rhino-Sole for 2 good soles and dozens of patches. Send P.O. for 1s. 9d. to

**STEVENSON'S (Dept. P.), 144, Greenway Avenue, WALTHAMSTOW, LONDON, E. 17.**

**Trade Enquiries to 172, Fleet Street, E.C.4.**

## 60 Volt BATTERIES FOR 2/3

We will tell you how you can make your own wireless Batteries by a simplified patented process at an average cost of 2/3 for 60 volts.

You can make them for yourself and save money and sell them to your friends and make money. Many intelligent men and women are doing this. One man made £960 in spare time only. Send to-day for definite proof of money earned and free details how to start to:

**England-Richards Co., Ltd., Dept. (246), King's Lynn, Norfolk.**

Famous Maker's Offer?

**£5 Radio-Gram CABINET for 65/-**

**SEVEN DAYS' FREE TRIAL (OR 10/- MONTHLY)**

Polished Oak and Piano built! The acoustic Tone brings a fine thrill. Makers to *Radio-Press, B.B.C.*, 3,000 *clientele.* MODELS FROM 35/- to £15. *Photographs and List FREE.*

"D" £6-15-0

**PICKETTS** Piano-Tone Cabinets, (P.R.), Albion Road, Bexleyheath

FOR **DE-LUXE** RADIO-GRAMS

## PICKETTS CABINETS

*Recommended for Best Results!*

*All Advertisements for*

## PRACTICAL WIRELESS POSTAL RADIO BARGAINS PAGE

*should be addressed to*

**The Advertisement Manager, PRACTICAL WIRELESS**
**8-11, Southampton St., Strand, W.C.2.**

## GUARANTEED COMPONENT AND RECEIVER BARGAINS

Regentone 2-valve A.C. Receiver with Mullard valves. Original price £6 15 0. Special bargain offer **59/6**

Regentone 3-valve A.C. Receiver with Mullard valves and Moving Coil Speaker. Original price £12 0 0. Bargain price **£6 19 6**

The famous Pye "Q" Portable, complete with batteries, accumulators, etc., as delivered from the manufacturers. Original price £14 14 0. Bargain price **£9 9 0**

Three-gang screened condensers (made for Zetavox Receivers. Guaranteed accurately matched. With trimmers **8/6**

Four-gang condensers, as above **12/6**

For callers only at any branch—Hundreds M.P.A. assorted cabinets from **2/6**

*Many other radio bargains for personal callers at any of the branches given below.*

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

*Branches:*
11, Liverpool St., E.C.2. 100/101, Houndsditch, E.C.2. 276, Pentonville Road, King's Cross.

SOUTHERN RADIO Wireless Bargains; Ready Radio constructors' kits: 303 3-valve battery kit, less valves, 18/6, with 3 Mullard valves (P.M.1LF., P.M.2D.X., P.M.2), 36/- each (list 70/-); Meteor S.G. 3-valve kit, less valves, 26/-, with 3 Mullard valves (P.M.12a, P.M.2DX., P.M.2), 49/- each (list £5/7/6); Meteor S.G. 3-valve "A" kit, including cabinet, Celestion P.M. speaker, and kit of parts, less valves, £3/7/6, with 3 valves as above, £4/12/6 (list £8/17/6): Mullard Radio for Million 3-valve A.C. kits, complete, with 3 Mullard valves (P.E.N. 4v., 354v., 84v.), £3/12/6 (list £6/10). All kits advertised are brand new, and contained in original sealed cartons; valves advertised are the manufacturers' specified valves.

CELESTION P.M. Soundex Speakers, brand new, 16/- each (list 27/6); Cyldon 3-gang condensers, 0.0005, shrouded and trimmers, 8/9 each (list 32/-); genuine Amplion loud speaker units, 2/9 each (list 12/6); screened chokes (H.M.V.), 1/- each; condensers: 4 mfd., 2/6 each; 2 mfd., 1/9; 1 mfd., 1/- each, all 750 volt test; blocks, 12 mfd. (2+2+2+2+2+1+1), 6/9 each; 10 mfd. (2+2+2+2+1+1), 6/3 each; all 1,500 volt test; mains transformers, all capacities, in stock, and specials quoted for; all goods guaranteed. Carriage paid.—Southern Radio, 323, Euston Rd., London, N.W.1 (near Warren St. Tube). 'Phone: Museum 6324.

*Long Distance Wireless Secrets*

A book every listener has been waiting for. This practical work will solve your difficulties and enable you to obtain the best results of which your set is capable.

## FINDING FOREIGN STATIONS

**By R. W. HALLOWS**

**3/6**

*Obtainable at all Booksellers, or by post 3/9 from George Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2*

# Practical Letters from Readers.

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

### A Magnificent Volume

SIR,—I have just received my presentation copy of the Wireless Constructor's Encyclopædia, and I must express my surprise at such a magnificent volume. It makes a worthy companion to PRACTICAL WIRELESS, and I thank you for both. The binding is excellent, and it would be cheap at double the price. The matter in it is written in a style easy for the veriest novice to understand and yet even the oldest "fan" could not find fault with it. Your articles are, above all, practical, which is what we amateurs want. —R. G. VALE (Stroud).

### Pigtail Connections to Condenser Spindles

SIR,—I would like to make some comments with reference to the Short-wave article in the March 25th issue of PRACTICAL WIRELESS.

Your contributor, "Togni," states that a pigtail connection to the spindle of a variable condenser is sufficient to eliminate noise caused by imperfect or intermittent contact between spindle and bush.

The usual form of pigtail, the spiral, possesses inductance of no mean value, and an intermittent contact between spindle and bush causes the inductance of the circuit as a whole to vary, thus causing almost as much noise as when without pigtail.

Also, there is no pigtail fitted to the front bush of the average condenser, and as the difference of potential must be considerable between front and rear plates, the rubbing contact evil is still present.

To overcome these difficulties, I have constructed a condenser with skeleton ebonite end plates and no metal bushes. The pigtail connection is a strip of phosphor bronze, allowed to twist throughout its length, which is only one inch. The result is a condenser which is silent even below 10 metres.

The noise from a potentiometer can be eliminated by the simple method of not using one. I am working with a 2 meg grid-leak and 90 volts H.T., I get smooth reaction control with the grid leak connected direct to positive filament, and find a potentiometer unnecessary. This also applies to wavelengths below 10 metres. Noises from a swinging aerial, intermittent earthing of stay wires, etc., can be subdued by using an untuned screen-grid valve in the aerial circuit.

In conclusion, I should like to state that I am desirous of getting into touch with S.W. experimenters in the Stretford district. Wishing your paper every success. —W. FAULKNER (Stretford).

### Article on Televisor Construction Wanted

SIR,—I should be glad if you would publish instructions on building the parts and constructing a home-made Televisor, if possible. As far as I can see they are fairly expensive, and for all the use one would make of them it does not seem worth while to go to so much expense.—J. SWAN (Cambuslang).

[*We hope to shortly publish an article on this subject.*—ED.]

### An Appreciation : and a Criticism

SIR,—I beg to acknowledge safe receipt of the "Wireless Constructor's Encyclopædia," for which I thank you very much indeed. It is splendid value for the money, and contains really useful and practical matter of the utmost assistance to the novice and the veteran of wireless construction. Particularly interesting is the section devoted to television, enabling even the most ignorant person to grasp the fundamentals of this newest of sciences. I am also the possessor of the PRACTICAL WIRELESS binding case for data sheets, and I was absolutely surprised at its solid construction and workmanship. There is only one fault I can find with it, and that is in the method of securing the sheets. As the binder is made at present, with the press buttons on top, you either must wait until the series of data sheets is complete before fixing them, or you must take them off each week to put on the next one. If the press buttons had been placed at the bottom of the sheets, each one could be put on without disturbing the others. Still, we can't have everything to suit us always, but PRACTICAL WIRELESS is the nearest approach to that, so best wishes for the future.—CHARLES MORTIMER (Jnr.) (St. Pancras, London, N.W.).

CUT THIS OUT EACH WEEK

## DO YOU KNOW?

—THAT although a small condenser will often suffice in a decoupling circuit, the smallest that should be used, in the interests of stability, is .1 mfd.

—THAT dual matched loud-speakers present a great advance in reproduction, and correctly used are capable of practically "perfect" reproduction.

—THAT it is not practicable to build up, at home, a matched pair of moving-coil loud-speakers.

—THAT a tone-control circuit is often advisable with a Class B output stage, although the loud-speaker will decide the necessity of this.

—THAT a swaying aerial may prevent the reception of a station working on the short waves.

—THAT for the above reason, a short-wave aerial and lead-in should be anchored to insulators so that it cannot move in any direction.

—THAT a special form of valve has now been developed to enable an ordinary battery eliminator to be used with Q.P.-P. and Class B output stages.

—THAT it is a Neon device and is to be known as a "Stabiliser."

### NOTICE

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed : The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd.,* 8-11, *Southampton Street, Strand, W.C.2.*

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

### An Excellent Work

SIR,—I wish to acknowledge receipt of your book the "Wireless Encyclopædia," which is an excellent work, and most useful to anyone interested in wireless. It is a veritable mine of information, and right up-to-date with illustrations helping to make everything easy and clear. It exceeds all my expectations, and I can honestly recommend it to anyone desiring to know more about their sets, accumulators or anything connected with wireless. With PRACTICAL WIRELESS to keep us up to date with the latest improvements, and your Encyclopædia to refer to, there is little more that a wireless fan wants. Accept my best thanks for the book, wishing PRACTICAL WIRELESS every success in the future.—JAMES WM. CARROLL (Hull).

### Wonderful Example of High-class Craftsmanship

SIR,—Thank you for my presentation volume which I received in good condition. I find it a most useful work of reference, and indispensable to a budding amateur like myself. The interesting manner in which the subjects are dealt with is splendid, and easily understandable, as is also the alphabetical order in which the articles are written, thus obviating the trouble of wearisome searching through indexes, which more often than not prove fruitless. The articles are very useful and practical, and the binding and printing are first rate. The whole volume is a wonderful example of high-class craftsmanship in every sense of the word.

As for PRACTICAL WIRELESS, it needs no suggestions from me but this: keep it Practical. Thank you again for the "Wireless Constructor's Encyclopædia" and wishing PRACTICAL WIRELESS every success.—ERNEST L. BEAMER (Liverpool).

### "An Invaluable Work"

SIR,—I have just received my copy of your "Wireless Encyclopædia," and herewith tender my very best thanks. Its store of clear and concise information will stand me in good stead and I am exceedingly glad I have not missed your second chance to acquire this invaluable work. Wishing PRACTICAL WIRELESS every success.—W. E. R. (Guildford).

### "A Fine Work"

SIR,—I feel I must write and congratulate you on offering such a fine work as the "Wireless Encyclopædia" to the public. Everything in it is explained in an interesting fashion, and the diagrams help one considerably to understand thoroughly each detail. The work is excellently bound and printed on good paper. Like PRACTICAL WIRELESS, it is first class. Thanking you again, with best wishes for the future of PRACTICAL WIRELESS.—R. W. ARTINGSTALL (Stalybridge).

(*Continued overleaf.*)

*(Continued from previous page.)*

### The "Sonotone": Remarkable Results

SIR,—I wish to congratulate you on your fine radio weekly, PRACTICAL WIRELESS. Also let me convey my thanks for your "Encyclopædia," which is full of good things. It might interest you to know that I have built the "Sonotone 4" with Q.P.-P. using the "Transfeeda" in the first stage followed by the Q.P.-P. I have tried the set as per your circuit with wonderful results, but I am always after that little extra which seems impossible with an ordinary battery circuit. Anyway, here's the result of my experiment. Volume: enough for a dance hall; quality: perfect; stations: 84 medium-wave, 19 long-wave and 7 American. I must thank you for the most wonderful set I have built in my fifteen years as a radio engineer.—G. A. H. (Edgbaston).

## THE COSSOR NEON STABILISER

WHEN a battery eliminator is used to operate a receiver employing either a Q.P.-P. stage or a Class B valve, the varying current of the output valves gives rise to some peculiar effects. First of all, the majority of small mains units employ a series resistance in the H.T. positive lead to reduce the mains voltage to that normally required by battery valves, namely 150 volts maximum. In the case of a D.C. mains unit this will be quite a large value of resistance, and in the A.C. units the rectifier, whether valve or metal, will be arranged to give the output with a small series resistance to drop the excess voltage. Now it is well known that the passage of a current through a resistance results in a voltage drop, and the voltage depends upon the current which is passed. For instance, the passage of 1 milliamp through a resistance of 10,000 ohms will result in a voltage drop of 10 volts, whilst 10 milliamps flowing through the same resistance will result in a drop of 100 volts. (Voltage equals the product of current in amps. and resistance in ohms). A feature of the Q.P.-P. or Class B output stage is that the anode current varies with the volume of the signal received, and a meter inserted in the anode circuit of such a stage will show variations throughout the playing of a single musical item, and will also show that when the volume of a received station is reduced, so is the current reduced, but varying volume due to the number of instruments which are being played, or the musical expression, will also result in a varying anode current. Obviously, therefore, if a mains unit is employed, the varying current through the unit will result in a varying voltage output.

### The Stabiliser

This fault results in serious distortion due to a varying voltage on the output valve, a varying voltage on the detector and S.G. valves in the receiver, and this latter fact may cause serious instability due to oscillation. In order to overcome these defects Messrs. Cossor have produced a device known as a Neon Stabiliser, which is a small neon discharge device having a cathode and an anode, and is fitted with a standard valve base. The peculiarity of this device is that it works in exactly the opposite way to the resistance in the mains unit, that is to say, as the current across the Stabiliser increases the voltage drop is less, and *vice versa*. Therefore, by connecting this device across the mains unit the total output remains sensibly constant. The Stabiliser, known as the S.130, costs 7s. 6d., and a further article describing its application will be published in a future issue of PRACTICAL WIRELESS.

# RADIO CLUBS & SOCIETIES

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

### NORTHERN MERSEY SIDE WIRELESS SOCIETY (SOUTHPORT)

A meeting has been arranged by this society to take place on Monday, May 8th, when rules, regulations and programme will be arranged. Applications for membership and admission to this meeting should be made, sending full details, to C. H. Turner, 62, Zetland Street, Southport, not later than Saturday, May 6th.

### DENNISTOUN TRAMWAY DEPOT RADIO CLUB

The first outing of above club took place on Wednesday, April 19th, 1933, when thirty members set off from club headquarters by reserved bus to inspect the Scottish Regional Broadcasting Station situated at Westerglen, near Falkirk. On arrival at the station the party was received by the Chief Engineer, who provided members with description cards showing layout of building, also data concerning apparatus about to be inspected.

A tour was then made of the entire station, the power house, Diesel engines, filament current and high-tension motor generators, transmitter hall control rooms, and aerial masts being explained in detail by engineers conducting party round. The visit, which was of an hour's duration, was highly appreciated by those privileged to take part in proceedings. Hon. Sec., Wm. McKenna, 90, Paton St., Glasgow, E.1.

### SLADE RADIO

A lecture, entitled "Measurements of Characteristics of Low-frequency Amplifiers," was given by Mr. D. McDonald at the meeting of the above society held recently. He dealt with wave forms and breaking up into sine waves; also intensity of sound. After drawing the circuit of a simple two-stage amplifier, he described how to measure the frequency response and how to make a thermionic voltmeter. A method of measuring the response of an intervalve transformer without a valve was also shown. Overload or distortion was then dealt with, also load and harmonics and how to measure them from the output. The lecture proved of great interest and was enjoyed by the members. Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

### INTERNATIONAL SHORT-WAVE CLUB

I shall be glad to send any of your interested readers a copy of our "New World Time Chart" if they will apply to the address given below, *enclosing a 1½d. stamp*. A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

### HACKNEY RADIO AND PHYSICAL SOCIETY

Our last two meetings have been confined to discussing the design of a new receiver for the use of the members of this society and to the installation of a microphone. From these discussions a most satisfactory design has been evolved.

An interesting programme, copy of which is appended has been arranged for the ensuing weeks. Local readers of PRACTICAL WIRELESS are invited to inquire for particulars of these meetings.

| | | |
|---|---|---|
| May | 8. | Wood Finishes for the Amateur. |
| ,, | 15. | Gramophone Recital—Mr. Squire and Mr. Heath. |
| ,, | 22. | Modern Super Het design—Mr. A. Twiss. |
| ,, | 29. | Valve Characteristics—Mr. G. Deal. |
| June | 5. | Whitsun. |
| ,, | 12. | Quiescent Push-pull, Class B, and other forms of Amplification—Mr. A. Twiss. |
| ,, | 19. | Adding a S.G. Valve to D. and one L.F. Receiver—Mr. Cole. |
| ,, | 26. | Remote Control—Mr. Cole. |
| July | 3. | Simple Calculations and Measurements—Mr. Cole. |
| ,, | 10. | The Use of Chokes. |
| ,, | 17. | Universal High Voltage Mains Valves—Mr. A. Twiss. |

A. F. Rogerson, Hon. Secretary, 19, Sewdley Street, Clapton, E.5.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

# REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

## SPECIAL NOTE

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

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

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

### MATCHING LOUD-SPEAKER

**"I have got an old moving-coil loud-speaker which I have pulled to pieces and rebuilt. The speech coil I have wound to a resistance of 10 ohms, and it has no method of arranging a transformer. I know it will want matching to my ouput valve to get the best from it, but I am not certain what transformer to get. How can I find exactly what my valve requires to get correct matching?"—(T. P., Hampstead.)**

You do not tell us what valve you are using, so you will have to work out for yourself the correct ratio of the transformer. The first thing to know is the correct (or optimum) load of the particular output valve. If this is not available, you must find from Data Sheet No. 10 the A.C. impedance of the valve, and multiply this by two. The answer will be the optimum load, unless you are using a pentode, when it will be slightly greater than twice the A.C. impedance. You must then divide this figure by the resistance of your speech coil (10 ohms), and the square root of the answer will be the ratio of the correct transformer.

### ELIMINATOR TO BLAME

**"I have a four-valve receiver, S.G. detector, H.L. and P. The set was working well with a battery, but now I am using an eliminator and I find that the set is less selective, and there is a hum and crackling when I tune in North Regional or some foreign station. There is a small howling also when the dial readings are 130. Can you help me to set these right? I took out the valves and have put them back in the order I have stated. Should the H.L. be next to the screen grid?"—(T. H. M., Hampstead.)**

Obviously, if the receiver worked satisfactorily from batteries, the mains unit is causing your trouble. The lack of selectivity may be caused by an increased H.T. voltage on your S.G. valve. Check the output from the eliminator and compare with your battery supply. Hum and crackling may be due to a faulty resistance or an overloaded eliminator, although if only occurring at one point on the dial it may be due to the condenser plates touching, or some etheric disturbance on that wavelength. The order of your valves is quite O.K., although you will probably find that the detector valve and the H.L. valve are interchangeable.

### OVERLOADED OUTPUT STAGE

**"I have a three-valve-set. It was first of all made as a two-valve set, bringing in Daventry and Radio-Paris on the long waves, together with a few short-wave stations very well. I decided to add another valve, but the results are far from satisfactory. The National is not so loud or clear, and the tone in general is absolutely dead, with fearful oscillation. The new valve is resistance-fed. I should be very much obliged if you could help me."—(R. T., Hazeldene, Churt.)**

The trouble may be due simply to the fact that your output valve is not of the type which will handle the output from the two preceding valves. An overloaded output valve often gives weak signals accompanied by distortion. On the other hand, the choice of your anode resistance for the R.C. stage may be wrong, and you may be using a value so high that the valve is receiving only a few volts H.T., giving rise to distortion and weak signals in that stage. You should therefore check over all the values in this stage and make quite certain that the valve is receiving ample H.T.—not less than 80 volts should be applied to the anode, as it is an L.F. stage. The oscillation is no doubt L.F. trouble, and may be cured by decoupling the additional stage which you have added. The extra resistance required for the decoupler will result in a further drop in H.T., so that a very much larger H.T. battery may be needed.

### Q.P.-P. OR CLASS B?

**"Can the Q.P.-P. amplifier in issue of March 4th be used with a battery set known as the Screen Grid Four? I use a permanent magnet moving-coil speaker. If the Q.P.-P. is unsuitable for the above set, can you suggest anything to strengthen weak signals?"—(H. G., South Africa.)**

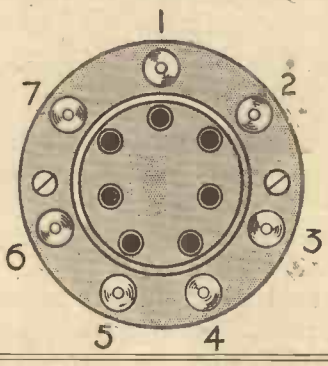
We would recommend Class B as an addition to your set in place of the Q.P.-P. amplifier. Make up the Class B unit described in the issue dated April 8th, and couple this direct to your output terminals. You will find this will give a very great increase in signal strength, and will also "steady" your output. To avoid overloading you should fit some form of volume control in the first L.F. stage, and this will depend on the method of coupling you are employing in that stage. If resistance-coupled, a variable grid leak will be sufficient, and if transformer-coupled, a potentiometer should be joined across the secondary winding of the transformer. The value should be chosen according to the particular make of transformer, and the maker's instructions should be followed in this respect.

## DATA SHEET No. 33

*Cut this out each week and paste it in a notebook.*

### SEVEN-PIN VALVEHOLDER CONNECTIONS

| Type of Valve | Numbering on holder. 1 | 2 | 3 | 4 | 5 | 6 | 7 | Terminal on valve top. |
|---|---|---|---|---|---|---|---|---|
| Class B | G2 | G1 | A1 | F | F | — | A2 | — |
| Single Diode Tetrode (Indirectly Heated) | — | G1 | G2 | H | H | C | D | A |
| Double Diode Tetrode (Indirectly Heated) | D1 | G1 | D2 | H | H | C | G2 | A |
| Low-Frequency Pentode (Indirectly Heated) | — | G1 | G2 | H | H | C | A | — |




### ONE OR MORE SPEAKERS?

**"I should very much like to know if I am using more from my batteries through having two or three loud-speakers in action."—(No name, Southampton.)**

This is a common worry to many who are new to wireless, and is also on the same lines as the theory that the reception of distant stations leads to greater wear and tear on the batteries. The factor which governs the consumption from the batteries is the valves which are used, and therefore twenty loud-speakers could be used with no more consumption of H.T. or L.T. Naturally, if the loud-speakers are all connected in series in the anode circuit of the output valve there would be a large voltage drop, and this would have to be made good by using a larger battery, but the current consumption would remain unchanged.

### HETERODYNE WHISTLE

**"When I tune to the North Regional station I get a horrible whistle with the signals, and if I slightly tune below that station I can hear a sort of bubbling sound with voices. What is the cause of this, and how can I remove it? It completely spoils my reception of this station, and I find much from the station to interest me in place of the London transmissions."—(R. H., Wembley.)**

The noise you hear is due to the close proximity of the German transmitter at Langenberg, and the Russian transmitter at Ivanono-Voznesenk. The latter uses the same wavelength as the North Regional, and Langenburg is only 10 kc/s above it. The result is what is known as "side-band splash," and unfortunately there is no cure. You can cut off the top notes of the response of your receiver, and this will remove the whistle, but there will still be the cross-talk effect, and until the ether is cleared up by those responsible we are, unfortunately, compelled to put up with this trouble. There are one or two other spots on the tuning dial where the same thing occurs, and no matter how good the receiver the trouble is always present.

### GANGING A CONDENSER

**"I am going to rebuild my set, using a three-gang coil unit, and to get one-knob control I am thinking of using my old three condensers and joining up the spindles. Will this work out in practice, or is there any snag which I must guard against? I appreciate that the three condensers will have to be ganged, but I could make up a simple coupling device and arrange for this to be locked at any position. I can work out the details, as I have a lathe and am an engineer by profession."—(R. J., Edinburgh.)**

There is nothing to stop you from making a ganging device and connecting the three condensers together. Neither is there anything to prevent you from ganging these three condensers at any part of the scale by arranging for your device to be clamped in any position. But the point which must be guarded against is the *matching* of all three condensers at all parts of the dial. You will find this is a difficult proposition, and is overcome in the commercial three-gang condenser by splitting the end plate of each section of the condenser and then rotating the rotors whilst tuning a circuit. By means of a special oscillator it is possible to ascertain when any one section goes out of tune, and the split section of the condenser out of tune is then bent until it is matched. In this way it is possible to have all three condensers dead in step at any point, and you will find this a little difficult to do at home without elaborate apparatus. If you can arrange three small trimmers capable of panel adjustment, your idea is workable, but you will find that the trimmers will require frequent adjustment when tuning from zero to maximum on your tuning dial.

**FREE ADVICE BUREAU**

**COUPON**

This coupon is available until May 13th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 6/5/33.

# CATALOGUES RECEIVED

*To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.*

**MAZDA VALVES**

WHEN choosing or using a valve it is essential to know all the finer points in the characteristics of that valve, and although the majority of manufacturers supply a printed slip with the carton, this generally restricts itself to the principal working voltages. The Mazda valve catalogue contains, in addition to the standard valve curves and operating data for each of the valves included in their extensive range, circuit diagrams for several receivers, with complete values for all components employed; notes on the use of D.C. mains valves; and a complete tabulated Index to the complete range. Readers who would like a copy of this book should write to The Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.

## Broadcast Query Corner

UNDER the above title, with the assistance of a recognized authority on foreign broadcasting matters and a regular contributor to wireless publications both at home and abroad, we have inaugurated a special Identification Service, which should prove of great assistance to our readers. When tuning in well-known stations it happens frequently that listeners pick up wireless transmissions of which they fail to recognize the origin. It is to solve these little problems that the *Broadcast Query Service* has been organized.

### Replies to Broadcast Queries

T. T. A. (Newburgh): G5QX, J. N. Smith, 73, Oakland Avenue, Bloomfield, Belfast, N. Ireland; G6LS, regret, cannot trace: write to *Radio Society of Great Britain*, 53, *Victoria Street, S.W.1*; G5IA, G. M. Whiteley, "The Hollins," Sowerby Bridge, Yorkshire; G5JO, L. Jones, 50, King St., Cambridge; G2KM, C. Stainton, 37, New Bridge Rd., Hull, Yorkshire; G2BY, H. A. Whatley, "Lyndhurst," Great West Rd., Lampton, Hounslow, Middlesex; G6RG, B. Groom, 157, Wood St., Galashiels, Selkirkshire, Scotland; G2XY. H. T. Littlewood, 82, Stainburn Crescent, Chapel Allerton, Leeds, Yorks; G5RM, R. A. Minter, 60, High St., Bromley, Kent; G2BH, G. W. Wiggleworth, 90, Blenheim Rd., Barnsley Yorks; G2LP, A. W. Knight, 32, St. Mary's Rd., Peckham, S.E.15, London; G2GF, P. E. A. Griffiths, 12, Glencoe Mansions, Chapel St., Brixton, S.W.9, London. SPARKS (Belfast): DDNY, Germany. Call incorrect, but if *initials* correct, Germany; GBC, Rugby; BSA, probably GSA, London Terminal (Rugby-Canada); G6UH, H. E. Smith, "Arawa," Granville Road, Limpsfield, Surrey; G6XR, G6HN, G5RD, G5NO—regret, cannot trace; write to the *Radio Society of Great Britain*, 53, *Victoria Street, S.W.1*; G6XM, W. James, 28, Grant Square, North Camp, Aldershot; G15QX, N. J. Smith, 73, Oakland Avenue, Bloomfield, Belfast. HOPEFUL (N.W.11): (1) Moscow on 1,000 m.; extra late news; (2) Leningrad. J. QUINN (Swinton): Can probably be ordered through any music dealer. ELJAIESSE (Bedminster): F8AJ, Aymon Claudet, Rue Georges Sand, Vierson (Cher); F8SO, F8WAZ, cannot trace; write to *Réseau des Emetteurs Français*, 17, rue Mayet, Paris, VIe; G6YA, A. H. Radford, 42, Wrington Crescent, Bedminster, Bristol; G2FC, cannot trace; write to *Radio Society of Great Britain*, 53, *Victoria St., S.W.1*; OXZ, Skamlebaek, Denmark; FTZ, Ste. Assise, France; FYQ, Lyons (France); FLE, Eiffel Tower, Paris; G5CP, regret, cannot trace.

## MAINS TRANSFORMER CONNECTIONS—*(Continued from page 253.)*

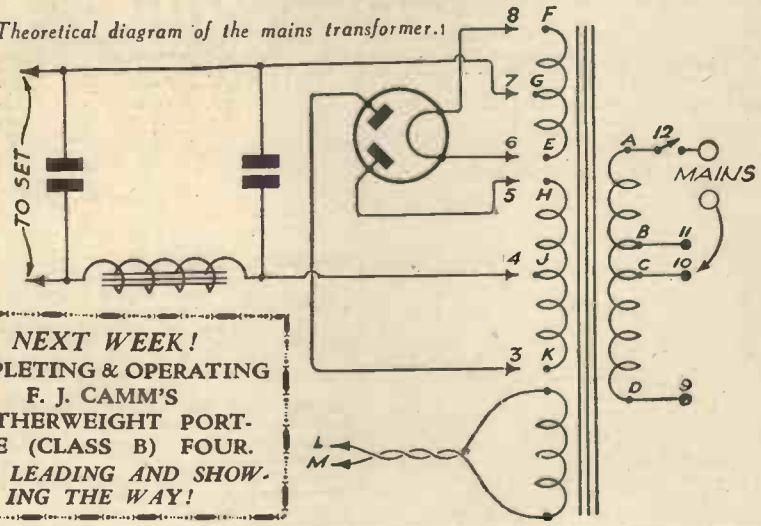
thus proving this to be the filament winding for the rectifier valve with centre tap at C.

The winding H, J, K lastly claimed my attention, and this proved, as it should have done, a high resistance winding with equal readings between H, J and J, K, giving me the centre tap at J.

As a further test before insertion in the set the mains were connected to the appropriate tapping on the primary and a 4-volt flash-lamp bulb was connected across L and M and it lit brightly. The bulb was then connected across E, G and then G, F, and it glowed with an equal intensity across each of these. As winding H, J, K was the only one left, it could be safely assumed to be correct.

All that remained to do then was to insert the transformer into the set and join the leads to their respective soldering tags.

*Fig. 4.—Theoretical diagram of the mains transformer.*




**NEXT WEEK!**
**COMPLETING & OPERATING F. J. CAMM'S FEATHERWEIGHT PORTABLE (CLASS B) FOUR.**
***STILL LEADING AND SHOWING THE WAY!***



# ADVERTISEMENT INDEX


| | Page |
|---|---|
| Amplion (1932), Ltd. | 279 |
| Bargain Page | 280 |
| Bennett College, Ltd. | 273 |
| Block Batteries, Ltd. | 273 |
| British Blue Spot Co., Ltd. | 275 |
| British Institute of Engineering Technology | 282 |
| British Rola Co., Ltd. | 270 |
| Bulgin, A. F. & Co., Ltd. | 277 and 279 |
| Cossor, A. C., Ltd. | 259 |
| Edison Swan Electric Co., Ltd. | *Inside Back Cover* |
| England-Richards Co., Ltd. | 280 |
| G.B. Pioneer Radio | 282 |
| Graham Farish, Ltd. | *Front Cover Strip* |
| Gramophone Co., The | 265 |
| Heayberd, F. C., & Co. | 282 |
| International Correspondence Schools | 278 |
| Lectro Linx, Ltd. | 279 |
| Lissen, Ltd. | *Inside Front Cover* |
| London Radio Supply Co. | 279 |
| Mason, E. C. | 279 |
| Mayfair Radio | 284 |
| New London Electron Works, Ltd. | 284 |
| Newnes' "Home Photographer" | 277 |
| Newnes' "Motor Cyclist" | 270 |
| Newnes' "Practical Electrical Engineer" | 282 |
| Pearl & Pearl, Ltd. | 280 |
| Peto Scott, Ltd. | 269 |
| Pickett Bros. | 280 |
| Radio Instruments, Ltd. | *Back Cover* |
| Reproducers & Amplifiers, Ltd. | *Inside Back Cover* |
| Rhino Sole | 280 |
| Riverside Mfg. Co., Ltd. | 280 |
| Siemens Electric Lamps & Supplies Ltd. | 270 |
| Southern Radio | 280 |
| Williams, T. | 284 |

**P. W. Gift Stamp No. 32**

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

**THE LEADING WIRELESS WEEKLY!**

# Practical Wireless

3D

*Published every Wednesday by*
GEORGE NEWNES LTD.
Vol. 2.——No. 34.
MAY 13th, 1933.
*Registered at the G.P.O. as a Newspaper*

## All About Outdoor Radio


# ROUND *the* WORLD *of* WIRELESS

### Chasing the Nightingale

THE annual B.B.C. hunt for the Nightingale will take place during the period May 22nd to 27th, in the intervals of the late dance music transmission, when an attempt will be made to relay his song for the benefit of listeners. The engineers consider theirs a thankless job as, although a microphone is placed near a bush which has been located for several nights as one of the bird's favourite spots, when the time comes for him to go on the air he either refuses to sing or it is discovered that he has flown elsewhere. However, stand by for the usual annual thrill, comparable only to the first call of the cuckoo in spring!

### Belgian Colonial Transmitter

THE Belgian Posts and Telegraphs have installed a short-wave transmitter, in the neighbourhood of Brussels, for the broadcast of news bulletins and wireless entertainments to the Congo. The station may be heard working in the early evening hours on 30 metres. The broadcasts are picked up at Leopoldville where, later, a station to work on a medium wavelength is to be installed.

### Germany's Listening Concessions

THE latest statistics show that the Reichsfunk has granted free licences to no less than 555,125 listeners who come under the heading of unemployed, blind or war invalids; these figures represent twelve per cent. of the total number of licences in force at that date, namely, 4,532,862.

### Spring-cleaning the Czech Rooster

LISTENERS may have noticed that the crowing of the cockerel, which opens the early morning Prague broadcasts, has lately taken on a more youthful tone. It is, in fact, a different bird. A record of the newcomer's greeting to the rising sun was recently made on a farm in the neighbourhood of the capital. Several competitors were tested until the engineers were satisfied that they had, at long last, discovered an ideal cock-crow for their purpose.

### The Dublin Relay Station

AS reception of the more powerful Athlone broadcasts in the environs of Dublin is not entirely satisfactory to the users of old crystal sets, the Free State authorities may shortly bring the old 1 kilowatt transmitter into operation as a relay for listeners in the capital.



### An Island in the Pacific Ocean

A GROUP of some two hundred members of the Hungarian professional classes who, owing to present economic conditions, are unable to earn a living in their native land, have approached the authorities to secure from some foreign country, preferably Great Britain, the loan or lease of an island in the Pacific Ocean where a new colony could be established. The settlers, it is stated, would remain in touch with the Mother Country by means of wireless; the installation of the necessary apparatus would be carried out by members of the party.

### Italian Broadcasts for Albania

IN view of the fact that attempts to establish a broadcasting system in Albania have not met with success, and that transmissions from the Bari studio are well heard in Durazzo, the Italian authorities propose to devote certain hours of the weekly programmes to special entertainments in the Albanian language.

### Radio-Normandie's Carillon Concerts

THE Fécamp studio proposes to carry out regular relays of carillon and choral concerts from the Rouen Cathedral, of which the belfry contains twenty-nine bells. The first of these attempts may have already been heard by readers, as it was proposed to inaugurate this feature on Saturday, April 29th. They will take place at 8.30 p.m. B.S.T.

### Broadcasts on 38,710 Kilocycles

THE B.B.C. short-wave transmitter which has been operating experimentally on 7.75 metres (38,710 kc/s), is situated at the top of Broadcasting House; its power is roughly 250 watts. The transmissions are carried out by means of an aerial suspended from masts 35 feet above the roof of the building. Tests show that excellent reception of the broadcasts can be secured within a radius of about fifteen miles. Similar experiments on ultra-short-waves are regularly made in Germany by the Witzleben Telefunken station near Berlin. In this case the broadcasts, on 7 metres, are put out with a power of 4 kilowatts. It is the most powerful ultra-short-wave transmitter in the world.

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

### Bach Between Items

TO commemorate the death of Johann Sebastian Bach at Leipzig, both this and the Dresden broadcasting stations have adopted as an interval signal a short four-note theme composed of the notes, B flat, A, C, B, which, when translated into German musical notation, spell BACH. The signal has a sound reminiscent of a vibraphone, and is produced by small hammers striking metal rods. At the conclusion of the day's programme the *Nazi Horst Wessel* song is played, followed by the German National Anthem (*Deutschland über Alles*).

### Choosing an Interval Signal

MOST European broadcasting studios at some time or other have appealed to their listeners for suggestions regarding a characteristic interval signal capable of identifying the station to foreign listeners, but it has been left to the Poste Parisien (Paris) to offer a prize of five-hundred francs for an original idea. As a result of a recent competition in which hundreds of suggestions were put forward, the station has finally adopted the first six notes of a well-known melody of Charpentier's Opera, *Louise*. The electrical device for reproducing these sounds will be built at once and listeners will shortly hear Poste Parisien's new mechanical call.

### Russia's Heavily Taxed Listeners

THE Soviet authorities have decided to construct twenty 200 kilowatt transmitters during the next two years. To pay for these new stations, since the beginning of April, they have considerably increased the cost of listening licences which are now issued in six different categories. The owner of a simple crystal receiver is now taxed three roubles per annum or, roughly, 8s. 3d., but if a valve set is used, the cost yearly is *fifty* roubles (£6 17s. 6d.). Rates have been specially fixed for subscribers to the wired wireless distributing centres and for members of collective clubs. A large revenue is anticipated from these latter organisations which in future will be made to pay as much as *five hundred* roubles a year! In cities such as Moscow, Leningrad, Kiev and so on it has been the custom for families to be grouped in listening centres termed House Radio Clubs. According to the number of members in these small associations so the tax is fixed by the authorities, but in view of the new law, wireless entertainments will become a costly if not prohibitive pastime, as most of these groups will fall into a class rated at two hundred roubles or roughly £55 per annum.

### Another Interval Signal

GRADUALLY, the ticking metronome, so long used by foreign studios to denote an interval in the programmes is being replaced by more and more melodious sounds. *Radio Beograd* (Belgrad, Yugoslavia) is the latest station to adopt a tune on a musical box to be switched on during pauses in the broadcast programmes. The theme chosen consists of the four first bars of an old Serbian folk song. As most of these short note combinations are easy to memorise, it will soon be possible to identify most transmitters by their individual signals in cases where no call is picked up.

**INTERESTING and TOPICAL PARAGRAPHS**

### Radio Lisbon

ALTHOUGH but little has been heard of Portugal's forthcoming broadcasting system, work on the 20 kilowatt Lisbon transmitter has been progressing satisfactorily. The channel allotted to this station is 283.6 m. (1,058 kc/s), a wavelength already used for some time by CT1AA for its Amateur broadcasts. Although the erection of the plant is well on the way, it is not expected that it will be ready to test before the autumn. Portugal already possesses a number of listeners to foreign stations, but up to the present, apart from a mere formal registration with the Post Office authorities, owners of wireless apparatus have not been compelled to pay any tax.

**THE NEW WASHFORD STATION.**

*A close-up view of the building of the new B.B.C. station at Washford Cross, Watchett, Somerset. This station will have a radius of 70 miles, and two programmes will be radiated simultaneously.*

### The New French Wireless Tax

ACCORDING to the new law French listeners will be compelled to pay a radio tax every first of January, if they possess a wireless receiver on that date. On simple crystal sets, fifteen francs (roughly 3s. 4d.); fifty francs for any multivalve set privately owned or double that amount if used for public auditions in cafés or restaurants, etc. No tax will be payable in the case of hospitals, schools, philanthropic institutions, or where sets are used by blind persons or war invalids. The revenue obtained will be used for the development of the French State broadcasting system, and for the operation and maintenance of existing stations and of those in course of construction.

### Vienna Launches Out

WITH the advent of the new high-power Vienna (Bisamberg) transmitter listeners may expect better programmes from the Austrian capital. Twice daily a new station orchestra of thirty-two musicians will broadcast special concerts, and in general, more wireless entertainments are to be given. In addition, during the latter half of May and throughout June, a number of relays are to be carried out from the Vienna Opera House as well as a series of outside broadcasts to celebrate the Austrian musical festival weeks. Arrangements are also being made for a number of entertainments to be broadcast to the United States *via* the Königs Wusterhausen short-wave transmitter. These will take place at 2.0 a.m. B.S.T. Definite dates have not yet been fixed.

### Another High Power Station

THE Turkish Government has decided to erect a super-power transmitter at Ankara; it is to be a copy of the 500 kilowatt station the Soviet authorities are completing at Noghinsk, near Moscow.

### The Westinghouse Brake and Saxby Signal Company

WE understand that since the 18th of April the offices of the above company have changed over to the automatic telephone system, and in consequence their telephone exchange and numbers are altered to Terminus 6432 (6 lines).

### Gramophone Societies

IT has been decided by the Public Performance Committee of the British Phonographic Industry that, despite the prohibition at present in force for the use of gramophone records for giving public performances, bona fide Gramophone Societies may continue their present activities on the understanding that permission to do so is revocable at any time after the members of the industry have definitely formulated their policy.

## SOLVE THIS!

### Problem No. 34.

Robinson had a normal four-valve set, fitted with an output-filter circuit and complete with decoupling arrangements in each stage. After building a televisor, he connected the neon lamp in place of the loud-speaker, but found that the lamp only gave sporadic flashes and the received image was not at all clear. After some experimenting he found the cause of this. To what do you attribute it? Three books will be awarded to the first three solutions opened which correspond with the solution which will be published next week. Address your solution to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, London, W.C.2, and post to reach us not later than May 15th. Mark your envelopes Problem No. 34.

### SOLUTION TO PROBLEM No. 33.

Robins had forgotten that the rectifying valve required a larger input to deliver the 500 volts, and therefore a new mains transformer was needed to get the benefit from his change-over.

The following three readers received books in connection with Problem No. 32:—

H. F. Leslie, 76, Holly Road, Aldershot, Hants. H. Fraser, 68, St. Johns Road, Waterloo, Liverpool, 22. D. V. Braund, 80, Knollys Road, S.W.16.

# All About OUTDOOR RADIO

## How to Obtain the Best Results from Summer-time Radio in the Open Air

By H. J. BARTON CHAPPLE,

Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

DURING the long winter evenings, and at week ends, the fireside has been the usual gathering place of the household, and the radio programmes have, no doubt, formed one of the principal sources of entertainment. Possibly, also, the radio fan of the family has exercised his ingenuity and spent his spare cash on the construction of a new receiver, so that, for the time, at any rate, the home equipment is considered perfectly satisfactory.

With the coming of spring, however, the fireside has become more and more deserted. Evenings will be spent in the garden before very long, while country excursions and picnics will be arranged. Many listeners, therefore, are asking themselves to what extent radio can play a part in the open-air life of spring and summer, and what must be done by way of special arrangements in order to derive the maximum enjoyment from " al fresco " radio.

### Two Main Divisions

To begin with, outdoor radio falls into two main divisions. To the hiker, motorist, picnicker and the river man it means a complete portable receiver which can be taken far afield, while to the home keeper and garden lover it means, generally, an extension line from the house receiver into the garden. The special needs and problems of successful outdoor radio are not identical for both classes of installation. They have many points in common, of course, but there are also individual problems peculiar to each type of equipment, so perhaps it will be best to deal with each separately. As the pukka portable set represents the requirements of a large number of open-air listeners, we will discuss this aspect first.

It is scarcely necessary to state that a portable receiver is a complete wireless equipment, consisting of a compact receiver, the necessary low tension, high tension, and grid bias batteries, a built-in loud-speaker and a frame aerial, all accommodated in a reasonably compact case, the total weight of the whole being kept down to a figure representing a not over burdensome load for an active outdoor man.

In technical design and mechanical construction, the portable wireless receiver of to-day is a vast improvement on earlier types, and its performance is correspondingly better. In fact, it is not too much to say that a high-class modern portable will give a performance, both as regards sensitivity and selectivity, which rivals that of the average household set. Indeed, in a great many homes, a portable set is employed for everyday indoor use. Many of the latest types use one or more screened-grid high frequency stages, although there are a number of excellent sets in which the H.F. stages are of the aperiodic type with triode valves. Since the introduction of special low consumption pentode valves, these have been adopted as output valves in many leading makes of portable sets, and recently portables with a pair of small pentodes in quiescent push-pull have appeared on the market.

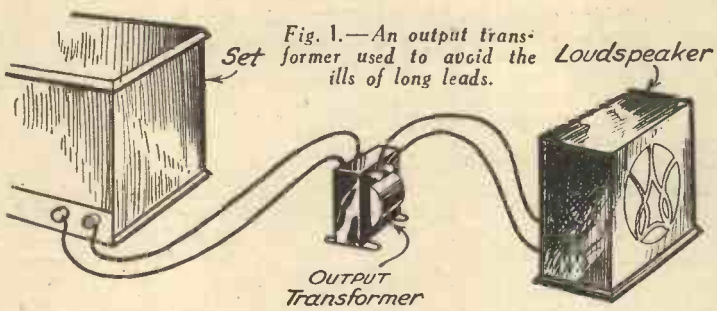



*Fig. 1.—An output transformer used to avoid the ills of long leads.*

### Limitations

From a good portable set, therefore, the listener should expect to obtain with ease a choice of programmes including the alternative B.B.C. stations, and a goodly array of foreigners, anywhere within the British Isles, and even a very ordinary equipment should provide at least a round half-dozen programmes at good strength. At the same time, the limitations of all portable equipment must be recognised. In the first place, considerations of space and weight usually restrict the high tension battery to a small capacity unit and a maximum of 100 volts. This at once imposes some limitation on the efficiency of the high frequency valves, and also upon the total output of the power stage so that, although valve designers have spared no effort to improve the efficiency of two volt battery valves to the end that they should give the very best performance possible under " portable " conditions, the listener must not expect quite the power and volume which he obtains at home with a set having, perhaps, one or two fewer valves, but possessing the great advantages of an ample high tension supply and an outdoor aerial.

Again, the very fact that the portable set must use a small frame aerial means that the incoming impulses are very weak; moreover, the general absence of the successive tuned couplings normally available in a home set further cut down the effectiveness of high frequency amplification, already restricted by the small H.T. battery, so that, on an average, two high frequency stages in a portable must be considered as equivalent in value to about one in a " cabinet " set.

### Apparent Loss of Volume

Another point at which the portable set is at a disadvantage is that, in addition to restricted power output, which, of course, means less actual volume of sound for a given signal, the *apparent* volume is further cut down simply because the set is working in the open air. In a room, much of the sound travels to the walls and ceiling, and, although a proportion of it is there absorbed, much is reflected back into the room. Out of doors, however, the sound travels outwards from the loud-speaker, and is not reflected back, hence all that affects the ear of the listener is the direct sound waves he or she intercepts. For this reason, some listeners feel that the volume from their portable is somewhat thin and weak under

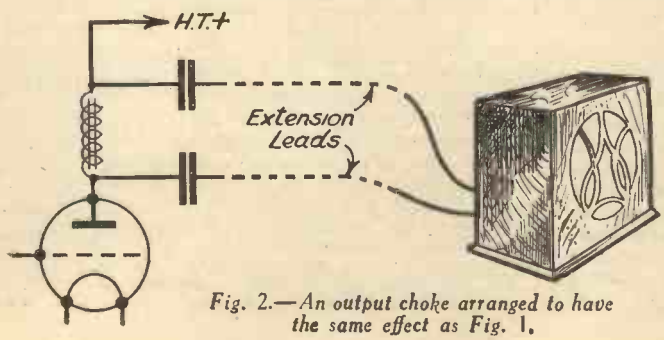



*Fig. 2.—An output choke arranged to have the same effect as Fig. 1.*

these conditions. However, there is usually enough for real enjoyment and, from personal experience, much greater volume would not greatly add to the owner's pleasure, and might considerably mar that of neighbouring parties.

The owner of a motor-car can, of course, by reason of the special transport facilities at his disposal, make use of a more powerful equipment if he so desires. Larger accumulators and high-tension batteries, carried independently of the receiver, a set approximating in design to a household receiver, and a portable aerial, should enable him to obtain most encouraging results.

Mention of the motor-car reminds me of some interesting television tests in the open air when the transmission of signals took place in the mornings.

I remember very well one of these instances, a portable "Televisor" being accommodated on the running board, while an enthusiast intently watched the images in the small aperture. Of course, now that the television transmissions are sent out by the B.B.C. late at night this is impossible, but with the hoped-for extension of facilities this kind of thing will be a future feature of outdoor radio.

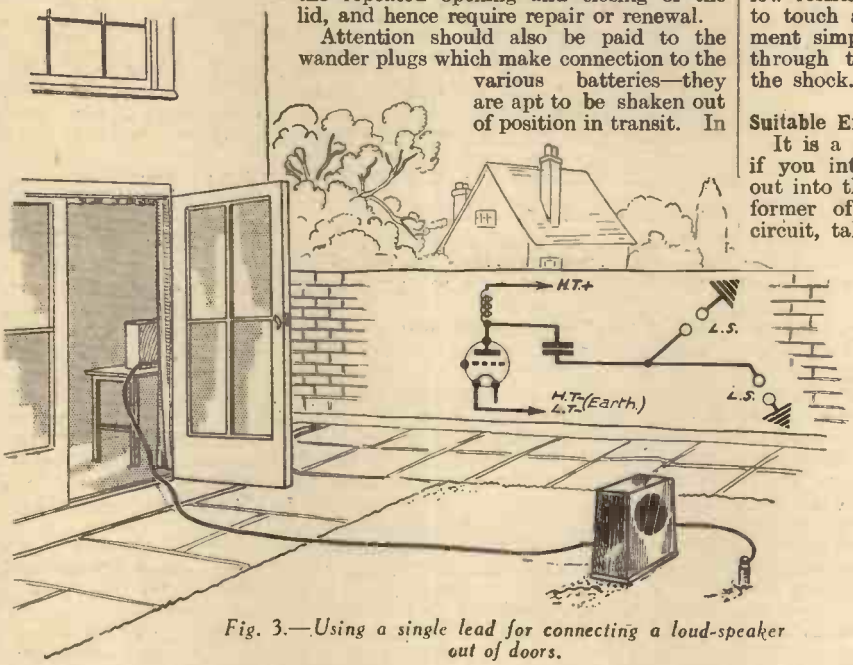



*Fig. 3.—Using a single lead for connecting a loud-speaker out of doors.*

### Overhaul

In preparing for open-air radio, many listeners will now be overhauling their own particular portable equipment. If the set has been put aside since last summer, a considerable amount of attention must be paid to it. It is to be hoped that the accumulator was treated properly before being laid up, and not stored in a partially uncharged condition with the acid in it. At all events, the battery should be cleaned up and sent to be charged, after which it will be as well to put the set into service at home for a week to see if the accumulator is in good condition and will retain its charge.

If it runs down immediately, the advice of the service man should be sought so as to ascertain if the battery can be reconditioned or whether a new one is necessary. The week of test will serve also to show whether the high-tension battery requires renewal (and do not forget the grid-bias battery at the same time) and if the valves and the circuit generally are in good order. The symptoms, of trouble are identical with those in any other wireless set, so there is no need further to discuss this point. Mention may be made, however, of a few specially vulnerable spots in a portable set.

### Vulnerable Points

Owing to the rather strenuous conditions of service by way of transportation and so forth, it is possible that the cone of the loud-speaker may need adjustment. Failure to operate may be due to broken connections in the wiring—accidents which are not very likely to happen in a set which is never moved. In many portables there are flexible connections between the frame aerial and the receiver proper, and these connections may be strained or broken by the repeated opening and closing of the lid, and hence require repair or renewal.

Attention should also be paid to the wander plugs which make connection to the various batteries—they are apt to be shaken out of position in transit. In order to reduce weight to a minimum, many portable receivers are arranged for resistance capacity coupling between the various amplifying stages. Breakdown of the anode resistances is another likely cause of poor performance.

### Garden Extensions

We must now turn our attention to the listener who requires simply an extension of his radio to the garden. In principle, this involves nothing more than is required for an extension loud-speaker in another room in the same house, but there are one or two precautions which should be observed. In the first place, it must be remembered that leads taken out into the garden are far more liable to mechanical damage, and to the effects of moisture, than those between two indoor rooms. It is advisable, therefore, that stout, well insulated leads should be used. "Tough rubber" or cab-tyre flexible, is very suitable for this job, but a length of lead-covered single or twin cable is even better, and could, if desired, be made a permanent fixture by running it along the fence to some convenient spot where it may be terminated in a weather-proof plug and socket, or in a water-tight junction box.

Another point to bear in mind is that where a loud-speaker is connected directly in the anode circuit of the output valve, as unfortunately so often happens, the speaker terminals are charged to the full high-tension voltage of the set—indeed, in the case of a pentode valve output stage the peak voltage on the loud-speaker terminals may be considerably greater than the maximum voltage of the battery. Not only would an earth on the speaker leads, whether due to injury or to moisture, cause a serious short circuit of the H.T. supply, but anyone accidentally touching any live part of the loud-speaker or its circuit would receive a most unpleasant shock. Indoors, standing on a dry floor or carpet, folk are well insulated from earth, and can touch a single high-tension terminal almost with impunity—not that anyone is recommended to try. But in the garden, especially if the grass or ground is moist, people are in excellent low resistance connection with earth, and to touch any charged part of the equipment simply means a good leakage path through the body to earth—and hence the shock.

### Suitable Extension Arrangements

It is a very wise precaution, therefore, if you intend to take your loud-speaker out into the garden, to fit an output transformer of suitable ratio in the output circuit, taking the speaker leads from the secondary winding of this transformer, and thus isolating the loud-speaker circuit from the high-tension supply as is shown in Fig. 1. Another method is to use a choke capacity output filter with high insulation condensers of, say, 2 mfd. capacity, in both speaker leads, as indicated in Fig. 2.

Where it can be arranged conveniently, however, I think the simplest scheme for garden extension wiring is to use the standard choke capacity output filter, as then only one extension lead is necessary. This is demonstrated clearly in Fig. 3. The usual output choke is included in the anode circuit of the last valve, while a 2 mfd. condenser is joined on one side to the valve anode, and on the other to the single extension lead. One or more loud-speakers can then be connected to this lead, the remaining terminal of the "reproducer of sound" being connected to earth through the medium of, say, a meat skewer, penknife blade, copper rod, and so on. The earth itself then acts as the return medium to the set when, of course, the negative of the high tension is earthed.

Finally, although this is not a technical point, it is to be hoped that those readers who do indulge in garden radio will be considerate to their neighbours by limiting volume to reasonable proportions and confining their listening to reasonable hours. It is not fair to have your loud-speaker blaring at full volume from early afternoon until midnight in the garden. Some people like to have a nap in the afternoon and many go to bed long before midnight. Besides, other people like to hear their own sets sometimes. No ordinarily reasonable neighbour objects to a little music in the next-door garden on occasion, provided quality is tolerably good, but not mere noise, and that continuously in season and out of season. Besides, in many districts objectionable garden radio is an offence against the local by-laws and carries a stiff fine. It is a very simple matter to add a volume control "at your elbow" to save constant walks to the set itself in order to make adjustments, and this should be adopted if felt desirable.

# Q.P.-P. — OR — CLASS "B"?

## A Discussion in Regard to the Relative Merits of the Two Systems.

By FRANK PRESTON, F.R.A.

IN a way it is rather unfortunate that two similar systems of L.F. amplification should have made their appearance at almost the same time, for the prospective constructor is liable to be left rather in a quandary as to which he should use. The position is still further complicated by the fact that both Quiescent Push-pull and Class "B" amplification are intended for one and the same purpose, namely, to provide a large, undistorted loud-speaker output from a battery-operated receiver. One can justly be excused for asking, "Which is the better system to adopt in my own case?" Rather than answer this question directly I propose to set out the merits and demerits of each method from the practical point of view, so that the reader may finally decide the issue for himself.

### The Circuit Arrangements

To make matters clear I have sketched out in Fig. 1 the wiring plan and circuit diagram for a Q.P.-P. amplifier, and in Fig. 2, for a Class "B" amplifier. It will be seen in each case that some of the components are shown as "ghosts"; these are the ones that are normally incorporated in the receiver proper, whatever its type may be. The other parts, indicated in full lines, are additional ones required, and which are of special types designed particularly for the new L.F. amplifying systems.

From Fig. 1 we observe that the Q.P.-P. portion follows directly after the detector valve, no intermediate stage being required to supply ample signal voltages to the grids of the pentodes. This is because the input transformer has a high step-up ratio, generally in the region of 1 : 10. In Class "B," however, we are obliged to use a step-down transformer in order to make the secondary of low resistance and to match the grid-filament circuits of the output valve to the anode circuit of the preceding one. In consequence of this it is essential to include one L.F. stage between the detector and Class "B" valves. The intermediate amplifier is known as a "driver" due to the fact that it "drives," or supplies power to, the secondary winding of the transformer following it. I do not think any further explanation need be given here since the theory of both methods of amplification has been adequately dealt with in previous issues of PRACTICAL WIRELESS. Let us, therefore, proceed with an analysis of the more practical aspects of the little problem we set out to discuss.

### Power and Quality

First of all it should be mentioned that the actual power output is approximately the same in each case if we assume the use of a similar H.T. voltage—preferably from 120 to 150. As a matter of fact, the output from Class "B" is slightly higher, but not greatly so; the difference in this respect is certainly not so great that it could easily be detected under normal circumstances. Furthermore, both systems are equally good as regards the quality of reproduction which they afford.



### Current Consumption

The mean anode current of two high-efficiency pentodes connected in Q.P.-P. approximates to 6 milliamps when using a 120-volt high-tension battery, whilst that of Class "B" is a little higher—about 8 milliamperes. But we have seen that the latter valve requires a "driver" valve for its correct functioning, and this takes a further 2 milliamps or so, and thus brings the total current consumption up to 10 milliamps. As to L.T. current: the two pentodes in Q.P.-P. take .4 amp. between them, whilst the single Class "B" valve consumes the same amount. Again, however, we must add to this the .15 amp. or so required by the "driver," with a result that the total filament current is just over half an ampere.

### Cost of Components

And what about the cost of the components in each case? We must first base this on the assumption that a separate amplifier is being made to follow directly after the detector valve in a normal receiver. For Q.P.-P. we shall require (1) one special Q.P.-P. input transformer—average cost, 15s.; (2) one tapped output choke or transformer—say, 16s. 6d.; (3) two 5-pin valve-holders, 2s.; (4) one G.B. de-coupling resistance—1s.; (5) one shunt resistance for connecting in parallel with primary of input transformer—1s.; (6) two pentodes—35s. We can see from our list that the total cost works out at about £3 10s.

And now let us see how this price compares with that for a complete Class "B" amplifier, including, of course, the "driver" valve and the L.F. transformer which feeds it. The necessary components and their average prices are: (1) one small L.F. transformer—7s. 6d.; (2) one 4-pin valve-holder—10d.; (3) one Class "B" "driver" transformer—10s. 6d.; (4) one 7-pin valve-holder—1s.; (5) one tapped output choke or transformer—16s. 6d.; (6) one small power ("Driver") valve—8s. 9d.; (7) one class "B" valve—14s. The inclusive cost in this case is seen to be approximately £3 and thus the Class "B" shows a slight advantage in the way of initial expense.

In both of the above examples I have purposely left out the resistance and condenser generally required for reducing excessive high-note response, but as these components are used in either type of amplifier, they will not affect the comparative price. In so far as we have already considered the question, we reach the conclusion that for a similar signal output the Q.P.-P. amplifier is rather more expensive in first cost, but since its L.T. and H.T. consumption is smaller, it will be cheaper to run; Class "B" scores in regard to "replacement" expenses, because both of its valves are cheaper than pentodes.

### Converting an Existing Receiver

The figures we have obtained above apply only when a complete and separate amplifier is to be made, and they will be modified considerably

(Contd. on p. 290.)

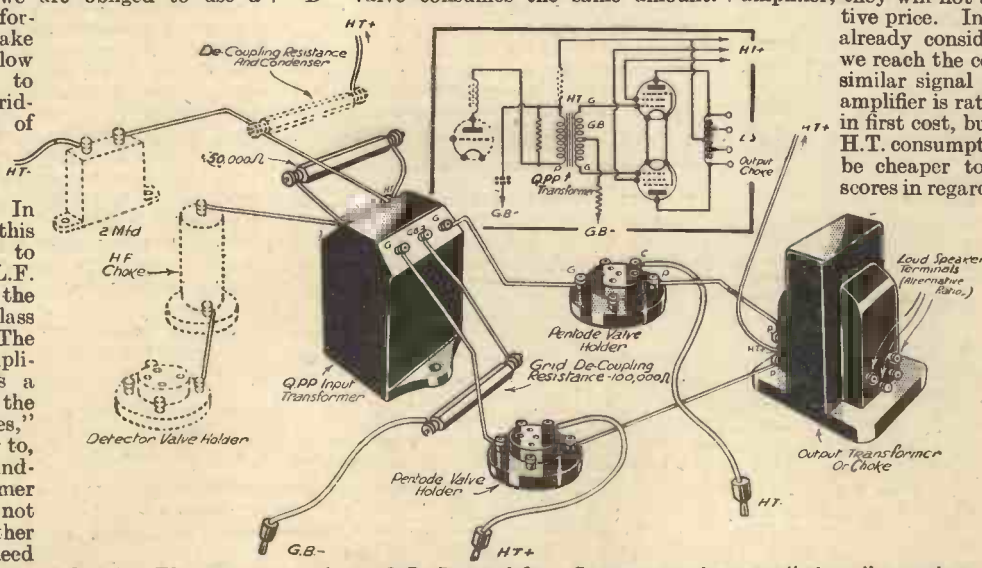



*Fig. 1.—The connections for a Q.P.-P. amplifier. Components shown as "ghosts" are those normally included in the receiver proper. L.T. wiring is omitted for the sake of simplicity.*

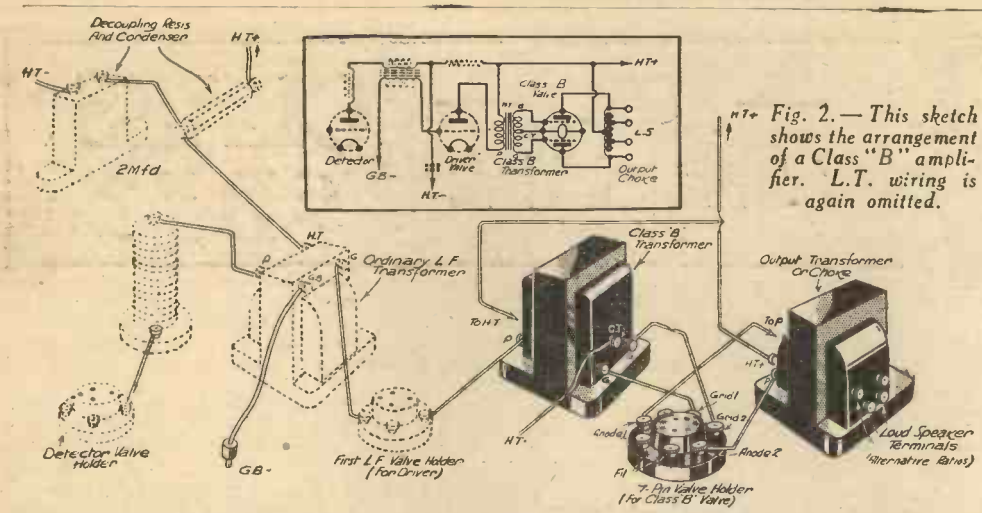



*Fig. 2.—This sketch shows the arrangement of a Class "B" amplifier. L.T. wiring is again omitted.*

(*Continued from page 289.*)

when it is required to convert the L.F. portion of an existing set to one of the new systems of amplification. For example, if the set is a three-valver having S.G., detector, and power valves, the cost of the "small L.F. transformer" "4-pin valve-holder" and "small power valve" can be deleted from the estimated price of a Class "B" amplifier, but all the listed components will be required for a Q.P.-P. conversion. Moreover, we shall be left with a spare transformer and power valve in the latter case.

But if our present set uses a pentode output valve the position will be rather different, because we shall only require one additional pentode with the other components listed above to convert the set to Q.P.-P. This will bring down the price to about £2 12s. 6d. In converting the same set for Class "B" a small power valve would be required in place of the pentode (which would then be "spare"), but the ordinary L.F. transformer could be retained. In other words, the cost of conversion would be almost exactly the same as for Q.P.-P. And since Q.P.-P. is more economical of current we should decide in favour of this system. When the receiver which is to be modified contains two low-frequency valves, Class "B" would be our undoubted choice, because the first L.F. stage could remain unaltered to serve the function of "driver." The only extra components then required would be the "driver" transformer, Class "B" valve, 7-pin valve-holder, and output choke, so that the cost would work out at something like two guineas.

**Operation of Class "B" and Q.P.-P.**

There is yet another side to the question—that of adjusting and operating our amplifier. Class "B" is most certainly to be preferred on this account because it does not require the rather delicate "balancing" of anode current, nor the correct setting of grid-bias voltage that quiescent push-pull does. In fact, no balancing of any kind is required, because all this is done by the valve-makers, and since the special Class "B" valve does not require any grid-bias, G.B. voltage adjustments are not called for as the high-tension battery gradually runs down. At least, this is so in regard to the output valve, but a slight adjustment to the "driver's" G.B. will probably be required at intervals. This might not always be necessary, because the working characteristics of the latter valve are by no means critical.

From the above brief summary we can deduce that when modifying an existing set to include either Q.P.-P. or Class "B" our decision as to the better system will principally be governed by the circuit arrangement of our present receiver; if it has a pentode output stage, Q.P.-P. will be favoured, but if the last valve is of the small-power type, or if the set has two L.F. stages, Class "B" will be somewhat more economical and convenient.

**Economy in H.T. Current**

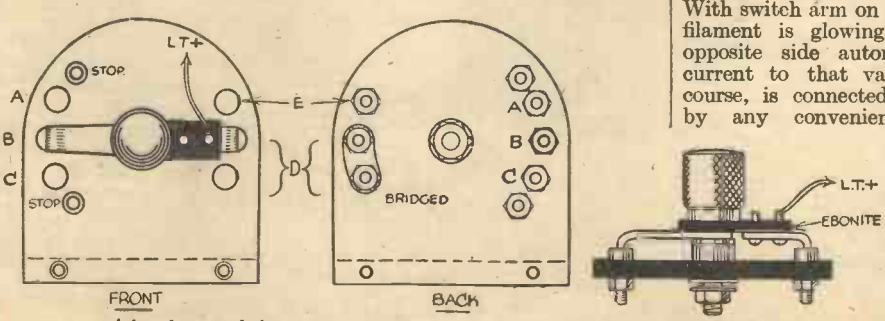
For most "domestic" requirements it will be found that the maximum possible output of signal current is scarcely ever required from either of the amplifying systems under discussion. When this is the case a distinct economy in running costs can be effected by reducing the H.T. voltage, or better still, by cutting down the signal input to the amplifier by means of a volume control. (The average anode current of either a Class "B" valve, or two pentodes in Q.P.-P., is proportional to the volume they are required to supply.) In some instances the reaction condenser, variable-mu potentiometer, or series aerial condenser, will serve the latter purpose, but with Class "B" a better method is to connect a potentiometer across the secondary of the transformer preceding the "driver" valve. A suitable value is 250,000 ohms, and the method of connection is indicated in Fig. 3.


*Fig. 3.—A volume control can be used to cut down the H.T. current consumption of a Q.P.-P. of Class "B" amplifier. This sketch shows the simplest way of fitting a volume control to a Class "B" amplifier.*

When full volume is never required the simplest thing is to replace the small power valve used as "driver" by one of the ordinary L.F. type. This will slightly reduce the consumption of low-tension current, as well as that of high-tension, and will not have any ill effect on the quality of reproduction.

## A SWITCH DODGE

A SWITCH for cutting out series aerial condenser, also H.F. stage and H.F. valve filament, can be made as follows: Cut a piece of ebonite to shape, as Fig., and arrange three contact studs on each side, the left side to have stops at each end. Drill a hole to take switch-arm spindle in the ordinary manner. The double arm must be arranged so as to insulate the filament part, and this is done by fixing switch arm to spindle with a piece of ⅛in. thick ebonite of required length. This is clamped under the switch knob in line with aerial switch part which is fixed as in ordinary practice. Attached to small ebonite strip is the end cut off from a spare switch arm, and this is drilled to take two small screws, one of which is used to take a flexible lead to the L.T. positive terminal. The two studs at D are bridged underneath with a piece of copper foil and stud E is left blank. Stud A goes to first terminal of series aerial condenser, B goes to second terminal of S.A. condenser, and C goes to top of detector coil. Studs D go to the filament terminal of the H.F. valve-holder. With switch arm on A or B the H.F. valve filament is glowing, but when on C the opposite side automatically cuts off the current to that valve. The aerial, of course, is connected to the centre spindle by any convenient method and the completed switch is screwed to the back of the baseboard alongside the earth terminal, or the earth terminal could be mounted on the same piece of ebonite as the switch.




*A handy switch for cutting out the series aerial condenser, and H.F. stage.*

—C. E. HOLDUP (Finchley).

# Some Mysteries I have Solved!

## An Interesting Account of Some Elusive Faults and How They Were Traced

By A RADIO ENGINEER

IT is a favourite theory of mine that, because all faults in radio equipment are due to definite electrical or mechanical causes, it is only a matter of systematic and careful testing to discover the nature and location of any defect. In nine hundred and ninety-nine cases out of a thousand this theory works perfectly. Watch an experienced service engineer examining a faulty set. First, an apparently casual, but actually very searching glance to try and detect obvious disconnections or broken contacts; then, rapidly, a dozen simple tests are applied. Often the trouble is spotted right away in the first five minutes, for the skilled tester has a rare acumen for locating likely faults. If the obvious initial tests do not bring the trouble to light, however, each portion of the apparatus in turn is gone over systematically, and by a process of elimination the defect is tracked down, first to a particular stage, then to one component, and finally to a particular point in that component.

Many amateurs have also acquired a high degree of skill in adopting similar methods, and usually have no very great difficulty in putting matters to right. Very occasionally, however, a fault is encountered which eludes all attempts at discovery, and baffles even experienced engineers. I have collected a few notes concerning some of these, and the following selection refers to cases which, at the time, seemed very mysterious, but were afterwards found to have quite simple explanations.

### Most Annoying

A most annoying type of fault is that in which a set behaves perfectly on the test bench, but as soon as it is replaced in its cabinet, immediately shows signs of the same trouble. My most recent experience of this kind was with a home-built set of the metal chassis type, which was subject to almost continual cracklings. On removing the chassis to a table and connecting it up, no amount of maltreatment would induce the least amount of noise—the performance of the set was normal and perfect. Then, as soon as the chassis was put back into its cabinet, on came the crashes and crackles.

After two or three repetitions of this, having already tested-out every connection and component and found nothing wrong, I was about to give up for the evening, when I stumbled upon the solution quite by accident. The chassis was standing on the table at the time, and in order to give it one final scrutiny at close quarters I pulled it towards me along the table. Immediately came a fearful crash. After switching off, I turned the chassis on end and examined the underneath again—and discovered the trouble. There were several metallized resistors included in the circuit, and these were accommodated with some other small components under the chassis. Owing to the sagging of some of the connecting wires, one of these resistances just touched the surface of the table, and as I dragged the chassis along this resistance caught the roughness of the table, causing the connecting wire to bend sufficiently to allow the end cap of the resistor to touch lightly against a terminal (Fig. 1). The resultant intermittent short circuit was the cause of the crashes and cracklings. The same state of affairs occurred when the set was pushed into the cabinet, but when the chassis was withdrawn the springiness of the wires allowed the resistance to fly back into position. Judicious bending of the wire and the use of an inch or so of insulating tape completely cured the trouble.

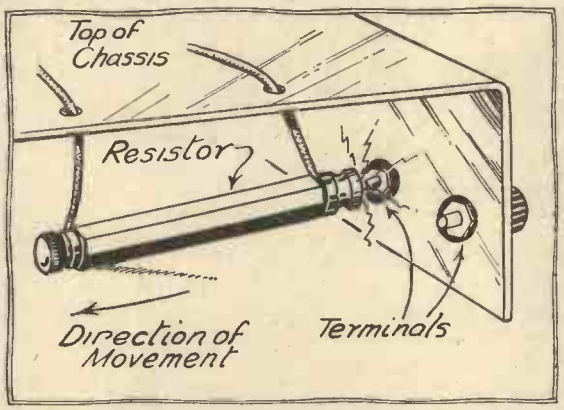



*Fig. 1.—Slack leads allowing a resistor to short circuit against a metal chassis.*

### Wire Continuity

One lesson which I learned early from experience, was never to trust a first test on the continuity of a wire. This point was driven home with considerable force on an occasion when I was endeavouring to cure bad crackle in a set. Everything pointed to a loose contact, but for the life of me I could not discover where it was. Every lead and wire had been separately tested for continuity, including the wire connecting the aerial terminal of the set to the lead-in tube. This was, as a matter of fact, insulated with particularly thick and stiff rubber, and it tested out perfectly O.K. With the set connected up again, all went well for a time, but soon the crackling recommenced.

I switched off to re-test, found nothing wrong, and connected up again; reception was now quite normal. Then, while fumbling absent-mindedly with the wires, on came the crackling. Quickly I looked to see what I was touching; it was the aerial connection, and as I wobbled it about the grating crashes increased in intensity. To put in a new wire was but the work of a moment, and the trouble was cured. On conducting an autopsy on the discarded wire I discovered a break just inside the insulation (Fig. 2). The stiffness of the rubber kept the broken ends sufficiently in contact to pass test while the wire was lying quietly on the table, but when connected to the set the wire was slightly bent, causing a rubbing, intermittent contact. Ever since, when testing wires for continuity, I always twist them about so that any fault which exists is exaggerated and more easily detected.

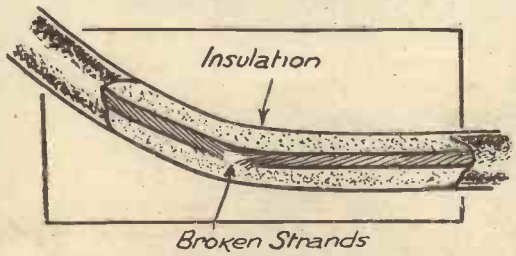



*Fig. 2.—Flexible wire fractured inside the rubber covering.*

### Heating Effects

When a fault occurs only after the set has been switched on for a certain time, always suspect some effect of heating, such as expansion. Metals expand when heated, and both shorts and partial open circuits can be caused in this way. There was the case of a set which always started crackling and other noises about a quarter of an hour after it had been switched on. When I was asked to look at the receiver, I switched on and waited for the fault to develop, which it did in due time, and I then switched off and began my search for the trouble. The usual continuity tests were applied to all the various components, and the anode resistance of a resistance - capacity - coupled low-frequency stage came under special scrutiny, because such spots are always likely places to find a break. The fault, however, could not be traced.

The set was reconnected and switched on again, and sure enough, in about ten minutes or so, the crackle recommenced. I still suspected the anode

*(Continued on page 294.)*

# Only 1,000 copies available

# The DESK REFERENCE ATLAS OF THE WORLD

~~15/-~~

AT THE SPECIAL REDUCED PRICE OF

TO REGULAR READERS OF PRACTICAL WIRELESS

**4/6**

Every Business Man, every Student, every man or woman who takes an intelligent interest in the political and social upheavals and developments now occurring in practically every country of the World, needs a thoroughly dependable Atlas for ready reference.

The "Desk Reference Atlas of the World" here shown is ideal for this purpose. It has been edited by John Bartholomew, M.C., M.A., F.R.G.S., the famous cartographer, and neither trouble nor expense have been spared in its preparation.

Thousands of these superb Atlases have been sold at 15s. each, and the Publishers have on file countless letters of appreciation from delighted purchasers in all parts of the country and in all walks of life.

This Atlas is designed to serve as a constant elbow companion alike in the office and in the home. It is informative, clear, handy in size and convenient in arrangement. The maps are entirely new in their selection and all have been carefully brought up to date.

Only 1,000 of these fine volumes now remain unsold, and we have arranged with the Publishers to offer them to regular readers of "Practical Wireless" as a very special "bargain" at the purely nominal price of 4s. 6d. each.

It must be definitely understood that this offer is limited to 1,000 copies and that when the present stock is exhausted—as it undoubtedly will be soon—the offer will automatically be withdrawn. Early application is therefore imperative and every reader who orders a copy is asked to enclose a stamped, self-addressed envelope for return of his or her remittance in the event of the supply being exhausted.

Only by sending your order *at once* can you be sure of securing this truly invaluable work of reference. Don't delay—*to-morrow may be too late!*

## ORDER FORM

To the Publisher, "Practical Wireless," 8-11, Southampton St., Strand, London, W.C.2.

I am a regular Reader of "Practical Wireless." Please supply me with one complete copy of THE DESK REFERENCE ATLAS OF THE WORLD (published at 15s.) at the Special Reduced Price of 4s. 6d. I enclose Postal Order for that amount together with self-addressed label, and stamped envelope for return of my remittance in the event of the stock being exhausted on receipt of my application.

*Name*.....

*Address*.....

.....

ADDRESS LABEL

*If undelivered return to Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

*Name* .....

*Address* .....

*Town & County* .....

.....

## Order your copy TO-DAY

Fill in the Special Order Form and address label here provided. Enclose with Postal Order for 4s. 6d. made payable to George Newnes, Ltd., crossed /& Co./ and stamped self-addressed envelope, and post to the Publisher, "Practical Wireless," 8-11, Southampton St., Strand, London, W.C.2.

(*Continued from page 291.*)

resistance, so switching off the set once more, I removed the resistance and tested it again—and found an internal disconnection, or rather intermittent connection. A new resistance was soon obtained, and after fixing it in place of the old resistance, the set functioned perfectly. Out of curiosity I then took another test on the discarded resistance, but now no sign of bad contact was to be discovered. It was not until I had opened it up for examination that I found the reason. The end of the resistance wire had become unsoldered from the terminal, but was resting against it, making a light contact. Undoubtedly, when the resistance wire had warmed up owing to the heat generated in high-resistance contact, the end of the wire expanded and moved away from the terminal, thus breaking the contact.

### "Dry" Joints

The "dry joint" type of fault is sometimes very difficult to trace, especially if it occurs in a manufactured component usually considered quite above suspicion. On one occasion an A.C. mains set started to suffer from a most mysterious defect. As soon as anyone walking across the room passed a certain spot, the most alarming crashes would occur in the set. At other times the receiver gave no signs of trouble. Now I knew that there was a loose board in the floor at the critical spot, and immediately connected the trouble with vibration set up by this board. Everything pointed to a loose contact which was jerked by the movement of the board. But the most stringent tests failed to reveal any bad contact, and it was only after I had gone over every joint, both likely and unlikely, that I found the offender. It was one of the filament pins of the rectifier valve. A "dry" soldered joint between the leading-in wire and the valve pin had worked loose. The wire was long enough to touch the bottom of the pin, and the contact was sufficient to allow the filament current to pass. When the table on which the set stood was shaken by someone walking over the loose floor board (Fig. 3), however, the loose leading-in wire vibrated in sympathy and the contact was rapidly made and broken. A few minutes with a soldering iron resulted in a perfect repair, and the valve is still in service and doing good work.

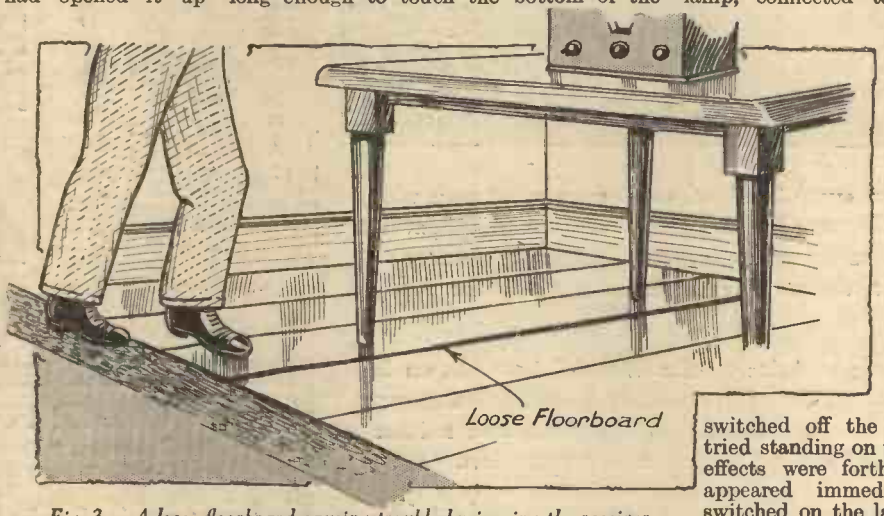



*Fig. 3.—A loose floorboard causing trouble by jarring the receiver.*

### Floorboard Incident

Another floorboard incident was still more mysterious, because the noise did not always occur when the loose board was stepped on. I was told that it never occurred during the day; I noticed it only in the evenings—and only sometimes then. A clue presented itself one evening when the set had been working quite satisfactorily for some hours. I went across the room and switched on a table lamp, connected to a wall plug. As I walked back to my chair I stepped on the fatal board, and at once deafening crashes came from the set. Looking round, I observed for the first time that the loose board was in a direct line between the wall plug feeding the table lamp and the wall plug feeding the set; in fact it was now clear that this was the board which the electrician had removed when he wired the plugs. I next switched off the lamp, and once more tried standing on the loose board. No ill effects were forthcoming, but they reappeared immediately I once more switched on the lamp.

Finally, I switched off the lamp and took up the board. As I had guessed, the electric wiring—lead-covered wire—ran immediately below the board, notches having been cut in the bearers to accommodate it. Examining more closely the connections to the lamp plug, I found that a very poor contact was made between one of the lead-covered wires and the screw terminal of the plug. When the wire was shaken, even quite gently, the contact resistance varied.

---

## A NOVEL METHOD OF DIAL ILLUMINATION.

THE majority of sets have the long-wave and the medium-wave stations inscribed on the same dial, and frequently one has to glance at the wave-change switch in order to ascertain which waveband one is working on. This is entirely obviated by the method described, as the station names of the waveband *not* in use are, though still in sight, are rendered invisible.

First of all, the pilot light must be replaced by *two*, side by side, as close together as possible. One way of doing this is by fixing two batten holders side by side.

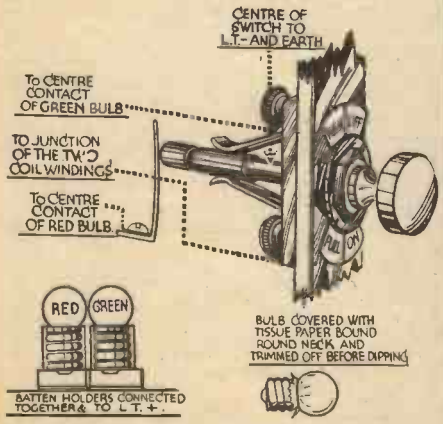



*Fig. 1.—A switching arrangement for controlling dial lights.*

These should be connected together. The two bulbs occupying these holders, must be made to give red and green lights respectively. This may be done by dipping them in suitably coloured ink several times, allowing them to dry between each dipping. A little gum mixed with the inks is very helpful.

Alternatively, each bulb may be covered with the thinnest tissue paper (tied round the base of the bulb and trimmed away, as shown in Fig. 1) before the bulbs are dipped.

The wiring connections are shown in Fig. 2. The only other addition is a strip of springy brass screwed to the baseboard close enough to the wave-change switch to make contact with the plunger when it is pushed in for the long waveband.

One other alteration remains. A strip of stout white paper, or better still, white celluloid, is fastened on to the dial over the existing station readings. If in your case the light shines *through* the dial, the original list of dial readings must be removed and replaced with a piece of white celluloid the same size and shape.

Now neatly print in the names of the stations on the new strip. Medium-wave stations must be printed in RED ink. Long-wave stations in GREEN.

When the set is switched on, only the station names of the waveband to which the set is switched will be visible. If the medium waveband is in use, the light on the dial will be green. The station names printed in red ink will stand out as though in black. The names printed in green under the green light will be invisible.

When the wave change switch is pushed in for long waves, the light on the dial will change to red. The medium-wave stations printed in Red will now become invisible, and the Green long-wave printings will appear. The effect is very pleasing.—E. H. OLIVER (Oxford).

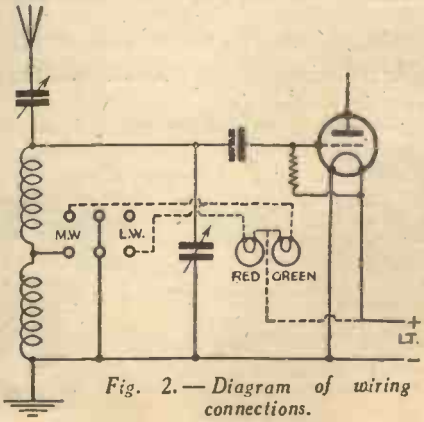
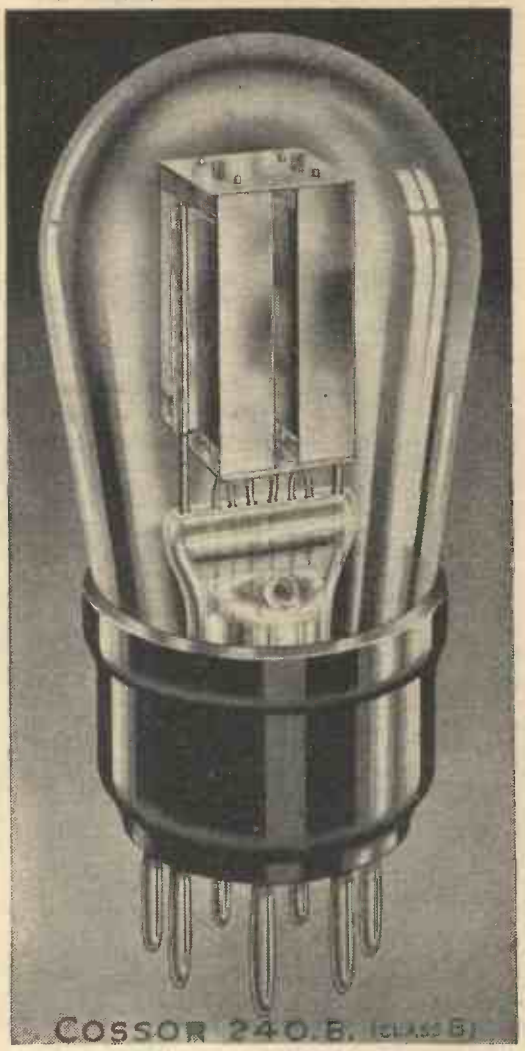



*Fig. 2.—Diagram of wiring connections.*

# COSSOR 240B

*—the new valve for*

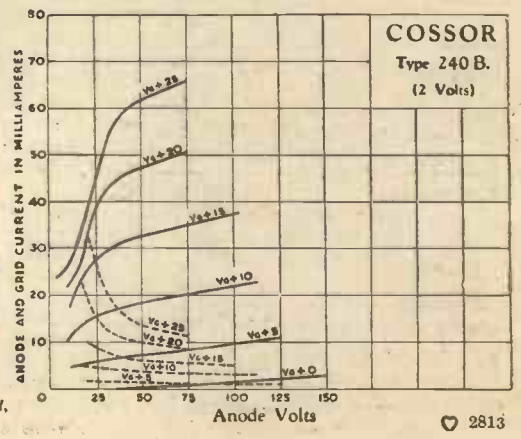
## CLASS "B" AMPLIFICATION




KINGS OF THE AIR

Filament volts 2.0; Filament amps 0.4; Anode volts 150 max.; Max. Anode Current Swing 50 mA.; Max. Peak Applied Signal (Grid to Grid) 40 volts; Static Anode Current at Va=100, Vg=0 (each half) 1·5 mA. Price **14/=**

Volume equal to that of the average Mains Receiver is now obtainable from Battery Sets with this new Cossor Valve, and with this remarkable output, the H.T. Current demand of the Cossor 240 B. is lower than that of a small power valve. Thus, a really large output is obtainable without in any way over-stressing the average H.T. Dry Battery.




Anode and Grid Current/Anode volts curves of Cossor Class "B" Valve Type 240 B.

**PLEASE USE THIS COUPON**

To A. C. COSSOR LTD., Melody Department, Highbury Grove, London, N.5.
Please send me, free of charge, a copy of Folder No. L93, which tells me how to use Class "B" Amplification.

NAME .....

ADDRESS .....

Pr. W. 18/5/33.

*A. C. Cossor Ltd., Highbury Grove, London, N.5 Depots at Birmingham, Bristol, Glasgow, Leeds, Liverpool, Manchester, Newcastle, Sheffield, Belfast, Cardiff and Dublin.*

♡ 2813

# A HOME-CONSTRUCTED MICROPHONE

## A Simple but Efficient Instrument for the Experimenter.

By G. L. GRISDALE

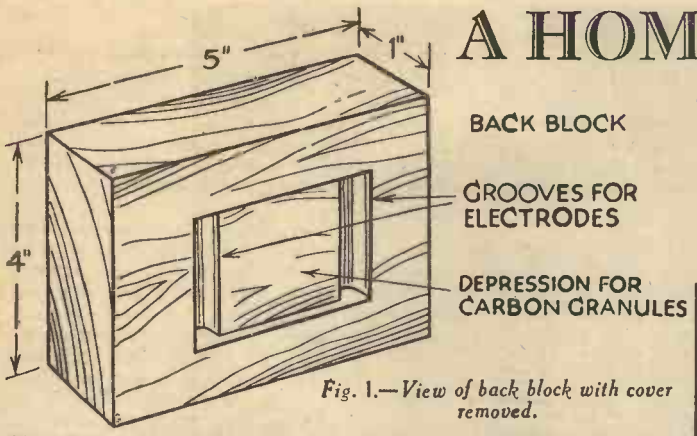



*Fig. 1.—View of back block with cover removed.*

THE radio experimenter will find many uses for a good microphone, and although there must be many who would like to possess such an instrument they generally regard it either as too expensive, or beyond their ability to construct one for themselves. Many who live in or near London, that paradise of junk shops and stalls, will have gone so far as to purchase one of the ex-G.P.O. or service speech transmitters which are so often to be found laying about in the aforementioned places. But in nearly all cases the results from these solid back types of instrument will be disappointing, because the transmitter is not intended to give good reproduction but only intelligible speech. Only in the very early days of programme transmission were these types of microphone used, as they were quickly replaced by more modern types. There is one advantage which the old type of transmitter has over any more modern type, and that is in the matter of sensitivity. It is often possible to overload a super power valve in the last stage of a two-stage amplifier by speaking close up to one of these microphones, but the quality, if it can be called such, is beyond description.

The home-constructed microphone here described, and illustrated in Fig. 1, is certainly not good in the question of sensitivity; the output from the microphone circuit to the grid of the first valve is of the order of 0.1 volt, or about one-tenth of the output of the average pick-up. This may not sound too encouraging, but it must be remembered that the commercial high quality microphones give about the same output, and that the condenser type of microphone, which is used extensively in talking picture recording, is considerably less sensitive.

The microphone is of the carbon type, working on the transverse current principle, that is to say, the current flows across the microphone between two electrodes, no current passing through the diaphragm. Thus the conducting diaphragm usually employed in microphones may be omitted, and a substance with more favourable acoustic properties may be used. The granules are enclosed between the diaphragm which is set into vibration by the sound waves, and a very stable surface which does not vibrate with the sound waves. Thus the granules of carbon are compressed by the sound and their resistance alters in sympathy with the impressed sound. The current flowing across the layer of granules between the electrodes is also varied in sympathy with the sound.

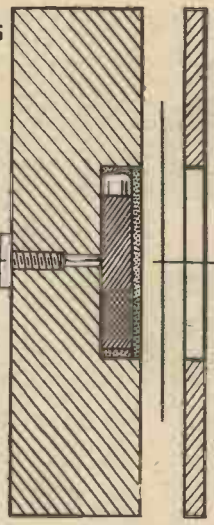



*Fig. 2.—Sectional view.*

### Details of Construction

Now regarding the construction of the microphone. The body of it must be heavy so that it will not vibrate and cause resonance. If it is of wood it will be quite good as far as sound properties go, and, in addition, it will be easy to work. So we start with a block of wood measuring about 4in. x 5in. x 1in. The dimensions do not matter much so long as it is heavy. The next job is to cut a shallow depression to hold the granules. Mark out a rectangle about 2in. x 1½in., and carefully cut a depression with a chisel about 1/16in. deep; if it is more than this the microphone may be insensitive, and, in addition, take more granules to fill it. In one of my own microphones I used a plywood block and made the depression just one-ply thickness deep.

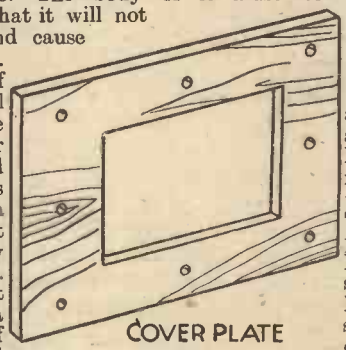



*Fig. 3.—Cover plate of microphone.*

Having cut and sandpapered the depression, the electrodes must be fitted. These are best made of carbon rods from torch batteries as I have found that metal electrodes are apt to cause crackles when the microphone is in use. If torch battery carbons are used they should be carefully scraped before use. The end with the small brass cap on it should be carefully retained, and any shortening necessary done from the other end. Two electrodes are necessary, and a wire should be soldered to the end of each; the wire should be thin and flexible, and a few strands from a piece of flex is suitable. Now take the block again and drill a hole through at each end of the depression and fit two terminals into these holes from the back of the block, each with a wire attached. The terminal must be threaded into the wood with the wire attached to the end and pushed through the hole, and this will be quite easily done if too much solder has not been used. With a chisel make a recess at each end of the rectangular depression to hold the rod. Solder each terminal lead to a carbon rod lead or direct on to the cap on the rod, as in Fig. 2, and tuck the spare wire away under the rod. Push the rod down flush with the bottom of the depression, and fix it there with strong adhesive or sealing wax. But scrape the wax or glue off in front of the rod so that there is good contact for the granules. It may be remarked here that the terminals should be short, or trouble will be caused when the rod is pushed into the groove which has been cut for it.

### Fitting the Diaphragm

This finishes the body of the microphone, and the diaphragm has now to be fitted, and the granules put in. The diaphragm lays flat across the front of the block, but it must first be fixed to the front piece of wood which is screwed on to the back. This front piece consists of a thin piece of plywood of the same size as the back, but having a hole cut through it of the same size as the depression. About eight small holes are drilled round the edge to take the screws. It is best to fix the front down once before the granules are put in, to make the screw holes in the back piece. If this is not done the granules may be shaken about where they are not wanted in the final assembly. Having made the screw

(Continued on page 316.)

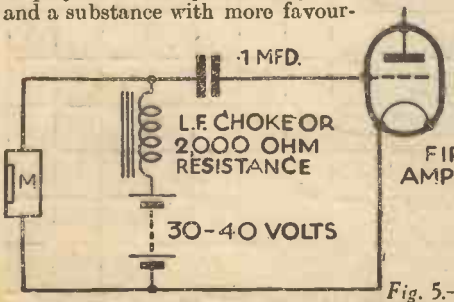



*Fig. 5.—How the microphone should be connected in the grid circuit.*

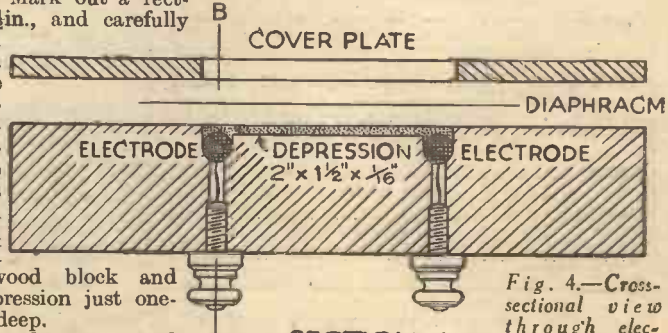


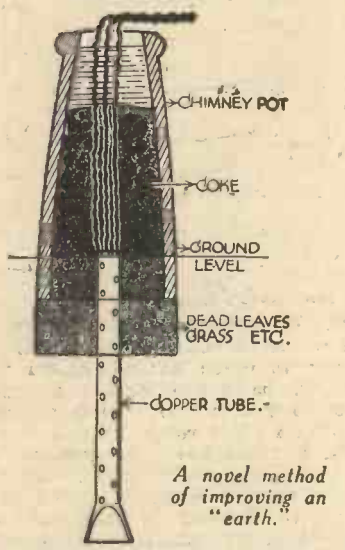

*Fig. 4.—Cross-sectional view through electrodes.*

THE HALF-GUINEA PAGE

# Radio Wrinkles FROM READERS

### An Improved Earth

THE accompanying sketch illustrates how I utilized a disused chimney-pot to improve my earth, which is extremely dry in its natural state. The device holds



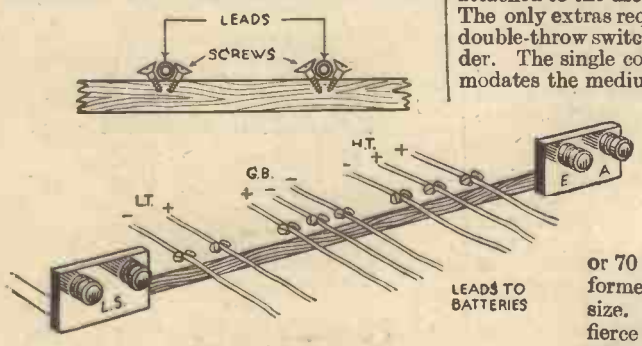

*A novel method of improving an "earth."*

about two gallons of water, which is slowly fed to the surrounding soil, after percolating through the coke, grass, etc.—H. IGGALDEN (Birmingham).

### Fixing Battery Leads

IT is a good plan for experimenters to keep the battery leads separate—that is to say, H.T. from G.B. and G.B. from L.T., and so on, because in a set where all the leads are in one cord it is very easy to make a mistake, which would result in the destruction of all the valves. Besides, it is much more convenient for those who are always altering their lay-out. Here is a method of doing this. Obtain a quantity of twisted rubber-covered flex, one strand red and the other black. The quantity, of course, is proportionate to the number of batteries. Also obtain a number of small wood screws with bevelled heads. The number is double that of the leads. Now, on the back edge take, say, the L.T.— lead, and at the output end of the receiver, near the speaker terminals, secure it as shown in the accompanying diagrams.

Screw the screws down tight and the lead is secured. Now secure all the leads in the




*A neat method of fixing battery leads.*

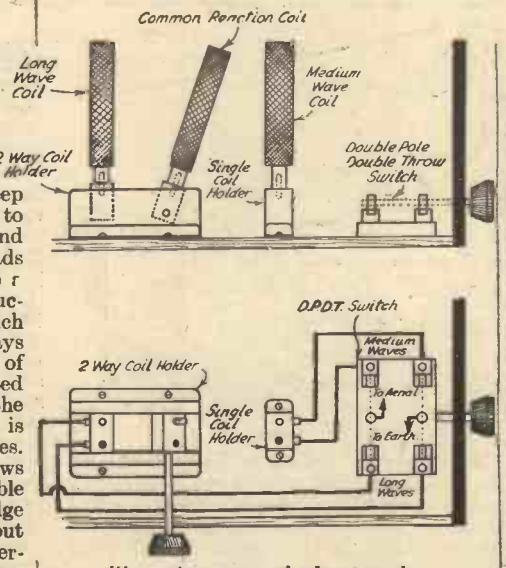
### *THAT DODGE OF YOURS!*

**Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us, addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.**

same manner. Of course, the number of leads vary with the type of set. Now twist your L.T. leads together and join up the battery. Do the same with the G.B. and H.T. leads. The twist can be secured by bands of thread at intervals of four inches.—G. D. BRUCE (Edinburgh).

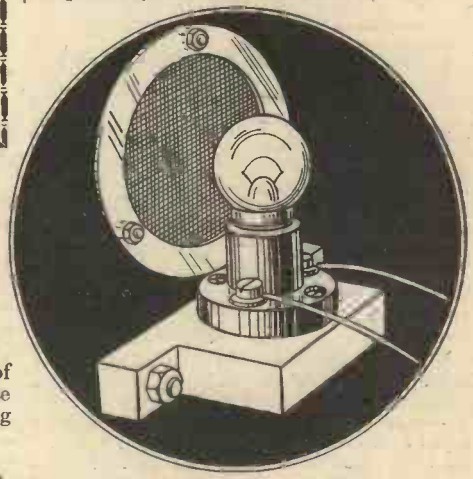
### Wave Changing When Using Plug-in Coils

THE accompanying diagram may be of interest to those readers who use plug-in coils of the basket type. By using




*Wave changing with plug-in coils.*

the method illustrated the only drawback attached to the use of these coils is removed. The only extras required are a double-pole double-throw switch, and a single coil holder. The single coil holder (which accommodates the medium-wave coil) is screwed to the baseboard about 3in. from the common reaction coil. The size of the reaction coil is best found by experiment, but one equivalent to 60 or 70 turns on a 4in. slotted former is about the best size. If the reaction is too fierce on the medium-wave band the single coil holder can be moved farther from the reaction coil and screwed down again, or the reaction can be reduced in size. In case of non-oscillation on either waveband, the connections to the coil must be reversed. The master-points on the d.p.d.t. switch are connected to the usual aerial and earth respectively.—S. COLLINS (Cowes, I.W.).



*Fitting a pilot lamp and window.*

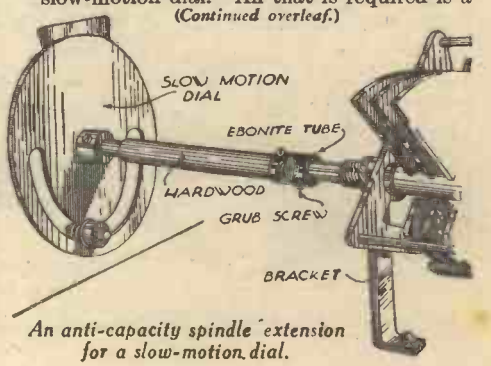
### A Novel Indication Lamp

MANY constructors have in their junk boxes an old valve window used in the days of bright emitter valves. These can be utilized in a simple way, in conjunction with a small lamp, to show whether the set is on or off. Firstly, decide upon the position of the lamp, and then cut a neat round hole to accommodate the valve window. Fix the latter into the hole and fasten securely. Then procure a piece of wood about 2ins. by 1½ins. and cut it into the shape shown in sketch. An ordinary fuse-holder is then obtained and fixed on the piece of wood, which in turn is screwed on the cabinet side, just underneath the valve window. The two leads from the holder are then taken to their appropriate positions on the set, the bulb is screwed into its socket, and the gadget is completed.—A. SMETHURST (Manchester).

### Reducing Hand-capacity Effects

THE accompanying sketch illustrates an easily-made and efficient extension handle for a short-wave set which can be adapted for use with practically any slow-motion dial. All that is required is a

(*Continued overleaf.*)

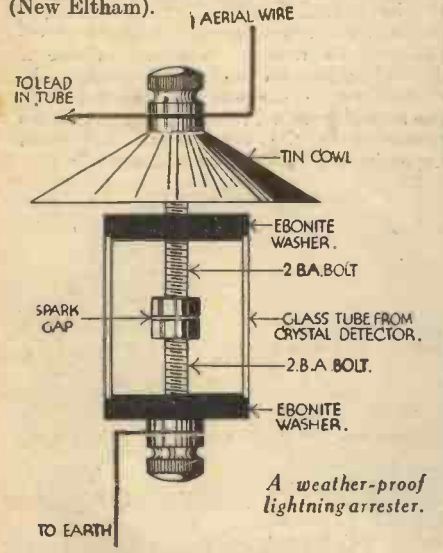



*An anti-capacity spindle extension for a slow-motion dial.*

## RADIO WRINKLES

(*Continued from previous page.*)

length of hard wood in the shape of a pencil for the extension handle, a piece of ebonite tube about 2ins. long, which will fit tightly over the condenser spindle, and a bracket which can be made from any stout piece of metal. A metal screen may be placed at the back of the panel and earthed, if desired.—E. J. CHAPMAN (New Eltham).



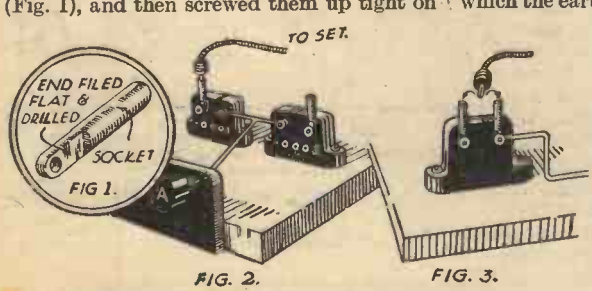

*A weather-proof lightning arrester.*

### Weather-proof Lightning Arrester

THE accompanying sketch gives details of an arrester which is sure in action and needs no switching in or out. It is always in set, should there be a storm. The components can be obtained from the junk box—the main parts are the two ebonite washers to fit the glass tube, which should make a tight fit and be drilled and tapped perfectly straight for the 2 B.A. bolts. The small tin cowl keeps the top dry, and is made from a small circle of tin, as if making a cone for a speaker. Solder the joint, and paint it to prevent rust. Adjust the gap between bolts as fine as possible, then shellac or glue well around washer and bolt. Insert arrester in aerial lead near window and connect earth terminal to earth outside the house. This arrester can be seen working in the dark, if there is bad static about, showing that it does its work. —E. THOMAS (Swansea).

### Handy Change-over Sockets

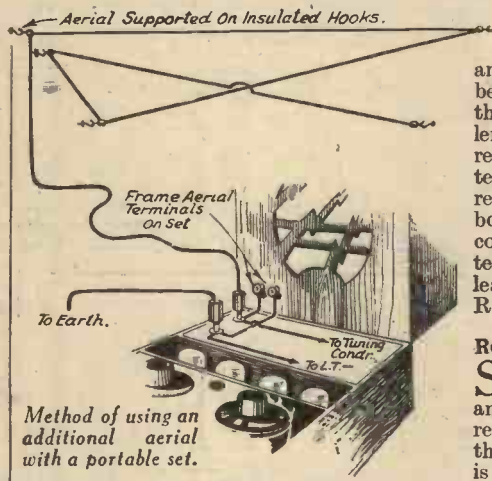
HAVING found out that a fixed condenser in the aerial circuit brought about a certain amount of selectivity, and in the course of experimenting that a .0001 condenser served medium waves, and a .0003 condenser long waves best, I adopted the following method to facilitate changing condensers. From some old type plug-in coils I took out the metal plugs and sockets. On the sockets I filed a flat on each side (Fig. 1), and then screwed them up tight on the condensers. The plug was then soldered to a short length of flex (the tapped hole in the end of the plug makes this easy by first threading the flex through it). The other end of the flex is then fastened to the coils. The condensers are wired to the aerial terminal as shown in Fig. 2. This idea can also be used for cutting out a condenser in any part of the circuit, as in Fig. 3.—A. GIBSON (Brotton, Yorks).




*Using plugs and sockets for changing condensers.*

### Improving Your Portable Set

FOR those whose portable sets are not fitted with turntables, or who cannot go to the trouble of fitting a turntable, the following idea is suggested. I have carried this out in practice for several months with success, using an indoor aerial and an earth. The set is placed near a window and the earth wire is taken to a buried earth immediately below the window, in the garden (a pipe earth would serve the same purpose). The aerial, of single stranded cotton or silk-covered wire, is plugged into the set with an ordinary plug-socket fitting and taken round the room as illustrated, being kept clear of walls as far as possible. Hooks screwed into picture rails fitted with a short length of insulated cord, will ensure the necessary clearance of walls. It will be seen from the sketch that the aerial is pointing in four different directions, which obviates the necessity for turning the set, as signals from nearly all directions will be brought in by this type of aerial. For those sets not already fitted for use with aerial and earth, this can easily be carried out by

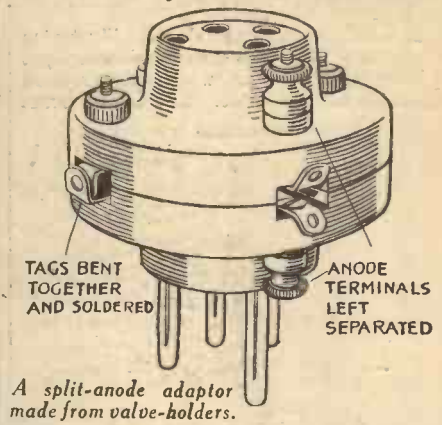



*Method of using an additional aerial with a portable set.*

drilling two holes through the back of case, as shown, and fitting two eye-sockets, the aerial and earth plugging into them from the outside. The lead from tuning condenser to frame aerial must be connected to this aerial socket, so that when the indoor aerial is plugged in it connects in circuit with the frame aerial. The other *end* of the frame coil and lead to negative filament battery must be brought to the *bottom* eye-socket, to which the earth is plugged in. More stations, and with greater volume, will be brought in without moving the set. The tuning will naturally be slightly different, as this alteration really amounts to increasing the inductance, consequently one will require less condenser reading on your dials than hitherto, for any given station. When desiring to move set to another room or locality, the aerial and earth can be disconnected, and the set then functions exactly as before conversion.—F. J. ARNOLD (Gillingham).

### A Home-made "Split Anode" Adaptor

FOR this simple device two valve-holders are required, and four or five valve legs, according to the type of holder used. The valve legs are inserted, threaded end first, into one of the holders, and retained by a blob of solder underneath. If necessary, strip the thread with pliers. Insert the other ends temporarily into the second holder while soldering, to ensure correct alignment. Place the holders base to base, as shown, and clamp them together by two bolts passed through the holes normally intended for fixing down. Complete the adaptor by joining the adjacent pairs of filament and grid terminals by any method. Personally, I found it easy to bend the tags one over the other and solder them together, but other ways, such as short lengths of "glazite," are obvious. A refinement would be to remove the three terminal screws from each holder, and replace them by bolts passing through both, with a brass distance-piece to ensure contact on the lugs. With the anode terminals left for the attachment of meter leads the adaptor is thus ready for use.—R. JAMES (Harrow).

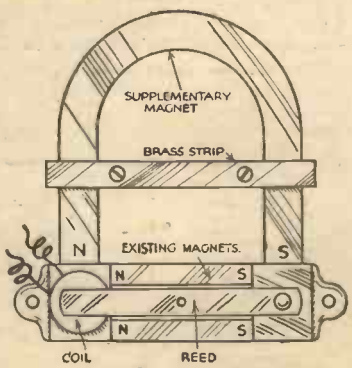



*A split-anode adaptor made from valve-holders.*

### Rejuvenating Loud-speaker Units

SOME time ago I experienced trouble with a speaker unit losing its magnetism, and there are probably a number of other readers who have experienced the same thing. The way in which I cured my trouble is as follows:—

I placed a horse-shoe magnet (taken from an old unit) against the magnet of the unit, as shown in sketch, and the speaker was nearly twice as loud as before. Any U-shaped magnet will do.—L. LAWSON-DURHAM (Holt, Norfolk).



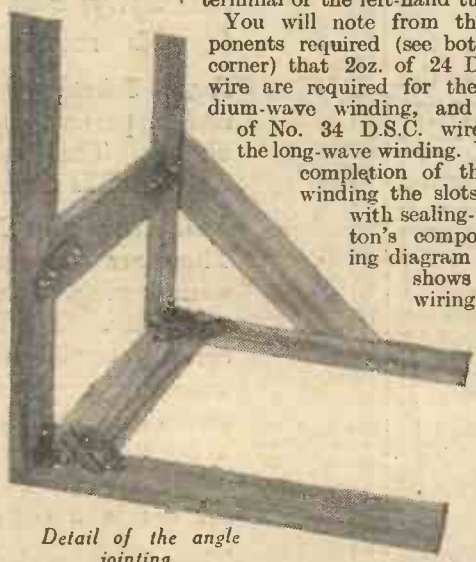

*Method of rejuvenating loud-speaker magnets.*


*Rear view of the Featherweight Portable Four.*

# STILL LEADING—AND


*Portable Set ever placed before the Home Constructor, Serving our Readers. Every Possible Requirement of The Featherweight Portable Four is covered by*

THE remaining illustrations of the Lightweight Portable Four given in these pages show all of the construction necessary to complete it. They also illustrate perhaps in a more detailed form than last week the originality of the design, and the fact that I have made a genuine attempt (I believe a successful attempt) to get out of the rut into which home-constructed sets have fallen in the past ten years. I hope (as has been the case with so many PRACTICAL WIRELESS features!) that it will start a fashion. I endeavour to originate them, with the needs of the amateur whose purse is limited but who requires first-class performance, well in mind.



*Detail of the angle jointing.*

I had no space last week with which to deal with the frame aerial. This is wound into the comb-like slots of the Bulgin Frame Aerial Spacers which are screwed diagonally at each corner of the swinging front. These spacers have the slots inclined so that when the wire is placed in them there is no possibility of them slipping out. The spacers should therefore be fixed with the inclined slots directed *outwards*.

**Frame Aerial Winding Details**

Solder one end of the 24-gauge wire to the upper right-hand contact of the tuning condenser, and take the wire across to the upper slot of the nearest spacer. Run the wire across to the left, through the upper slot on the left-hand spacer and down to the lower spacer, across the lower edge, and so continue to the slot where you commenced. Carry the wire through this slot again, and make a further turn, repeating the process so that there are three turns in the first slot. Pass to the second slot, and wind three turns in this, after which two turns only are wound in each remaining slot until eight slots have been used. There now remains the two wide slots. The end of the 24-gauge wire must be cut, and it should be soldered, together with the beginning of the 34-gauge wire, to the upper terminal of the three-point switch. The long-wave winding consists of twenty-three turns in each slot, and the finish of the winding is joined to the lower terminal of the left-hand tuning condenser.

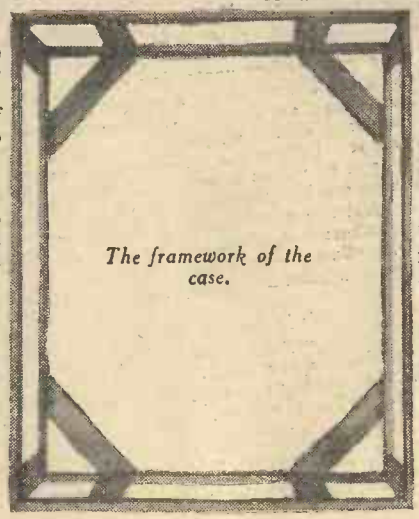
You will note from the list of components required (see bottom right-hand corner) that 2oz. of 24 D.C.C. wire are required for the medium-wave winding, and 2oz. of No. 34 D.S.C. wire for the long-wave winding. Upon completion of the frame aerial winding the slots may be sealed with sealing-wax or Chatterton's compound. The wiring diagram given last week shows how simple the wiring up really is, and how few wires are really used. Notice that low-tension negative and high-tension negative leads are connected to the three-point wave-change switch, and that H.T. positive is connected to the centre tapping of the speaker transformer; the L.T. positive lead, of course, goes direct to the on-off switch.

**The Carrying Handle**

Carrying handles may be purchased quite cheaply from most leather stores, although the one I used was taken from an old attache case and re-covered in the same material as was used to cover the case.

## ORIGINALITY!

Two metal strips will be required to pass through the swivels of the handle. Two clamping plates will be required as well, one to go beneath, and one on top. The handle itself spans the two cross struts interposed between the front and back top rails, and the clamping plates (one above and one below) are bolted over these. This makes a very rigid form of attachment, and there is no risk of the handle breaking adrift.



*The framework of the case.*

**The Batteries**

The Ediswan high-tension battery is snugly accommodated in the bottom of

IDEAL FOR THE RIVER—

# SHOWING THE WAY!

# erweight" rtable four

by F.J.CAMM

*uctions for Completing the Splendid Lightweight ver's full size Blueprint of which was given last week's issue. This is probably the Lightest and bears Further Tribute to our Policy of a Portable Here Combined in One Receiver! My Personal Free Advice Guarantee.*

e, and on this stands the accumu- d the grid-bias battery. The leads to l-bias battery are taken direct to the

*e completed receiver.*

nts, namely, the transformer and l condenser.

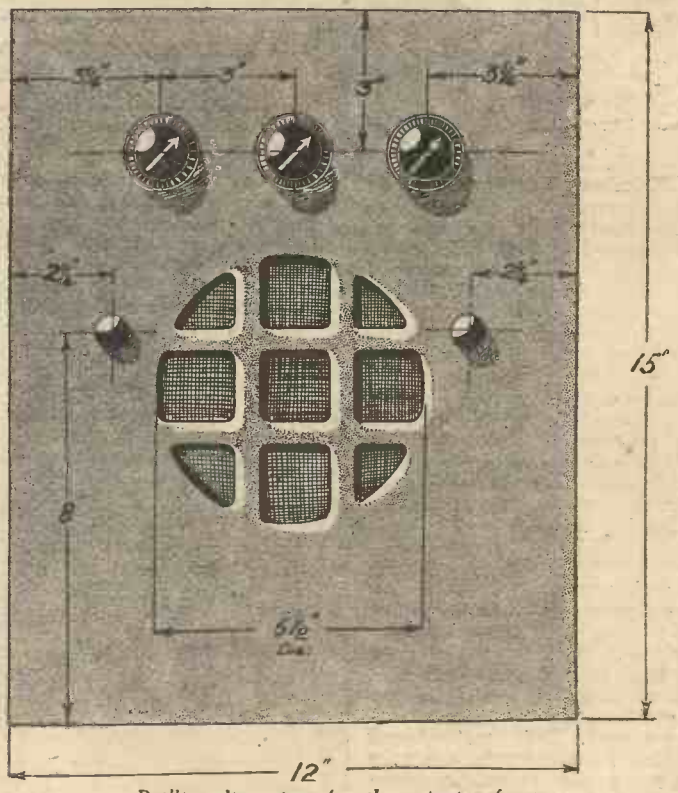
**g Instructions**

ittle need be said about operation.

The two extreme knobs at the top control the tuning, and they should be both moved to zero position to start with. Slowly rotate them, keeping them approximately in step until signals are heard, when final adjustment to their positions can be made. The reaction condenser can be used to build up volume, but for preliminary tuning it should be set to its minimum position. About 4½ volts grid bias should be used, and, of course, the full 120 volts from the high-tension battery. It is in the adjustment of the Featherweight Portable Four that you will realise the great convenience of the design. The swing hook at the top is merely released when the whole receiver front can be swung outwards and is immediately accessible. Considerations of design led me to use the flat form of frame aerial, and I naturally expected a loss of efficiency as a result. I have not experienced it, for the number of stations received, the volume, and the quality of this production equal the best portable on the market, and it is with every confidence that it will satisfy readers that I place it before them backed with my personal guarantee of free advice until it functions in the same manner as mine. A final note—do not forget to orientate the receiver to make full use of the directional properties of the frame aerial.

## OUT OF THE ORDINARY!

## A REALLY FIRST-CLASS PERFORMER.




*Drilling dimensions for the swinging front.*

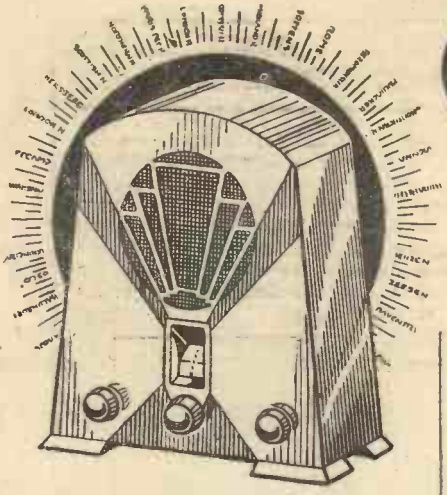
### SPECIFICATION OF FEATHERWEIGHT PORTABLE

Two Utility Bakelite Condensers, .0005 Type W. 297.
One Wearite H.F. Choke, Type H.F.P.A.
One Lissen Dual Range Shielded Coil.
One Graham Farish Lillos Condenser, .0003.
One Graham Farish Ohmite Spaghetti Resistance, 10,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 50,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 100,000 ohms.
Three Clix 4-pin Chassis Type Valve-holders.
One Clix 7-pin Chassis Type Valve-holder.
One Bulgin On/Off Switch, Type S. 38.
One Bulgin Wave-Change Switch, Type S. 36.
Four Bulgin Frame Aerial Spacers, Type I.12.
One Bulgin Senator Transformer, Type L.F. 12.
One Lissen Class B Driver Transformer.
One 2 megohm Grid Leak, with wire ends, Lissen.
One T.C.C. .01 mfd. Fixed Condenser, Type M.
One T.C.C. .0002 mfd. Fixed Condenser, Type M.
One T.C.C. .002 mfd. Fixed Condenser, Type M.
One T.C.C. .1 mfd. Fixed Condenser, Type 50.
One T.C.C. 1 mfd. Fixed Condenser, Type 50.
One T.C.C. .001 mfd. Fixed Condenser, Type M.
One Cossor 220 S.G. (Metallised) Valve.
One Cossor 210 H.F. (Metallised) Valve.
One Cossor 215 P. Valve.
One Cossor 240 B Valve.
One Rola Loud-speaker, Type F.5-PM-1-Class B.
2 ozs. 24 D.C.C. wire and 2 ozs. 34 D.S.C. wire for frame.
One Ediswan 120 volt H.T. Battery, ref. 60706.
One Ediswan 9 volt Grid Bias Battery, ref. 60807.
One Ediswan 2 volt accumulator, E.L.M.2.
Four Wander Plugs (H.T.+, H.T.—, G.B.+ and G.B.—).
Two Spades (L.T.+ and L.T.—).
One coil Glazite, flex, screws, wood for case, carrying handle, etc.

*Light enough for ladies to carry.*

'HE GARDEN—

—OR THE PICNIC



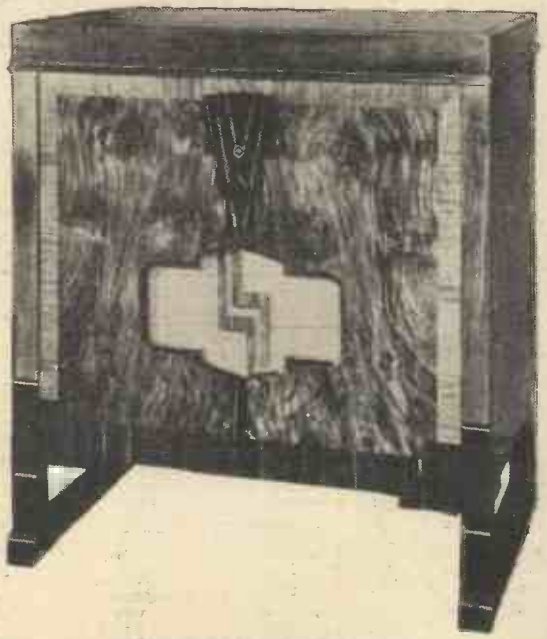
# OUR VIEWS ON RECEIVERS

## H.M.V. AUTORADIOGRAM SEVEN, MODEL 524.

MUSIC lovers will be very interested in this receiver which is produced by His Master's Voice Company, and which is designed to enable the very best to be obtained in music from either gramophone records or by radio broadcast. Leaving out the question of the cabinet, which has been designed to harmonize with practically any furnishings and which is acoustically sound in every way, the apparatus is a most interesting piece of work and is described by the makers as a "3-in-1" instrument. These three are, in order, (1) a seven-valve super-heterodyne broadcast receiver; (2) an electrical gramophone, and (3) an automatic record-changing device.

### Controls

The complete apparatus is divided up to form the most convenient assembly from the point of view of manufacture and operation. Inside the cabinet, the wireless receiver is fitted to the left-hand side of the cabinet and is held in a vertical position, with the valves horizontally arranged. To the motor-board are attached three controls, the main tuning knob, a tone controlling device and a three position switch, providing long waves, medium waves and gramophone points. Two tuning dials are visible through small windows and these are calibrated in wavelengths. To the left of these controls are arranged the pick-up, turntable and automatic record device. On the front of the cabinet is a volume-control which operates on either radio or gramophone reproduction, and just above this is a small push button which is employed to reject a record should it be desired not to listen to that particular item. More will be said of this later. At the bottom of the cabinet stands an electro-magnetic moving-coil loud-speaker. The tuning arrangements for the super-heterodyne receiver are very simple, but slightly different from the usual practice. In place of the customary screened coils, the inductances in this receiver are unscreened, but are so arranged that there is no interaction between them. A four-gang condenser is employed for tuning, and the range covered is from 200 to 550 metres, and from 900 to 2,000 metres. The aerial input is of the band-pass type, coupled to a variable-mu H.F. valve. This is choke-capacity coupled to the first detector (a three-electrode valve) which operates on the anode-bend principle. The oscillator follows, and this has a tuned-grid circuit, magnetically coupled to the grid circuit of the first detector. The I.F. amplifier is also of the variable-mu type, and this is coupled to the second detector (also a triode), which employs the same method of detection as the first detector. The automatic bias resistance in the cathode lead of this valve is "split," and a portion is short-circuited when the receiver is switched over to "gramophone," so obtaining the correct bias for this valve when employed as an L.F. amplifier. The output valve, which is supplied by means of a resistance-fed L.F. transformer, is a PX.4, giving an output of 2¼ watts.



*The H.M.V. Autoradiogram.*

### Tone Control

In order that the tone, on either broadcast or gramophone, may be adjusted to suit the acoustics of the room, or personal tastes, a 600,000 ohm resistance is joined from the grid of the output valve to earth, via a 2,000 mmf. condenser. This enables the reproduction to be modified to give brilliance to the top notes or to reduce the amount of top-note response and give that "mellow" tone which is favoured by so many listeners.

### Automatic Record Changing

The mechanism to hold the records may be adjusted to take 10in. or 12in. records, and a large knob at the rear of the turntable is suitably engraved for this purpose. The records are held in a pile (eight records) over the turntable, and the spindle is specially extended to accommodate this number. When the control is adjusted to provide automatic playing, the elaborate mechanism which is installed permits the first record to drop to the turntable (a distance of only a few inches), lowers the needle to the surface of the record, and when the end of the track has been reached, the pick-up is raised, carried back to the outside of the turntable, and the second record descends on to the first. The pick-up then comes to the first groove, the needle is lowered, and the second record is played. A slight interval must, of course, elapse between each record, so that it cannot be used for non-stop dancing, but with the apparatus as adjusted, the total playing time is half-an-hour or so, which provides a splendid dance programme for the home, and which may be extended by using 12in. records. The reproduction is, of course, remarkably good, and the response is splendidly balanced. No trace of boom can be heard, and the tone adjuster enables the records to be played without undue surface noise. One interesting feature of the H.M.V. pick-up is, of course, that owing to its freedom it gives off almost as much sound as the ordinary acoustic gramophone, and this is held by many to be a fault. Naturally, where the needle is arranged to have perfect freedom to follow faithfully the sound track on the record, it must in itself act as a small "sound-box," and this is a sign that it is of good design, not bad. However, the makers of this Autoradiogram have taken steps to avoid any unpleasant effects from this source, and to this end the entire lid is lined with felt. Furthermore, a notice is printed on the rear of the lid (inside) instructing the user to close the lid whilst playing records, and under these conditions no trace of needle chatter can be heard even when the volume is reduced to such a level that it offers no entertainment value.

### Price

It might be expected that an elaborate piece of apparatus such as this would cost a fabulous sum, but actually it may be obtained, for either A.C. or D.C., for only 55 guineas, which, when it is remembered that the apparatus is scientifically balanced, is a very small sum indeed. There was a time when such a receiver could not be purchased for four times this amount, and it is therefore a real step towards better musical reproduction, which is within the reach of everyone.

# The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

*Conducted by F.J. CAMM*

### Daylight Effect

AN expression used in reference to the difference noticed between the reception of wireless signals during the day as compared with that at night. It is a well-known fact that on the medium and long wavelengths reception after dark is considerably better than in daylight. Reception over the greatest distance is obtained when the whole distance between the transmitter and receiver is in darkness. This accounts for the fact that the most favourable time for reception of American stations in this country is in the small hours. It is then night over the whole distance between the two countries.

Curiously enough, at short wavelengths the daylight effect seems to diminish and it is possible in some cases to communicate over long distances equally well in daytime as at night. However, there are certain peculiarities regarding the daylight effect at short waves, such as a kind of reversal of the effect at certain distances. For example, a station will become inaudible when darkness falls, but will be easily picked up hundreds of miles farther away. Also, effects are different at 20 metres to what they are at 45 metres, and vary still again on the ultra-short waves.

### D.C.

Abbreviation for *direct current*.

### D.C.C.

This means *Double Cotton Covered* and refers to a well-known type of insulated copper wire. The bare wire is covered in two layers of cotton thread, the first being wound in one direction round the wire and the second in the opposite direction. When used in a dry atmosphere cotton-covered wire has very good insulating properties and is quite suitable for winding wireless coils. If the atmosphere is damp, however, the cotton absorbs moisture from the air and loses its good insulation to a considerable extent. Under these circumstances the more expensive silk-covered wire is superior. Good enamelled wire is probably better than either.

THE BEGINNER'S A B C OF WIRELESS TERMS
*Continued from page 272, May 6th issue.*

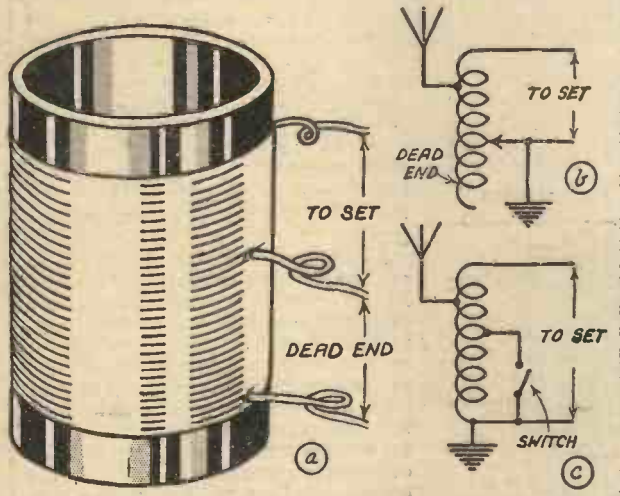



*Fig. 1.—(a) and (b) show the meaning of "dead end," while (c) shows a method of overcoming the effect.*

### Dead Beat

This term is used in reference to certain measuring instruments in which the pointer or indicating needle comes to rest very quickly. This desirable feature is obtained by what is known as *damping* (see under that heading) and is to be found in the majority of voltmeters and ammeters used for wireless purposes. Without damping of some sort or other the pointer of the meter would keep on swinging backwards and forwards for a considerable time before taking up its final position. This would be most noticeable with the better-class instrument, as the bearings are here made to be practically frictionless.

### Dead-end Effect

In the early days of wireless it was quite common to make one large tuning coil serve the purpose of several. This was done by taking tappings so that when tuning to the lower wavelengths a considerable portion of the coil was just "dead end." The dead end of the coil had a deleterious effect on the efficiency of the portion being used. Unwanted currents were induced in the unused portion due to its close proximity to the rest of the coil. These currents in turn reacted on the active turns and impaired their efficiency. Sometimes matters were improved by short-circuiting the unused turns, but later on it became customary to use plug-in coils. In this case there was no dead-end loss because there was no need to "short" any turns, a separate coil being used for each wave-band.

Nowadays it is usual to provide at least two separate windings on each coil—one for the medium waves and one for the long waves. The dead-end effect is overcome by short-circuiting the long-wave portion with a switch when the medium waves are being received. Fig. 1 shows the difference between dead-end and shorted turns: (*a*) shows a simple coil. If the upper turns only were connected in circuit and the lower end left free, then the lower turns would constitute a dead end. This is also represented diagrammatically at (*b*), while (*c*) shows how the dead end can be eliminated by means of a shorting switch.

### Decibel

Unit used in the measurement of the strength of sound. One decibel is the measure of a sound just audible to the human ear.

### Decoupling

Every wireless set using valves has to be supplied with high-tension current. This may be derived from a battery or

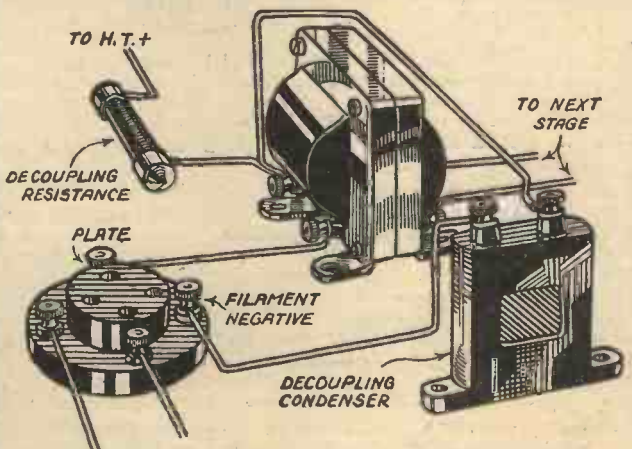



*Fig. 2.—How a decoupling condenser and resistance may be fitted in the anode circuit of a valve.*

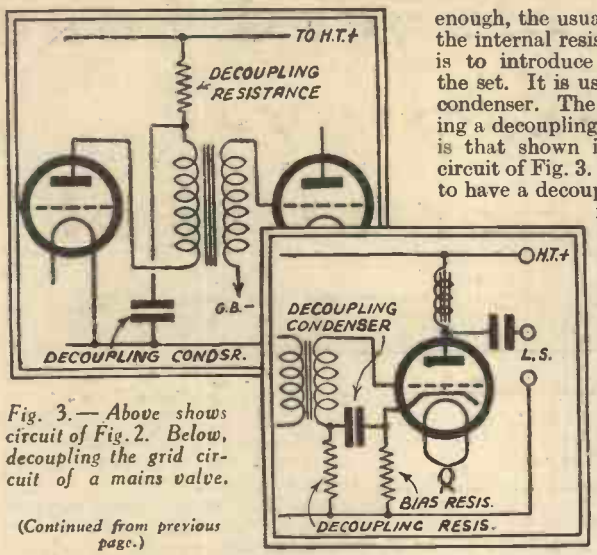



*Fig. 3.— Above shows circuit of Fig. 2. Below, decoupling the grid circuit of a mains valve.*

*(Continued from previous page.)*

from the electric light mains, but whatever the source it has a certain resistance. This resistance is usually higher in the case of mains supply than with a battery, although when an H.T. battery gets old its resistance may be very high. The effect of this resistance is often to produce howling in the receiver. It does this because the resistance being common to the anode circuits of all the valves tends to couple them together, so that energy from the later circuits is fed back to the earlier ones. It is perhaps rather difficult to understand this, but the effect is something like that obtained when the earpiece of the telephone is held near the mouthpiece. Anyone who has tried this will know that a horrible howl is produced. What happens is that any little sound made when placing the transmitter and receiver together is magnified by the mouthpiece, and travelling through the system emerges from the earpiece. This being so close to the mouthpiece sends the magnified sound into it so that it goes round again. This keeps on until the sound builds up into a howl. In our wireless set energy from the last valve gets led back to the first one, so that currents are sent through the set. These become magnified in their journey until they arrive at the last valve again, when part of them is once more fed back to the first valve. The result of this "perpetual motion" is to seriously interfere with the legitimate signals and to produce a howl.

Decoupling is, as its name suggests, a means of preventing this. Curiously enough, the usual method used to combat the internal resistance of the H.T. supply is to introduce another resistance into the set. It is used in conjunction with a condenser. The usual method of arranging a decoupling resistance and condenser is that shown in Fig. 2 and the upper circuit of Fig. 3. It is sometimes necessary to have a decoupling device of this nature fitted to every valve in the set. In the lower sketch, in Fig. 3, an example is shown of a decoupling device being used in the grid circuit as well as the anode circuit of a valve. This is because the valve is a mains valve and gets its grid-bias from the same source as its anode current —namely, from the mains. The decoupling used in the anode circuit is provided by a choke and a condenser instead of a resistance and condenser. This is because the valve happens to be the last one in the set and the choke is used to feed the loud-speaker.

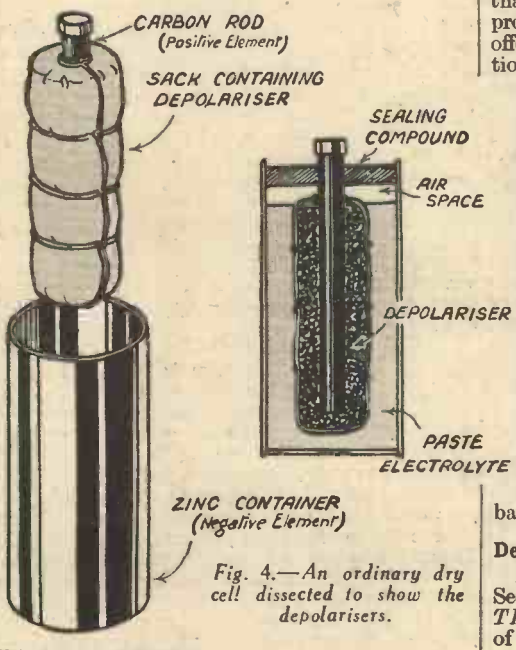



*Fig. 4.—An ordinary dry cell dissected to show the depolarisers.*

**Demodulation**

Most wireless sets exhibit to some extent or other a peculiar property. This is noted when a comparatively weak station is broadcasting on a wavelength near that of a powerful one. Owing to the closeness of the wavelengths and the slight flatness of tuning of even the best receivers both stations should be audible at once. However, the powerful station seems to affect the weaker one and to cut it out. This must not be confused with "drowning" it out, since the weak station cannot be heard between pauses in the programme of the other. However, if the other station shuts down, then up will come the weak one! This *demodulation effect*, as it is called, is due to the detector of the receiver. It does not occur with two stations of equal strength, but only when one is much louder than the other.

**Depolariser**

A substance, usually a chemical, which is used inside a battery to prevent its internal resistance rising as current is taken from it. Nearly all primary cells, unless provided with a depolariser, would only work for a few seconds without the current dropping to practically nothing. This is because such cells function by reason of chemical action. This action commences as soon as the battery is connected up and one of the results is that tiny bubbles of hydrogen gas are produced inside the cell. These bubbles offer a very high resistance or opposition to the passage of the current. To overcome this trouble some substance called the *depolariser* is put in the cell to dissolve or combine with the hydrogen and so remove it as formed.

Fig. 4 shows the construction of one of the cells of an ordinary dry battery. In this type the active elements consist of a centre rod of carbon suspended in a zinc container. The space between is filled with a paste corresponding to the liquid electrolyte of a wet battery. If there were nothing more than this the battery would work well only for a short period because the bubbles of hydrogen would collect all over the carbon rod. This rod is therefore surrounded by a mixture of small chippings of carbon and manganese dioxide. This mixture is the depolariser and is contained in a little cloth bag to keep it in position. See also *CELL*.

**Detector**

A device for rectifying wireless waves. See also *RECTIFIER, CRYSTAL DETECTOR, VALVE, etc.* Several examples of detectors are shown in Figs. 5 and 6.

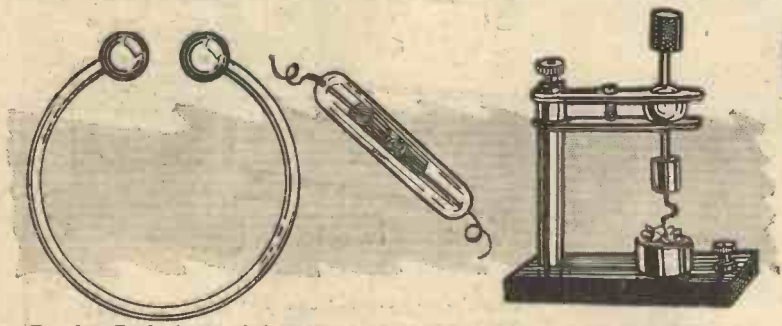


*Fig. 5.—Early forms of detector—the cymoscope, coherer, and crystal detector.*

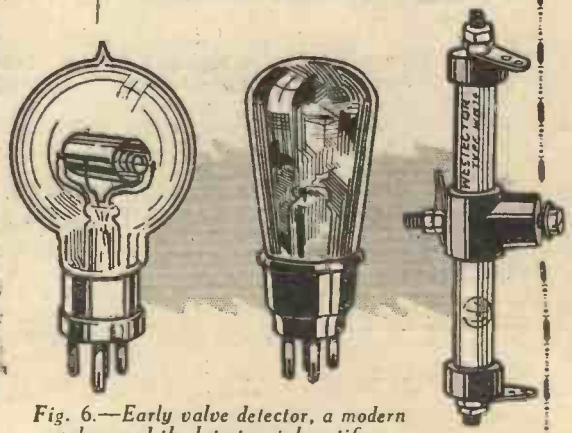


*Fig. 6.—Early valve detector, a modern valve, and the latest metal rectifier.*

# ULTRA SHORT-WAVE RECEPTION

## Some Hints for Improving Reception Below 10 Metres.

By ERIC JOHNSON

INTEREST is very rapidly increasing in reception on waves of the order of 10 metres and less. Although the ordinary type of short-wave receiver can give a very good performance on these high frequencies, nevertheless, better and more reliable working can be guaranteed if the set be designed with this special end in view.

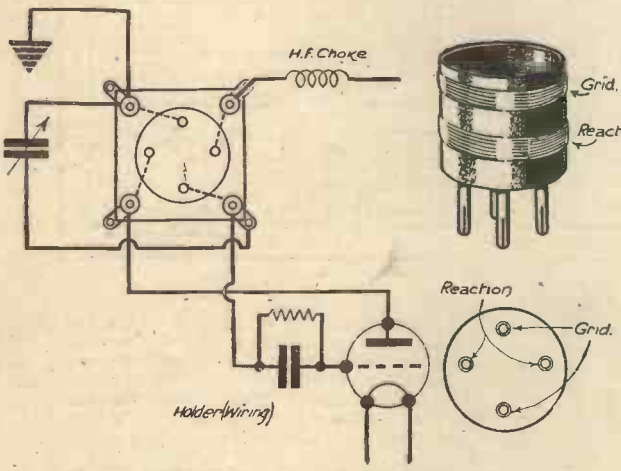



*Fig. 1.—A valve base used as a short-wave coil former.*

One would not expect the ordinary broadcast receiver to function as satisfactorily on, say, 30 metres as 300 metres; firstly, the tuning condenser would be hopelessly large, and doubtlessly other components would not have the optimum values; secondly, probably only the average amount of care would have been expended on layout and general construction. In the same way reception on 5 metres is vastly different from reception on 50 metres. As much extra care will be needed here as in the first example.

### Careful Layout Necessary

It is quite superfluous to point out that only the most careful layout and meticulous construction will achieve reliability. As in all short-wave receivers the L.F. department may be trusted to look after itself, so long as the average amount of trouble is taken; the detector stage is the all-important one. In the first case the tuning condensers must be of a reasonable size. Anything larger than .00005 mfd. is ridiculous, and, in fact, the latter size makes for difficult tuning unless a really good high-ratio slow-motion dial be used. An excellent tuning condenser may be made from the old multi-plate neutralising condensers. All except two plates should be removed, and for really easy tuning these may be double spaced. Generally, these condensers are fitted with some form of extension handle, which is all to the good. Most are without pigtail connections, however, and this deficiency should be remedied before fitting in the set. The coil problem is an important one. It has been the practice until quite recently to make these of bare, spaced wire of fairly large diameter. As a consequence, it was found that it was extremely difficult to coax the set down to 10 metres even, the reason being that one found oneself trying to work on fractions of a turn of wire. Under these conditions obtaining sufficient feed-back for reaction was something of a problem. As the success of all short-wave sets hinges on this, the ordinary amateur did not progress far. It was then that the amateur transmitting fraternity popularised the valve-base coil. These are constructed of quite thin d.c.c. wire wound around the base, the ends being brought through suitable holes and soldered to the valve legs. Although this seemed to violate all good principles of short-wave reception, the results surpassed anticipation. Owing to the small diameter, coils of a comparatively large number of turns could be made having the same inductance as one or two turns of the customary large size. Reaction coupling was simplified, and the receiver went much lower down in wavelength; furthermore, the external field was reduced, another favourable point. The ordinary valve-holder of the low capacity type is, of course, used as a coil-holder.

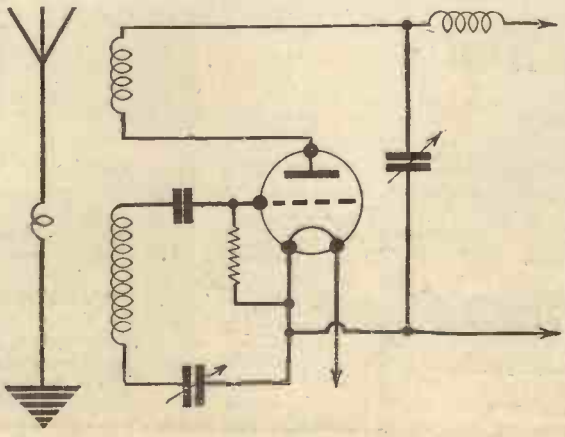


*Fig. 2.—An alternative position for the tuning condenser.*

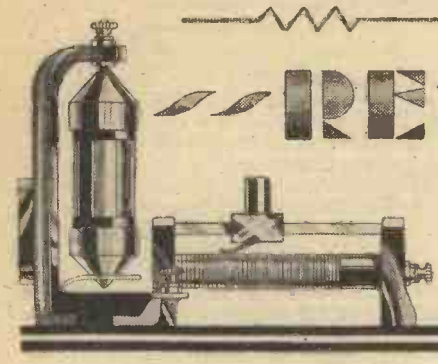
### Making S.W. Coils

A word or two about the actual construction of these coils. The general idea may be gleaned from Fig. 1. Most listeners have a few discarded valves in the junk box. The actual glass envelope may be removed by immersion in hot water or methylated spirit, when the fixative will dissolve allowing the glass to be pulled away from the case. By holding the latter in a small vice holes may be drilled adjacent to each valve leg. After winding on the requisite number of turns for reaction and grid coils the wire ends should be passed through the holes and soldered to the appropriate legs. Incidental and stray capacities in short-wave receivers play such an important part in determining the wavelength, that it is useless to give anything more than approximate sizes. However, it is best to start off with about six turns on the grid coil which should land one well down in the "'teens," and gradually remove turns until the wavelength is reduced to the required point.

### Series Tuning

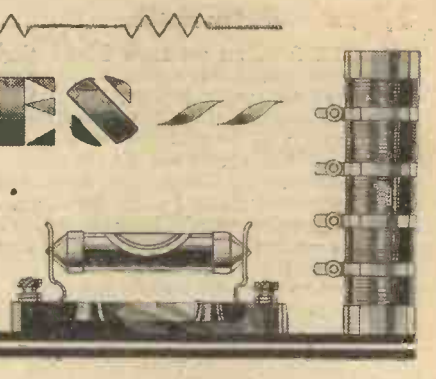
Although the tuning condenser is generally connected in parallel with the tuning coil, series tuning is by no means uncommon in ultra-short-wave sets. The circuit is shown in Fig. 2. Even when the condenser is at its maximum the total capacity across the tuning coil is always less than the incidental circuit capacity. As a result, it is possible to go down to a very low wavelength. One disadvantage, which is quite important at high frequencies, is that the grid-leak has to be returned direct to L.T. positive; its self-capacity is, therefore, added to that of the valve, which we have already probably endeavoured to reduce by employing a skeleton valve-holder. When connected across the grid condenser its capacity is added to the latter, but being such a minute proportion of the whole it has no appreciable effect; with the valve, however, it may well be compared with the grid-filament capacity.

One final word about aerial coupling. Although coupling through a very small capacity to the tuning coil is very efficient and convenient, it must be remembered that the effect will be perhaps seriously to increase the minimum wavelength of the receiver, this being by reason of transference of a part, small it is true, of the aerial capacity. In that case, therefore, it may repay to experiment with a one turn aperiodic coil as in the diagram, *very* loosely coupled.



# RESISTANCES

## WHY AND HOW · THEY ARE USED.



By W. B. RICHARDSON.

*Part II: Resistances in a Mains Receiver*

IT is in the modern all-mains type of receiver that the greatest use is made of both fixed and variable resistances.

A glance at Fig. 1 reveals no less than ten different resistances in a three-valver of quite modest pretensions. There would, of course, be proportionately more in a four or five-valver. However, the three-valver will serve to furnish us with at least one example of most of the uses to which resistances are likely to be called in present-day receivers of the A.C. mains type.

For the purposes of this article I shall deal one by one with the resistances shown in the circuit diagram, Fig. 1. This circuit, with one or two slight modifications, is an A.C. version of the battery circuit given in Part 1. Naturally, any resistances which are identical in function with those in the battery circuit will be dealt with as summarily as possible, while those which are necessitated purely owing to the mains operation will receive most attention.

Before examining the resistances themselves it is just as well to remind ourselves of the value of the voltages which are handled in a set of this description. Instead of a mere 120 or 160 volts H.T., as is used in the average battery set, the mains receiver shown here employs a maximum voltage of 350. This is obtained by stepping up the voltage of the mains by means of a transformer.

### Voltage Dropping and Decoupling

Now let us take the various resistances in numerical order. The first one, R1, serves two purposes. Primarily it is a voltage-dropping resistance, that is, it is used to reduce the voltage applied to anode of the screen-grid valve to a value which it will stand without harm. Its secondary use is for decoupling purposes. Consider first its function as a voltage-reducer. The H.T. voltage available after smoothing is about 250 volts, and the particular variable-mu valve shown requires a voltage of no more than 200. We, therefore, have to drop 50 volts. To arrive at the correct value for R1 to give this drop, we look up the anode current of the valve from the pamphlet issued by the makers. In this case this is nearly 8 milliamps. We know from Ohm's Law that resistance equals voltage divided by current $\left(R=\frac{E}{C}\right)$, therefore the resistance required equals $\frac{50}{.008}$=6,250 ohms, say, 6,000 ohms as a round figure.

For its decoupling function R1 is supplemented by the condenser C1. As R1 is of a fairly high value the condenser need be no larger than .01 mfd.

Before going further, I want you to understand that the values of the resistances I am giving here, although a useful guide to those employed in the average mains set are not hard and fast. Obviously, in a receiver employing a different circuit from the one shown here, and more particularly other valves the values might work out quite differently. However, my object is not to give values to suit all cases, but rather to explain to you the function of the various resistances and show how their values are arrived at.

After R1 we come to a network of resistances, R2, R3, R4, and R5. They certainly look rather formidable, but if we realise right away that they have only two main functions to perform between them their arrangement will not appear so complicated. The first function is to supply variable bias to the variable-mu valve, and the second is to give a suitable voltage to the screen of the same valve. The resistances looking after the bias are R2 and R3, while R4 and R5 are the chief controllers of the screen voltage.

For an understanding of the working of R2 and R3 we must know how grid-bias is applied in an all-mains set.

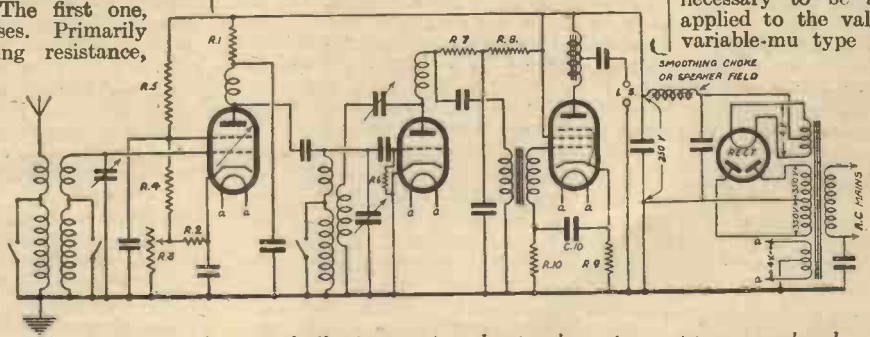



*Fig. 1.—Circuit of a typical all-mains receiver showing the various resistances employed. The text deals with the function and value of each.*

### Getting Grid Bias from the H.T.

The most obvious way of making the grid of a valve negative in respect to its filament is to connect a battery (known as a grid bias battery) between the two. This is shown in Fig. 2, and is the method employed in a battery set. In this example a 4½-volt battery is shown.

Now there are two ways of looking at this biasing business—you can either take the filament as the zero point and say the grid is 4½ volts *negative* to it, or you may consider the grid as the starting-off point and say the filament is 4½ volts *positive* to the grid. With mains valves the *cathode* corresponds to the filament of a battery valve. The filament in a mains valve is merely used to heat the cathode. It is the latter which is the "business" element and gives off the electrons. Well, then to make the cathode *positive* in respect of the grid is the same thing as making the grid *negative* to the cathode. Now look at Fig. 3. Here you will see how a resistance R2 is used to obtain bias from the high-tension supply. The plate of the valve being connected to H.T. positive is at a high positive potential in respect to the grid, which is connected to H.T. Let us say for the sake of argument the difference is 100 volts. This drop in voltage will occur across the internal resistance of the valve denoted by the dotted resistance R1. If, however, a resistance R2 is included in series with R1, then the drop will be divided between them. Thus, for example, if R2 is the same value as R1 there would be 50 volts dropped across each. In other words, we should be getting 50 volts H.T. and 50 volts grid bias from the supply. If R2 were smaller than R1, then the voltage dropped across it would be proportionately smaller than that across R1. In practice, of course, R2 is made just sufficiently large to give the necessary few volts required for bias.

In the case under consideration it is necessary to be able to vary the bias applied to the valve, since this is of the variable-mu type in which the variation of bias forms the volume control of the receiver. To arrange this the two resistances R2 and R3 in Fig. 1, are used in place of the resistance R2 in Fig. 3. R3 is the bias resistor proper which can be varied from zero resistance to a fairly high figure. R2 is included in series with it so that there is always a slight bias even when R3 is at zero. This is necessary because the valve is designed to work with a small minimum bias.

### Bias Resistor Values

Now as to the value of R2 and R3. The usual way to calculate these is to ascertain the current flowing through them. This divided into the bias voltage required gives the necessary resistance. It is simply a further application of Ohm's Law.

(*Continued overleaf.*)

(Continued from previous page.)

Taking R2 first, we see from Fig. 1 that it has the combined anode and screen currents of the valve flowing through it. The valve makers state that the maximum anode voltage of 200 (at which we are running the valve) the anode current is 8 milliamps. To this must be added the screen current of about 1 milliamp at optimum screen volts. Again, from the maker's pamphlet we find that the normal grid bias required by the valve is 1.5 volts. R2 will therefore have to be of such a value to provide this minimum bias when R3 is at zero. We can calculate this value from Ohm's Law thus:

$$R = \frac{E}{C} = \frac{1.5 \times 1,000}{9} = 166.6 \text{ ohms.}$$

The nearest obtainable value to this would be 150 ohms, although a 200 ohms resistance would perhaps be better in the interests of stability.

The value of R3 depends on what degree of volume control is desired. To give a fair range requires a variation of bias between 0 and about 40 volts; therefore to obtain this the resistance must drop 40 volts when "all in." The calculation is the same as for R2, namely, voltage required divided by current passed. However, in this case the current is more than that passing through the valve. There is also that passed by the screen potentiometer composed of R4 and R5. This latter is about 3 milliamps, so that the total current passing through R3 is about 9 mA. plus 3 mA. = 12 milliamps. To give a voltage drop of 40 the value of R3 must therefore be $40 \div .012 = 3333.3$ ohms. A suitable value would be 4,000 ohms.

Before dismissing R2 and R3 I must just say a word about their wattage dissipation. I think it is fairly obvious that R2 will not be overloaded even if of the smallest rating since it is not a very high resistance. Let us see how it works out. We know that wattage equals voltage multiplied by amperage, thus the wattage required for R2 is $\frac{1.5 \times 9}{1000} = .0135$ watts. Quite a modest dissipation and well within the capacity of the average metallized or spaghetti type of resistance. The wattage of R3 is worked out in a similar manner. The voltage in this case is 40, and the current 12 milliamps thus the power dissipation is $\frac{40 \times 12}{1000} = .48$ watts. Thus the average wire-wound potentiometer or volume control would be quite suitable, in fact most such components will stand 5 watts.

Now as regards the voltage on the screen of V1. This is regulated by the resistances R4 and R5 together with some part of R3 (the actual amount depending on the position of the slider). These three, as you see, form a potentiometer across the full H.T. supply.

The screen of the valve takes its voltage from the junction of R4 and R5. Naturally, the voltage applied to the screen will depend on the ratio of R5 to R4 and R3 together. If R5 is large compared with the other two, then most of the 200 volts from the H.T. supply will be dropped across it and the voltage on the screen will be low. If, on the other hand R4 and R3 together form a higher resistance than R5 then the greater drop will be across these and so the potential on the screen will be higher.

Actually there are three things which govern the values of R4 and R5. Firstly, there is the voltage required by the screen; secondly, the current it takes; and, thirdly, the amount of current which must pass

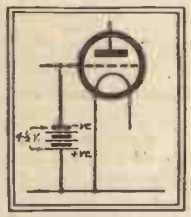


*Fig. 2.—How grid bias is obtained in a battery set.*

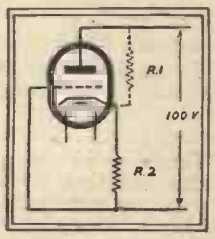



*Fig. 3.—Showing how, in a mains set, the grid bias battery is replaced by a resistance.*

through the resistances themselves. This last must be fairly large compared with the current taken by the screen in order to obtain a sufficiently steady voltage. It should be at least three times the screen current. In this case, therefore, the minimum figure is three amps.

In determining the values of R4 and R5 we shall ignore R3 for the moment by assuming it is set at zero. The correct voltage for the particular variable-mu valve we are using is 80 volts therefore to pass 3 milliamps at 80 volts R4 must be about 27,000 ohms. The nearest standard resistance to this is 25,000 ohms. Assuming we use this then it will pass $\frac{80}{25,000} = 3.2$ milliamps. Now, this current plus the screen current of 1 milliamp will have to flow through R5. To determine R5 we have to divide the voltage it has to drop, namely 250 less 80, by the current it has to pass, thus: $170 \div \frac{(3.2 + 1)}{1,000} =$ just over 40,000 ohms. A resistance of 40,000 ohms would therefore be used.

The reason for connecting the lower end of R4 to the slider of R3 instead of direct to H.T. may appear rather strange, especially as it amounts to the same thing when the volume control is set at zero. However, it is done to compensate for the drop in screen volts which naturally follows an increase in grid bias. For efficient working the voltage on the screen of a variable-mu valve must remain nearly constant whatever the position of the volume control.

As we have already seen, the grid-bias volts are obtained by taking them from the H.T. voltage. This deduction does not matter so much in the case of the plate voltage, but cannot be tolerated in the case of the screen voltage. Of course, a small proportionate reduction is quite in order but the connecting of R4 to H.T. would give the same reduction in screen volts as in plate volts, namely, 1 volt for each volt increase in bias. How the joining of R4 to the slider of R3 improves matters may be explained by the fact that R3 is in series with R4 and R5 across the full H.T. supply; therefore an increase in R3 from zero upwards means an increase in the proportion of the voltage dropped across R3 and R4 together, as compared with that dropped across R5. Since the voltage on the screen is dependent on the ratio of R3, R4 to R5 an increase in R3, R4 will give an increase in screen volts. This increase will partially compensate for the loss due to grid bias.

The next resistance in the set is the grid leak R6. A suitable value is ½ megohm. R7 is the feed resistance to the L.F. transformer and its value must be decided by the make and type of transformer employed. A usual figure is 30,000 ohms.

Resistance R8 is a decoupling resistance. Its value should be about the same as that of the corresponding resistance in the battery set described last week, namely, 20,000 or 30,000 ohms. Regarding the wattage of R7 and R8 one-watt types would be large enough since the anode current of the detector valve is only about 3 milliamps.

R9 is the grid bias resistor for the output valve. The grid bias required by this particular valve at 250 volts on the plate is 9 volts while the anode current is 30 milliamps, therefore, since the resistance has to pass 30 milliamps (the anode current passes through the bias resistor, of course) and gives a voltage drop of 9 volts its value must be:—$9 \div \frac{30}{1000} = 300$ ohms. 300 ohms, therefore, is the value chosen. As regards its current carrying capacity the use of a ½ watt type would provide an ample margin of safety. The actual wattage dissipation of R9 is clearly $\frac{30 \times 9}{1000} = .27$ watts.

The last resistance in our set is R10. This is used for decoupling purposes in conjunction with C10. Its object is to prevent any hum or ripple picked up by the bias resistance from manifesting itself on the grid of the pentode. A suitable value for the resistance is 50,000 ohms while the condenser should be about 1 or 2 mfd. As there is practically no current passing through R10 the question of wattage does not arise so a resistance of the lowest rating will suffice.

## ROUND THE WORLD OF WIRELESS

(Continued from page 286.)

### Buenos Aires Calling

TEST transmissions from the new "Radio Excelsior" broadcasting station at Buenos Aires, which has just been completed, have recently been received in England. The wavelength of the station is 361 metres and the power 20 kilowatts (unmodulated aerial carrier energy). The test programme, consisting of announcements in English and other languages, military and dance band items, English sea songs, and a pot-pourri of Irish songs, was clearly heard, particularly before sunrise, a frame aerial being used when atmospherics became troublesome and an ordinary "open" aerial at other times. The transmitter for the new "Radio Excelsior" station was designed and constructed in England, at the Marconi Works, Chelmsford, to replace an earlier installation of comparatively low power. Its modern features include low-power modulation, crystal frequency control, and careful provision for a frequency response substantially flat between 30 and 10,000 cycles, ensuring first-class quality of reproduction.

"Radio Excelsior" has one of the highest broadcasting aerials in the world, the horizontal aerial being suspended between two towers 700 ft. in height.

# MOVIE MYSTERIES EXPLAINED

THE May issue of "Home Movies and Home Talkies" contains two pages of fascinating pictures showing how professional effects are obtained in the big Studios.

## OTHER CONTENTS

Are you thinking of having a Cruising Holiday this year? If so, you should make a point of reading Adrian Brunel's article, "How to Take YOUR CRUISE FILM." Another illustrated article of special interest at this time of the year is "Making Movies at the Zoo"—that paradise of picture-makers. Also further information on Home Talkies, and particulars of TWO PRIZES of £10 and TWO of £5 offered to readers.

*Obtainable at all Newsagents, Bookstalls and Dealers, or post free 7½d. (Subscription rates: Inland and Abroad 7s. 6d. per annum. Canada 7s. per annum) from George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.*


*Geo. Newnes, Ltd.*

# WHY PAY EXORBITANT PRICES FOR VALVES?


*Turn to page 244 of your "Practical Wireless" dated April 29th, and read what the Technical Staff of this journal say about BRITISH 362 VALVES. These wonderful valves bring you better radio at lower prices, and, despite the huge demand, we can give you DELIVERY BY RETURN OF POST.*

SEND DIRECT TO THE MAKERS FOR

**BRITISH 362 VALVES**

**THE NEW CLASS "B"**

**This new valve gives Mains Volume from a Battery Set at Negligible Current Drain. Immediate delivery with full instructions. 7-pin base as illustrated, or side terminal.**

**9/-**

**POST FREE**

*If you also require a "driver" valve, send for the British 362 Power Valve.*

**Compare the prices of British 362 Valves. They are FULLY GUARANTEED to have as high, or higher, characteristics as any valve (British or foreign). They are equal to any and better than most. Non-microphonic. Buying direct by post from the makers SAVES YOU 50%. Post your order to-day. Immediate delivery of all types.**

| R.C., H.F. L.F. & DETEC. | POWER | SUPER POWER | SCREENED-GRID or VAR-MU. | PENTODE TYPE |
|---|---|---|---|---|
| 3/6 | 4/- | 4/6 | 7/6 | 10/- |

**All Post Free. In 2v., 4v., or 6v. Metallised 3d. extra.**

**If valves of a certain make have been specified for your Set, send the name and type with your order and we will send you 362 Valves of similar characteristics. Cash with order. Cheques and P.O.'s must be crossed and made payable to :—**

**The 362 RADIO VALVE Co., Ltd. (Dept. W.8), 415, Mare St., Hackney, London, E.8.**


# Utility

For the wonderful little portable described in this week's issue the designer specifies two Utility Bakelite Condensers. Utility Bakelite Condensers are the finest of their type, they occupy a minimum of space and are accurately rated to the capacities stated.

*From your dealer or post free from the makers.*

**WILKINS & WRIGHT LIMITED**

Utility Works, Hollyhead Road, Birmingham

*London Agent:*

*E. R. Morton, Ltd., 22, Bartlett's Buildings, Holborn Circus, E.C.4*

# TUNES THE "FEATHER-WEIGHT" PORTABLE

★

**Utility W297 Bakelite Condensers, complete with knob - - - 2/- EACH**

## *The Motor Cyclist's Enquire Within.*

THIS is the only Reference Year Book covering every phase of Motor Cycling. Contains complete and comprehensive information with practical illustrations relating to all makes of machines and accessories, facts and figures regarding competitions, records, clubs, legal matters, overhauling and repairing, tuning, classified buyers' guide, etc.

# The Motor Cyclist's Reference Year Book

**Edited by F. J. CAMM.**

**1932—1933 EDITION**

*Obtainable at all Newsagents and Bookstalls, or post free 1/2 from George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.* **1/-**


*Read this*

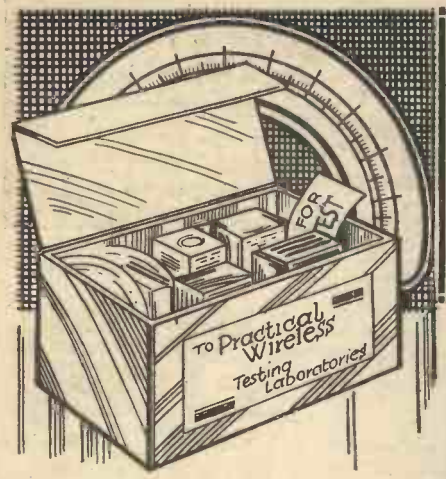
# QUALITY Produces EFFICIENCY

**TESTED BEFORE DESPATCH**

The original BECOL ebonite low loss formers are thoroughly reliable. They are used in all parts of the world. Look for the BECOL trade mark. Ask your dealer. If unable to supply, write direct. SEND NOW, enclosing 6d. (post free) for up-to-date handbook of tuning coils for DUAL RANGE, BAND-PASS, and SUPER-HET. circuits. Fully illustrated with data. A very interesting handbook.

**RODS, SHEET, TUBES, PANELS**

**The BRITISH EBONITE Co., Ltd., Hanwell, London, W.7.**



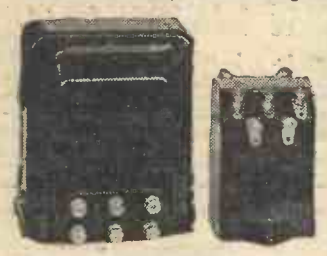

# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

### VARLEY CLASS B COMPONENTS

THE two transformers illustrated below are the new Class B couplers produced by Messrs. Varley, Ltd. On the left is the type DP.42 Output Choke, which is designed to couple any type of Class B valve to practically any existing type of loud-speaker having a high resistance. The inductance is 10 henries per half primary at the maximum current of 33 mA. The D.C. resistance is only 350 ohms, so that there is no serious voltage drop. The choke is tapped to provide three separate ratios, 1.5 to 1, 2 to 1, and 2.5 to 1. It is a most substantial component weighing very nearly 2lbs., and it gives splendid results. It costs 16s. 6d., including royalty. The smaller component is the Driver Transformer, and this weighs only 9ozs. It is designed to couple the Cossor or the Mullard type of Class B valve, and therefore has two sets of secondary terminals. The ratio provided on one set is 1 to 1, and on the other 1.5 to 1. The primary has an inductance of approximately 30 henries, and is designed to carry a current not exceeding 6 mA. The resistance of each half of the secondary is 100 ohms on the 1.5 to 1 ratio, and 150 ohms on the 1 to 1 ratio. The price of this transformer is 15s., inclusive of royalty.



*Varley Class B transformer and output choke*

### LISSEN CLASS B HYPERNIK TRANSFORMER

TO the already extensive range of Lissen transformers, the Class B Driver, illustrated below, has now been added. This is a splendidly-designed component, and has the following electrical characteristics. The primary inductance is approximately 25 henries, and is designed to carry a maximum D.C. of 5 mA. The resistance of the primary is 500 ohms, so that the voltage drop at maximum current is only 2.5 volts. The secondary has a total resistance of approximately 400 ohms, giving a ratio of roughly 1 to 1. It is thus suitable for the Class B valves which are at present on the market, and no doubt a further model will become available when the new types of Class B valve make their appearance. For coupling the loud-speaker to the Class B valves the Lissen Centre-Tapped Output Feed Choke should be used. This has already been reported on under the heading of quiescent push-pull components, and the correct load is obtained with this particular component.

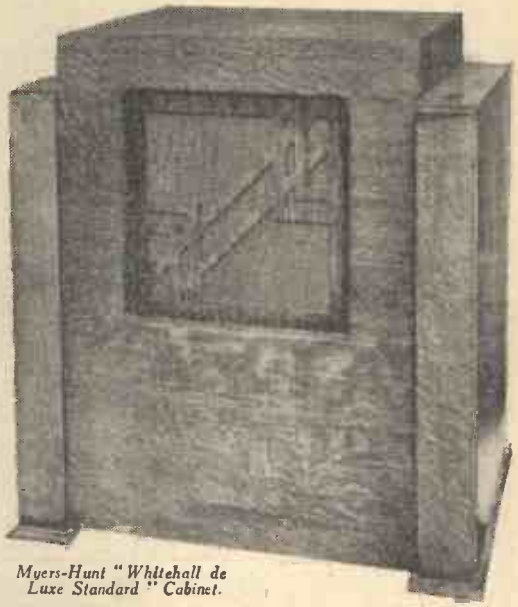

*Lissen Hypernik Class B transformer.*

### RADIOPHONE SCREENED DOWN-LEAD

THE manufacturers of the British Radiophone condensers are now entering the market with other components, and one of the first additions to their range is a screened down-lead which is of most use in areas where what is known as "man-made static" is troublesome. As has already been stated in our pages, trolley-buses, flashing signs, and other such apparatus give rise to cracklings and other distressing noises in the loud-speaker, and in many cases completely prevents distant reception. It has been found that screening the leading-in wire assists greatly in reducing this form of interference, and the particular lead supplied by Messrs. The British Radiophone, Ltd., is made up from three rubber tubes of small diameter held inside a larger tube. This results in a solid rubber tube, having three equal-sized air channels running through its length. At the centre, the lead-in wire is held between the three tubes, and it is thus air-spaced. The exterior of the outer tube is covered with plaited wire, and this is joined at the end to a substantial wire for earthing purposes. It has been tested in some very severe cases and found to operate most effectively. In the PRACTICAL WIRELESS laboratory, a receiver was connected to the normal aerial and a large electric motor connected to the lathe was switched on. The noise from the speaker prevented the reception of even the London station, but when the screened lead was used, and the screening earthed, the noise from the motor was reduced to such a value that the programme could comfortably be listened to. In the case of outside interference the reduction is in most cases complete, and the strength of distant stations is not appreciably affected. The cost of this lead is 9d. per foot, and it will be found invaluable in areas where outside disturbances are severe.

### "WHITEHALL" CABINET

A MOST attractive cabinet is illustrated on the right, and is a product of the Myers-Hunt Cabinet Co. Usually, the cabinets which are obtainable for the home-constructor are built to have a most pleasing appearance, but the requirements of a cabinet (from the radio point of view) are too often overlooked. In this case, however, the cabinet appears to have been designed with all its requirements in view. Firstly, the accommodation is ample for the ordinary home receiver *and* the loud-speaker. A shelf may easily be fitted to accommodate the batteries in the case of a battery-operated receiver. There is ample room for the 9in. type of speaker, and to enable this to occupy a good position at the rear without unduly increasing the size of the cabinet the simple "stepped" arrangement of the cabinet has been employed. This also adds to the appearance. The material from which the cabinet is made is not ply-wood, but most substantial oak, and in the cabinet illustrated this is ¾in. thick. The result of this, combined with the shape of the cabinet, is that resonance is avoided, and the reproduction is particularly pleasing and free from boom. The finish of the cabinet is very fine, and the workmanship is of a high order. In solid-figured oak, this cabinet costs 30s., and in walnut, 40s. The inside measurements are 16in. wide, 11in. deep, and 17½in. high.



*Myers-Hunt "Whitehall de Luxe Standard" Cabinet.*

### LONG THROAT SWITCHES

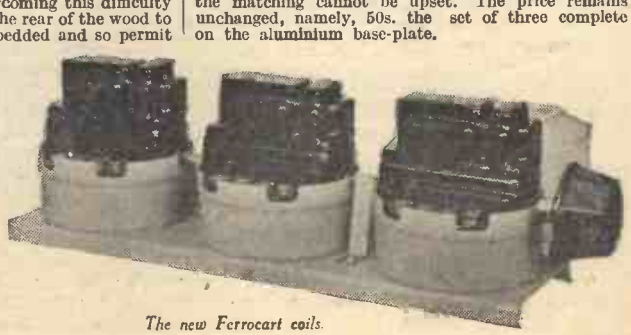
WHEN constructing a radio-gramophone it is often found necessary to mount one of the small Q.M.B. switches on the cabinet side, or on the motor board. When the cabinet has been designed on sound lines, the wood is often round about half an inch in thickness. Consequently, it is found extremely difficult to screw on the nut which holds the switch in place, owing to the shortness of the threaded portion of the switch. One way of overcoming this difficulty is to cut away a square piece at the rear of the wood to allow the switch to become embedded and so permit at least two turns to project. This is difficult and makes the attachment of the connection wires difficult. For such cases the Claude Lyons Long Throat Switch will be found particularly suitable. It is exactly the same as the standard Q.M.B. switch, except that the threaded portion—or throat—is nearly an inch long. It may thus be secured to the thickest cabinet or panel with ease and requires only the drilling of a three-eighths hole. It is supplied in a 3-amp., 250 volt rating, and costs only 1s. 9d.

### BURNE-JONES SLOW-MOTION DIAL

A NEW Magnum product has come to hand in the form of a neat slow-motion dial. It can be used for either panel mounting, may be secured to a baseboard, or attached to the frame of a single or ganged condenser. A steel frame carries the whole assembly and the scale is mounted on a robust bush which will accommodate spindles up to ¼in. in diameter. A small steel grub screw serves to lock bush in position. A special slotted plate is fitted to anchor the fixed vanes of the condenser, and the drive is of the smooth, non-slipping type, having the spindle supported at both front and rear. A taper bearing obviates undesired movement. The escutcheon is of distinctive design, and an oxydized copper finish is provided. The dial supplied may be obtained calibrated in wavelengths against the standard Magnum Canned Coils, or with a plain scale marked 0/100. A lampholder is fitted to enable rear illumination to be provided. The cost of the complete assembly is 3s.

### NEW FERROCART COILS

MESSRS. COLVERN, LTD. have submitted new models of the famous Ferrocart coil. The electrical characteristics remain unchanged, but in view of the awkward handling that might be given to these coils, not only in transit, but also by curious purchasers of the coils, it has been found desirable to completely enclose the coil in a moulding, as may be seen in the illustration In this way, no damage can be done to the coil, and the matching cannot be upset. The price remains unchanged, namely, 50s. the set of three complete on the aluminium base-plate.



*The new Ferrocart coils.*

# IMPRESSIONS ON THE WAX

## A REVIEW OF THE LATEST DISCS

By E. REID WARR

### Recordings from the Programmes

Here are the best recorded versions of some recently broadcast items. The pieces have been carefully selected to give at least one to suit every individual taste.

### *Very* English Music

Every composer's work bears traces of his nationality, and it would be difficult to find any music more typical of England than Eric Coates'. There was a programme of music a few weeks ago, and amongst the items was the suite *From Meadow to Mayfair*. Here is simple music which never bores one. There is a fine recording, done a few months ago. The two records are played by the London Symphony Orchestra on *H.M.V. C*2448-9 *at* 4*s. each.*

### One for the Kiddies

Did you hear *Alec Shaw, the Scottish Bird Man*, in a Vaudeville hour recently? The hours he has spent with the songsters have given him a most uncanny power of imitating their song. You will find all of his "turn," with its little explanatory remarks, on *Columbia DB*936. This record is a very delightful half-crownsworth.

### A Seventeenth Century Gem

One of the loveliest songs you will find in any language is *Plaisir D'Amour*. It was sung by Lucyenne Herval some time ago. There is a marvellous record of it made by Yvonne Printemps on *H.M.V. DB*1625. It is sung to a harpsichord accompaniment, and its plaintive air haunts one for days. Its companion song *Au Claire de la Lune* is extremely good also. It is a six-shilling record, but worth every penny.

### Tauber and "The Merry Widow"

The famous *Vilja* (pronounced *Villia*) was sung in an afternoon programme recently. It is one of those songs which always seem welcome. Tauber has sung it, and splendidly, too, on a *Parlophone Odeon R.O.* 20188 (4*s.*). You can imagine that Tauber *would* sing this well!

### A Very Tuneful Overture

—That from *Mignon*. Played very creditably by the Northern Studio Orchestra. It contains music of the kind which is called "nice"—"jolly"—pretty." There is an excellent performance of it by the *Orchestre Symphonique of Paris* on *Columbia DX*355 (4*s.*).

### And Still Another

*Offenbach's Orpheus in the Underworld.* this is better than Thomas's "Mignon." A record everybody ought to have is that of the performance by the *Berlin State Opera Orchestra* on *H.M.V. D*1293. This is done in the grand manner with tremendous skill and power.

### A "Best Seller" in Songs

Haydn Wood's *Brown Bird Singing* has had a tremendous run. It has been performed in every way imaginable (Reginald Dixon played it on the organ in a recent programme, which recalls the very delightful record *H.M.V. B*6184 (2*s.* 6*d.*), where it is played as a waltz by Ray Noble and the Mayfair Orchestra, and it is very appropriately backed by *Bird Songs at Eventide* in the same style.

### A Schubert Song Worth Hearing Again

The *song's* the thing really, although *Am Meer* was played by an orchestra in a recent broadcast. There is a new *Decca Polydor* (*No. DE*7020, 2*s.* 6*d.*), on which the famous German bass, Schlusnus, sings it. He is quite in the front rank, and should be heard. The song on the other side, *By the Weser*, is very good, too. Both are, of course, in German.

### An Operatic Star in a Popular Number

They are all doing it nowadays. That oft-played song, *Her Name is Mary* (and a very good little song, too), heard in tea-time music, has been most unaffectedly sung by that very good tenor, Kullman on *Columbia DB*1006 (2*s.* 6*d.*). He forgets that he is an opera star when he sings this—that's why it's so good.

### A Spanish Triumph with Shakespeare

Some weeks ago *Should He Upbraid* was sung. It is strange that the most perfect singing of a song so essentially English should be by a Spaniard, but nobody can help but agree after hearing Conchita Supervia sing it on *Parlophone RO*20186 (4*s.*). Inflexion and understanding of Shakespeare's words are perfect, the accent well-nigh so. This record is of the highest possible merit, and Bishop's fine old song has been faithfully dealt with.

### Some New Gems from the Classics

One or two delightful recent issues of Columbia and Parlophone which have just come to hand may be cordially recommended. The first is certain to be enjoyed by everybody—it belongs to that strangely named "popular classical" school. The titles are *Intermezzo—Cavalleria Rusticana* and the *Intermezzo—Pagliacci*. They have been done before, many times, of course, but here are singularly impressive performances by the Milan Symphony Orchestra. You will find these favourites on *Parlophone E*11339 (4s.).

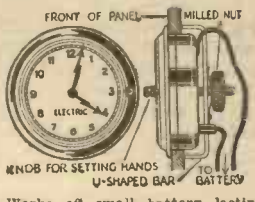
Then to Wagner. The British Symphony Orchestra, under Bruno Walter, have done *Siegfried's Journey to the Rhine* from the *Götterdämmerung* on *Columbia LX*191 (6s). Again, a very luxurious rendering of well-known music.

Gounod and Bizet follow—the popular classic again. I like Charles Kullmann's singing (in English, mark you) of *All Hail, Thou Dwelling* and the *Flower Song—Carmen*, on *Columbia DX*442 (4s.). Both are sung without any tricks, cleanly and

(*Continued on page 314.*)





# RADIO RAMBLINGS

*By JACE*

*Jottings from my Notebook*

### Lectures on Television

A SPECIAL course of four lectures on Television will be given by H. J. Barton-Chapple, Wh.Sch., B.Sc., A.C.G.I., D.I.C., A.M.I.E.E., at The Polytechnic, Regent Street, on Wednesdays, commencing May 10th, 1933, from 6.30 to 8 p.m.

The syllabus for the complete course is as follows :—

May 10th.—Definition. Relationships and differences between television and photo-telegraphy. Analogies. Nature's television system. Importance of visual persistence. Illustration of principles of television.

May 17th.—Photo-electric cells. Spot light and flood light principles of working. Disc and mirror drum transmitters. Distortion at transmitting end.

May 24th.—Synchronizing. Image structure. Picture ratios. Transmission channels. Ultra-short-wave possibilities.

May 31st.—Different types of television receivers. Consideration of wireless receivers for television. Image distortion. General survey of modern practice with suggestions for future developments.

The course is intended for those who have attained a reasonable standard in electrical and high frequency technology.

### Automatic Wireless Beacon.

WIRELESS is being used in many novel ways for the guidance of navigators both in the air and on the sea, and an automatic wireless beacon of particular interest is being installed in the Irish lightship *Comet*. The wireless beacon will have an energy in the aerial of 100 watts and will be operated in conjunction with a submarine sound signalling device to enable navigators to ascertain not only their position in respect to the lightship, but also their distance from it. During the transmission periods the wireless beacon will transmit a warning dash, followed by a series of dots at regular intervals. The submarine sound-signalling device will transmit a signal, the beginning of which will be synchronized with the end of the five seconds warning dash of the wireless. Wireless waves travel with the speed of light, and are therefore received practically without time lag by any receiving station within the service area of the beacon, while the sound waves emitted by the submarine signalling device travel through water at the rate of 4,800 feet per second. The signals will be arranged so that the number of dots received by wireless before the reception of the submarine signal will be equal to the number of miles the receiving ship is from the beacon. The navigator will thus be enabled to ascertain his distance from the beacon without computation. The lightship will have a distinctive signal which will be emitted before each transmission. A chain of twenty-three wireless beacons is in operation around the coasts of the British Isles for the safeguarding of shipping, and the Marconi Company have a contract in hand for two new beacons for the Chinese authorities to assist navigation on the important routes to Shanghai and the Yang-tse-Kiang.

### New Use for Radio

TALKING of ships reminds me of a novel instrument that I inspected in a large factory devoted to the manufacture of nautical and other instruments for recording purposes. This particular instrument is called an echometer, and is being fitted to vessels in increasing numbers to obviate the need for "swinging the lead" in obtaining soundings as to the depth of water under the ship. Actually the instrument consists of a radio transmitter and receiver which sends out signals from the hull of the vessel and picks up the echo of these signals after it has travelled to the bottom of the sea and back. The difference in time between the sending of the signal and its subsequent reception is measured, and as the speed of wireless waves is known it is a fairly simple matter to calculate the distance the bottom of the ship is from the ocean bed.

### What Will the Show Reveal?

THIS year's Radio Exhibition at Olympia, takes place from August 15th to August 24th. What with set manufacturers introducing new models in March, and the makers of accessories giving us new coils, valves and the "cold" detector so early in the year, I almost feel like asking if there *can* be any more new things in so short a time. In the way of components, I must confess that I can only think of permeability-tuning coils. As regards complete receivers, I imagine that we shall find that all the better quality ones are fitted with automatic-volume control, some system of automatic tone compensation and, in the case of battery sets, with either Class "B" or "Q.P.-P." output. But we must wait and see.

### Parasitic Oscillation

A CURIOUS difficulty one sometimes meets when trying out a new set is that caused by what is referred to as parasitic oscillation. It is due to some part of the set oscillating at quite a different wavelength to that which the set is actually tuned to. Parasitic oscillation generally makes itself known by the fact that reaction control is not so effective as one would expect. When the knob is rotated, signal strength is not increased as it should be, and at a certain point a "click" is heard denoting that oscillation has actually set in. Despite this, no carrier-wave "howl" is heard and signal strength is generally poor. In other instances the effect of parasitic oscillation is merely to render the receiver completely "dead" so that reception is impossible. Oscillation, in the latter case, can be detected by the usual method of touching the detector-grid terminal with a moistened finger; a loud "double-plop" is a sure sign of oscillation.

When trouble of the kind referred to is experienced, it can generally be traced to long wires in the grid or anode circuits which are interacting to produce oscillation at the "wavelength" of one of the wires. Another frequent cause of parasitic oscillation, especially on long waves, is the use of a tapped coil in the tuned-grid circuit following an S.G. valve; oscillation then occurs at the wavelength of that portion of the coil "above" the tapping. The most certain cure is to dispense with the tapping and make connection to the ends of the coil only. Sometimes it can be prevented, however, by inserting a 100 ohm resistance between the detector anode and the reaction condenser.

### One-knob Control

I HAVE often wondered if the old hand at radio really views with approval the modern fetish for "one-knob" control. I know I myself have no great love for it, even though I am not blind to the very obvious advantages it possesses for inexperienced "knob-twiddlers," but I think the experienced man has a tinge of regret at the passing of the sets with a large number of controls. Tuning to-day is so elementary, and with the improvements in "ganging" it has become so simple a matter, that the radio expert of the family is no longer needed when a distant programme is required, in fact, even the baby can use some modern receivers. This is undoubtedly a very fine thing for the family, but it is a bit "tough" on the expert who has to cool his heels until perhaps television will give him another opportunity of demonstrating his prowess. Talking of ganging reminds me that it is as well not to change the value of your H.T. tappings too much in a ganged set, or you may put the tuned circuits seriously out of step. Variation of H.T. value might cause a change of input capacity, so that it is best to decide on the H.T. voltage before setting the trimmers.

### Wavelength and Frequency

SOME of my readers may be confused between the calibrating of stations in wavelengths or frequencies, and it has long been felt that some ruling on the subject should be made. We still know most stations by their wavelengths, whereas officially the separation between them and other matters is always considered in kilocycles. It is a simple matter to convert wavelengths into kilocycles, for if 300,000 is divided by the length in wavelengths the result will be the frequency, and *vice versa*, dividing 300,000 by the frequency in kilocycles will give the wavelength. For many years the National Physical Laboratories have maintained a standard of frequency based on a tuning-fork, and a properly designed and operated tuning-fork can form a standard frequency unit of reliability of about one part in ten million. This is quite equal to the results obtained from the best pendulum clocks, with the advantage that the tuning-fork is less susceptible to earth tremors and disturbances. During a slight earthquake last year a small change was recorded in the rate of the pendulum clock kept as a standard, and the error—about four parts in ten million—was recorded on the tuning-fork chronograph which was unaffected by the shock. Either of these results would seem to be fairly accurate, accurate enough, at any rate, for all practical purposes.

# Practical Letters from Readers.

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

### A Receiver for Flat-dwellers Wanted

SIR,—I have been a reader of your journal from about the ninth week of its start and find it most helpful and interesting, but I am disappointed that although you said earlier that so many of your readers wanted particulars of a portable or transportable set suitable for amateurs to make up and at a reasonable price, that you hoped shortly to cater for them, I have watched in vain for the details. By the way, I have never seen explained to beginners *why* one cannot use any set on a frame aerial and no earth. The beginner's courses never make this clear. I agree with your correspondent of a few weeks ago who pleaded for *quality* rather than quantity. Please do something for we flat-dwellers. There are thousands of us, and whilst there are sets of every description detailed for aerial and earth users, we only get an article on a portable set very occasionally.—M. J. RUSSEL (London, W.).

[*Particulars of a Lightweight Portable of up-to-date design are given elsewhere in this issue. A frame aerial may, of course, be used as an ordinary aerial by connecting one end only to the aerial terminal. Normally, however, it is used as a "closed loop," and as such takes the place of the tuning coil.*—ED.]

### A "Priceless Book"

SIR,—As an old hand at wireless dating from pre-war days, I feel I must express my appreciation and thanks for my copy of the Constructor's Eycyclopædia. In the early days I would gladly have paid 10s. or more for such a priceless book, but all my information had to be bought from experience (oft times very costly). Your paper is in the unique position that it is the only journal that is in every way *practical* and essentially a wireless journal for the wireless man. Thanking you and your staff for at last giving us a real wireless paper, and wishing it all success.—C. M. POPE (Forest Gate).

### H.T. Batteries for Class "B" Amplification

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

It is possible that objection to this type of battery may be raised on the score of bulk and weight, and also the fact that in existing sets which are modified for Class "B" amplification the accommodation for the H.T. Battery may be limited. In order to meet this objection we are introducing a 120 volts double capacity battery which, whilst retaining the normal length and breadth of the standard battery, is increased in height to about 3¾in. This battery is our No. 1168 size, measuring 10in. x 6in. x 3¾in. high, fitted with plug socket tappings in 10-volt steps. The list price is 17s. 6d. The normal discharge rate can be taken as from 12 to 15 milliamperes, i.e., the average discharge rate for a Class "B" amplification set.—A. WILLMOTT, Siemens Electric Lamps and Supplies Limited.

**WHAT IS SERVICE?**

**Every reader of "Practical Wireless" is entitled to FREE Advice!**

*(See Page 315)*

### A "Practical Wireless" Receiver in India: Remarkable Results

SIR,—After using the Newnes "Long Distance Four" (S.G., Det., and 2 L.F.) for one year in India, I think you will be interested in the results which I have obtained with it. The set was used in Quetta last year for eight months, and

*(Continued overleaf.)*

**CUT THIS OUT EACH WEEK.**

# DO YOU KNOW?

—THAT the grid bias applied to two valves in push-pull is the same as for one similar valve used alone.

—THAT a fuse bulb may be connected to a battery to provide a very simple circuit tester.

—THAT a receiver described in any periodical should not indiscriminately be placed on a metal chassis or in a metal cabinet.

—THAT for similar reasons, a circuit design should not be altered without consulting the designer.

—THAT the presence of an earthed metal body seriously affects valves as well as coils.

—THAT interaction can take place between the anodes of two valves if these are of the non-metallized variety.

—THAT the average mains supply meter does not record the consumption of power below about 5 watts.

**NOTICE.**

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

(*Continued from page 313.*)

since November has been in use here at Simla. The results have been excellent on short, medium and high wavelengths. Throughout last summer I received Chelmsford, Rome, Paris and Moscow, also many other short-wave stations at loud-speaker strength. The first two in particular, were very good.

Since the Empire Station at Daventry started in December, I have listened to the programmes nearly every night. Some nights it has been so loud that I have had to use the volume control. In addition to the Empire service for the Indian Zone, I have received the programmes radiated to the Australasian, Canadian and South African Zones. Recently, during a thunderstorm, I used the lead-in only (12ft. of wire from door to set) and a temporary earth, and received at loud-speaker strength PHI experimenting on 25 metres. The medium and high waves are sometimes spoilt by atmospherics, but otherwise are received clear and loud. The medium-wave stations include London National, Heilsberg, Scottish Regional, Breslau, Paris, Mühlacker, London Regional, Bombay and Calcutta. During the winter these stations were received at loud-speaker strength, but now, owing to the lighter evenings, they are much weaker, and are received best late at night. I have not devoted much time to high wavelengths, but during the little time which I have spent, I have received Moscow, Tashkent, and two or three other stations unidentified.

Considering the distance of all of these stations (even Bombay, our local, is about 1,000 miles away) and the reception being at good loud-speaker strength, it speaks very highly of such an excellent receiver.

This is another case where the old two-pin plug-in coils are giving first-class reception, and the little trouble taken in coil changing is worth it.—A. E. CLARKE (Simla, India).

### From a South African Reader

SIR,—I am a regular reader of PRACTICAL WIRELESS, and I must offer my appreciation of its contents. It is indeed a practical paper, for every wireless listener and experimenter and I can confidently recommend it to any one taking up wireless.

Can you publish a set for overseas conditions, about five valves, with a range of 10—650 metres without changing coils? Long waves are not suitable for South African conditions as they only bring in noise and atmospherics. The British Empire short-wave station for the South African zone comes in very weak, and fades out at times. I have received your Constructor's Encyclopædia, and I am very pleased with it. Wishing your paper every success.—M. LEVENTOSH (Cape Town).

### A Beginner's Appreciation

SIR,—I have just received one of the most remarkable books on wireless ever published. Of course I refer to "The Wireless Constructor's Encyclopædia." To the man in the street it will prove a rare treasure store of knowledge.

I cannot praise it highly enough, for above all it explains in simple language all that one could wish to know about the great "mysteries" of wireless, whilst at the same time it is presented in a manner acceptable to the expert and amateur alike. For years I have been "interested" in wireless and yet have feared to explore the realms of mystery which I thought surrounded it, until there appeared on the market your very excellent weekly,

(*Continued in column 3*)

# RADIO CLUBS & SOCIETIES

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

#### SLADE RADIO

Mr. G. T. Peck repeated his recent lecture on "Dual Speaker Equipment" at the meeting of the above Society held recently. After describing the set which is capable of receiving any one of six stations at will he gave details of the special remote control switch which also incorporates a volume control. The special selector switch was described and also the amplifier which includes a control valve to deal with peak voltages. A demonstration of the radio portion was followed by a selection of gramophone records, each of a different type. The reproduction with the dual speakers proved exceptionally good and although the output available was 7½ watts there was no trace of distortion. At another meeting of this Society, held last week, there was a debate on "Should long-wave broadcasting be scrapped?" Before the debate started a vote was taken, which showed an overwhelming majority against, but the result was not made known until the close of the meeting. The first speaker was Mr. G. T. Peck, who raised quite a number of reasons why it should be scrapped. The second speaker was Mr. A. Freeman, who spoke for the retention. A general discussion then took place and a number of very interesting points were raised. Just before the end of the meeting another vote was taken, but with the same result. At the next meeting there will be a lantern lecture entitled "The acoustic side of reproduction," by Mr. A. S. Radford. Details of the Society, which offers exceptional facilities to those interested in wireless, will be sent on application. Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

#### ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

The West London Branch of this Society is now being organised. Those interested should write to A. D. Menezes, 9, Warrington Crescent, W.9 for particulars.

#### HACKNEY RADIO AND PHYSICAL SOCIETY

At a meeting of the above club held on April 24th we had the pleasure of according Mr. A. Deutsch a warm welcome when he gave a very interesting lecture on the Variable-Mu Valve and Automatic Volume Control. After explaining the construction of the Variable-Mu valve, and the manner in which many problems associated with its construction have been overcome, Mr. Deutsch dealt at length with its characteristics and advantages. Having dealt fully with this type of valve the lecturer spoke at length on Automatic Volume Control, and explained many methods of accomplishing this. An interesting programme has been arranged for the coming weeks, and local readers of PRACTICAL WIRELESS are invited to write for particulars.—Hon. Sec., A. F. Rogerson, 19, Sewdley Street, Clapton, E.5.

#### INTERNATIONAL SHORT-WAVE CLUB

The London Chapter of the International Short-Wave Club held a very successful meeting at the R.A.C.S. Hall, Wandsworth Road, S.W.8, on Friday April 28th, at which Mr. R. H. Woodhall, A.M.I.E.E., gave a lecture on Rotary Transformers for radio purposes. His lecture was illustrated by lantern slides. Various rotary transformers were exhibited, including a hand driven generator which can supply H.T. and L.T. to a radio transmitter in case of emergency. A special colonial supersonic receiver was also demonstrated. This was supplied by current with an M.L. Converter. At our next meeting on May 19th we are to have a lecture by L. H. Fitz Gibbons, A.M.I.R.E., on Short-Wave Converters.—A. E. Bear, European Representative, 10, St. Mary's Place, Rotherhithe, London, S.E.16.



(*Continued from first column.*)

PRACTICAL WIRELESS. I enjoy the hours I spend reading through its many pages as much as I enjoy reading a thriller, because it is presented in such an interesting and instructive manner. Do please "carry on" with the good work.

I have read PRACTICAL WIRELESS each week since first it appeared, and in that short time I have learnt more about my set, how and why it works than I ever did plodding a lonely furrow for many years before. I shall continue to read your journal and trust you and your staff will accept my sincere appreciation.—R. A. KEMP (Muswell Hill, London, N.).

## IMPRESSIONS ON THE WAX

(*Continued from page 311.*)

unaffectedly. His voice is first-rate, and this record will find many places in the average listener's collection.

Lastly, one for the elect. The *Andante Cantabile* movement from Schubert's *Death and the Maiden* has been done by the Léner String Quartet on *Columbia LX*201 (6s.). There is a wealth of beauty in this piece. Chamber Music at its best here; if your tastes run that way, hear it. If you think your tastes ought to, hear it just the same.

### Handel is so Jolly

Did you hear *Handel's Origin of Design* broadcast for the first time some weeks ago? The Ballet music from it has been recorded for *Columbia* by the *London Philharmonic Orchestra*, conducted by Sir Thomas Beecham. It has a bubbling, infectious gaiety plus Handel's emphatic straightforwardness. There is only one fault with this recording—the whole work should have been done. When it is done, there's an interesting story to tell. Meanwhile, hear record *LX*224.

### The Light (and Not So Light) Fantastic

Here is a new band worth watching—John Jackson's. You will find two excellently played fox-trots on *H.M.V. B*6322; the titles are *I'm Playing with Fire* and *Sittin' in the Dark*. Another first-rate pair is on *H.M.V. B*6300. These are *My Darling* by Don Bestor's Orchestra, a fine band with a dreadful vocalist, and *One Little Word Led to Another* by Isham Jones's Orchestra. Two good fox-trots, these. The play *He Wanted Adventure* gives two good numbers by Ray Noble's Orchestra. These are *My Heart's to Let* and *When You've Fallen in Love*. On *H.M.V. B*6323.

A singularly restrained, but interesting, couple of slow fox-trots are on *Brunswick* 1447. Guy Lombardo's Royal Canadians play *I Called to Say Good Night* and *Street of Dreams*.

Rumbas have a vogue just now. There is a good one on *Decca F*3454 called *Serenata Cubana*, backed by a beguine *La Belle Créole*. These are quite the genuine article. There is a tremendous lot for money on one of the new 4-*in*-1 records (*No.* 31), *Puss! Puss! Puss!* and a song *Night After Night*, besides two others as well. There is too much vocal, really. A *Sterno* (*No.* 1134), *Standing on the Corner* and *One Little Kiss From You*, is quite good. Oscar Rabin's Romany Band play them, but I don't think they are much more gipsy than their blouses, or whatever they wear. Their style is anything but!

**TO HAVE *BECOME* FIRST INDICATES SERVICE IN ITS REAL SENSE! TO HAVE *BEEN* FIRST MERELY PROVES ANTIQUITY.**

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

# REPLIES TO QUERIES and ENQUIRIES

## by Our Technical Staff

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

*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

### SPECIAL NOTE

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

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

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

### SCREENING THE AERIAL

**"I am most unfortunate in my wireless hobby, and the reason is easily explained. I am living in the same road as is used for the trolley-buses, and over a shop. There are two electric neon signs on the shop, and next door is a cinema. This has a flashing sign on the roof (not more than 20ft. from my aerial), and the motor and other electrical apparatus in the cinema kick up a most awful din during the evening. I did not know this until I bought a six-valve set. Now I can't use it, but can you tell me how I can do something to get a little clear music sometimes? I believe you will be able to help me, as I see from your letters page that you have helped others in their difficulties."—(W. F., Nottingham).**

You are certainly unfortunate in your position, W. F., but there is hope for you yet. As you have got a commercial receiver we do not recommend you to tamper with that, but your aerial and earth may be arranged so as to reduce to a minimum the interference which you experience. First of all, experiment with the following different types of earth. (1) A coil of wire, say about 50ft., loosely bunched up, and left on the floor under the table on which your set stands. (2) A sheet of copper gauze, or perforated zinc, about 2ft. square, arranged in the same way. (3) An 8 mfd. fixed condenser joined to the earth terminal. One of these will certainly be found as good as an outside earth with your particular set. For the aerial, the smallest indoor wire will be sufficient, but if you must use an outside wire, obtain a length of the special new type of screened lead-in which is advertised in our pages, and connect the screening of this to earth. It will be found to create a vast improvement, and the combination of this and one of the above earths should enable you to receive many stations clear of the interference. Of course, your range will be somewhat reduced, but this you must be content with if you are to reduce the noises with which you are troubled.

### SPARKS FROM THE FURY

**"I have built the Fury Four, and have used a metal foil on top of the baseboard in order to ensure stability and to facilitate the earth return leads. When I switched on I had forgotten to plug in the H.T. negative plug, and so I switched off, and when I put the plug against the socket of the battery I got a flash. I waited a moment and attempted to put in the plug again, but got a spark every time. What does this show? I expect something is wrong, but I do not know where to look."—(U. G. F., Brixton).**

Obviously you are short-circuiting the high-tension battery in some way, and although there are many places where you could do this owing to a mistake in the wiring, we think you will find that the fault has arisen through your using the metal foil on the baseboard. The H.T. positive lead is taken to a soldering tag, which is screwed to the underside of the baseboard, and you have probably used a rather longer screw than you should have done, and the point of this has protruded sufficiently to touch the metal foil. A moment's thought will show that the two terminals of the H.T. battery are thus connected, as the foil is joined to H.T. negative. Remove this screw before you look elsewhere for the trouble.

### FUSE FOR BATTERY SET

**"I have finished the construction of a three-valve set, and before putting it to use would like to fit a safety fuse. Where should this go, and what value do you have to make sure that the valves will not be damaged owing to a short on the H.T. side?"—(S. H., Enfield).**

The choice of a fuse is carried out in the following way. Firstly, you must total the filament consumption of all your valves. Thus, if you are using two .1 and one .25 valve, the total current is .45 amps. Therefore the fuse should be chosen which will blow at some value lower than this (.45 amps. is 450 milliamps). Obviously, it would be possible to use a 20 milliamp fuse, but you must remember that there may be reservoir condensers in the circuit and the charging current required may rise to such a value that the fuse will be blown unnecessarily. Therefore, use the highest value which is obtainable, and which is just lower than the rating of the total filament current.

**DATA SHEET. No. 34.**

*Cut this out each week and paste it in a Notebook.*

**OPTIMUM LOAD VALUE FOR PENTODE VALVES.**

| *Maker.* | *Type No.* | *Optimum Load.* |
|---|---|---|
| COSSOR | 220.HPT | 17,000 ohms |
| | 220.PT | 7,500 " |
| | PT.41 | 8,000 " |
| | PT.41.B. | 8,000 " |
| | MP/PEN. | 10,000 " |
| LISSEN | PT.225 | 18,700 " |
| | PT.240 | 12.500 " |
| | PT.425 | 11,000 " |
| | AC/PT | 8,000 " |
| MARCONI and OSRAM | PT.2 | 17,000 " |
| | PT.425 | 9.000 " |
| | PT.4 | 7,500 " |
| | MPT.4 | 8,000 " |
| | DPT | 8,000 " |
| MAZDA | PEN.220 | 17,000 " |
| | PEN.220.A. | 7,500 " |
| | AC/PEN. | 8,500 " |
| | DC/PEN. | 10,000 " |
| | DC.2/PEN | 10,000 " |
| MULLARD | PM.22 | 8,000 " |
| | PM.22A | 15,000 " |
| | PM.24A | 10,000 " |
| | PEN.4.V. | 8,000 " |
| SIX SIXTY | SS.220.PEN. | 12,000 " |

### DAMAGED MOVING-COIL

**"My loud-speaker is of the moving-coil type, and I have been fitting a new bolt to the top of the chassis to make it firmer on my baffle-board. I find, however, that it gives a nasty grating noise now, and I have done nothing to the electrical side of it at all. I did not even handle it, but left it attached to the front of the cabinet while I drilled the new hole. I did not use undue pressure, and cannot see how I can have damaged it. Can you offer any suggestion, before I dismantle it?"—(P. R. M., Teddington).**

The reason is not far to seek. The speech coil of your type of speaker moves in a very small annular gap cut in the face of a powerful magnet. You have drilled a hole in a metal carrier, and have no doubt overlooked the fact that the falling metal dust would be attracted to the powerful magnet. No doubt, some of the metal filings have entered the gap and are causing the grating by rubbing against the speech coil as it vibrates in the gap. You will damage the speech-coil by leaving it as it is, and you must therefore completely dismantle it and clean away all metal dust and other matter which you will no doubt find in the gap. Afterwards, cover the speaker with a fine cloth bag to avoid a repetition of the trouble.

### OUTPUT TRANSFORMER DATA

**"I want to wind an output transformer for my receiver, which employs in the last stage a Marconi PX4 valve, and my loud-speaker is home-made, with a speech-coil of just under 10 ohms resistance. Can you tell me the windings and core size for the transformer, and give me any other details for it?"—(A. W. M., Surbiton).**

The optimum load for the PX4 is approximately 3,000 ohms, and therefore, your transformer must have a ratio of 20 to 1. The anode current of the PX4 is just under 50 mA, so that the primary would have to consist of at least 34 gauge wire. Suitable stampings would be No. 30, of which 100 would be required, and the primary should consist of 3,000 turns of the 34 gauge wire, and the secondary would obvously consist of 3,000 divided by 20, or 150 turns. For this, a heavier gauge wire may be used, and No. 22, 24, or 26 may be used at your discretion. Terminal strips and fixing feet may be fitted according to your own ideas.

### ELECTROLYTIC CONDENSER

**"I have just bought an 8 mfd. electrolytic condenser, but when I tested it with a flash-lamp bulb it passed a light. Is this a sign that the condenser is faulty? I understood that a condenser should not pass a D.C., and I took the condenser back to the shop and got it changed, but the same thing happens with the new condenser. Where am I wrong in my test?"—(A. K., Ealing).**

An electrolytic condenser is not a condenser until it is polarized by a fairly high current. The two electrodes of this type of condenser are separated by a fluid or paste, and they conduct current in their normal condition. When this current rises to a certain value a film forms over one plate, and they no longer conduct but act as a very efficient condenser. Your test with a 4-volt battery and lamp resulted in such a small current being passed that the film did not form, and therefore, you were not really testing the condenser. If you connect it as it is intended to be connected, in an eliminator circuit, for instance, you will find that it is a very efficient condenser indeed.

### GRADED VOLUME CONTROL

**"I have recently bought a volume control for use across my pick-up, and on examining it, I find that it is supposed to be 'graded.' Does this mean that it is different from the ordinary potentiometer, or that it is classified according to its value? Are the connections the same as in the ordinary case?"—(P. C., Birmingham).**

A graded volume control is simply a potentiometer with the resistance element arranged with a larger area at one end than the other. Usually, these are wire wound, with the wire wrapped round a flat, but wedge-shaped former, and consequently, the movement of the contact arm on one end of the element results in a greater variation from one turn to the next than at the other end of the element. The potentiometer should be connected in the ordinary way, that is to say, the arm is joined to the grid and the two ends are joined across the pick-up, but to obtain the advantages of the grading the larger end of the resistance should be remote from the grid-bias connection.

**FREE ADVICE BUREAU**
**COUPON**

This coupon is available until May 20th, 1933, and must be attached to all letters containing queries.
PRACTICAL WIRELESS, 13/5/33.

# CATALOGUES RECEIVED

*To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue." PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.*

### "RAWSWOOD" MAINS TRANSFORMERS

A USEFUL range of high-class power transformers and output filter chokes is given in the latest folder issued by Rawswood Electrical Co., Preston New Road, Blackpool. The instruments listed include standard and special voltage types, L.F. transformers and a power pack for use with A.C. Mains. Only the finest materials are used in the manufacture of the transformers, which are designed to function satisfactorily even under very difficult conditions. Core sizes are ample for the particular wattage output and periodicity for which they are designed. A copy of the folder can be had on application to the above address.

### C.A.V. BATTERIES

IN a handy folder we have just received from C. A. Vandervell, Ltd., details are given of this firm's Non-Spillable "Jelly-Acid" Batteries, together with a range of H.T. batteries suitable for portable and transportable receivers. The non-spillable type, which can be fitted into a set in any position, is very clean and compact and requires no more attention than ordinary batteries. They are re-charged in exactly the same manner as the free acid type. Included in the folder is a useful chart of all the popular receivers showing the most suitable C.A.V. batteries to use with them. A copy of the folder will be forwarded to any reader on application to C. A. Vandervell, Ltd., Well Street, Birmingham.

### NEW CLIX COMPONENTS

AMONGST the new components recently introduced by Lectrolinx, Ltd., is a seven-pin chassis mounting valve holder (floating type) with terminals. Each socket automatically aligns itself to any variation in the centres or angle of incoming valve pins, at the same time giving maximum surface contact between sockets and pins. Other new small components made by this firm are non-corrosive spade terminals, and chassis mounting strips with terminals. Further particulars and prices are given in a leaflet entitled "Further Aids to Constructors," a copy of which can be obtained from Lectrolinx, Ltd., 79A, Rochester Row, Westminster, S.W.1.

### "WEGO" CONDENSERS.

A PARTICULARLY useful range of condensers of various types is given in a booklet we have just received from Wego Condenser Co., Ltd. Various types have been altered and the test voltage for type BLU has been increased to 750 v. D.C. rated for 350 v. D.C. working, and type CV, previously rated for 1,000 v. test and 400 v. working has been increased to 1,500 v. test and 450 v. D.C. working. This type is suitable for use with indirectly-heated valves and will withstand the heavy voltages when switching on. The working voltage of type H.R. tested on 2,000 v. D.C. has been increased to 800 v. All other types remain as before. In order to facilitate quick deliveries of these condensers, the Wego Co. announce that from May 1st stocks of all standard types will be held at 61, Spencer Street, London, E.C.1. Mr. F. W. Lechner is in charge of the department, the telephone number of which is Clerkenwell 7058. A copy of the booklet can be obtained from the firm at Bideford Avenue, Perivale, Middlesex.

### HELLESEN CONDENSERS

THE firm of Hellesens, Ltd. is noted principally for batteries, but a most comprehensive range of condensers is also manufactured by this firm. The latest catalogue issued shows the complete range, and gives, in addition to the various types and values, complete physical dimensions of each type. The ranges include Wet Electrolytic, Dry Electrolytic, Moulded Mica, and in each type there are large and small units. Ten pages are devoted to the principles underlying the design of electrolytic condensers, and a description of the method of construction, operating characteristics, and other interesting information is included. The address is Hellesen Works, Morden Road, South Wimbledon, S.W.19.

## Replies to Broadcast Queries

URWINS (Scarborough): DIQ, Koenigswusterhausen (Germany), relaying programme to U.S.A. (29.16 m.). WHISKERS (Blackpool): G5ML, F. W. Miles "Tudor Lodge," Gibbet Hill, Kenilworth, Warwickshire; G6LP, Cannot trace, write to Radio Society of Great Britain, 53, Victoria Street, S.W.1; G6VK, A. E. Brookes, 19, Alexandra Road, Uplands, Bedminster, Bristol (Glos.); G6PY, C. W. Parry, 13, Huddersfield Road, Barnsley, Yorks; G5UI, J. E. Perkis, 67, Arthur Street, Ryde, Isle of Wight; G6IH, J. C. G. Kealy, 5, St. John's, Bedford Road, Kempston, Bedford; G6US, N. E. Read, 32, Earl's Court Road, Kensington, London, W.8. SEAR (Belfast): CUS, Beam Station, Lisbon, Portugal; FRO, St. Assise, near Paris (France); ILX, regret, cannot trace; PDI, cannot trace this call, but undoubtedly commercial transmitter at Kootwijk (Netherlands); DEZ, call sign apparently mutilated but no doubt a commercial transmitter at Zeesen, Germany. DX ENTHUSIAST (Luton): SU1EC, Lieut. E. S. Cole, Haking House, Abbassia, Cairo (Egypt); SU6HL, I. E. Hill, Royal Air Force, QSL to BM/2HXG, London, W.C.1; G2QX, A. E. Groom, 13, William Street, Luton, Bedfordshire; G6PY, L. W. Parry, 13, Huddersfield Road, Barnsley, Yorks.

### A Home-constructed Microphone

*(Continued from page 296.)*

holes, take the front piece off again and glue the diaphragm on the back of it, as in Fig. 3. Various types of diaphragm may be used, those suggested being oiled silk, thin rubber, thin mica (which is fairly expensive) or even paper. The best yet tried has been oiled silk stretched across the front and glued. Keep the diaphragm under a weight till it is fixed, and the microphone is then ready for filling with granules. These are the fine grade supplied for the purpose by Messrs. Le Carbone, Coventry House, South Place, London, E.C.2, at 5s. per ounce. Half an ounce is sufficient for two microphones. Fill the depression level with the top and place the top on, sandwiching the diaphragm between the two pieces of wood. Screw the whole down tightly so that no granules can leak out. These granules have a habit of getting through the smallest chinks.

#### Using the Microphone

The microphone is now ready for use. It must be used with an amplifier of at least three stages if loud-speaker results are required. The microphone must not be used with the usual microphone transformer as it has a high resistance; the best way to couple it is by the resistance or choke method, as indicated in Fig. 5. The voltage required across the microphone itself is about 30 for best results, but this must be found by experiment. Many uses can be found for an instrument of this type.

## ADVERTISEMENT INDEX


| | | | |
|---|---|---|---|
| Belling Lee, Ltd. | 316 | Mason, E. C. | 311 |
| British Blue Spot Co., Ltd. | *Back Cover* | Newnes' "Home Movies" | 309 |
| British Ebonite Co., Ltd. | 309 | Newnes' "Modern Motor Repair" | *Inside Back Cover* |
| Bulgin, A. F., & Co., Ltd. | 311 | Newnes' "Motor Cyclist's Reference Year Book | 309 |
| Colvern, Ltd. | 299 | Newnes' Motorists' Maps | *Front Strip* |
| Cossor, A. C., Ltd. | 295 | Pioneer Radio Mfg. Co., Ltd. | 316 |
| Crafts, Ltd. | 305 | Riverside Mfg. Co., Ltd | 311 |
| Dubilier Condenser Co., Ltd. | 305 | Sound Sales, Ltd. | 313 |
| Electrical Trading Association | 299 | The 362 Radio Valve Co. Ltd. | 309 |
| Frost Radio Co. | 316 | Vince Dry Batteries, Ltd. | 305 |
| Gilbert, J. C. | 311 | Watkins Bros. & Co. | 316 |
| Graham Farish, Ltd | 313 | Westinghouse Brake & Saxby Signal Co., Ltd. | 299 |
| King's Patent Agency | 316 | Wilkins & Wright, Ltd. | 309 |
| Lissen, Ltd. | *Inside Front Cover* | | |
| Lumen Electric Co. | 316 | | |

# *Important* TO ALL GARAGE OWNERS, WORKERS AND MECHANICS


**First 4 Parts Now on Sale 1/- each**

**FREE CHARTS**

IN PART 1.
**ENGINE TIMING**

IN PART 2.
**DAIMLER FLUID FLYWHEEL**

IN PART 4.
**SELF-CHANGING GEAR BOX**

## A SPLENDID INVESTMENT FOR ALL INTERESTED IN CAR MAINTENANCE AND REPAIR

In a convenient compass will be found all the practical points and special repair methods applicable to the leading makes of cars.

General methods of overhauling a car from end to end are given. Detailed notes on decarbonising, valve grinding, electrical trouble tracing.

How to deal with engine stoppages and erratic running.

The maintenance of brakes, steering gear, electrical equipment and bodywork.

Under each of these headings special notes are given dealing with the particular car in which you are interested.

This up-to-date work will save you time and money.

## WONDERFUL ILLUSTRATIONS

Contains hundreds of action photographs, showing the best methods of carrying out adjustments and repairs on all current popular models.

## VALUABLE TABLES

Tables showing Petrol Consumption, Oil Pressures, Tyre Pressures, Braking and Acceleration values form an interesting and valuable feature.

## ARE YOU INTERESTED IN CARS?

If so, there can be no question that you will find this new work worth many times its cost. It will show you how to keep your car keyed up to give the best performance. Your engine, brakes, clutch, gearbox, all require minor adjustments from time to time. "MODERN MOTOR REPAIR" shows the approved methods of making these adjustments.

If you wish to overhaul your car thoroughly, or to examine a second-hand car before purchase, you will find articles in this work which will save you pounds. You will also learn how to obtain the *highest possible mileage per gallon without sacrificing the over-all performance.*

Recent innovations in the motoring world, such as the Daimler Fluid Flywheel, the Startix Automatic Starting Equipment, Self-Changing Gearboxes, are explained and illustrated in a wonderfully clear and practical manner.

**SPECIAL FEATURES IN FIRST FOUR PARTS—NOW ON SALE**

**PART 1.**

FREE ENGINE TIMING CHART, containing Valve and Ignition Timing Details for over 100 Engines.
OVERHAULING A CAR.
TUNING AN M.G. MIDGET.
CAR WIRING DIAGRAMS SIMPLY EXPLAINED.
TRACING ELECTRICAL FAULTS.

**PART 2.**

FREE EXPLANATORY CHART
THE DAIMLER FLUID FLYWHEEL.
THE ROVER FREE WHEEL.
TUNING MORRIS ENGINES.
CHECKING UP A CAR AFTER ACCIDENTAL DAMAGE.
CAUSES OF DIFFICULT STARTING.

**PART 3.**

BRAKE FAULTS AND REPAIRS.
TUNING A TRIUMPH.
COIL IGNITION FAULTS AND REMEDIES.
WING AND PANEL REPAIRS.

**PART 4.**

FREE EXPLANATORY CHART SELF-CHANGING GEAR BOX.
CLUTCH FAULTS AND REMEDIES.
TUNING THE AUSTIN 12/6.
REPAINTING WINGS.
DECARBONISING AND VALVE GRINDING.

You will find in the work hints on tuning for speed, and for all-round performance which will be invaluable to you, as they are written by men who know the particular cars from A to Z.

Here is an opportunity of improving your acquaintance with the subject. MODERN MOTOR REPAIR will tell you when it is essential to call in the services of an expert, and so will save you time and money by advising you as to what repairs are and are not practicable in the home garage.

**ASK YOUR NEWSAGENT TO DELIVER THE PARTS REGULARLY EVERY FRIDAY**

*Geo. Newnes, Ltd.*

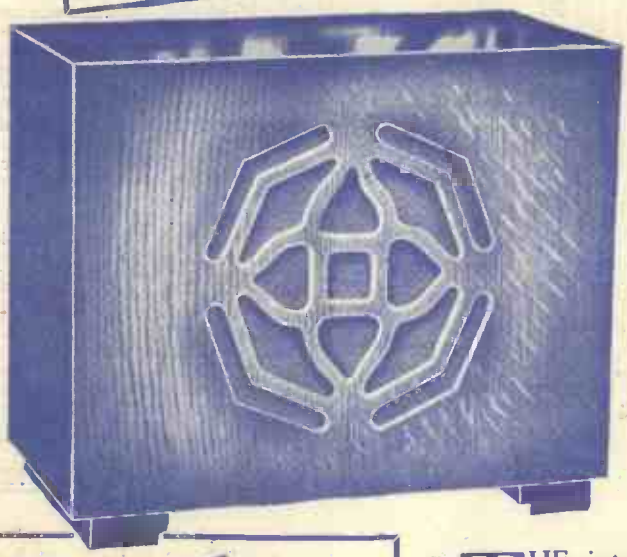
*To be completed in about 24 Weekly Parts*

# MODERN MOTOR REPAIR

*Obtainable from all Newsagents and Bookstalls, or post free, 1s. 2d. each, from George Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

# NEW BLUE SPOT

# Cabinet Models

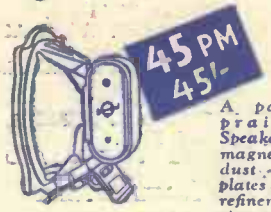


## Designed for the wonderful new MOVING COIL SPEAKERS

*This is* MODEL **22PM** *in Oak* **45/-**
*(with 29PM Speaker)*

**29PM 32/6**

*A thoroughly reliable Speaker ensuring first-class performance.*



**45PM 45/-**

*A particularly praiseworthy Speaker with special magnet fitted with dust-proof side plates and all latest refinements in design.*

**99PM 59/6**

*The world's finest Moving Coil. Exclusively designed magnet ensuring powerful and permanent energy with special moulded dust-proof plates and the very latest refinements in design. A really de luxe Speaker.*

THE introduction of this new range of Blue Spot cabinet speakers marks a new departure in cabinet design. Here you have beauty going hand in hand with efficiency in the highest degree. Lovely woods, superb craftsmanship, artistic design. A new and distinctive note in the speaker grille. An unobtrusive quality, delightful to the eye.

You are sure of perfect reproduction with a Blue Spot Cabinet Speaker. The cabinets are specially designed from an acoustic point of view. The speaker movements are mounted to baffles and not directly to the cabinets, the baffles then being specially fitted to the cabinets. No better performance or value is possible. Write for Catalogue No. P.R. 14.S.

### OTHER MODELS

**62PM** in walnut or mahogany **67/6** *(with 45PM speaker)*

**32PM** in walnut **87/6** *(with 99PM speaker)*

### SPECIAL FEATURES *of Moving Coil Speakers*

Scientifically designed and well made Output Transformers with each Chassis. ● Plugs and sockets, in lieu of solder tags, for easy valve matching. ● Suitable for Power, Super Power, Pentode and Class B Output (29 P.M. on request). ● Special Q.P.P. Pentode models 2/6 each extra. ● New process Cones and Speech Coils—no trouble from moisture, warping or fouling in the gap. ● Cadmium plated pole pieces, copper plated chassis with felt surrounds. ● Every model stands firmly on its own base. ● Cabinet models have special acoustic features, the Chassis being mounted to independent baffle which is specially fitted to cabinet. Unrivalled finish, construction and performance.

**BRITISH MADE**

## THE BRITISH BLUE SPOT COMPANY LTD

BLUE SPOT HOUSE · 94/96 ROSOMAN STREET · ROSEBERY AVENUE · LONDON · E.C.1

*Telephone: Clerkenwell 3570.* *Telegrams: "Bluospot, Isling, London."*

Distributors for Northern England, Scotland and Wales: H. C. RAWSON (Sheffield and London), Ltd., 100 London Road, Sheffield; 22 St. Mary's Parsonage, Manchester; 177 Westgate Road, Newcastle-upon-Tyne; 37, 38, 39 Clyde Place, Glasgow.

Blue Spot REGISTERED TRADE MARK

P. W. Gift Stamp No. 33

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/- per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

# THE LEADING WIRELESS WEEKLY!


# Practical Wireless

3D.

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 2.——No. 35.
MAY 20th, 1933.
Registered at the G.P.O. as a Newspaper


## RADIO BY ROAD & RIVER

- D.C. MAINS PROBLEMS
- RECENT RADIO DEVELOPMENTS
- THE RADIOPAX CLASS B FOUR
- OPERATING THE FEATHER-WEIGHT PORTABLE FOUR, Etc., Etc.

Practical Wireless

EDITOR:
Vol. II. No. 35 || F. J. CAMM || May 20, 1933
Technical Staff:
H. J. Barton Chapple, Wh.Sch., B.Sc., (Hons.), A.M.I.E.E.
W. J. Delaney, Frank Preston, F.R.A., W. B. Richardson

# ROUND *the* WORLD *of* WIRELESS

### Radio Statistics

FROM figures published by the *Union Internationale de Radio diffusion* at Geneva, the number of European broadcasting stations has risen in four years from 170 to 238; that of South America from 40 to 85, and the Asiatic transmitters from 10 to 26. The total output, which was roughly 268 kilowatts in 1926, increased to 2,590 in 1930, and now exceeds 4,600 kilowatts.

### Monte Ceneri Working

TESTS from the Lugano (Monte Ceneri) station were heard on April 18th on its temporary wavelengths of 678.7 m. (442 kc/s.), although the broadcasts were not carried out at full power. This Swiss transmitter will serve the Italian-speaking districts of the Helvetian Republic.

### Bigger Stations for Latvia

HAVING successfully passed its tests, the 15 kilowatt Madona (Modohn) transmitter has taken up its daily duties in the relay of the Riga programmes. Although at present the channel used is 452 m. (664 kc/s.), it is likely that a longer wavelength may be adopted later. The end of the year will see the 25-kilowatt station at Kuldiga (Goldingen) completed. In both instances the plants will be so designed that increased power may be obtained with the minimum of reconstruction. The wavelength of the Kuldiga station has not yet been fixed.

### Mid-Atlantic Aerodrome and Radio Station

IT is not often that the imaginary plot of a film story becomes a reality, yet such is the case with the German steamer *Westfalen*, which has left Hamburg to take up her duties as a floating airport in the South Atlantic. When she has been established on the proposed site, an air service will be started between Germany and South America. The *Westfalen* is equipped with workshops for carrying out repairs, for refuelling aeroplanes, and possesses a complete transmitting and receiving radio station to permit two-way communication with aircraft carrying out the service.

### Change in Policy of Radio Industry

THE latest move by one of the largest radio manufacturers may revolutionise the whole policy of the radio industry. It is learned that The Gramophone Company has decided to break away from the accepted principle of introducing new instruments in the autumn only. Hitherto the Radio Exhibition held in August has been the recognised occasion for all manufacturers to display their new ranges. By marketing a new six-valve automatic record changing superheterodyne radio-gramophone recently, H.M.V. are demonstrating their intention to follow a new line of policy.

## SERVICE!

**Continuing the theme introduced on this page last week, may we amplify our definition of the word "*service*" by pointing out that the word "*service*" is not a synonym for *bewilderment?***

**We do not seek to bewilder our readers by placing before them a new design, incorporating some rush development, every week. Every modern development is known to the Editorial Staff of this paper immediately it is released by the manufacturer, and in most cases before.**

**In some cases we are bound to secrecy. We do not betray the confidence thus reposed in us!**

**In other cases we prefer to hold our hand until we are assured, not only that the development is in the right direction and is on sound lines, but also that supplies are available to the public. A further example of Real Reader Service.**

### Dr. Rhodes

BY the appointment of Dr. Harold Rhodes, Organist of Coventry Cathedral, to be Organist of Winchester Cathedral, Midland Regional loses a regular outside broadcaster who has been much appreciated. His last recital before leaving is on May 31st.

### Massed School Choirs

MASSED choirs from sixty-two schools in the Stafford district will be heard on June 1, when the fourth day's programme of Stafford Schools Musical Festival is relayed. They will sing Beethoven's "Creation's Hymn" and Holst's "Roadways" and "O England My Country."

### "The Bottle Imp"

"THE BOTTLE IMP," by Robert Louis Stevenson, has been adapted for broadcasting on May 20 (Regional). The story of Keewe and his wonderful bottle was written for a Polynesian audience. It is found among the Island Night's Entertainments. The original players and audience must all easily have recognized themselves in this fairy tale of the South Seas. Lance Sieveking will produce the microphone adaption and the cast will consist of a cosmopolitan crowd, unique in the annals of broadcasting and including English, French, American, negro, Polynesian, Japanese, and Indian artists.

### "Old Memories"

MEMORIES of the Lyric Theatre, Hammersmith, will be revived by a programme to be broadcast on May 20, with Sir Nigel Playfair as compère and Alfred Reynolds as conductor of the B.B.C. Theatre Orchestra. The name of the Lyric, Hammersmith, is inseparably connected with the names of Nigel Playfair and Alfred Reynolds, for these two created the Lyric tradition. During their régime, such plays as "Derby Day," "Midsummer Madness," "Tantivy Towers," "The Beggar's Opera," "Abraham Lincoln," and "Riverside Nights" were presented to Hammersmith audiences. Numbers from these and other notable successes will be heard by National listeners on May 20, with Gwen Knight, Trefor Jones, and Stanley Pope as soloists.

### Garden Music

MUSIC of the Garden is the subject of the Midland Studio Orchestra's programme on May 30th. One of the features is "The Selfish Giant," by Eric Coates—based on the Oscar Wilde fairy tale. Norah Holloway, who is the vocalist, has taken part in a number of Irish programmes from Midland Regional. Frank Cantell conducts.

### Exploration at Home

LATER in the evening S. C. Kaines Smith, Curator of Birmingham Museum and Art Gallery, and author of several recent books on art, gives a talk describing the part of the City Museum in "Exploration at Home." A second talk on the part of the County Museum is to be given to Midland listeners by a County Curator.

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

### New Egyptian Stations

IT is reported that the Egyptian Government has voted a sum of money to permit a resumption of work on a 20 kilowatt transmitter at Abu Zabal (near Cairo) and a 1 kilowatt station at Ras-el-Tin, the site of an old fort at Alexandria. As soon as they are brought into operation such privately-owned stations as Radio Heliopolis, Szabo, Radio Voice, Farid, and the Alexandria Broadcasting Company will close down. The transmitter at Abu Zabal will work on 525 m.; the wavelength for Alexandria has not been definitely fixed.

### Physical Jerks in Two Doses

PHYSICAL training of the whole nation appears to be one of the aims of the new German Government. As the gymnastic broadcasts at 6.15 a.m. were considered too early for the majority of listeners, the Berlin studio repeats the dose at 8.15 a.m. for the late sleepers. All German broadcasting stations are requested to follow suit. Munich and Nürnberg are gilding the pill by transmitting a daily concert between 7.0 and 7.30 a.m. B.S.T.

### Radio Salonica

THE small transmitter at Salonica (Greece) which operated during the run of the International Exhibition in that city and later closed down for lack of support, has now resumed experimental broadcasts on 269.8 metres. It is operated by a group of wireless amateurs who are endeavouring to secure a State subsidy; if this aim can be achieved an attempt will be made to secure a concession for the establishment of a broadcasting system in Greece.

### Japanese Police Radio

FOLLOWING the lead given by the American cities the Tokio Police authorities have equipped five fast cars with wireless transmitting and receiving apparatus. Communication between headquarters and the flying squads is carried out on a short wave, and in code to prevent the messages being read.

### Belgium's "One Horse" Stations

IN addition to the two 15 kW. transmitters at Velthem (Louvain) which broadcast the Brussels French and Flemish programmes, Belgium possesses some eight or nine privately owned stations ranging in power from 100 to 300 watts which are nightly on the air with short wireless entertainments. In view of the fact that the State considers the country will be adequately served by the two main transmitters when their power has been increased the authorities may close down all other stations or alternately licence five to be operated by one organization.

### A Political Cabaret

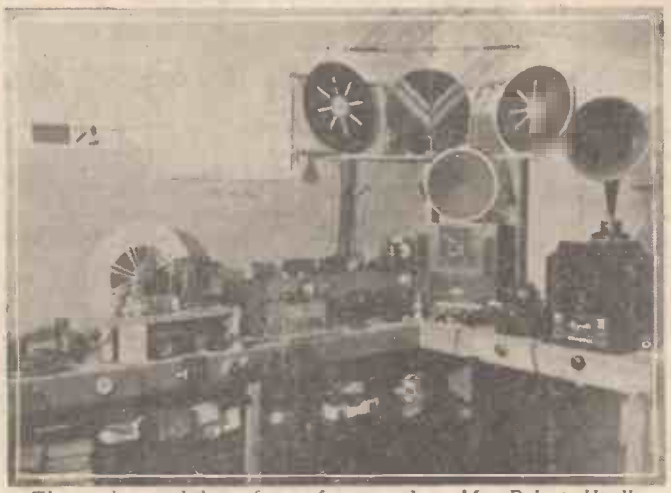
A NEW feature of the Kōnigs Wusterhausen (Germany) long-wave transmitter will shortly take the form of a bi-weekly political review presented as a cabaret. In this entertainment the present government authorities hope to show up the petty weaknesses of their predecessors in both songs and sketches. New dramatists and a special cast of artists have been engaged for these broadcasts.

**INTERESTING and TOPICAL PARAGRAPHS**

### "The Bottle Imp"

ROBERT LOUIS STEVENSON'S short play originally written for a Polynesian audience has been adapted for the microphone and will be broadcast through the Regional stations on May 20th. The cast will include a cosmopolitan crowd of English, French, American, Negro, Polynesian, Japanese and Indian artists.

AN AMATEUR'S WIRELESS DEN.



*The wireless workshop of one of our readers, Mr. Robert Hindle, 135, Haslingdon Old Road, Rawtenstall, Rossendale, Lancs.*

### For Short-wave Listeners

RADIO IBERO-AMERICANA (EAQ, Madrid), which works nightly from 11.30 p.m. B.S.T., has lowered its wavelength from 30.4 to 30 metres (10,000 kilocycles) and is now practically free o interference from the commercial telephony transmissions. Every Saturday evening at 7.0 p.m. B.S.T. the station broadcasts a programme specially destined to European listeners.

### Spain's Broadcasting Plans

PROPOSALS to erect a 500 kilowatt station in the environs of Madrid having been turned down in view of the cost, the Spanish authorities now plan to give the capital a 100 kilowatt station and to erect 20 kilowatters at San Sebastian Valencia, Barcelona and Seville. With the exception of the Catalonian studio it is expected that the greater part of the wireless entertainments for all stations will emanate from Madrid.

### Deputizing for Radio Toulouse

AS a permit to operate the St. Aignan high-power transmitter has not yet been granted, Radio Toulouse broadcasts its news bulletins and musical programmes through the 250 watt Agen station working on 456.7 m. (657 kilocycles). The power, however, is too small to permit listeners in the British Isles to secure a good reception.

### A Texas Radio Programme!

THE *New York Times* reports that the El Paso (Texas) Bar Association at a recent meeting strongly condemned the action of a judge who permitted the local station (KTSM) to install a microphone in his court during the hearing of a murder trial. When the proceedings lacked interest listeners, at intervals, were switched over to the studio for news bulletins and during court intermissions music was broadcast.

### Lyon-la-Doua

THE French station which you hear between Beromunster and Langenberg is the PTT transmitter at Lyon-la-Doua. Although usually rated at 5 kilowatts, its power has lately been increased, and reception of the programmes by British listeners has improved since alterations were made to the aerial masts. Lyons PTT possesses both male and female announcers. One or two strokes on a bell may be occasionally heard as an interval signal, and the studio, following a local broadcast, usually closes down by playing an old French army marching song: *Le Chant du Départ.* For the greater part of its programmes Lyons relays *Ecôle Supérieure*, Paris.

### Wireless Telephony to India

THE Public Wireless Telephone service between Great Britain and India was formally inaugurated on May 1st, and forms the last link between London and most of the British Colonies and Dominions overseas. It is worked between 9.0 and 1.0 p.m B.S.T. on week days through Rugby and Kirkee respectively, the receiving stations being Baldock (Herts) and Dhond (India). The distance covered is, roughly, six thousand miles.

## SOLVE THIS!

### Problem No. 35

A simple all-mains two-valver has been built by Brown and employed perfectly standard arrangements. When finished it was switched on and Brown was very pleased to note that no hum could be heard from the loud-speaker. The tuning dial was rotated, but as soon as the local station was tuned in a very loud hum appeared and completely marred the reproduction. This hum could not be heard unless a station was operating, and the set was perfectly silent during the hours when no broadcast was taking place. What was the cause and cure? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark them Problem No. 35. All entries must be received by May 22nd.

### SOLUTION TO PROBLEM No. 34

A D.C. current is essential in order to provide a "striking" voltage from the Neon, after which the signal voltages may be impressed on this preliminary brilliancy. The Output Filter circuit prevents the passage of the necessary D.C.

The following three readers received books in connection with Problem No. 33.

C. Poulter, 15, Mendord Road, Fulham, S.W.6.; A. Cook, 4, Goolden Street, Chorlton-on-Medlock, Manchester, 13.; G. Gilbert, 3, Abbey Road, Beeston, Nottinghamshire.

# A Review of RECENT RADIO DEVELOPMENTS

In this Article the Author Summarizes the Developments which Have Taken Place in Receiver Design During the Past Few Months. Among These are Automatic Volume Control, Quiet A.V.C., Q.P.-P., Class "B" Amplification, Introduction of "Cold" and Other New Valves, and Iron-Core Tuning Coils.

By FRANK PRESTON, F.R.A.

THERE are two kinds of "arm-chair" radio critics; one maintains that the science is still in its infancy and the other, that it can progress no further. Any experienced engineer knows that both are equally wrong. Radio is *not* in its infancy by any means—it has long since grown out of that stage—but at the same time, it is just as far from finality as any active science can be. The numerous developments which have taken place during the past few months are clear proof to any thinking person that rapid strides in technique are still being made, and will be made for a very long time to come. Looking back over the last half-year one can trace the introduction of automatic volume control (A.V.C.), "*quiet*" A.V.C., quiescent push-pull and class "B" amplification, the "cold," and innumerable other kinds of valves, iron-core tuning coils and several other interesting innovations.

Most of these novel features have previously been dealt with in detail in PRACTICAL WIRELESS but as they have come upon us with such breathless rapidity it is felt that many readers may, through lack of time, have been unable to assimulate the underlying principles. I therefore propose to deal briefly with these developments and to point out the bare essentials so that those who feel that their wireless knowledge is getting a little out-of-date can quickly make good that deficiency and prepare themselves for still further surprises which are sure to come in the very near future. At this juncture I would make it perfectly clear that none of the new features referred to are of such a nature that they will immediately render existing sets obsolete, nor do I think that coming events will have that effect; they are all in the nature of modifications and refinements which will *gradually* find their way into current practice. The home constructor is in the very happy position that he can incorporate the new systems in his own receiver just as, and when, he thinks they are worth while. All new inventions have to pass through the embryo stage and it is to be regretted that many of them are often released to the public before they reach maturity. It will therefore be pointed out which of the developments are for "general consumption" and which (for the present) can only be of real value to the experimenter.

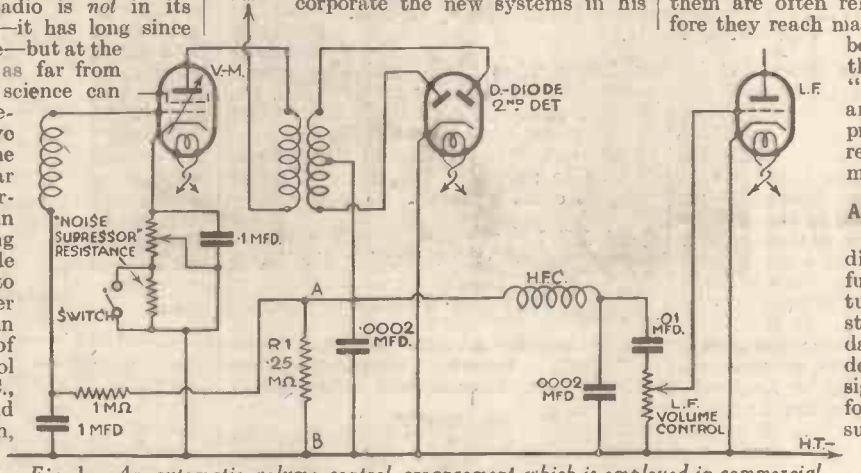



*Fig. 1.—An automatic volume control arrangement which is employed in commercial superheterodynes. Notice the "noise supressor" resistance used for quiet automatic volume control (or A.V.C.).*

### Automatic Volume Control

One of the greatest disadvantages of a powerful receiver is that as one tunes from station to station there is always the danger of being almost deafened by a strong signal. It is very discomforting to receive a sudden "blast" of sound whilst tuning-in, and automatic volume control is intended to remedy this state of affairs. The main idea of the scheme is that as a strong signal is received the amplification (or gain) of the H.F. valves is automatically reduced, whilst it is proportionately increased when the set is tuned to a weak signal. In other words, the amplification is made to vary in inverse proportion to the strength of the signal received, with a result that the volume level obtained from all stations is approximately constant. There is a subsidiary advantage of A.V.C., however, because it tends to overcome one of the greatest difficulties of long-distance reception—fading. As a signal fades the degree of amplification is increased, and *vice versa*, so that the volume remains unaltered.

From the foregoing remarks it will be very obvious that A.V.C. is of no real value for any except a highly sensitive and powerful set which has an ample margin of volume. In more practical terms, the receiver must either be a super-

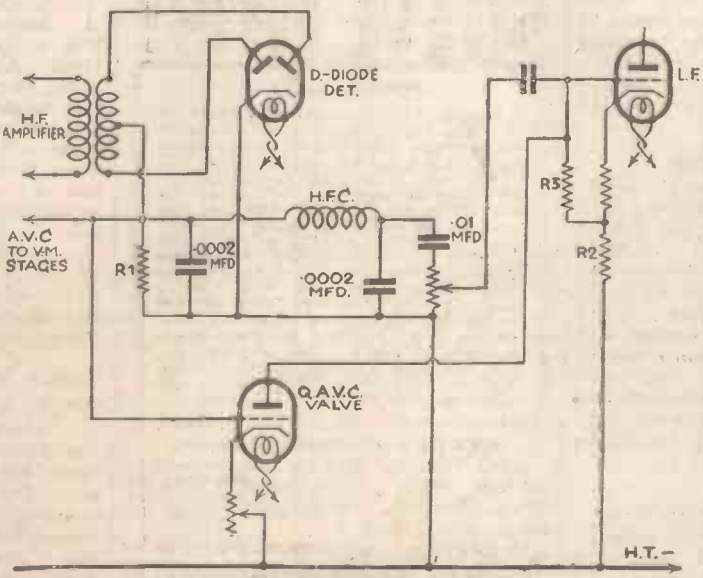



*Fig. 2.—A method of obtaining quiet automatic volume control. When the set is "off tune" the Q.A.V.C. valve draws current through R.3 and so over-biases the L.F. amplifier.*

heterodyne or have two or more stages of H.F. amplification.

**The Principle of A.V.C.**

Automatic volume control has only been made possible by the invention of variable-mu valves and it is upon these that its operation depends. You know that the amplification of a V.-M. valve is reduced by the application of a higher grid bias voltage and that it reaches a maximum when the G.B. is cut-down to zero. If this fact is clearly kept in mind there is no difficulty in understanding the principles of A.V.C. A stronger signal causes a greater flow of current in the detector circuit and so it is only necessary to make that current produce a *voltage* which can be applied as grid bias to the V.-M. valves. Any current *can* be made to produce a voltage by passing it through a resistance, and this is the underlying principle of automatic grid bias, as you are no doubt fully aware.

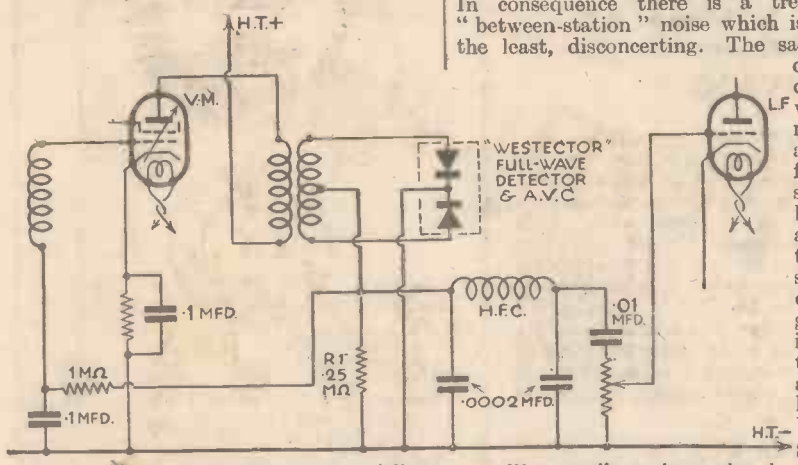



*Fig. 3.—This circuit shows how a full-wave "Westector" can be employed as second detector and A.V.C. in a superheterodyne. Compare the arrangement with that of Fig. 1.*

**The Double-Diode Valve**

Different methods of obtaining A.V.C. were recently explained in an excellent series of articles entitled "Holding the Foreigners" so I do not propose to repeat them. Instead, I will make reference to yet another method which is already employed in several American and at least one British, superheterodyne—it is shown diagrammatically in Figure 1. A double-diode valve is used as second detector and functions on the full-wave system, the actual mode of operation being very similar to that of a full-wave valve used in high tension eliminators running off A.C. mains. Current flows through the .25 megohm grid leak (R.1) and the intensity of this is governed by the strength of the signal applied to the detector valve. As the signal strength (and hence the current) increases, so does the voltage drop across R.1, and point "A" becomes more negative in respect to "B." The negative potential at "A" is applied as grid bias, through suitable decoupling resistances, to the grids of preceding V.-M. valves. Only one V.-M. valve is shown for sake of simplicity, but it will be seen that any number could be used in practice.

**A Disadvantage of A.V.C.**

The advantages of A.V.C. have already been enumerated but no reference has yet been made to a rather serious *dis*advantage which accompanies all ordinary systems of automatic volume control. When the set is not tuned to a station it gives full amplification, so that all the various forms of "mush" and parasitic noises are amplified to the greatest possible extent. In consequence there is a tremendous "between-station" noise which is, to say the least, disconcerting. The same difficulty becomes very noticeable on a fading signal, because although the strength of programme is maintained at a uniform level the background noises come into great prominence as fading takes place, and often attain a strength equal to, or greater than, the proper signal. This, in itself, is sufficient to counteract one of the chief benefits to be derived from A.V.C. and therefore it had to be overcome before any further progress could be made.

**Quiet A.V.C.**

Any method of overcoming the latter difficulty must lie in the introduction of "quiet" automatic volume control by which the set will not respond to signals of less than "programme" strength (such as "mush," "valve hiss," etc.). There are two fundamental methods of providing Q.A.V.C., as it is now called, one of which acts on the H.F. amplifier and the other on the L.F. portion of the set. The former one is shown in Fig. 1. It is seen that there are two biasing resistances, one fixed and one variable, connected in the cathode lead to the V.-M. valve. The variable resistance acts as a normal volume control, but the fixed one is used as a "noise suppressor." When the latter is in circuit (switch contacts open) a fairly high minimum bias is applied to the valve so that it will be insensitive to weak signals, but after a station has been tuned-in the switch can be closed, and volume thereby increased.

The general principles of a Q.A.V.C. system acting on the L.F. amplifier are illustrated by Fig. 2. A.V.C. is provided for the V.-M. stages in exactly the same manner as in the method of Fig. 1, by means of a double-diode detector. A Q.A.V.C.—actually an ordinary three electrode—valve is also biased from the same source and is so arranged that when the bias voltage exceeds a certain figure it does not pass any anode current. But when the bias voltage falls to zero the Q.A.V.C. valve takes a certain amount of anode current which is derived from the voltage drop across resistance R.2, and is passed through the resistance R.3, the latter being the grid leak of the first L.F. valve. When current is drawn through R.3 a voltage drop occurs across it and this is applied as additional grid bias to the L.F. valve. As the bias voltage increases beyond a certain value the L.F. valve fails to operate and, therefore, no signals are passed through it to the loud-speaker. It can thus be seen that when the set is not tuned to a station, and therefore a minimum bias is applied to the V.-M. valves, the L.F. amplifier becomes inoperative and, in consequence, the mush is not reproduced.

Modifications of this method of providing quiet automatic volume control are employed in several receivers on the American market, but so far as I am aware Q.A.V.C. is not at present incorporated in any British sets. It has not yet completely emerged from the experimental stage, and it is thus impossible to give practical details.

**"Cold" Valves for A.V.C.**

By employing a double-diode as combined second detector and A.V.C. the necessity for a separate "control" valve acting on the V.-M. stages is obviated and thus one valve is "saved." The saving is not so great as might at first be imagined, however, because the diode does not give as much amplification as does a leaky-grid, or power grid detector. The net result is that an additional L.F. valve becomes necessary. Two ways of overcoming this difficulty have recently become available; one (and one which I think will achieve a good measure of popularity) is to employ a "cold" valve of the newly introduced Westinghouse "Westector" type in place of the double-diode shown in Fig. 1. The latter does not require any L.T. supply and need not be considered as a valve from the "current consumption" point of view; the valve which would otherwise have been used as detector can therefore be employed as an L.F. amplifier. The connections for a "Westector" used as a combined full-wave detector and A.V.C. are illustrated in Fig. 3—this circuit, it will be observed, is almost identical with that of Fig. 1.

**The "Double-Diode Triode."**

A second way of keeping down the number of valves is to make use of an entirely new valve which is called a "double-diode triode." This has only one filament (a cathode really, since it is of the indirectly-heated type), but has three anodes and a grid arranged in the manner illustrated by the sketch of Fig. 4. The two auxiliary anodes act in conjunction with the cathode as a double-diode rectifier, whilst the grid and main anode, along with the same cathode, form an L.F. amplifying valve. Thus we have, in effect, two valves in one bulb, sharing a common cathode.

*(To be concluded.)*

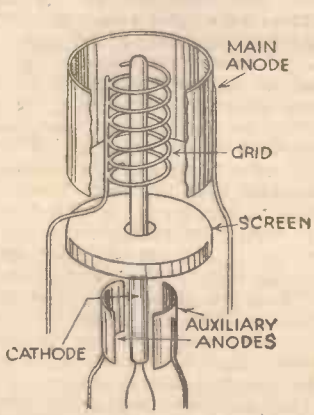



*Fig. 4.—Showing the form of construction of a double-diode triode valve.*

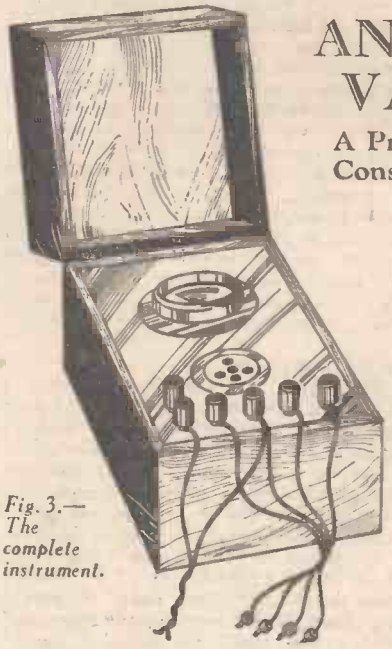


*Fig. 3.—The complete instrument.*

# AN INEXPENSIVE VALVE TESTER

## A Practical Article Describing the Construction of a Cheap but Efficient Instrument.

By J. EVANS

HOW many of you have bought a new valve to replace one that you suspected of being defective, only to find to your surprise and disgust that results were not thereby improved? Had you been able to test the old valve before purchasing the new one, this unnecessary expenditure would have been avoided.

Simple valve testers are easily constructed and what is more important, they can be operated by the veriest tyro. It is therefore surprising that they are so seldom used by amateur constructors. The tester described in this article need not cost more than 12s., provided the receiver batteries are used for supplying the G.B., H.T., and L.T. voltages, and it may be assembled in half an hour.

### Valve Emission

In order to understand the action of the tester, a slight knowledge of valve operation is desirable. Scientists inform us that matter is composed of atoms, and that these atoms consist of a central positive electric charge surrounded by numerous free negative electric particles, commonly known as electrons. When a wire is heated it is found that some of these free electrons are shot off from the atoms, and it is upon this peculiar behaviour of a heated wire that the action of the modern wireless valve depends. In the case of the battery valve this wire constitutes the filament (the cathode in the case of the indirectly heated valve). The L.T. accumulator is used to heat it to incandescence, in the same manner as the mains are used to heat an ordinary electric lamp, and free electrons are consequently shot off into the valve vacuum. Surrounding this filament wire there is a metal plate, sometimes called the anode, to which a high positive voltage is applied from an H.T. battery or an eliminator. The function of this plate is to attract the free electrons shot off from the filament (positive attracts negative), so that a continuous stream of electrons may pass from the filament to the plate. The plate-filament circuit will then be complete, and a current will flow from the positive terminal of the H.T. battery, through the valve, and back to the negative terminal. It is therefore obvious that the valve will not work unless the filament is emitting electrons. Unfortunately for the set owner, valve filaments will not keep on shooting off electrons indefinitely. There comes a time when their emission gradually falls off—the valve is then said to have lost its emission. A valve tester should therefore indicate whether the filament is emitting the normal number of electrons. In the tester about to be described, this is done by connecting a milliammeter in the valve plate-filament circuit, as shown in Fig. 1.

### Constructional Work

The construction of the tester is very simple. Drill six holes about ¾in. apart, and about ½in. from the edge of an ebonite panel measuring about 5in. square, and fix the battery terminals in these. Drill five small holes to accommodate the valve-holder, and meter-fixing screws, and then fasten these components securely to the panel. The wiring is clearly shown on the wiring diagram (Fig. 2). If a well-finished appearance is desired, the wiring may be taken under the panel. The panel may then be housed in a small cabinet, as shown in Fig. 3, and a valve emission chart may be tacked to the inside of the lid. A well-polished cigar box can quite easily be converted into a serviceable and neat-looking cabinet.

### Testing

When it is desired to test a valve, it is only necessary to connect the tester by

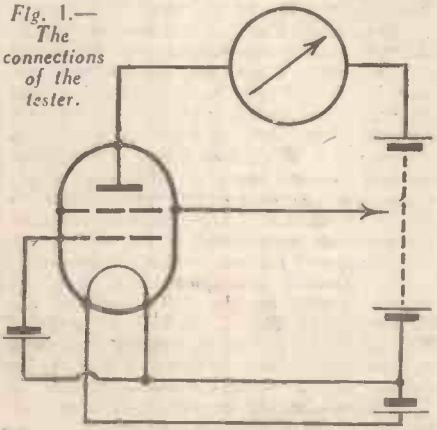


*Fig. 1.—The connections of the tester.*

means of the battery leads to the normal L.T., G.B., and H.T. sockets—the batteries used for operating the receiver may be employed for this purpose provided they are known to be in good condition. The valve is then inserted into the valve-holder, and the reading on the milliammeter noted. In the table, Fig. 4, is given the approximate average current consumption of the most commonly used directly-heated valves, but these figures are not, of course, intended for accurate calculations. It is suggested that high impedance valves of the H., H.F., and H.L. types be tested at zero grid bias, and therefore G.B.— and G.B.+ leads of the tester should be joined together when testing such valves. The low impedance valves of the L.F., P., and S.P. types should, however, be negatively biased in accordance with the valve manufacturers' instructions, otherwise their current consumption will be too high. When testing any of the above-mentioned valves, *i.e.*, triodes, H.T.1 battery lead is left disconnected—this lead is only used when testing pentodes and S.G. valves, as mentioned below.

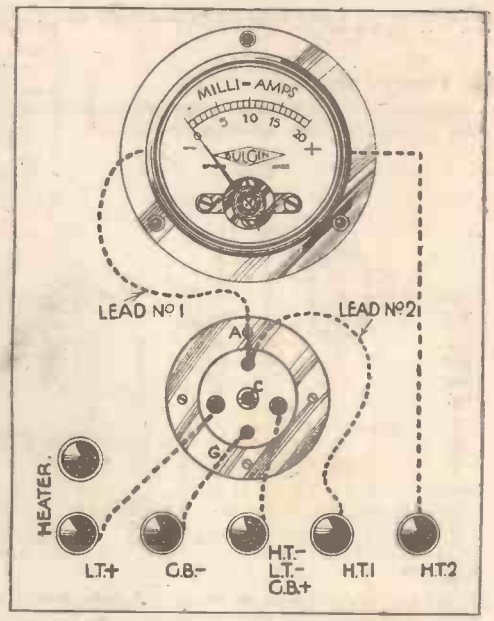



*Fig. 2.—The wiring arrangements*

When testing S.G. valves, lead No. 1 on the wiring diagram Fig. 2, should be disconnected from A terminal of valve-holder and connected to cap terminal of valve, and H.T.1 battery lead should be plugged into approximately 60 volts. No G.B. voltage is necessary for this type of valve. When testing pentodes, lead No. 2 should be disconnected from the A terminal of the valve-holder and connected to the auxiliary grid terminal of the pentode. This usually protrudes through the side of valve base, but in some cases it takes the form of a fifth pin in the centre of base. For this reason a five-pin valve-holder is specified for the tester. H.T.1 battery lead is then plugged into auxiliary grid voltage socket suggested by the valve manufacturers—approximately equal to H.T.2 voltage.

As a five-pin holder is employed, this tester may also be used for testing indirectly-heated mains valves, but a slight modification of wiring is then necessary. The lead joining the valve-holder to L.T.—, G.B.+, H.T.— terminal should be disconnected from this terminal and connected to the unused heater terminal, and the cathode terminal of valve-holder should be connected to H.T.—, G.B.+ terminal. The L.T.— battery lead should then be transferred to the above-mentioned heater terminal. A 4-volt accumulator, and the usual dry G.B. and batteries may be used for testing age indirectly-heated valve.

### Testing Characteristics

Most constructors wish to check valv

(Continue

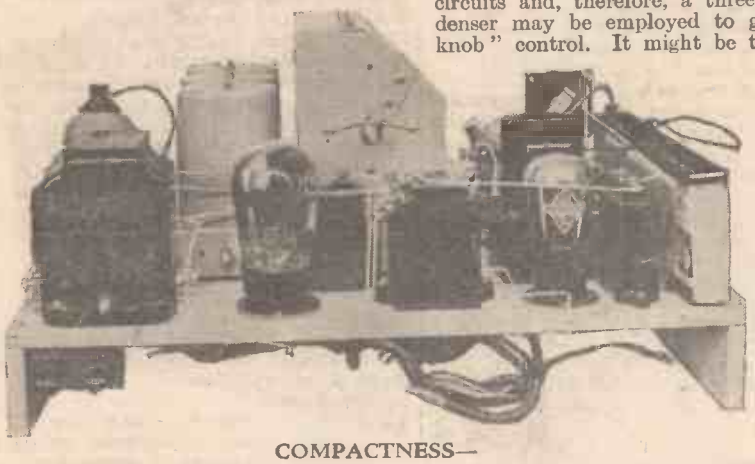
*INTRODUCING—*

*By OUR TECHNICAL STAFF*

# THE RADIOPAX CLASS B FOUR

Advance Details of Our New Receiver, Employing Unit-Assembled Band-Pass Coils and Condenser

IN these days of high-powered stations working on closely adjacent wavelengths the problem of selectivity is a very great one. Many listeners now live under the shadow of one of these stations, and the result is that the "local" occupies such a large portion of the tuning scale that it becomes quite a difficulty to hear more distant stations. The remedy is, of course, a superheterodyne receiver or a simpler type of receiver employing band-pass tuning. The advantages of this form of tuning have already been discussed in these columns, and receivers employing the principle have been described. There is, however, one important point relating to this form of tuning, and that is the question of ganging. Obviously there will be at least two tuned circuits in a band-pass receiver, and a ganged tuning condenser may be used for tuning these circuits. When an H.F. stage is employed there will be three tuned circuits and, therefore, a three-gang condenser may be employed to give "one-knob" control. It might be thought by some that if the three coils are accurately ganged and matched, and the three sections of the tuning condenser also ganged and matched, that the connections have only to be made to provide a completely ganged and matched receiver. Actually, however, this is not the case, and serious loss of signal strength may result from stray capacities introduced by the wiring.



COMPACTNESS—

**The Radiopack**

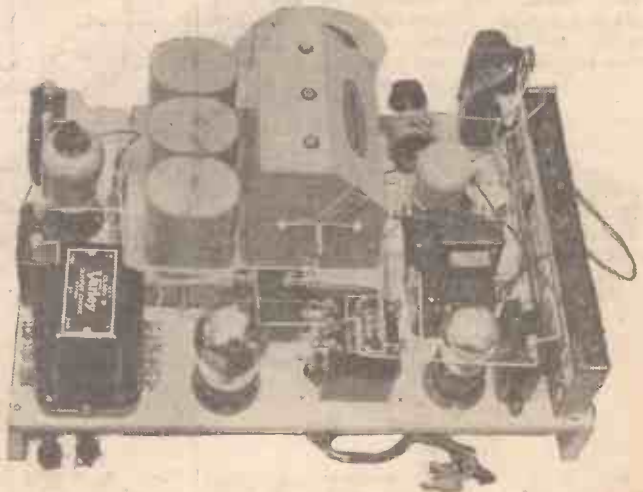
If, therefore, we are to be sure of our ganging, it is necessary to correctly match the condenser sections with the coils, and the necessary connections between them. Usually this is difficult to carry out, but Messrs. Radiophone have made up a very efficient unit which carries this principle to its conclusion. It consists of a metal chassis on which is mounted a three-gang condenser, three tuning coils, wave-change switches, and a potentiometer and on-off switch. This complete unit is made up and then ganged, with the result that the matching holds throughout the complete range of wavelengths covered by the coils and condensers. Obviously there remains very little wiring to complete a receiver, and we have included this useful unit in our latest receiver, which is introduced in this article.

**The Circuit**

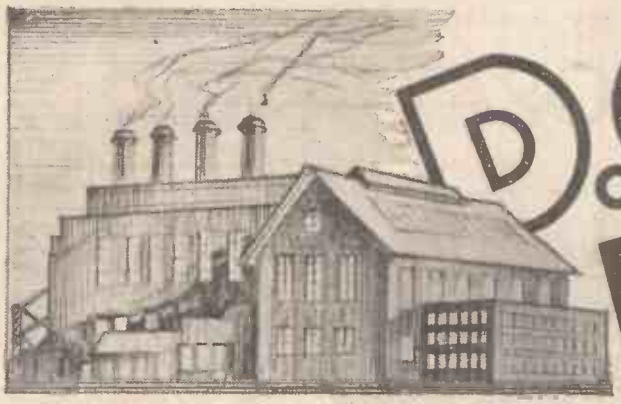
The circuit is a little unorthodox, and it will be seen that the band-pass circuits are not included in the aerial as is usual, but a single tuned circuit is used in this position. The H.F. valve is of the variable-mu type, and this is coupled to the detector valve *via* the band-pass circuit. This enables a very satisfactory form of ganging and matching to be carried out, and also improves selectivity. When a band-pass circuit is arranged in the aerial, the question of ganging is rather difficult, but when using a variable-mu valve, the selectivity may be nicely controlled by means of the bias control on the valve, and then the band-pass circuits may be accurately balanced between the equal loads of the H.F. and the detector valves. The detector valve is coupled to the first L.F. by means of a tone-control L.F. transformer, and this is of Lissen manufacture, and has been used in order to compensate for the high-note response of the Class B output stage. It is thus simple to reduce the high-note response on items where the shrillness is unpleasant.

## COMPONENENTS FOR THE RADIOPAX B.4.

One British Radiophone Band-Pass "Radiopack" with Gramophone Switch.
Three 1 mfd. Dubilier Type B.B. Fixed Condensers.
One 2 mfd. Dubilier Type B.B. Fixed Condenser.
Two .0001 mfd. Dubilier Type 670 Fixed Condensers.
Two 1 meg. Graham Farish "Ohmite" Resistances.
One 30,000 ohm. Graham Farish "Ohmite" Resistance.
On 10,000 ohm. Graham Farish "Ohmite" Resistance.
One .0003 mfd. Graham Farish "Litlos" Reaction Condenser.
One Bulgin Standard H.F. Choke.
One Varley Type D.P. 40 Class B. Driver Transformer.
One Varley Type D.P. 42 Class B. Output Transchoke.
Lissen Tone Control Hypernik ...rmer and Resistance.
... Chassis Mounting 4-pin ...s.
...ssis Mounting 7-pin
...lo. 3 Grid Battery
One Peto Scott Baseboard Mounting Component Bracket.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B Terminals—Aerial, Earth, and Pick-up (2).
One Belling-Lee 5-way Battery Cord.
Two Belling-Lee Wander Plugs marked G.B.+ and G.B.—.
One Blue Spot, Type 45 P.M. Loudspeaker.
One 220 V.S.G. Cossor Valve.
One 210 Det. Cossor Valve.
One 215 P. Cossor Valve.
One 240 B. Cossor Valve.
One Smiths 2RGN7 2 Volt Accumulator.
One Smiths Anodex 120 volt Class B H.T. Battery.
One Smiths Anodex 16.5 volt G.B. Battery.
Two Coils Glazite, Length of Flex, Screws and Sundries.
AERIAL AND EARTH EQUIPMENT.
One Graham Farish "Filt" Percolative Earth."
One "Goltone" "Metocel" Screened Down Lead.
One Graham Farish Gard Lightning Arrester.



—AND ACCESSIBILITY!



# D.C. MAINS PROBLEMS

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

A VERY large number of letters reaches the editorial offices of PRACTICAL WIRELESS, in which requests are made for articles and designs dealing with the problems associated with users who have D.C. mains installed in their homes. At first sight it seems rather remarkable that this section of radio reception has been very much ignored, but probing the matter a little more deeply, the reason can be found. As a general rule, D.C. mains working is beset with many ticklish problems arising from the very nature of the supply, and in consequence, comparatively few manufacturers and designers have devoted time and trouble to solving them.

No doubt another reason for this attitude can be found in the assumption that once the big grid scheme, which is now in process of development all over this country, is satisfactorily linked up, all mains users will be supplied with 50 cycle A.C. This somewhat perfunctory dismissal of the matter, however, is open to serious question. While it is admitted that supply authorities will buy their A.C. in bulk from the high-powered generators, it does not follow that it will be distributed to individual consumers as A.C. Those authorities who have a local distribution network of D.C. will be more inclined (from reasons of expense primarily) to rectify the A.C., say, through the medium of mercury arc rectifiers, and maintain their present D.C. distribution at least for some time.

### Supply Undertaking Figures

In fairness to D.C. mains users, therefore, I decided to carry out some tests on their behalf, so as to be in a position to pass on any useful information through the medium of these columns. It was only the other day that some figures came into my hands which gave some illuminating facts as a result of the census of the 662 supply undertakings in this country. They were contained in a report issued by the Electricity Commissioners, and showed that 253 of these supply undertakings distribute alternating current only, 288 both alternating and direct current, and 121 direct current only.

The D.C. mains market cannot, therefore, be ignored, and while D.C mains sets as a general rule are far more difficult to design so that they achieve a measure of success comparable with an A.C. mains-fed set using the same number of valves, it is to be hoped that the information I have prepared for readers will prove of assistance to them. Figs. 1 and 2 show photographs of two sets in course of construction, both of which were made up and employed in some of the tests I made, and complete data dealing with a three-valve D.C. mains receiver which I shall present to readers is now in course of preparation.

*Fig. 1.—One of the D.C. mains experimental receivers in course of construction.*

### Nature of D.C.

Every user of alternating current realizes that his supply must be rectified (that is, made uni-directional) before he can use it to supply power to his wireless receiver, and concurrently with this we find the man with D.C. often imagining that he has merely to connect his set to the mains in lieu of batteries for satisfactory functioning. Unfortunately, this is far from being the case. Certainly the voltage and current supply is uni-directional, but invariably it is far from being a *steady* source of power. This is due very largely to the "ripple" brought about in the normal course of events by commutation at the generating station. In effect, the supply voltage resembles somewhat that shown in Fig. 3, where we have a supply voltage of certain value together with a superimposed ripple variation of magnitude unknown. The variation takes place at a relatively high frequency when judged from "heavy" electrical engineering standards, it being, as a rule, anything from 200 to 500 per second.

### Filters

If the supply was used direct to feed the anodes of the receiver valves, therefore, a most objectionable hum would result and it is hence necessary to smooth the supply through the medium of a suitable filter before it can be employed. The circuit for such an arrangement is indicated in Fig. 4, and follows orthodox lines except that there is no reservoir condenser included on the supply side of the unit. Any scheme for storing up energy is entirely unnecessary with D.C., for up to the limit of the fuses in the home installation there is ample energy available for most radio purposes. This is one marked difference when we compare with the case of A.C. which demands the reservoir condenser.

Another point meriting attention arises from the fact that it is not possible to raise the voltage of a D.C. supply by the s[ame] means used with A.C. Recourse m[ust]

(*Continued overleaf.*)

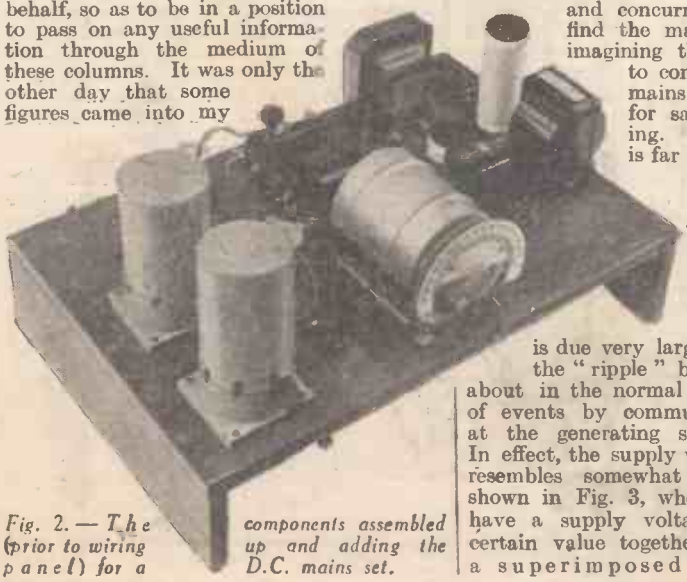


*Fig. 2.—The components assembled (prior to wiring up and adding the panel) for a D.C. mains set.*

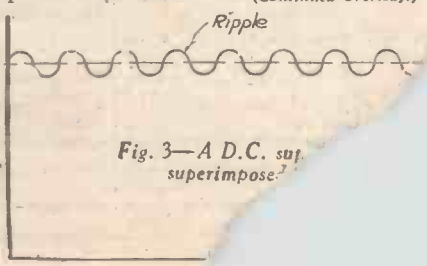



*Fig. 3—A D.C. sup[ply] superimpose[d]*

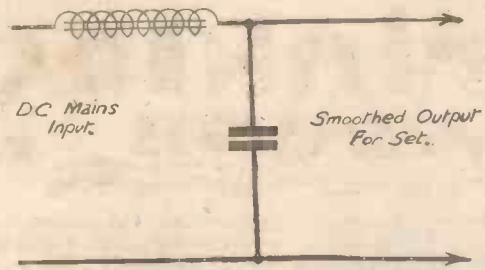



*Fig. 4—A simple smoothing circuit for D.C. mains.*

## D.C. MAINS PROBLEMS

(*Continued from previous page.*)

made to rotating machinery, such as that illustrated in Fig. 5, when high voltages are required by the user, and unless this is done the voltage available for ordinary wireless purposes is somewhat less than the rated supply, the drop in voltage being brought about by the smoothing or filter apparatus. However, as the bulk of the D.C. supplies has a voltage of between 200 and 240, this value is adequate for most general radio receiver purposes, so we will not at this juncture deal with the question of rotating machinery.

### A Three-wire System

Speaking of supply voltages brings me to an important point in connection with the use of direct current mains which arises from the method of distribution. As it is found more economical to generate the electricity at a relative high voltage, most of the supply stations commute their current at the source at a voltage varying from 400 to 500 volts. For power purposes, this is quite satisfactory, but when it comes to lighting and general domestic electrical appliances a voltage of half this figure is desired. The authorities meet this request in a very ingenious manner, which has come to be known as the three-wire system of distribution. The scheme was designed independently by both Edison and Hopkinson.

A centre tapped arrangement is provided at the generating station, and the main positive and negative leads (X and Y of Fig. 6), are called the "outers" while the third lead Z, is known as the middle or "neutral" wire. Readers will see for themselves that the neutral wire is only called upon to carry the "out of balance" current of the double distribution system XZ and ZY, and the scheme is most satisfactory, especially when care is taken to "balance the load" between XZ and ZY as far as is possible.

### A Safety Measure

reasons of safety, the centre or wire is earthed at the generating that we have two supplies of volts (according to generated d the greatest difference of ove or below earth (zero) nly the 200 or 250 volts. the radio man's point of the fact that whereas he negative main is e ZY supply the It is normal th the com- T.—, but re would be a dead short across his mains, and the fuses would blow immediately.

It is a golden rule with D.C. radio receiver working, therefore, never to connect the apparatus directly to earth. A condenser of at least 2 mfd. capacity must be joined between the earth terminal of the set and the negative electric main. Naturally, this 2 mfd. fixed condenser must be correctly rated so as to withstand the direct current voltage which is applied across it, that is, the full mains voltage with earthed positive main users, and as a safeguard the condenser should have been tested at a voltage of between twice and three times that which it is required to withstand. Furthermore, the quality of the condenser must be above suspicion, and where possible readers should use one of the non-inductive type, for cases sometimes arise where set instability has been traced to the use of a condenser which has not conformed to the non-inductive rating.

*Fig. 5.—Recourse must be made to rotating machinery in order to "step-up" the voltage of a D.C. supply.*

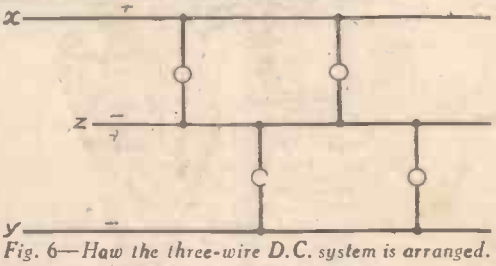



*Fig. 6—How the three-wire D.C. system is arranged.*

### D.C. Receiver Considerations

There are several other points which must be watched in connection with sets worked from D.C. mains, and in dealing with these in turn it must not be thought that I have chosen any order of "merit" (or "demerit"). Different situations or conditions of environment lend emphasis to one or more of them in differing degrees of importance, so let us now turn to the receiver itself so as to ascertain where lie the main differences when compared with the battery or alternating current mains counterparts.

Before the introduction of special indirectly-heated mains valves for D.C. use, valves of the two, four, or six volt variety were employed with filament current of 0.1 ampere. These were wired in series together with a high resistance, also in series with the filaments, the object of the latter being to reduce the filament current to the correct value. The fall of voltage across this resistance was then utilized to apply the correct anode voltages to the various valves, somewhat in the manner shown by the skeleton diagram of Fig. 7.

Wiring valve filaments in series is, of course, the opposite to battery or A.C. mains practice, where the filaments are in parallel. As, however, the D.C. mains voltage cannot be "stepped down" it would be most uneconomical from the current consumption point of view not to adopt this series working. Furthermore, there is a measure of safety inasmuch that if a valve filament should fail accidentally, the circuit is rendered inoperative automatically and no current flows. Sets built up in this manner in the earlier days of mains working, gave extremely good results, but as most of the D.C. mains valves now used employ filaments of the indirectly heated variety, we will not spend time in discussing the older methods of reception. The working technique has really been greatly simplified by these newer valves, and I shall have more to say on the points that arise in my next article.

*(To be continued.)*

### Wireless Comparisons

A LARGE motor-car agency have hit upon a novel plan for selling new cars. They invite prospective customers to bring their old car along to a nearby test track and go through a series of hill-climbing, stopping, and acceleration tests in conjunction with a new car driven by the salesman. Naturally enough the new car generally shows up well in comparison with the performance of the customer's old car, and many sales are made in this way. This should be a good tip for radio dealers and fans. Next time you hear an atrocious set working take along your latest PRACTICAL WIRELESS model and let the owner of the old set hear what REAL wireless sounds like. You may, in this way, persuade him to buy or build a modern receiver.

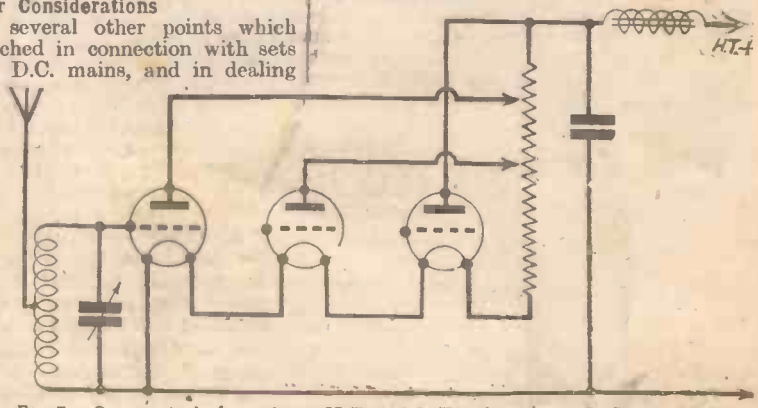


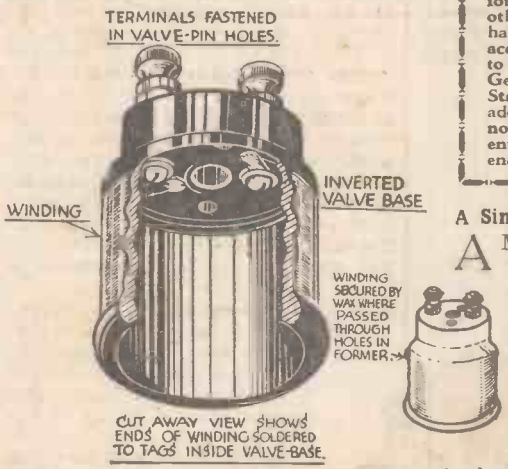

*Fig. 7—One method of supplying H.T. and L.T. voltages in a D.C. receiver.*

THE HALF-GUINEA PAGE

# Radio Wrinkles FROM READERS

### A Novel Short-wave Choke

THE illustration shows a novel use for old valve bases. First empty the base, breaking out the glass, etc., then pull out the contact pins. Enlarge the plate and grid holes to 4 B.A. size and drill

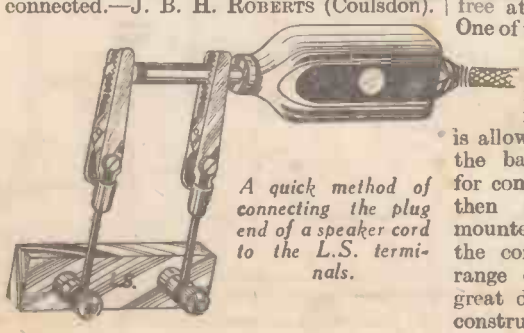



*Using an old valve base as a choke former.*

a hole in the centre of the base. Make a small hole at the top and bottom of the base, and anchor some 40-gauge enamelled wire close to one of the holes. Wind on between 75 and 130 turns of this wire, and take the ends through the small holes. Solder each end to a tag or thicker wire and attach each to a 4 B.A. bolt which is pushed up through the holes already drilled. Fix a locknut and terminal and you have a cheap and efficient short-wave choke which can be fastened to the baseboard by a screw through the centre hole. A spot of compound or glue will keep the wire from slipping.—A. JONES (Merthyr Tydfil).

### Connecting a Loud-speaker

THE accompanying sketch shows a quick and effective method of temporarily connecting a speaker which is fitted with a plug, to a set having L.S. terminals instead of a jack. Connect two crocodile clips to terminals by short pieces of stiff wire and the plug can then be held firmly in the jaws of the clips. If output filter is not used, care should be taken to see that positive and negative terminals are correctly connected.—J. B. H. ROBERTS (Coulsdon).



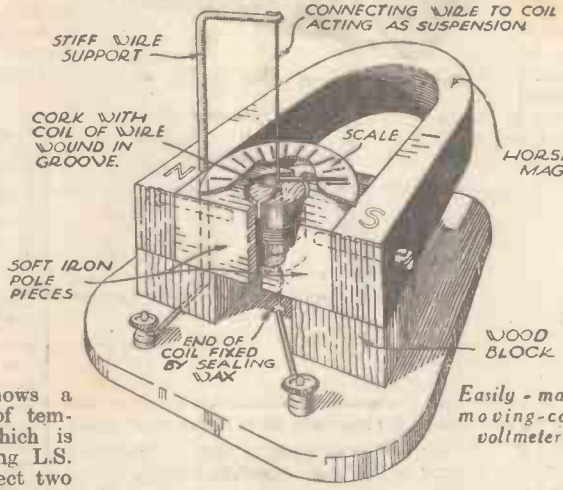
*A quick method of connecting the plug end of a speaker cord to the L.S. terminals.*

### *THAT DODGE OF YOURS!*

**Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS." George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.**

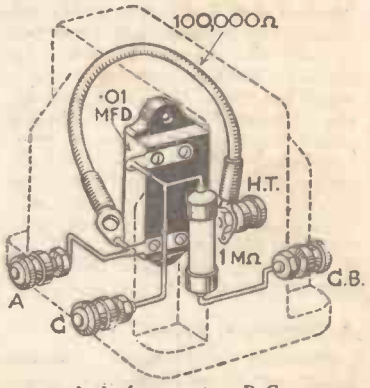
### A Simple Moving-coil Voltmeter

A MOVING-COIL voltmeter may be constructed quite simply from a horse-shoe magnet, a cork, and an old 1,000-ohm earphone bobbin. Let us assume that the horseshoe magnet has a distance of 3 inches between pole pieces, A block of soft iron 3 inches long and of the same thickness as the magnet must be obtained, and as large a hole as possible drilled in the centre. The block is then cut carefully in half with a hacksaw, and the two pieces fixed one to each pole of the magnet, as shown in the diagram. A cork is then obtained that will




*Easily-made moving-coil voltmeter.*

fit freely into the hole between the two pole pieces. A groove about ⅛in. wide and ⅛in. deep is cut in the cork, and as much wire as possible is wound into the groove from the earphone bobbin, leaving about 6ins. free at each end for connection purposes. One of the ends is fixed to a support situated centrally over the hole between the pole pieces so that the cork hangs in such a way that it is free to turn in either direction. The other lead is allowed to remain slack, but is fixed to the baseboard with sealing-wax for convenience. Both leads are then connected to terminals mounted on the baseboard, and the construction is finished. The range of the instrument depends a great deal on the care taken in the construction. It should be capable of reading fractions of volts. The meter may be calibrated by comparing it with a standard instrument. By connecting a good 1-ohm resistance across its terminals the readings given are then equal to the current flowing through the resistance. The instrument is only suitable for D.C.—J. HICKMOTT (West Kensington).




*A neat method of mounting R.C. components.*

### A Compact R.C. Unit

THE parts required for this neat little unit are: one 100,000 ohm spaghetti resistance; one .01 mfd. coupling condenser (mica); one 1 meg. grid leak, and the bakelite case of a burnt-out transformer. Carefully remove the core and windings and connect the R.C. components as shown in sketch. This method keeps them tidily together and is much easier to wire into a set.—W. CRICHTON (Glasgow).

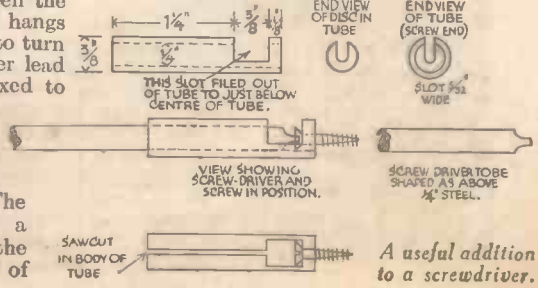
### The Care of Valves

A POINT to bear in mind concerning valves is that they should not be repeatedly withdrawn and re-inserted in the holders. Not only does this causes additional strain on the holders; it also causes a certain amount of shock to the filaments, especially if the valves are pulled out of their holders while the filaments are cooling.—A. J. B. (Harrow).

### A Screwdriver Accessory

THE accompanying sketches show a handy adapter I have devised for use with a screwdriver to drive home wood-screws, etc. The construction of this simple gadget will be clear from the illustration, and I may say that I have found it extremely useful in construction work. It is cheap, strong, and easy to make.—H. W. JEANES (Patcham).

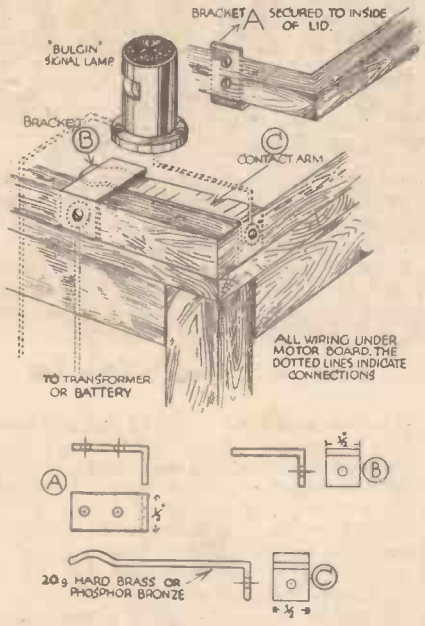
(*Continued overleaf*)




*A useful addition to a screwdriver.*

## RADIO WRINKLES

*(Continued from previous page.)*



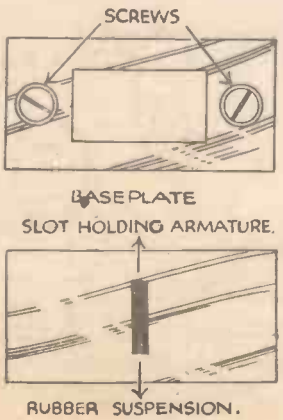

*Automatic switching for a radio-gram. light.*

### A Radiogram Light

A SIMPLE light, with automatic switching, for a radiogram can be easily arranged as shown in the accompanying sketches. Only three parts are required, and these consist of pieces of hard-drawn strip brass or phosphor bronze, connected as shown in the top sketch. When the lid is lowered the bracket A depresses strip C, thus breaking contact with bracket B and switching off the lamp. On lifting the lid to change a record, or fit a new needle, contact is automatically made again and the lamp lighted. The slot in the signal lamp allows the light to be concentrated on the needle.—E. W. FURBANK (Leeds).

### A Pick-up Suspension Dodge

HERE is a little dodge that will be of use to those readers who possess a pick-up having a rubber suspension. After being in use for some time, the rubber suspension weakens and allows the armature too much movement between the pole pieces, with consequent chatter and loss of volume. It can be very often cured by reversing the rubber, and it will then be found the slot in rubber holds armature tighter. The base-plate holding armature must be taken out by removing the two screws. Care must be used in putting it back to see that the armature is dead central between pole pieces. The writer has tried this and it has certainly improved the performance of the pick-up.—S. P. BAYLY (Leigh-on-Sea).

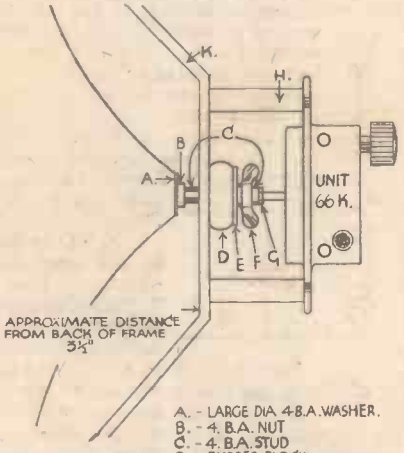



*A useful pick-up dodge.*

### Improving a Linen Diaphragm Speaker

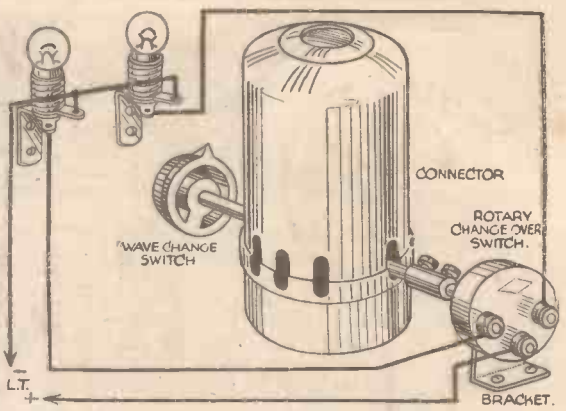
THE accompanying sketch and suggestions should be useful to those readers who wish to improve both the range and sensitivity of a linen diaphragm speaker. I used a single fabric cone, or diaphragm, stretched on a twelve-sided frame of 1in. square section, doped with Collodion Meth, which is not quite so brittle as the usual celluloid dopes. Through the centre of the fabric is fixed a 4B.A. brass stud 2½in. long, with a nut and large diameter washer on either side. This stud passes through a ¼in. diameter hole in the bracket bridging the frame at the back, thence through a block of soft springy rubber about ¼in. diameter by ¼in. thick, and finally a brass washer 4BA by ¼in. diameter. A 4BA wing nut is now threaded on and tightened up to a safe tension for the fabric, probably leaving about an inch of the stud protruding.

The unit I use is about three years old, and in the alterations to this part of the speaker lies the secret of the improved performance. The armature is held suspended between the four poles by a brass spring and adjuster, and this, together with the fixing and adjusting screws, coil, and spring must be removed, leaving the reed sweated to the armature bridge. The armature will then be found to cling to one pair of poles, it does not matter which.




*Making improvements to a linen diaphragm loud-speaker.*

Suitable spacing pieces must now be obtained (I used brass tubing) to space the unit from the bracket and rubber assembly, and the reed and 4BA brass stud must be suitably shortened so that, when all is screwed up, there is about $\frac{1}{16}$in. gap between the ends. A spot of solder will join these together, after which the wing nut should be adjusted so that the tension of the fabric forces the armature off the pole-pieces and restores it to its original position midway between the four poles. The advantage is that we now have the original state of affairs in a speaker of this type, but have dispensed with a force which was powerful enough to hold the armature off the pole-pieces. The accompanying sketch should make the alterations quite clear.—B. E. CLEGG (Rochdale).




*A method of fitting coloured dial lights.*

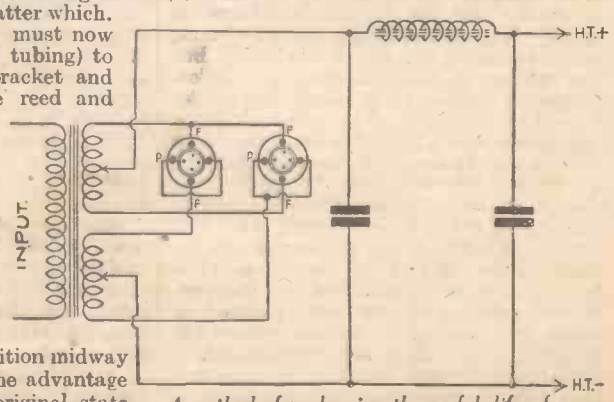
### Coloured Dial Lights

HERE is a novel way of telling at a glance which waveband you are receiving. A single pole rotary switch is required, also two bulbs and holders fitted with spring clips. One bulb can be left clear, but the other one must be coloured. Fix the bulbs in their holders and clip them behind the dial. If you have a tuning coil with the wave-change switch incorporated, the rotary switch can be screwed on the end of the rod with the extension piece (used for ganging another coil), and held in position by a small bracket. The connections are made as shown in the illustration. When the wiring is finished the dial light will change colour, as you alter the waveband from long to short.—A. C. DAY (Redcar).

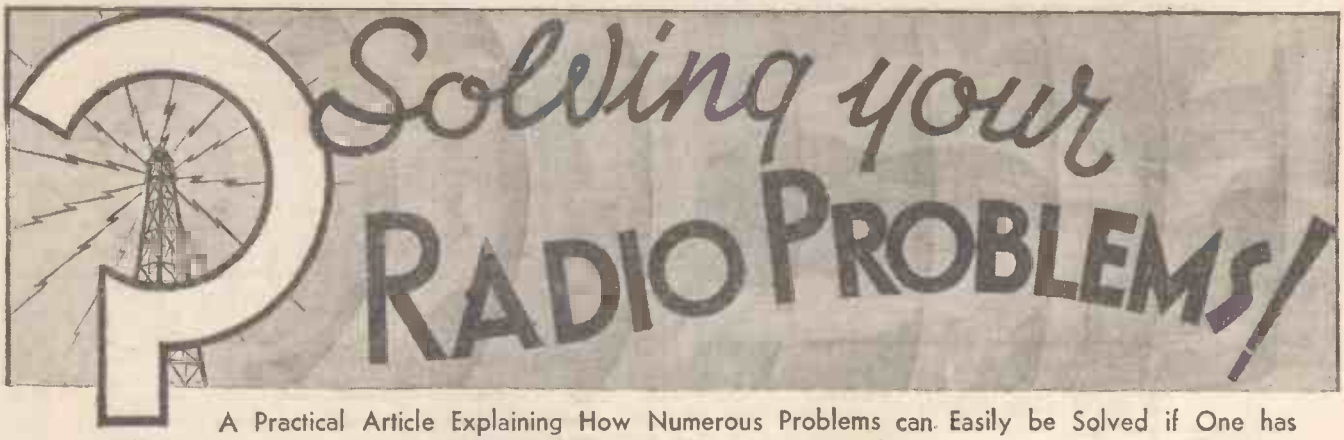
### Rectifier Valve Economy

NO doubt many readers have more than one rectifier valve which has had its day and has been put on one side as useless. Why throw these away? A simple and effective method of using these valves is to wire up another valve holder, as in the accompanying diagram, when a useful life can again be obtained from them.

A sceptical reader might say, "Oh! there will be a lot of extra hum." I have not found this so in practice owing to the characteristics of the valves being fairly constant. The load on each valve is, of course, halved, as the anodes are in parallel, hence the rise in output volts to normal.—"PRACTICUS" (Bradford).




*A method of prolonging the useful life of a rectifying valve.*




A Practical Article Explaining How Numerous Problems can Easily be Solved if One has a Knowledge of the Meaning of Impedance.

By RADIO ENGINEER

HAVEN'T you often wondered why your set oscillates more easily as you reduce the capacity of the tuning condenser? Or what is the purpose of the H.F. choke connected in the anode circuit of a detector valve? Or why the "tone" of the set is altered by connecting a condenser across the primary winding of a low-frequency transformer? Or why the loud-speaker works best when it is properly "matched" to the output valve?

No doubt you have frequently asked yourself the above questions without being able to supply a really satisfactory answer. As a matter of fact all these little problems, and many more, can easily be solved if one has a passing acquaintance with the meaning of a word which is used very often in wireless circles and yet of which many people seem to be "scared." I refer to the word "impedance." Perhaps it does sound rather technical, but it is quite harmless and extremely useful.

**Resistance and Impedance**

You know what resistance is; it is the opposition which certain materials offer to the passage of electrical current. Impedance has a similar meaning, but is applied, not to direct current, such as one may obtain from a battery, but to alternating or high-frequency current of the kind which is used in a wireless set to produce sounds in the loud-speaker. It is measured, like resistance, in ohms.

**Impedance of Condensers**

Perhaps the simplest way to observe the difference between resistance and impedance is to consider for a moment an ordinary fixed condenser of the kind connected across the high tension supply. It usually has a capacity of about 2 microfarads. The condenser has an infinite resistance to direct current—else it would short-circuit, or take current out of, the battery. But the purpose of that condenser is to allow unwanted alternating or speech frequencies to leak away. It must therefore present a low resistance—more correctly, impedance—to them. It *does*, because its impedance to frequencies of about 250 cycles per second (that of the average female speaking voice) is only about 300 ohms. At a frequency of 4,000 cycles per second (rather higher than that of the top note of a piano), it has an impedance of only 20 ohms. If the same condenser were inserted in series with the aerial lead-in, where the frequency of the alternating currents which would flow through it might be anything from 100,000 cycles upwards, its impedance would be practically zero.

In considering the latter points we have observed one simple but important fact; namely, that the impedance of a condenser varies with the frequency of the alternating currents passed through it—as the frequency is increased the impedance becomes less. Suppose we now think in terms of a "smaller" condenser, say one having a capacity of .0002 mfd. or 10,000 times less than that previously referred to. Its impedance at 250 cycles is approximately 3 *million* ohms; at 4,000 cycles it is 200,000 ohms and at 100,000 cycles it is still over 5,000 ohms. But at 1,000,000 cycles per second (corresponding to a wavelength of 300 m.), the same condenser offers an impedance of rather more than 700 ohms.

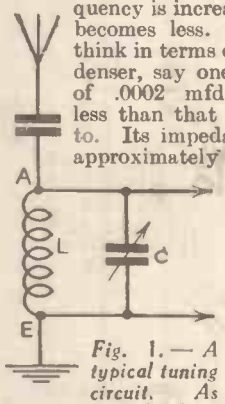



*Fig. 1.—A typical tuning circuit. As the capacity of C is reduced a smaller "load" is placed on L, so that the impedance between points A and B becomes greater.*

It can be now seen that the impedance of a condenser varies with its capacity, and with the frequency of the current passing through it. As a matter of fact the impedance is actually *proportional* to the product of the capacity and frequency and, given the values of the two latter factors, we can easily calculate the impedance of any condenser from the formula:—Impedance (in ohms)$=\frac{1,000,000}{2\pi \times f \times C}$, where $\pi$ is 3.14, f is the frequency and C the capacity in microfarads. However, we need not worry ourselves with mathematics for the present, but the formula is given just to consolidate, as it were, our deductions.

**Impedance of Coils and Chokes**

And now suppose we consider the impedance of different kinds of coils. A piece of 24 gauge wire 43yds. long has a resistance (to D.C.) of 3 ohms and its impedance to A.C. is not greatly different, provided the wire is kept in one straight line. But if it is wound into a coil of say 220 turns 1¼in. diameter—this would actually be a tuning coil for the long waveband—it would offer an impedance of 5 ohms to currents at 100 cycles per second or of 4,000 ohms at 200,000 cycles (corresponding to the wavelength of Moscow RV1). Now suppose we were to fit an iron core into the coil, its impedance would go up to over 100 ohms at 100 cycles. And so we could go on making comparisons, but there is no need for this, since we have found that the impedance of a coil *increases* with a rise in frequency—just the opposite to that of a condenser. We can also see why an iron core is used in coils which have to deal with low frequencies, smoothing and L.F. chokes for example; it is to secure the necessary impedance at low frequencies. Moreover, the principal advantage of the new Ferrocart coils is made evident; by using an iron core the required impedance is obtained by the use of fewer turns of wire.

**Question Number One**

Having arrived at these conclusions, some of the questions stated in the opening paragraph are easily answered. Starting with the first one: the aerial tuning circuit consists of a coil and condenser connected in parallel as shown in Fig. 1. To tune to a lower wavelength (higher frequency) the capacity of C is reduced. What does this involve? Well, in the first place the impedance of C is increased, which is equivalent to reducing the "load" on the coil L, and besides this, the impedance of L increases due to the higher frequency. As a result the impedance between the points A and E becomes higher, so that the signal voltages between these two points are made greater. Expressed differently, the "efficiency" of the tuning circuit is enhanced, and because of this the valve oscillates more readily.

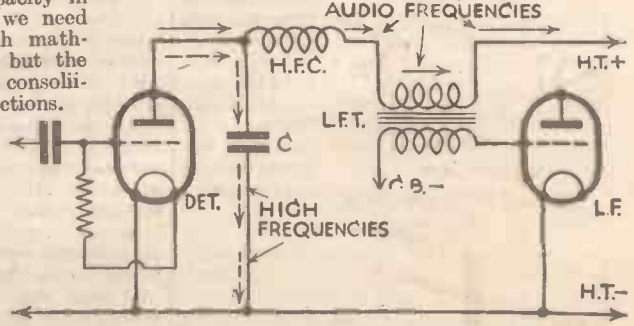



*Fig. 2.—The anode circuit of a detector valve where high and low frequencies have to be separated. The H.F. choke passes the low frequencies and condenser C the high frequencies.*

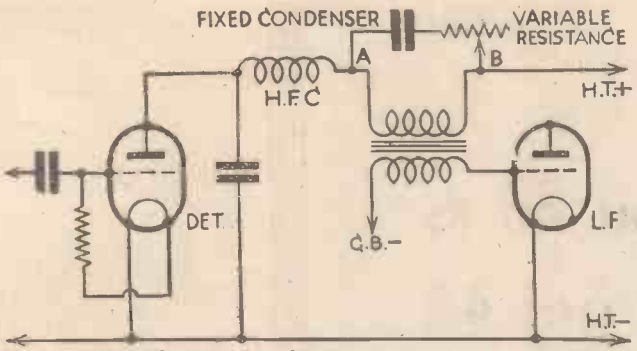



*Fig. 3.—A simple tone control circuit. If the impedance of the series condenser and resistance is made less than that of the transformer primary at any frequency, all sounds at that frequency will be reduced in intensity.*

**Why Use An H.F. Choke?**

Let us look at the second question: "What is the purpose of the H.F. choke connected in the anode circuit of a detector valve?" (See Fig. 2). The choke has to do three things. It has to present an easy path for the direct current flowing from the H.T. battery to the anode of the valves; to allow low frequency (or audio frequency) current to pass from the detector to the L.F. valve, and to prevent high (or signal) frequencies from getting into the L.F. amplifier. The first two tasks are easy and could be performed by a straight piece of wire, but the third tends to complicate matters. Let us think for a moment. We saw that a coil of wire—and that is all a choke really is—has less impedance to low than to high frequencies. Well then, if a suitable size of coil is chosen it will have a fairly low impedance to audio frequencies below 6,000 cycles or so, and a comparatively high one to signal frequencies ranging from 100,000 cycles upwards.

My desire to enter into mathematics at this point is no greater than yours, so I will merely state the results of calculations in respect to a choke of average ready-made type having a specified inductance (which we can take as being a measure of the number and diameter of turns) of 100,000 microhenries. The impedance of such a choke to frequencies of the order of 6,000 cycles is about 4,000 ohms, whilst its impedance at 600,000 cycles (500 metres) is very nearly 400,000 ohms. Speaking comparatively, then, the choke will pass the lower frequency a hundred times more easily than the higher one and, therefore, it will satisfactorily fulfil its required purpose. As regards the choke's resistance to direct current, this can be ignored as it will only amount to something like 200 ohms. In addition to the choke, a condenser is sometimes used to assist in the separation of high and low frequencies and is connected in the position marked C in Figure 2. In so far as H.F. is concerned the choke acts as a "rejector," but the condenser is an "acceptor." The meaning of these terms is almost too obvious to require explanation since it is clear that the condenser is to allow the high frequencies to leak away to earth, whilst the choke prevents their passage through it.

We can appreciate that the object of the condenser is just the reverse of that of the choke; it must have a low impedance to high frequencies and a high impedance to low frequencies. Again, however, the impedance in each case must be considered on a comparative basis, but since we established a "standard" of impedance for the choke we can work on the same figures. We must not consider the choke alone, though, because this is only a part of the detector anode circuit and the L.F. currents have to pass through both this component and the primary winding of the low frequency transformer. The latter will probably have an impedance of 100,000 ohms at 6,000 cycles, so this must be added to that of the choke. In other words the total impedance to L.F. currents is 104,000 ohms.

It is evident, then, that the condenser must have an impedance of not less than 104,000 ohms at 6,000 cycles or else it will "draw off" some of the L.F. as well as the H.F. Using the formula previously given it is an easy matter to find that a .0003 mfd. condenser has an impedance of round about 100,000 ohms at 6,000 cycles, and so we know that this is the highest capacity that should be used under normal circumstances. As its impedance at 600,000 cycles is less than 100 ohms it will provide an easy path for currents of such a frequency.

**Tone Control**

What would happen if the capacity of this condenser were increased? As we have seen it would "rob" the transformer and hence the L.F. amplifier, of some of its audio currents. The actual amount of current it would take would naturally depend upon its exact capacity and upon the frequency. For example, if the condenser had a capacity of, say, .01 mfd. its impedance at 6,000 cycles would be only about 2,500 ohms so it would take away nearly all the audio current at such a frequency. But at 300 cycles its impedance would be about 50,000 ohms whilst that of the transformer would probably be a good deal less, so that practically the whole of the current would pass through the transformer. From this explanation it will be seen that the condenser could be used as a tone control to give a cut-off to the higher notes, and by properly choosing its capacity any desired amount of high-note attenuation could be obtained. It will readily be appreciated that the condenser may be connected in the position shown in Figure 2 or directly across the transformer primary winding—its function would be precisely the same in either case.

If it were desired to obtain a gradual variation in tone whilst the set were in use, it would be necessary to have a means of varying the impedance of the condenser. Obviously a variable condenser would serve the purpose, but one having a capacity so high as that required would be both cumbersome and expensive. A much easier solution then is to connect the condenser in series with a variable resistance as shown in Figure 3. By altering the setting of the latter component the impedance between points A and B could be adjusted to any required figure, since a variation in resistance is equivalent to a change in capacity. In practice, a tone control of the type just referred to is not generally used in the position shown, but is connected across the speaker terminals as indicated in Figure 4. Its purpose is to counteract emphasis given to the higher notes by a pentode valve.

In an arrangement such as this, the most suitable capacity for the condenser must be based on the loud-speaker impedance, with which it is in parallel. Thus if the speaker were of 15,000 ohms at 6,500 cycles the most convenient impedance would probably be about one third as much at the same frequency. A suitable capacity would be .005 mfd. and if it were used in conjunction with a 10,000 ohms variable resistance a variation of from 5,000 to 15,000 ohms would be possible. It is obvious that the proper values for the condenser and resistance we have just considered would be quite different if the loud-speaker impedance were, say, 20,000 ohms. In the same way, if a moving-coil speaker of only 5 ohms impedance (an average value) were fed through an output transformer, the condenser-resistance combination would have no effect if it were connected directly across the speaker terminals. *The values must be chosen in respect to the circuit in which they are to be used.* As a matter of fact a condenser of 75 mfd. would be required to be connected between the actual loud-speaker terminals to produce the same effect as the .005 mfd. component across the primary of the output transformer.

**Matching Impedances**

So far we have considered the impedances of condensers and inductances in a comparative way, so now we can study the question of "matching" impedances. In any receiver the most important points where matching must be attended to are the output and input circuits of the valves. The anode circuit impedance must be matched to the impedance between the filament and anode of the preceding valve, and to the impedance between filament and grid of the following one.

**Output and Input Impedances**

To obtain the maximum output from any valve the impedance in its anode circuit must be at least equal to that between its filament and anode (stated on the Instruction Sheet as "Anode Impedance"). In practice it is found best to make the former equal to twice the latter at *average* frequencies. I say "average" frequencies because, as we have seen, the impedance of a coil or transformer varies enormously with the frequency of currents passing through it. We are now able to see why a cheap transformer does not do justice to low notes; due to the small amount of iron used in the core and the comparatively few turns on its primary winding the transformer's impedance becomes much too small at low audio frequencies, below, say, 500 cycles.

(Continued on page 341.)

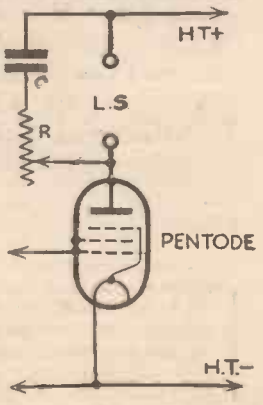


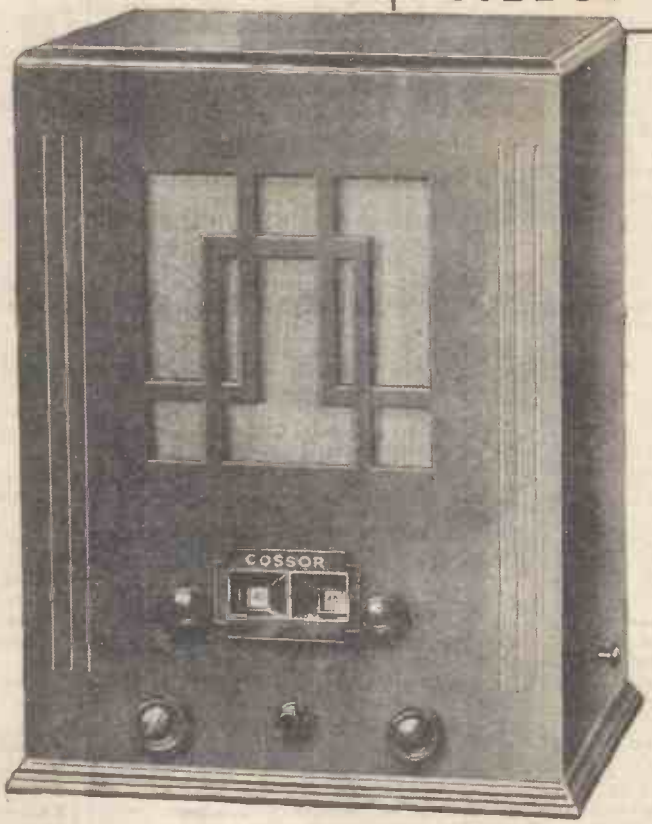

*Fig. 4.—The arrangement used to counteract the high note emphasis given by a pentode. The impedance of C and R must be less than that of the speaker at higher audio frequencies.*

KINGS OF THE AIR

# "... congratulate you on its EFFICIENCY ... I get 48 EUROPEAN STATIONS & 10 AMERICANS on my COSSOR MELODY MAKER

"It is the only set I have ever had, also I know nothing about wireless"—continues the writer of this striking tribute to the remarkable performance of the Cossor Melody Maker.

Available for Battery or All-Electric operation this remarkable Receiver incorporates every advanced feature of design, including many found only in more costly Sets. It is definitely Britain's greatest value in Screened Grid Radio. Send the coupon for a full size Constructional Chart.




To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5
Please send me free of charge a full size Constructional Chart that tells me how to build the Cossor *All Electric / *Battery Melody Maker.
(*Strike out type not required).

| | My usual Retailer is |
|---|---|
| Name | |
| Address | Address |
| | |
| PRAC. 20/5/33. | |

**BATTERY MODEL 335**
**With Self-Contained Loud Speaker**

Kit of Parts includes 3 Cossor Valves (220 V.S.G. Variable-Mu Metallised Screened Grid, 210 H.L. Metallised Detector and 220 P. Output); Individually Shielded Coils. All-metal Chassis and all parts for assembling the Receiver as illustrated; handsome cabinet 18½ in. x 13½ in. x 10½ in. and 10 in. Balanced-Armature Loud Speaker. Provision is made for fitting Gramophone Pick-up Socket and Plug.

Price **£6.17.6**

*Hire Purchase Terms: 17/6 deposit and 9 monthly payments of 15/-*

**BATTERY MODEL 334**

Kit of Parts, similar to Model 335 except that no loud speaker is supplied. Handsome cabinet 9½ in. x 13½ in. x 10½ in. Price **£5.15.0**

*Hire Purchase Terms: 15/- deposit and 9 monthly payments of 12/6*

**BATTERY MODEL 333**

Kit of Parts, complete with Valves for building Cossor Melody Maker Chassis for fitting to your own cabinet. Specification as Model 335 but without loud speaker or cabinet. Price **£4.19.6**

*Hire Purchase Terms: 15/- deposit and 9 monthly payments of 10/6*

**ALL-ELECTRIC MODEL 337**
**With Self-Contained Loud Speaker**

Kit of Parts for All-Electric Melody Maker Model 337 similar to Model 335 (as illustrated) but for all-electric operation, including Cossor Valves, handsomely finished Cabinet, 18½ in. x 17½ in. x 10½ in., Loud Speaker and all parts. For A.C. Mains only 100-125 or 200-250 volts (adjustable), 40-100 cycles. Price **£8.10.0**

*Hire Purchase Terms: 20/- deposit and 9 monthly payments of 18/6*

**ALL-ELECTRIC MODEL 336**

Kit of Parts, similar to All-Electric Model 337 except that no loud speaker is supplied. Handsome cabinet 10½ in. x 17½ in. x 10½ in. Price **£7.10.0**

*Hire Purchase Terms: 21/- deposit and 9 monthly payments of 16/-*

**ALL-ELECTRIC MODEL 338**

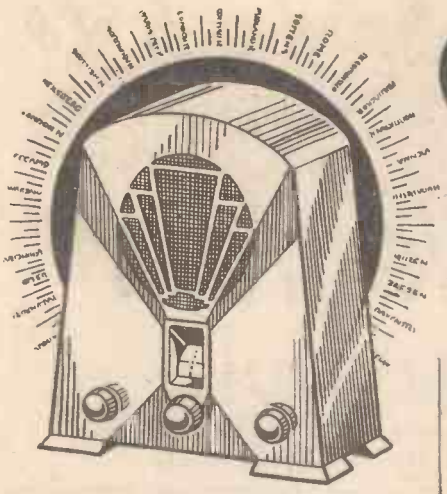
Kit of Parts for All-Electric Melody Maker Model 338 Chassis. Identical with Model 336 except that no cabinet is supplied. Escutcheon and template for drilling your own cabinet is included. Price **£6.15.0**

*Hire Purchase Terms: 28/6 deposit and 6 monthly payments of 20/-*

Models 336 and 338 are available for use on A.C. Mains only, 200 to 250 volts (adjustable), 40-100 cycles.

*Prices do not apply in I.F.S.*

♡ 2857



# OUR VIEWS ON RECEIVERS

## BRITISH GENERAL DOUBLE BAND-PASS THREE VALVE (A.C. MAINS)

THE most serviceable type of receiver for general use, without doubt, to-day is the modern three-valve all-mains set. If it is enjoying a well-deserved popularity, it is entirely due to the fact that in this type makers are able to supply *at a moderate price* an instrument which, although perhaps not possessing all the selective qualities of a superhet., is still sufficiently selective to cut out unwanted transmissions and sensitive enough to enable its owner to secure a large number of foreign programmes, whilst providing him with a reproduction in both speech and music of a quality likely to give general satisfaction.

In a long list of receivers of this class which fulfil such conditions in varying degree, the *British General Double Band-Pass Model* may be said to hold its own. In fact, compared with other sets sold at an equal price, it stands well to the fore. In the circuit full use has been made of the advantages of a variable-mu screen-grid valve which, in conjunction with the benefits derived from double band-pass filters and adequate screening, ensures a degree of selectivity surpassed only by much more expensive instruments. Here we find a mixed input filter to the high-frequency (Cossor MVSG) stage (the band-pass filters are with bottom and capacity coupling and negative inductive coupling) coupled to a 904V. Mullard detector valve and hence by a parallel-fed 7.1 transformer to a Mazda A.C. (pen.) output which, in its turn is matched to a built-in permanent magnet, moving-coil loud-speaker by a transformer of generous dimensions. (In the British General radiogram model, dual compensated speakers are supplied.) The measured, undistorted output was found to be between 2.3 and 2.5 watts, which is very high for this class of receiver. The model under review operates from 200-250 volts, 40-50 cycles, A.C. mains, the voltage to suit the individual being made variable by the insertion of two screws with insulated heads into their corresponding sockets at the top of the mains transformer—a very simple operation. Full wave rectification of the current is obtained by means of an Osram U10 valve rectifier. The chassis, complete with loud-speaker, is housed in a walnut table-cabinet of attractive appearance; the side-pieces with hand grips being matched in wood of a darker colour. The front of the cabinet is of simple design, showing only the speaker grid, a recessed metal escutcheon revealing an illuminated condenser dial bearing at its base the selector control (tuning knob), and beneath it a lever wave-range and gramophone switch of a novel design. Apart from the tuner, there are only two knobs, namely, the combined volume control and mains switch (left) and intensifier or reaction control (right). The lever wave-switch is slotted for three positions: left, "short," *i.e.*, medium wave-length range (200-540 m.); middle, for reproduction of gramophone records; and, right, for the reception of transmissions on channels above 1,000 metres. The illuminated dial is actually calibrated in wave-lengths (with 10-metre divisions on the lower range), and gives

*The British General Double Band-Pass Three Valve A.C. Model*

sufficient latitude, although apparently limited to 540 metres, to tune in Budapest; on the higher wave-lengths, Leningrad on 857 metres can be received below the 1,000-metre starting point; the range, in this instance, reaches fully 2,000 metres, thus permitting the logging of Kaunas. The receiver incorporates a very useful contrivance in the shape of an aerial trimmer which, if carefully adjusted to local conditions (length of outside aerial, etc.), greatly assists in operating the set at its maximum efficiency. The trimming condenser knob is at the back of the receiver and must be adjusted on a weak signal, in most cases, say, a distant broadcast on a wave-length below 300 metres. When finally the correct position has been found, it need not be altered unless the set is connected to another aerial. Both the volume and reaction controls work very smoothly and tuning, consequently, is very simple. The length of the aerial, to some extent, is immaterial, but it should not exceed 60 or 70 feet, including lead-in; if interference from electric trams or trains is experienced it may be found advisable to reduce it. The best possible earth system should be adopted.

In this instrument particular care has been taken in regard to the smoothing arrangements; the receiver is very quiet. Even with a D.C.—A.C. converter, the mains hum was barely noticeable, and then only where excessive reaction was applied. For the reception of programmes from the local station the mains aerial provided was found quite efficient. On test, the *British General Double Band-Pass Three* proved its good qualities on both wave-bands. On the longer wave-lengths the first station to be tuned in at full loud-speaker strength was Leningrad on 857 metres (below the dial readings), and in succession Kiev, Moscow, Scheveningen Haven, Oslo, Kalundborg, Luxembourg, Reykjavik, Moscow (T.U.), Motala, Warsaw, Eiffel Tower, Daventry and Huizen were well heard. Selectivity was undoubtedly good and no difficulty was experienced in getting Königs Wusterhausen clearly separated from its neighbours.

On the lower band, a large number of stations was quickly logged, and clear reception was obtained of all B.B.C. Regional and National stations, also from such broadcasters as Fécamp, Nürnberg, Trieste, Rennes PTT, Turin, Heilsberg, and from Breslau, Poste-Parisien, Radio Toulouse, Lwów, Sottens, Paris PTT, and so on. The strength at which most of the transmissions was heard was of entertainment value. Excellent electrical reproduction of gramophone records can be obtained if a pick-up is connected to the two sockets on the terminal panel at the back of the cabinet. Volume must be controlled by an external potentiometer, and the lever switch on the receiver set to the gramophone position. Provision has also been made for the connection of an extra external loud-speaker by the insertion of a plug in the socket at the back of the cabinet. The quality of reproduction was, if anything, superior to that usually expected from the average type of three-valver. Bass notes were clean, with no boominess, and balance of frequencies over the entire scale was well preserved. Speech was clear, of pleasant tone and quite natural in character. The *British General Double Band-Pass Three* is essentially one of the best of its class; it is made by the British General Manufacturing Co., Ltd., of Brockley, London, S.E.4. Its price is 18 guineas, and we have no hesitation in recommending it to the attention of readers.

# The "Featherweight" Portable Four

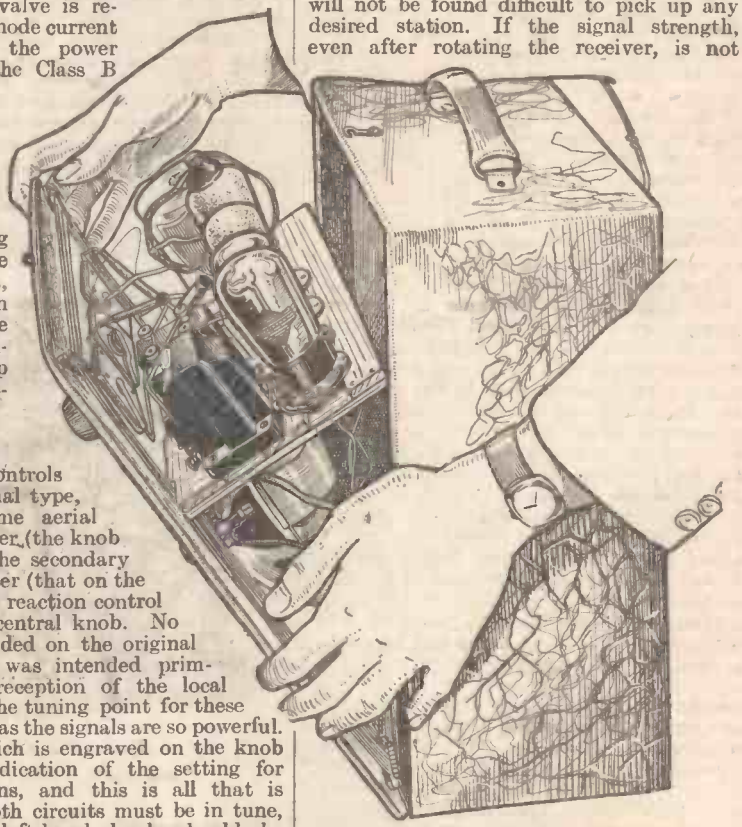
by F.J.CAMM

## Operating and Adjusting This Remarkable Portable, Which Carries My Personal Guarantee

THE closing note last week was to remind you to rotate the Featherweight Portable so as to obtain the maximum signal strength from the station it was desired to receive. In order to make this quite clear, it should be stated that the receiver should be stood in such a position that, when standing on one side of the receiver, you would look along the handle in the direction of the station to be received. In this position maximum signal strength will be obtained. There may be cases, however, when the station it is desired to listen to is in a direct line with some nearer and higher powered station. In this case, of course, interference would be experienced, and the procedure is therefore as follows. Place the receiver in its correct position first of all, and tune in the desired station, ignoring the interference. Then slowly turn the receiver round, using the reaction control to bring back the strength of the station. It will be found that, provided the tuning positions of the stations are sufficiently wide apart, the interference may be removed by this method. Naturally, a receiver of this description is not intended to receive hundreds of stations from all parts of the world on its self-contained aerial; it has been designed for a specific purpose, namely, to provide entertainment when out in the open, and in the majority of cases only one or two stations will be required, and then the receiver fulfils its purpose.

### Adjusting the Voltages

No trouble can be experienced with the accumulator, which is of the 2-volt type, and is simply connected to the two L.T. leads. The capacity is sufficient to enable the receiver to be used practically all through the summer, provided, of course, the receiver is only brought into use occasionally when out on picnics, etc. The H.T. battery provides the voltage for all the valves, the required breaking-down being carried out by the various resistances in the receiver itself. Thus there is only need to insert the positive and negative leads in the two end sockets on the battery and all valves become automatically supplied. The grid bias battery, however, may be employed in different ways. When economy of upkeep is the prime consideration, the bias applied to the driver valve should be the full 9 volts. In this condition the anode current of the driver valve is kept down, but the volume will be slightly less. As the bias on the driver valve is reduced, so the anode current increases and the power output from the Class B valve increases. It is best, therefore, to adjust the bias at some point between 4.5 and 9 volts, bearing in mind the above factors, and a choice can thus be made between economy of upkeep and power output.



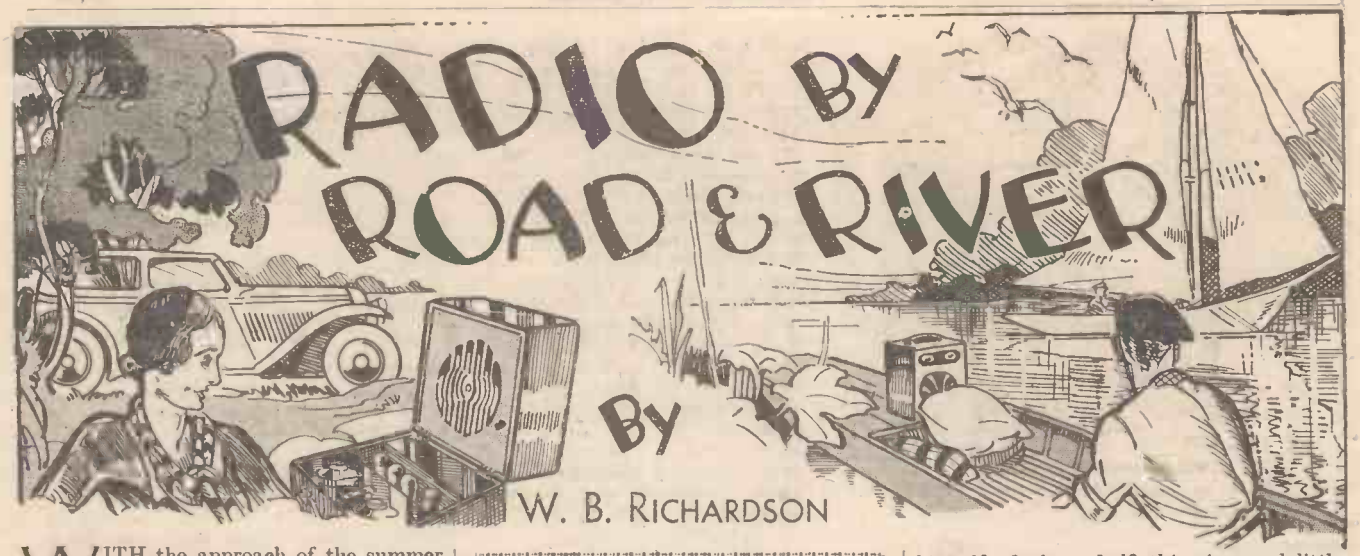
### Panel Controls

The panel controls are of the normal type, namely, a frame aerial tuning condenser (the knob on the left); the secondary tuning condenser (that on the right), and the reaction control which is the central knob. No dials are provided on the original receiver, as it was intended primarily for the reception of the local stations, and the tuning point for these is easily found as the signals are so powerful. The arrow which is engraved on the knob gives some indication of the setting for future occasions, and this is all that is necessary. Both circuits must be in tune, so that the left-hand knob should be rotated slowly, whilst the right-hand control is swung from one side to another of the setting taken up by the first control. Station searching is thus simplified and it will not be found difficult to pick up any desired station. If the signal strength, even after rotating the receiver, is not sufficient, the central control should be adjusted to bring the signals to the desired strength. As I pointed out last week, should any adjustments be necessary, the swing hook is simply released and the front of the cabinet lowered when all parts are immediately brought within your reach, and there is no part which is inaccessible.

Just a final note: If you require to have one of the Featherweight Portable Fours assembled for you from the specified components appearing to the left, write to one of our Kit advertisers, such as Peto-Scott or Burne-Jones, either of whom will undertake to erect the receiver exactly as described by me.

### SPECIFICATION OF FEATHERWEIGHT PORTABLE

Two Utility Bakelite Condensers, .0005 Type. W. 297.
One Wearite H.F. Choke, Type H.F.P.A.
One Lissen Dust Range Shielded Coil.
One Graham Farish Lifdex Condenser, .0003.
One Graham Farish Ohmite Spaghetti Resistance, 10,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 50,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 100,000 ohms.
Three Clix 4-pin Chassis Type Valve-holders.
One Clix 7-pin Chassis Type Valve-holder.
One Bulgin On/Off Switch, Type S. 38.
One Bulgin Wave-Change Switch, Type S. 36.
Four Bulgin Frame Aerial Spacers, Type I.12.
One Bulgin Senator Transformer, Type L.F. 12.
One Lissen Class B Driver Transformer.
One 2-megohm Grid Leak, with wire ends, Lissen.
One T.C.C. .01 mfd. Fixed Condenser, Type M
One T.C.C. .0002 mfd. Fixed Condenser, Type M.
One T.C.C. .002 mfd. Fixed Condenser, Type M.
One T.C.C. .1 mfd. Fixed Condenser, Type 50.
One T.C.C. 1 mfd. Fixed Condenser, Type 50.
One T.C.C. .001 mfd. Fixed Condenser, Type M.
One Cossor 220 S.G. (Metallised) Valve.
One Cossor 210 H.F. (Metallised) Valve.
One Cossor 215 P. Valve.
One Cossor 240 B. Valve.
One Rola Loud-speaker, Type P.5-PM-14-Class B.
2 ozs. 24 D.C.C. wire and 2 ozs. 34 D.S.C. wire for frame.
One Ediswan 120-volt H.T. Battery, ref. 6970C.
One Ediswan 9-volt Grid Bias Battery ref. 6980T.
One Ediswan 2-volt accumulator, E.L.M.2.
Four Wander Plugs (H.T.+, H.T.—, G.B.+ and G.B.—).
Two Spades (L.T.+ and L.T.—).
One coil Glazite, flex, screws, wood for case carrying handle, etc.



# RADIO BY ROAD & RIVER

By W. B. RICHARDSON

**An Instructive Article on Radio While Travelling, with Hints on the Building of an Inexpensive Lightweight Portable.**

WITH the approach of the summer months many of us will be taking week-end trips into the country and to the sea. The majority will also have a week or fortnight's holiday at some time or other. If the weather is kind there is no doubt that during most of the period we shall be too fully occupied with sports and pastimes to bother about wireless. But even so there are bound to be certain times such as during a break for a picnic lunch, or in the cool of the evening, on the river, or by camp-fire, when a little music will be very welcome. In the event of indifferent weather the wireless may prove to be a real boon.

### A Good Idea

Naturally, the idea of taking a set away with them occurs to most people, but very few get any further than that. They find all sorts of snags, such as the weight, bulk, and fragility of the receiver, to prevent them stowing it in the car or popping it into the luggage-van of the train. Again, if they haven't a genuine portable they are worried about how to carry the set, how to fix up a temporary aerial, and so on.

Well, let us look into the matter and see if the difficulties are really as great as they imagine, and if there is not some easy way of overcoming them.

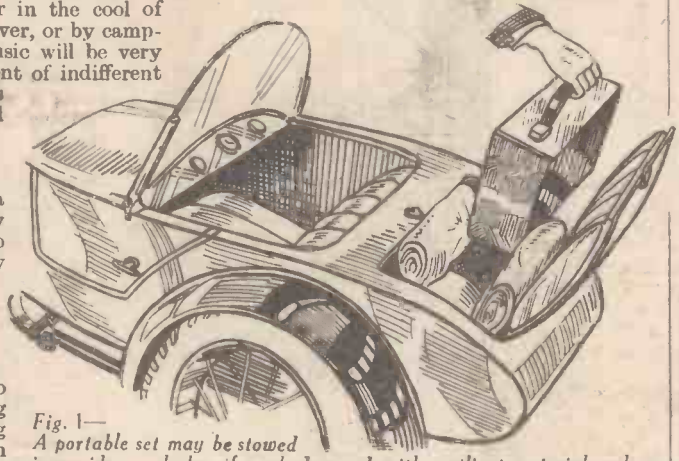


*Fig. 1— A portable set may be stowed in a side-car locker if packed round with resilient material such as blankets or coats.*

The problem of wireless away from home naturally divides itself into two parts. Firstly, there is the question of transportation, and secondly, that of operation. That the average "portable" is still rather heavy and cumbersome there is no doubt. In fact, the majority of such sets seem to measure about 15in. x 15in. x 9in., and to weigh something like 30lbs. However, there is no reason why the home constructor with a little ingenuity could not build a three-valve portable for himself of about half this size, and little more than half the weight. Particulars of how such a set can be constructed will be given later on. Obviously, with a receiver of this description, most of the terrors of transport disappear. In the meantime, let us consider the best way of carrying *any* type of receiver.

### How to Avoid Jolting

When travelling by car, the best position for the set is on one of the seats, where it will be comparatively free from vibration, but if there is no room here it should be stood on the floor, as near the centre of the car as possible.

With a small sports car or a motor-cycle combination where space is limited, and the set has to be stowed in a locker, it is a good plan to stand it on something resilient such as an old inner-tube, an air-cushion, a large rubber hot water bottle, or a folded mackintosh, and to pack round it blankets, an old coat, or anything which will keep it from chafing against other articles or the sides of the locker. If the lid of the locker shuts down rather close to the set, another coat should be placed on top of it to prevent it from bouncing up and hitting the lid when travelling over bumpy roads.

### Carrying the Valves.

If the roads are likely to be very bad then it is safest to remove the valves—if this can be done easily—and to pack them separately. They could be tucked between articles of clothing in a suit-case, for example.

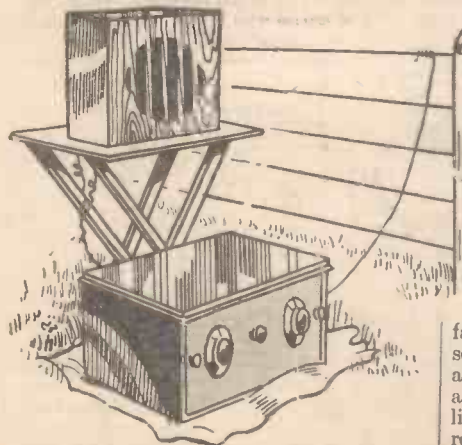


*Fig. 2.—Using a wire fence as a temporary aerial.*

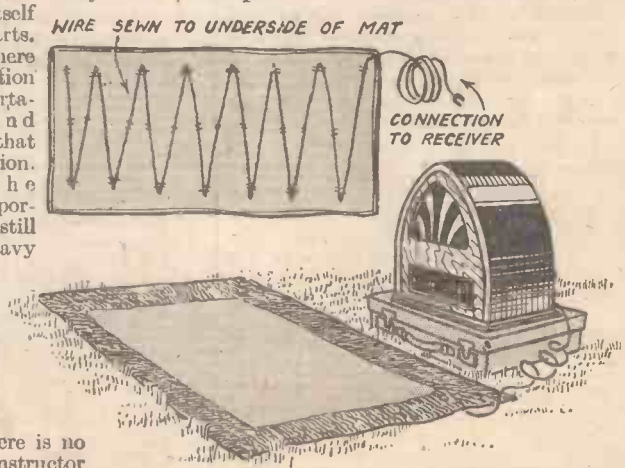



*Fig. 3.—How a capacity earth can be arranged by sewing a length of wire to the underside of a car mat.*

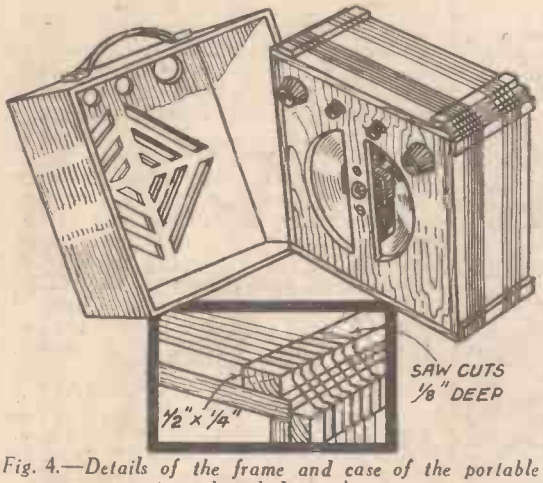



*Fig. 4.—Details of the frame and case of the portable receiver described in the text.*

### Wireless Afloat

On the river there is obviously no jolting as there is with a car or motor-cycle. Perhaps the only precaution it is necessary to take is to avoid getting the set wet by splashing from oars or paddles. Wireless sets do not like wet or damp! In the case of a set kept in the cabin of a yacht or motor-boat, it should be stood on a shelf or on a bunk rather than on the floor, where damp may rise from the bilges and cause corrosion and other troubles.

### In a Moving Car

Now let us consider the operation of the receiver under various conditions. First of all, while actually travelling. This is more difficult with a car than with a boat. In America the problem of car radio seems to have been tackled very successfully by several makers, by fitting receivers as part of the standard equipment. In England, however, we have not yet reached this stage (although I believe American cars so equipped are available in this country), and so have to content ourselves with ordinary receivers if we wish to listen while on the move. Of course, there is one drawback with a set built in the car, and that is that it cannot be removed for use elsewhere.

If an ordinary set is switched on inside a moving car, the first thing that will be noticed is the interference caused by the ignition system. This takes the form of loud and regular crackling noises. The fitting of a 100,000 ohm resistance in the lead to each sparking plug will improve matters considerably, without affecting the running of the engine. Special resistances are made for the purpose by Messrs. Dubilier, Ltd., and Lodge Plugs, Ltd. Earthing the set by connecting the earth terminal, or in the case of a portable, the negative terminal of the L.T. battery, to any part of the metal chassis of the car will be a further step towards a cure.

If the car is a metal-bodied saloon, difficulty may be found in providing an effective aerial, owing to the screening of the metal. It is rather hard to find any solution which does not involve the erection of unsightly wires above the roof or somewhere outside the body. With a portable with a self-contained aerial, the pick-up will be cut down for this very reason, while naturally, the erection of a supplementary aerial *inside* the car will not help matters very much. With a fabric body, on the other hand, a very effective aerial can be made by zig-zagging insulated wire along the underside of the roof, and securing it in position with little pieces of sticking-plaster tinted to match the interior colouring, or it may be held by small hooks driven into the framework. A suitably-tinted Pix aerial, stuck round the inside of the roof just above the windows, will make an even neater job, and probably is quite as effective.

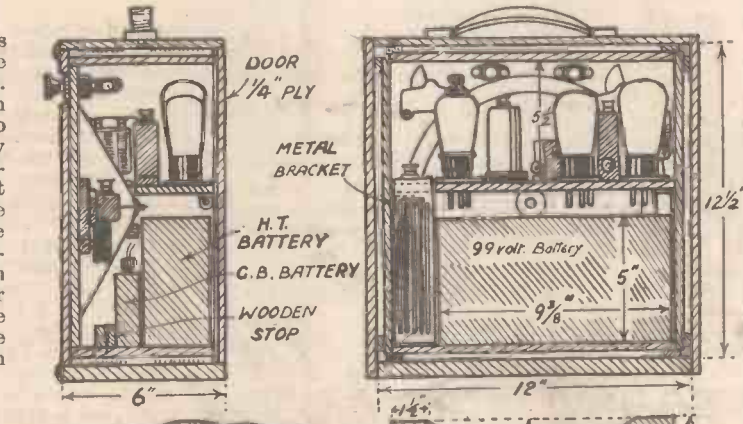



*Fig. 5.—Sectional drawings showing the interior arrangements.*

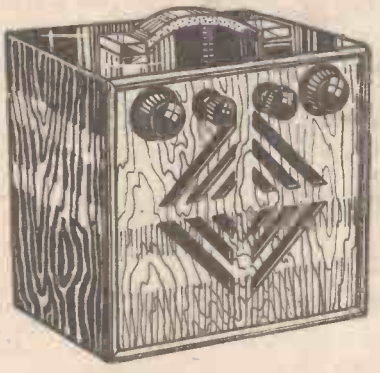


*Fig. 6.—The completed receiver.*

### A Water "Earth"

The successful operation of a set on a moving boat is usually much more certain than in a car. Here the water itself provides the best possible earth, while an effective aerial can usually be rigged up by running a couple of wires under the awning in the case of a punt, or from the mast, in the case of a yacht. Motor-boats with cabins may have an aerial inside the roof of the cabin, after the manner of the roof aerial in the saloon car. With a portable, aerial and earth will, of course, be unnecessary, unless extra range is desired. In any case, reception on the water is usually exceptionally good.

Regarding the water earth connection a good plan is to solder a piece of sheet zinc two or three inches square to the end of the earth wire and to let it trail over the side of the boat just below the surface of the water. With a motor-boat, it is simpler to attach the earth wire to one of the engine-nuts. The engine, of course, makes contact with the water through the propellor. Here, however, the problem of electrical interference again crops up, and it will require similar methods to those adopted in a car to cut out the cracklings from the magneto. In extreme cases, both in car or boat, it may be necessary to shield the set by lining it with copper foil, and earthing the foil. Joints in the foil should preferably be soldered, and obviously it should not touch any of the non-earthed terminals or bare wires in the set. In the case of a portable, shielding in this way will cause the built-in aerial to become inoperative, therefore, an outside aerial should be attached by means of the sockets or terminals provided for the purpose.

### Improvized Aerials

Undoubtedly most use will be made of the set while stationary, and a few hints on temporary aerials and earths will not be out of place here. When out in the country many miles from the nearest broadcasting station it is often necessary to rig up some sort of aerial and earth to supplement

(Continued on page 334)

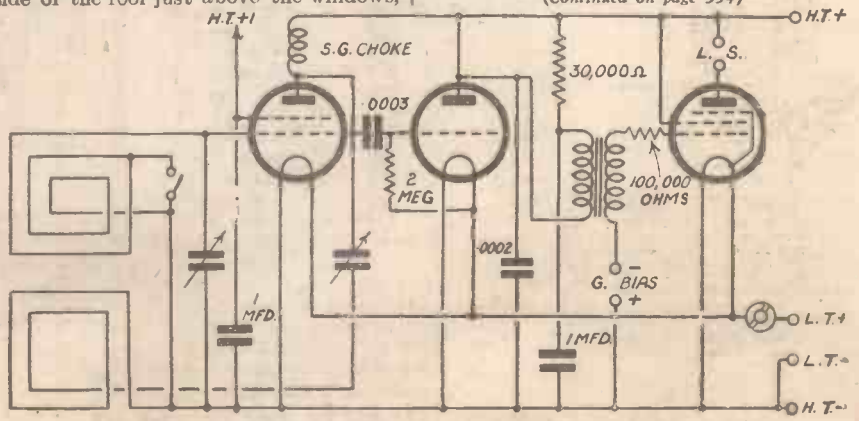



*Fig. 7.—The circuit of the lightweight portable described in this article.*

(Continued from page 333.)

the frame in the set. In the case of an ordinary set without a frame (and very often such a receiver is more compact and suitable for transport than the orthodox portable), a small aerial will be essential. If it is used anywhere near trees the easiest way to arrange this is to tie a weight to the end of a length of single flex, and to sling it over one of the branches. Even bare wire will answer quite well as the necessity for insulation with such an arrangement is not so great as is generally imagined. A wire fence may also be used as an improvised aerial as in Fig. 2.

The best earth connection is obtained when there is a river or stream handy. It is then only necessary to attach a tin or some small metal object to the bared end of the earth wire and to sink it just below the surface of the water. Even a knife stuck into damp ground will be better than nothing. Where the earth is dry the best arrangement is some form of capacity earth such as a length of wire trailed along the ground under the aerial. When travelling by car quite a good capacity earth can be made by sewing a length of wire zig-zag fashion to the underside of one of the car mats as in Fig. 3, and using the mat as an earth. Of course the mat is prepared beforehand so that the wire is more or less a permanent attachment. If the wire is stitched on underneath, as shown, it will not in any way interfere with the normal use of the mat.

### A Home-constructed Portable

Now let us have a look at the little set illustrated in Figs. 4 and 5. It is a self-contained three-valver of particularly light and compact design. It measures approximately 13in. by 12½in. by 6in. and weighs about 18 lbs. The cabinet may consist of an ordinary speaker case, but the inside measurements must not be less than 12½in. by 12in. by 5½in. The method of construction will be fairly clear from the illustrations, but the following details may be helpful. A wooden framework as in Fig. 4 is made to slide inside the case. It is of ¼in. ply throughout while the front is fretted as shown to take an Ormond No. 3 speaker unit. As the adjusting knob is rather large it makes a neater job to saw off the spindle so that it comes flush with the front of the frame. A hole about 1½in. diameter, drilled in the centre bar on which the unit is mounted, will allow the access of a pair of pliers to the sawn-off end for adjustment if necessary. The cone, which is edged in the usual way with a narrow ring of fabric, must be as small as possible without touching the unit otherwise it may foul the H.T. battery or the shelf on which the components are mounted. The size is approximately 2½in. deep by 8¼in. diameter or about 9½in., including the fabric ring. The tuning and reaction condensers, of Polar "Compax" type, and the on-off and wave-change switches are mounted on the front of the frame. Clearance holes are cut in the front of the case to allow these to protrude when the frame is inserted. The aerial is wound with 19 turns of 24 gauge D.C.C. wire for the medium waves and 55 to 60 turns of 28 gauge for the long waves. The medium-wave windings are spaced a twelfth of an inch apart by means of fine saw cuts in the cross pieces as in the inset, Fig. 4. The long-wave windings are put on close together. The number of reaction turns is best found by experiment as it varies somewhat according to the components used. With most valves eight turns are sufficient. Five should be wound on the outside of the long-wave windings and the other three next to the short-wave ones, that is, between the two sets of windings.

### How the Components are Arranged

The frame itself, by the way, measures 11½in. by 11in. by 5½in. from the outside, while the aerial supporting pieces at the corners are 5½in. by ½in. by ¼in. The shelf inside the frame is shown in plan in Fig. 5, and is shaped to fit closely round the cone without actually touching it. There is also a piece cut from one end to allow the top of the L.T. accumulator to come above. This is necessary with the accumulator specified, as it is 7in. high. The shelf is mounted a little higher than midway between the top and bottom of the frame. In this position there will be just room to remove the valves without taking out the shelf, that is, when using chassis mounting valve-holders and a short S.G. valve such as a Cossor.

On the shelf are mounted the rest of the components. This again is shown in Fig. 5. As space is obviously very limited small components should be chosen. To prevent unwanted couplings the H.F. choke should be of the screened pattern, and the S.G. valve metallized. For the same reason the decoupling condenser for the screen of the valve should not be omitted.

Underneath the shelf there is just room for a 99 volt H.T. battery (Ever Ready Winner Model) to stand on its side with a C.A.V. 2A-5 type accumulator occupying the space at one end. As mentioned before, the top of the accumulator passes up through the shelf on which the components are mounted. The grid bias battery is accommodated behind the H.T. battery. Wooden stops are screwed to the base of the frame to prevent these batteries from sliding to the front and striking against the cone. It will be noticed that the H.T. battery is inserted face inwards so that the wander plugs must be connected up before the battery is put in place.

### The Circuit and Wiring

Wiring up is not particularly easy owing to the restricted space. The best way is to mount all the components on the shelf and wire them up as far as possible before inserting it in the frame. If at the same time the wires leading to the controls are placed in position, then when the shelf is inserted they can be slipped over the terminals on the variable condensers and switches and the terminals can then be tightened up. Naturally, complete wiring diagrams and instructions cannot be included in this short article, but the experienced constructor will find no difficulty in working out the wiring from the circuit diagram in Fig. 7.

# The Editor's Generous Offer to readers


## THE P.W. Data Sheets Binder value 1s. 6d.

*CONTAINING*

## The Set of 19 DATA SHEETS value 4s. 9d.

**FOR 2s. 3d. ONLY**

THE "Practical Wireless" Data Sheets Loose-Leaf Binder as illustrated here has a stout linen covered stiff board cover, specially made to stand hard wear, having a special flap with cloth hinges and enamelled press-button fitting for speedy insertion (and removal) of the Data Sheets which are specially "holed" to fit. Also there is an invaluable manilla gusset-pocket for holding loose sheets, newspaper clippings, notes, and other odds and ends. These most useful Loose-Leaf Binders for preserving the Data Sheets have been expressly made for the purpose and will prove most acceptable and helpful to Radio constructors.

**DO NOT MISS THIS**

The only way now to secure your "Practical Wireless" Data Sheets Binder and set of 19 Data Sheets at the special reduced price is to fill in and post the Order Form to-day together with a Postal Order for 2s. 3d. **Although we are despatching your Binder and Data Sheets by return, we are asking you to order "Practical Wireless" for at least thirteen weeks and *trust* you to continue to take "Practical Wireless" for that period at least.**

**No Gift Stamps to Collect**

To obtain your "Practical Wireless" Data Sheets Binder and set of Nineteen Data Sheets.—First, if you are not a regular reader, place an order with your Newsagent to deliver or reserve a copy of "Practical Wireless" every week for the next thirteen weeks. Then fill in and post the Order Form together with a Postal Order for 2s. 3d. to "Practical Wireless" Special Offer, 8-11, Southampton Street, Strand, London, W.C.2.

### THE DATA SHEETS

These complete and comprehensive Data Sheets have been specially prepared by F. J. Camm (Editor of "Practical Wireless") to fill a gap in the literature of wireless construction. They have been designed with the needs of the amateur well in mind; they are printed on a special brand of hard-wearing manilla board to stand up to constant use. The series will provide you with a means of rapidly surveying the field of wireless construction, operation and adjustment, and enable you by a mere flick of the finger to consult that fact, figure or formula which formerly you have not easily been able to find.

*The nineteen Data Sheets deal with the following subjects:*

No. 1—Accumulator Charging
No. 2—Coils & Coil Winding
No. 3—Resistances
No. 4—Mains Transformers
No. 5—Wire & Wire Gauges
No. 6—Chokes, H.F. & L.F.
No. 7—Condensers
No. 8—Battery Eliminators
No. 9—Screws & Screw Threads
No. 10—Battery Operated Valves
No. 11—Mains Valves
No. 12—Handy Formulæ
No. 13—Terminals, Plugs & Fuses
No. 14—Loud-speakers
No. 15—European Broadcasting Stations
No. 16—European Broadcasting Stations
No. 17—Handy Tables
No. 18—Gramophone Pick-ups
No. 19—World Time-Table

### ORDER FORM FOR P.W. DATA SHEETS BINDER AND SET OF 19 DATA SHEETS

In accordance with the conditions of your special offer, please send me one "Practical Wireless" DATA SHEETS BINDER and the set of NINETEEN DATA SHEETS.

Reader's Name .....

Full Address .....

.....

I have instructed my Newsagent to deliver "Practical Wireless" to me each week for thirteen weeks.

Newsagent's Name .....

Address .....

Reader's Signature .....

Postal Order No. ..... for 2s. 3d. enclosed. Post to "Practical Wireless" Special Offer, 8-11, Southampton Street, Strand, London, W.C.2.

BEGINNER'S SUPPLEMENT Conducted by F. J. CAMM

# Simple Facts About REACTION

The author explains how you can obtain full benefit from the use of one of the most important controls on your Receiver

THAT the intelligent use of smooth, well-balanced reaction will do marvels in the way of increasing the power and range of a set there is no question. It is small wonder, therefore, that it is used in almost every set in existence. It is true many commercial receivers are ostensibly without it, but if most of these are carefully examined it will be found that they either employ it in the usual manner under the label of "volume control," or else are designed so that there is always a certain amount of back coupling present between the various circuits. This means that the reaction effect, although not so marked, is, nevertheless, present.

However, it is not so much with the commercial set that we are concerned as the home-constructed one. You will notice that I say "smooth, well-balanced" reaction. Well, it's just because sets so very often fall short of this standard that I am writing this article. I want to give you a few notes on the various methods of employing reaction, together with some hints on improving its control on your own set.

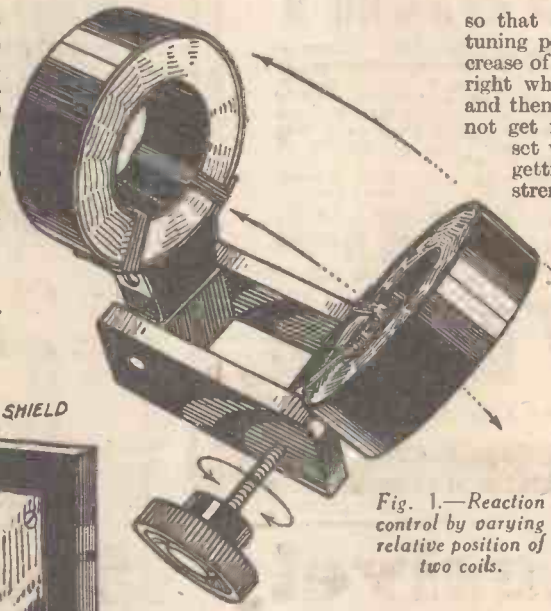


*Fig. 1.—Reaction control by varying relative position of two coils.*

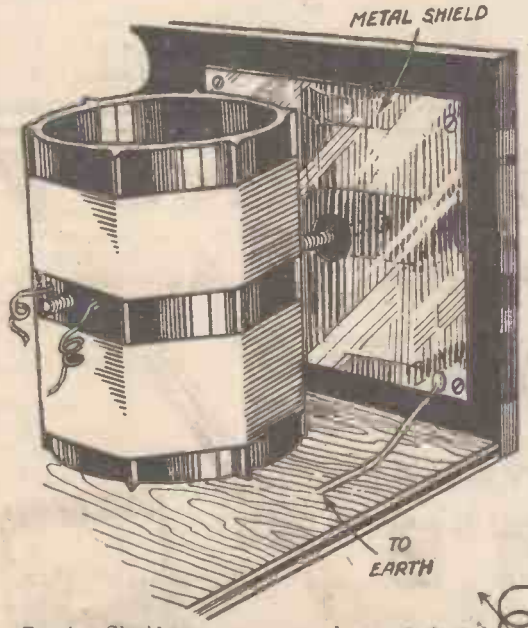



*Fig. 4.—Shielding reaction control to prevent hand-capacity effect.*

### Inductive Method

Although not often seen nowadays, the usual form of reaction coupling at one time consisted of a separate reaction coil inductively coupled to the aerial or anode coil. Control was effected by varying the relative positions of the two coils, either by swinging the coils near to, or away from, one another, as in Fig. 1, or by using a rotor, as in Fig. 2. These methods certainly had the merit of simplicity and always seemed to provide plenty of "punch." However, they suffered from one drawback, namely, that each time the reaction was varied the tuning had to be slightly readjusted. Nevertheless, as there are still one or two tuning units on the market which employ the rotor method, and as there must also be scores of old sets in use which use either that or the swinging-coil arrangement, a word or two on the method of operation will not be out of place.

### How to Use It

The procedure I find best to bring up a weak station is to "swing" the tuning dial slowly backwards and forwards, passing a degree or two on either side of the required station, at the same time slowly increasing the reaction. As the reaction increases so the station will sound louder each time you pass it. When it has reached its maximum strength, just before the faint suggestion of a whistle appears on each side, stop the swinging of the dial exactly on the wavelength of the station. You will then have reached the most sensitive point. If you increase the reaction any more you will only cause distortion and, finally, definite howling will occur, with the likelihood of disturbance to neighbouring sets.

The idea of swinging the tuning dial backwards and forwards is so that you can be sure of the exact tuning point of the station with each increase of reaction. If you simply set it right when the reaction is at a minimum, and then bring up the reaction you will not get full signal strength, because the set will not still be in tune. Not getting a very great increase in signal strength you may be tempted to increase the reaction still further, and since the station is off tune you may go well past the oscillation point without getting a definite whistle or howl. However, if you readjust the tuning dial you will soon realize by the accompanying squeals that the reaction is too far advanced. This state of affairs could not, of course, occur by the swinging method, as ample warning is given by the increase in signal strength, accompanied by a rushing noise each time the station is passed and before any howl develops.

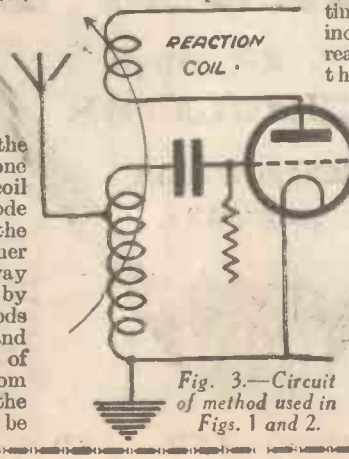



*Fig. 3.—Circuit of method used in Figs. 1 and 2.*

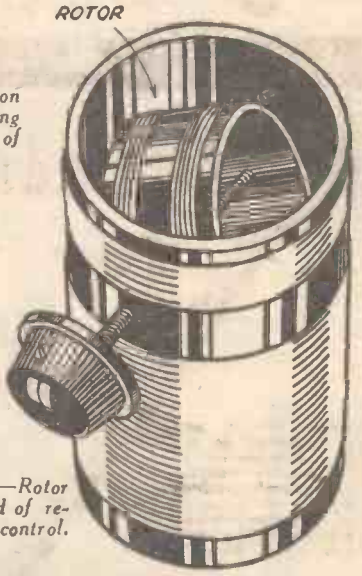



*Fig. 2.—Rotor method of reaction control.*

### Hand-Capacity Effects

A trouble often experienced with old sets is the well-known hand-capacity effect. It is due to the proximity of the hand to the coils inside the set. You may tune in very carefully and have the reaction just right, and then as soon as you take your hands from the controls the music disappears. It returns with full vigour as soon as you touch the knobs again. This is due as you know to your hand, which is more or less at earth

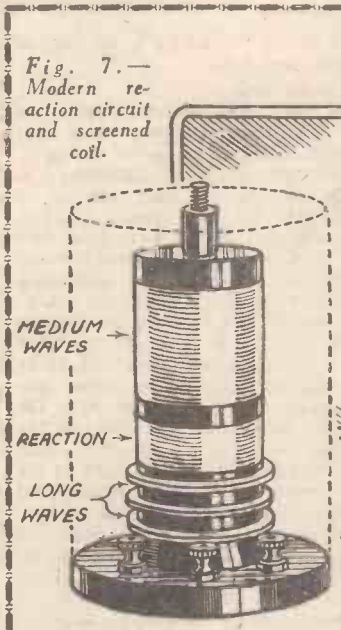



*Fig. 7.—Modern reaction circuit and screened coil.*

potential, acting as a condenser in conjunction with the wire of the coils, your hand forming one plate and the coils the other. A similar effect may also occur between your hand and the tuning condenser, especially if the latter is of an old pattern in which the fixed vanes instead of the moving ones are connected to the end plates.

### A Cure

A cure can usually be effected by placing a sheet of thin metal (preferably not iron or tin plate) at the back of the panel so as to shield the tuning condenser and coils. This plate should be joined to the nearest earthed point. It must not touch the reaction-control spindle or the high potential side of the tuning condenser. To avoid this, drill a hole for the reaction spindle to pass through, as in Fig. 4, but with the condenser: the procedure depends on the type of the instrument. If it is a modern one with moving vanes joined to the end plates, it will probably not need shielding, but make sure that it is connected up correctly. *The moving vanes must be earthed* and the fixed ones joined to the grid end of the tuning-coil, not *vice versa*.

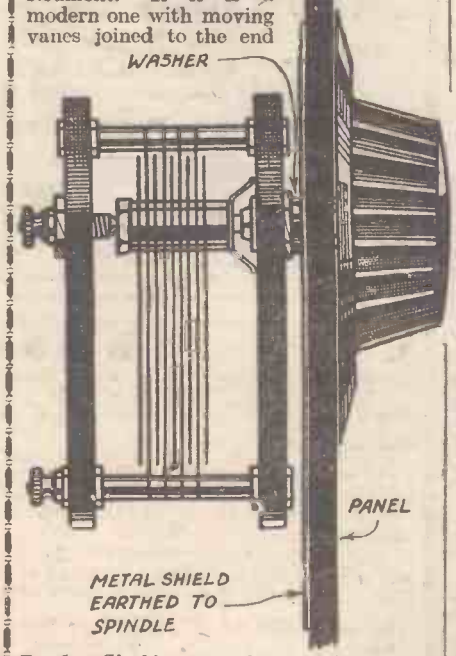



*Fig. 5.—Shielding a condenser with ebonite end plates.*

If it has ebonite end plates, then the moving vanes should still be earthed, but make sure that the heads of any bolts passing through the end plates do not touch the shield. Keep them clear of the shield by means of washers, as in Fig. 5.

### Capacitative Reaction Control

The most common form of reaction control in use to-day is the capacitative. Here, the inductive coupling between the reaction coil and the tuning coil is fixed, but the amount of current passing through the reaction coil is varied by means of a variable condenser. The reaction coil may either be a tapped portion of the tuning coil itself, as in Fig. 6, or a separate coil, as in Fig. 7. If the latter, it may be wound on the same former or arranged in some other way, so as to be in close proximity to the tuning coil. An H. F. choke is usually placed in the plate circuit as a barrier to H.F. currents in that direction, and it is also advisable to include a by-pass condenser as shown by the dotted lines in Fig. 7. This is to provide an alternative path when the reaction condenser is set to its minimum position. A suitable value is .0002 mfd. Another idea is to use a differential condenser as in Fig. 8. Theoretically, this has an advantage over the former in that the capacity between plate and filament remains constant, whatever the setting of the condenser, therefore, there is no chance of attenuation of the high notes with increase of reaction. In practice, however, there is really nothing between the two arrangements as with that shown in Fig. 7. the reaction condenser rarely needs to be larger than .0003 mfd. This, in conjunction with a .0002 mfd. by-pass condenser is not excessive.

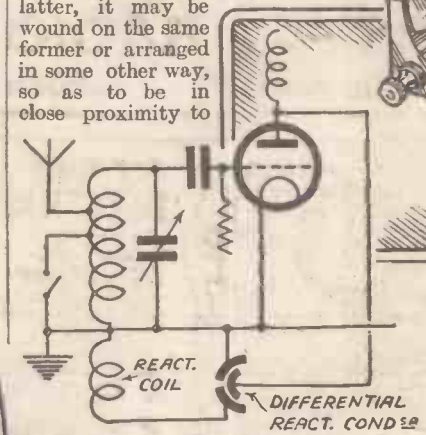



*Fig. 8.—Circuit using differential control, also a typical differential condenser.*

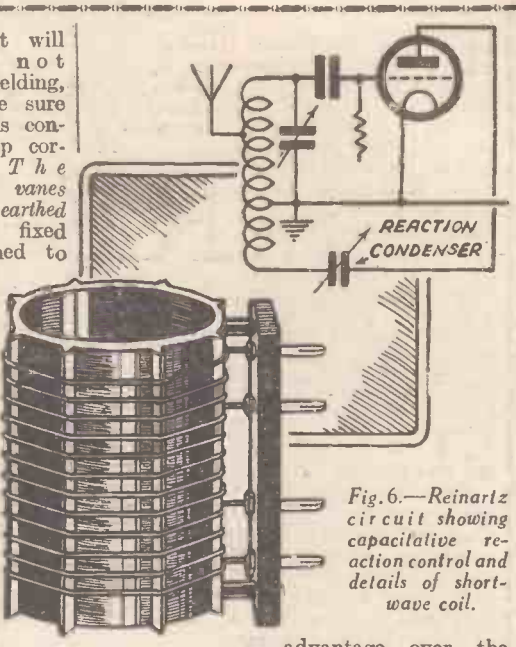



*Fig. 6.—Reinartz circuit showing capacitative reaction control and details of short-wave coil.*

### "Ploppy" Reaction

Capacitative control is without doubt an advance on the inductive method in that it does not upset the tuning, but, nevertheless, it has one weak point. This is a tendency towards fierceness or "ploppiness." Of course, ploppiness is not confined to this form of control alone, but in the absence of other faults, is, perhaps, the more marked. Everyone

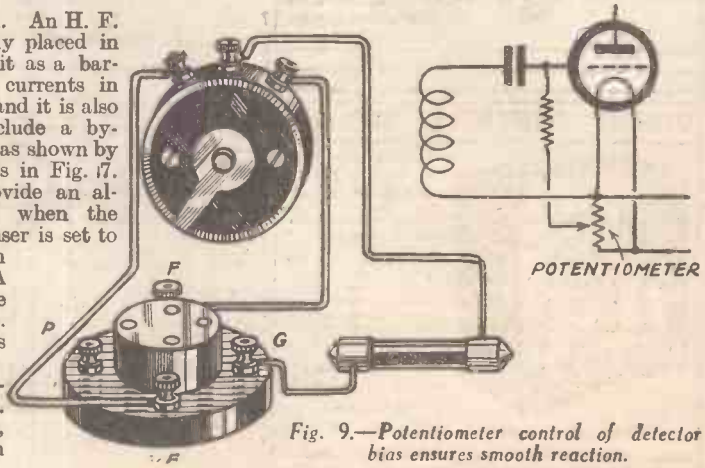



*Fig. 9.—Potentiometer control of detector bias ensures smooth reaction.*

knows the symptoms. Instead of a gradual passing into oscillation with just a slight rushing noise to indicate the transition, the set suddenly breaks into oscillation with a "plop." At its worst, this makes the set very difficult to handle, as no degree between moderate volume and actual howling seems possible.

Fortunately, there is an easy remedy which is almost infallible. It is the fitting of a potentiometer to control the detector grid-bias. It is arranged as in Fig. 9. The potentiometer should have a resistance of at least 400 ohms, otherwise it will consume an appreciable amount of current. A tapped potentiometer will very often do quite well—suitable tappings being ¼, ⅓, and ½. The two ends are connected across the filament as shown in Fig. 9, and the grid-leak return taken to the best tapping.

Obviously, ploppy reaction may be aggravated by such things as too high a plate voltage on the detector valve, unsuitable grid-leak, and condenser values, or an unsuitable valve. It is, therefore, just as well to test these points first. It may save you the trouble, and expense of fitting the potentiometer.

### Reaction and the Screen-Grid Detector

The use of a screen-grid valve as the detector has recently come to the fore. It has certain advantages over the triode such as low input damping, but is inclined to give ploppy reaction. In this case, potentiometer control of grid-bias is not always effective as a cure, but an arrangement which usually gives good results is shown in Fig. 10. Here the reaction

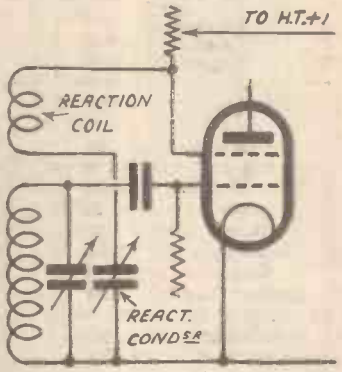



*Fig. 10.—Reaction from screening grid of S.G. detector valve*

is taken from the screening-grid instead of the anode. Its success depends on getting the right voltage on the screening-grid, and if this is done the control of reaction becomes delightfully smooth. The best voltage is usually about 30, and the use of a potentiometer is to be recommended if the H.T. battery is not tapped at frequent intervals.

### Selectivity and Tone

One of the chief characteristics of reaction is its effect on selectivity. Besides the increase in signal strength, there is always a marked improvement in selectivity as the reaction control is advanced, and for this reason it often pays to make full use of it on your own receiver. Often interference from another station can be eliminated by increasing the reaction. If the station to which you are tuned is then too loud the volume should be reduced by one of the other forms of volume control fitted, such as by lessening the capacity of the small condenser usually fitted in series with the aerial or by increasing the bias on the variable-mu valve, if one is used. Any tendency to side-band cut-off, due to the increased selectivity is best compensated for by use of an intervalve tone control, or by reducing the tone compensation provided in the case of pentode ouput. A variable control is always preferable because the same degree of reaction will not always be used. Of course, approximate compensation can be obtained for circuits using very selective tuning coils with considerable reaction by employing an intervalve transformer with a rising characteristic, or by using uncompensated pentode output.

# A Useful Radio Desk

## A Neat Arrangement for Accommodating Batteries and Radio Books

By W. OLIV

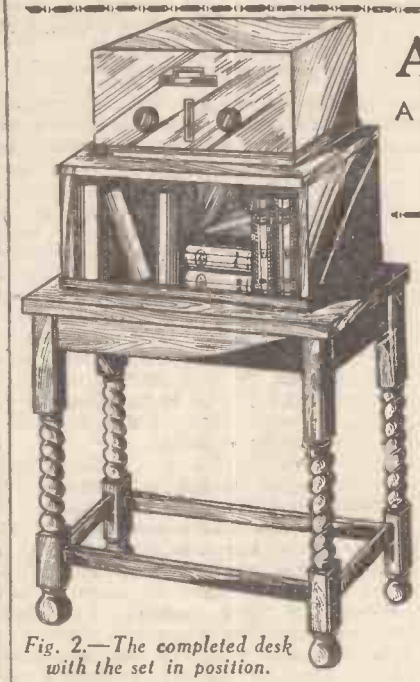


*Fig. 2.—The completed desk with the set in position.*

UNLESS a battery-operated set is entirely self-contained, with the necessary batteries, etc., housed inside the cabinet, it is difficult to keep the installation neat and tidy, and at the same time to have all the items readily accessible. A very useful wireless desk or table that solves the problem in a novel way is shown in the accompanying illustrations. The construction of this handy piece of radio furniture is well within the capabilities of any amateur.

The desk consists of a plain table surmounted by a superstructure which accommodates the set and batteries, and also affords convenient shelf-room for reference books on radio matters. It is not necessary to make the table especially for the purpose unless you prefer to do so, as almost any plain table of suitable dimensions can be converted into this radio desk by adding the fitting shown in Fig. 1.

### Details of Superstructure

This superstructure is a simple box-like arrangement with a longitudinal partition fixed vertically near the centre. The space behind this partition forms the battery compartment, which should be roomy enough to accommodate the H.T. battery and accumulator (as shown in Figs. 3 and 4), while that in front of the partition can be used as a bookshelf for radio books (as shown in Fig. 2).

The parts are assembled with glue and nails, the heads of the latter being punched beneath the surface and concealed with plastic wood. When completed the superstructure can be stained and polished to match the table, and screwed down on to the top of the latter in the position shown in Fig. 4. When the set is in position on the upper shelf, it is at a convenient eye-level for accurate dial-reading, and one's elbows can be rested comfortably on the table while manipulating the tuning controls; these details make a material difference to the comfort or otherwise of spending an evening "searching" for distant stations.

The table or desk is intended to be placed against a wall; the batteries and leads are then out of sight, and the resulting effect is quite neat. This arrangement is actually better than the usual self-contained cabinet, in that it affords free ventilation for the batteries, thus helping to keep the H.T. battery cool and dry, and preventing any corrosive fumes from the accumulator reaching the interior of the set.

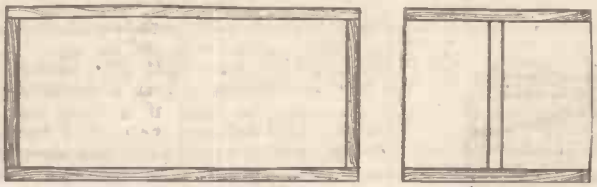


*Fig. 1.—The superstructure with compartments for batteries and books.*

**That Circuit you require is in 25 Tested Wireless Circuits by F. J. Camm 1/-, or 1/2 by post from Geo. Newnes, Ltd., 8/11, Southampton Street, Strand, London, W.C.2.**

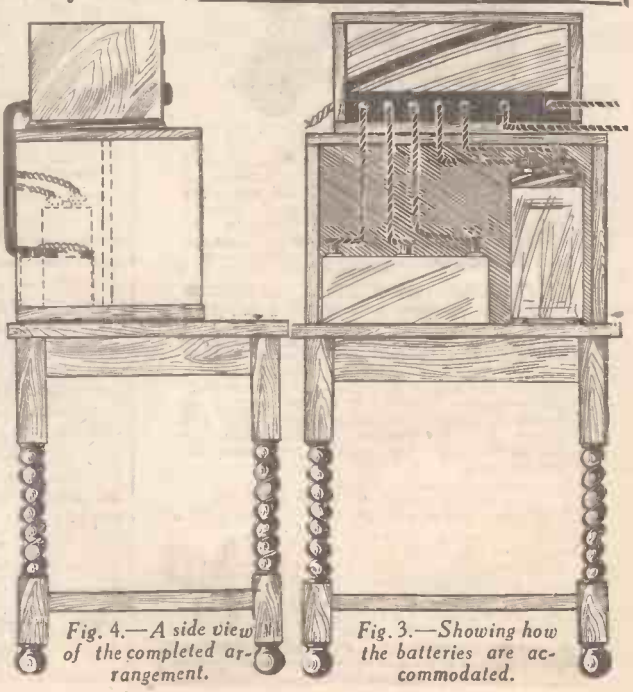


*Fig. 4.—A side view of the completed arrangement.*

*Fig. 3.—Showing how the batteries are accommodated.*

## SOLVING YOUR RADIO PROBLEMS

*(Continued from page 328)*

As to the input (grid-filament) impedance of a valve, this is always high in a low-frequency valve which is not passing grid current. Consequently, if we are properly to match this to the anode circuit impedance of the preceding valve a step-up L.F. transformer is employed. For best results the ratio between secondary and primary should be the same as the proportion between the grid circuit, and preceding anode circuit, impedances. In the case of a Class "B" valve, the conditions are exactly reversed. Since this valve passes grid current, its grid-filament impedance is lower than the anode impedance of the "driver" valve; hence a step-down transformer must be employed.

You know that a 1 : 1 ratio coupling (a tuned-grid circuit) is generally used between an S.G. and detector valve. The reason is now fairly obvious; an S.G. valve has a high anode impedance, and the detector has a (comparatively) low grid impedance since it passes a small amount of grid current. In practice the two impedances are just about equal and, therefore, neither a step-up nor step-down effect is required between them.

### Matching the Aerial Circuit

We now come to a point which is very frequently neglected—the matching of the aerial tuning circuit to the grid circuit impedance of the first valve. You know that the ordinary aerial-earth system is actually a condenser, and its capacity may be anything from .0001 mfd. to .001 mfd. We have also seen that a condenser has impedance, so that if a large capacity were joined between the ends of the aerial tuning coil it would have the same effect as a resistance connected between the same points. Thus, no matter how "good" the coil was, its efficiency would seriously be impaired and it would not match the grid-filament impedance of the valve it fed.

### The Series Aerial Condenser

You can see now why selectivity may be improved by connecting a condenser in series with the aerial lead-in. It acts as a series impedance, you can consider it as a resistance if you like—and so increases the resistance in parallel with the coil. Suppose we take an actual example and assume that our aerial has a capacity of .0003 mfd. Its impedance at 300 metres (1,000,000 cycles) will be 500 ohms, and this "load" would actually be placed "across" the tuning coil if no series condenser were used. But if the aerial were connected to the coil through a .0001 mfd. condenser (impedance about 1,500 ohms), the aerial "load" would only amount to 2,000 ohms. The net result would be not only a gain in selectivity but also in efficiency. We can see from this that a series aerial condenser, although it increases selectivity, does not always reduce the set's sensitivity—it all depends upon the relative capacities of the condenser and the aerial. There are many other wireless problems that can be solved by applying the principles of impedance, but I will leave them for you to think out yourself.

# RADIO RAMBLINGS

By JACE

*Jottings from my Notebook*

### Micro-Wave Apparatus

THE Exhibition arranged by the Physical Society at the Imperial College of Science and Technology, South Kensington, was of particular interest to radio fans, and a large proportion of the exhibits was devoted to radio and electrical apparatus. The Marconi Co. showed a micro-wave transmitting and receiving installation, which demonstrated the generating and propagation of waves of about 50 centimetres in length. Micro-wave communication is getting a lot of attention these days, and readers will remember my description in these columns of the apparatus in course of erection for cross-Channel communication between French and English aerostations. Most of these transmitters on micro-waves utilise a parabolic reflector to focus the transmission into a narrow beam. A similar system is used in the light beam apparatus shown by Marconi, in which radio signals are imposed on a beam of light. In this case a sodium discharge tube is placed in the focus of a parabolic mirror and is modulated by a small power valve across the grid and filament of which is applied the speech current.

### Class B and the L.T.

A POINT which must be borne in mind when converting a receiver to the Class B principle, is that the latter type of valve requires a filament current of .4 amps. As the Driver valve should also be of the small power type and requires .2 amps. in place of the .1 taken by a small L.F. valve, the accumulator will not last so long, and a larger cell should be chosen.

### Fox "Syncro-Dynamic" Radio

THE difficult problem of arriving at the correct balance of quality and selectivity has been very seriously tackled in the design of the Fox chassis, and the result of the researches in this direction has been to retain all the possible constituents of the former, without detriment to the advantages of the latter. It was, therefore, necessary to evolve a highly efficient band-pass circuit that would give a high degree of selectivity without rendering the receiver less sensitive to broadcast signals. This has been accomplished by using extremely high-efficiency coils in the aerial filter, and high-gain inter-stage inductances in the H.F. amplifiers. The matching of the four tuned circuits has been calculated with a mathematical degree of accuracy which has resulted in an extremely high overall sensitivity characteristic, consistent with an average peak separation of about 9 kc/s. Greater H.F. efficiency has been obtained by using normal A.C. screened-grid valves in preference to variable-mu types, where the utmost possible efficiency is in many cases unobtainable. Effective volume control is provided by a potentiometer in the H.F. bias-circuit, which is also arranged to close the aerial inductance circuit on a reduced setting. The effect is to provide practically linear control from silence to full volume. The detector is of the power grid type, using a 354 V. with normal values, and has a high-frequency "stopper" choke in its anode circuits. Much attention has been paid to the de-coupling in all H.T. and grid-bias circuits, ensuring the complete stability of the receiver and a surprising absence of mains hum. The low-frequency stages have been designed to combine capacity coupling with a minimum of high-note loss, and no attempt has been made to obtain a high magnification of audio frequencies with its normal accompaniment of distortion due to overload. The pentode output valve, an indirectly-heated Pen4V, provides an undistorted output of approximately 2½ watts. A tonal modulator is incorporated in the intermediate L.F. amplifier, which provides a regulation of the passage of high notes, if desired. The mains transformer is provided with a range of primary taps to cover principal voltages from 100 to 250 at 40 to 60 cycles. A D.W. 2 full-wave rectifier is used. The chassis is constructed of 22 gauge steel, and is sprayed with a silver-colour finish.

*One of the Columbia Receivers retrieved from the recent explosion at Mitcham. Although badly damaged, each set was found to be in working order after being excavated from the débris.*

### Buy British

HERE are two instances that go to prove that it is better to buy British. Firstly, a few weeks ago there was a disastrous explosion about which I am sure you all read in the newspapers. In one of the houses that were blown up was a British-made wireless set of a well-known commercial make. The set was blown sky high, and was later retrieved from a pile of debris two streets away. The cabinet was terribly battered and it looked as if its life's work was over. Not a bit of it, however! On being switched on it worked perfectly, the whole of the chassis, batteries, and valves having withstood the tremendous shock successfully. When you think of it, however, the modern set, with its extensive use of metal and chassis method of fabrication, is a much more sound engineering job than hitherto.

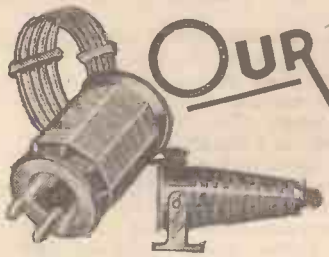
Secondly, a few weeks ago many British valve firms altered the design of the cathodes of their A.C. valves considerably, in such a way as to give a much longer service life to the valves. The emission was found to have been improved, and the filament was specially held so that sagging and distortion was impossible. This was *not* announced publicly in any way, and the advantages of this improvement were handed on without any fuss whatsoever.

### Neon Lighting for a Radiogram

RESEARCH electrical engineers are trying to produce a cheap and safe form of neon lighting for domestic use, whereby the danger of shocks will be minimised by stepping up the frequency of the mains to such an extent that shocks will not matter so much. I tried this form of lighting for some time to give a soft lighting effect to a large radiogram I was using at the time, as I am a firm believer in the advantages of listening to special broadcasts in dim or half lights, and I found the soft glow of a neon tube to be especially soothing. All went well for a few months until the set developed a most annoying and powerful hum. I tried all the usual remedies without success until I somehow or other tried out the set with the neon tube out of circuit. The hum immediately stopped, but I never found out the real cause of the trouble, or rather the solution of it, for I was never troubled with the complaint as long as the neon tube was inoperative. Anyway, the light nights came along and I did not bother with it again, but even now I sometimes ponder over it.

### Paper Condensers

DAMP, humid conditions of the atmosphere, and of the soil, are good for wireless reception, and I read an item the other day that started me pondering as to whether a damp set would give better results than a dry one. An amazing line of thought admittedly, and one that I hope will not induce you to pour a bucket of water over your set as a new line of experiment. Anyhow, you may or may not know that the capacity of a condenser is directly proportional to its state of "dryness" or "dampness," and in the manufacture of the paper used in certain types of condensers, and in cables and other electrical apparatus, great precautions are taken to ensure that the paper is perfectly dry. To ensure that the paper used in highly accurate paper condensers is always of the correct hygroscopic value, that is, in plain English, of the same wetness, a novel instrument has been devised. This takes the form of a large condenser with two silver plates the capacity of which can be varied.



# OUR SHORT WAVE SECTION


CONDITIONS generally have been fairly good all round, and with the exception of earthquake periods, most days have permitted a fair reception of a number of broadcasts on short-waves. Atmospherics, on some nights, and in particular on the 40 metre band, were such that listening on headphones was no pleasant pastime and their intermittent crashes on certain occasions almost wiped out telephony transmissions.

Moscow 50 m. is on the air nightly and you may hear talks from this station in various languages, including English, at 8.0 p.m. From the announcements I find that this transmitter no longer relays the Trades' Unions station on 1,304 m., but Moscow Old Komintern on 1,000 m. On the other hand, the T.U. programme appears to be taken by a powerful Russian station on 46.6 m. (6,438 kc/s) Somewhat below this on 6,611 kc/s (45.38 m.) you may hear from time to time an operatic performance from Moscow or Leningrad, or even a relay from Bakou, Kiev or Samara; from a French announcement picked up some little time ago, I gathered that the station was one operated by the *Club Central de l'Armée Rouge* (The Central Club of the Red Army). Whilst on the subject of Moscow, you may now and again faintly hear a B.B.C. programme on almost the same reading as that logged for the Vatican station (50.26m.) it is the sixth harmonic of North National. Again, slightly above HVJ, you will pick up a somewhat distorted version of Bordeaux-Lafayette's broadcasts, namely, on 50.7 m.) Just at present, the 50 metre band suggests a good field for investigation as there have been a certain number of alterations made in wavelengths, and consequently, in this section you will find newcomers, if not interlopers.

**On the 48 Metre Band**

On 48.2 m., 2RO, Rome frequently carries out test transmissions, although according to my log, with but few exceptions, the broadcasts are still regularly made on 25.4 m. W8XK relaying KDKA, on 48.86 m. is a very powerful signal on almost every night from 9.0 p.m. G.M.T. onwards, and a slight twirl of the condenser at a later hour (between 12.30 and 1.0 a.m.) may bring you a whisper from YVIIBMO, Maracaibo, on 48.95 m. (6,127 kc/s) which frequently relays YVIBC, Caracas. In the call, *Aqui Broadcasting Caracas* will be mentioned. A direct relay of the main station is also carried out on 49.1 m. Its identity may be confirmed by the interval signal consisting of strokes on a gong, *i.e.*, two beats G and two beats F.

W3XAL, Boundbrook, which relays WJZ, of the N.B.C. system, I do not appear to have heard for some days, but on the other hand reception of W2XE, Wayne (N.J.) on 49.02 m., taking the WABC, New York (Columbia) programme has been particularly good. You might try for VE9GW, Bowmanville (Ont.) on 49.22 m. (6,095 kc/s) which acts as the short-wave relay of CKCW, Toronto; it has resumed its broadcasts and has already been heard by listeners in the British Isles.

**Denmark, Vienna and U.S.A.**

During the past three weeks or so the signals of OXY, Skamlebaek (Denmark) on 49.4 m. (6,073 kc/s) have been very powerful; in fact, the Copenhagen wireless entertainments heard through this channel have been better than *via* Kalundborg (1,153.8 m.). I do not know whether OXY has definitely abandoned 31.51 m., but if results are to be considered it will be difficult to induce the Danes to revert to the lower wavelength. It may be due to this unexpected invasion that UOR2, Vienna, has been compelled to move to 49.6 m. (6,048 kc/s) a position now shared with VQ7LO, Nairobi. Vienna, fortunately, does not work every night and should not often interfere with the Kenya station which appears to be at its best between 6.0 and 7.0 p.m., G.M.T. On 49.67 m. (6,040 kc/s) WIXAL relaying WEEI, Boston, of the N.B.C. red network, has been logged very regularly lately. It radiates the same programme as WGY, Schenectady, WEAF, New York and WTIC, Hartford. So far as I know, W4XB, Miami Beach (Flo.), still shares this channel, but I do not find it in my log over the last two months.

Just a degree or so above, on 49.83 m., DJC, Königs Wusterhausen, should give you a full loud-speaker signal. For the past ten days it has been on the air every night with political speeches, official talks and extracts from the Berlin or other German programmes. This station, which was formerly used for the relay of entertainments to the United States, will now provide special broadcasts after midnight of interest to German residents in North and South America.

**Above 50 Metres**

Casually working up above 50 m., which is an excellent landmark, as you will soon find, you should hear on about 55.5 m. or so the quarter harmonic of Radio Normandie (Fécamp). Make a note of it, as in its immediate neighbourhood, occasionally, a Berlin broadcast may be picked up. It is DTG, Königs Wusterhausen (56.9 m.), acting as one of the channels for the relay of a German entertainment to the U.S.A. You will find it sandwiched between the Fécamp whisper and the fifth harmonic of the National relays on 57.66 m. Again, slightly above on 58.31 m., on Tuesdays or Fridays between G.M.T. 19.30 and 21.30, the Prague Experimental station OKIMPT may possibly be logged. Announcements are habitually made in several languages and thus you may recognize the call. Here again, on 59.4 m., you should stumble across the sixth harmonic of London Regional. If you care to jot down their corresponding dial readings, these harmonics are very helpful for calibration purposes. Others further up the scale and equally useful are: 65.6 m. (fifth harmonic of Poste Parisien); 72 m. (fourth harmonic of National relays); 75 m. (Radio Normandie); and on about 109 m. (third Poste Parisien.)—J. COOTE.

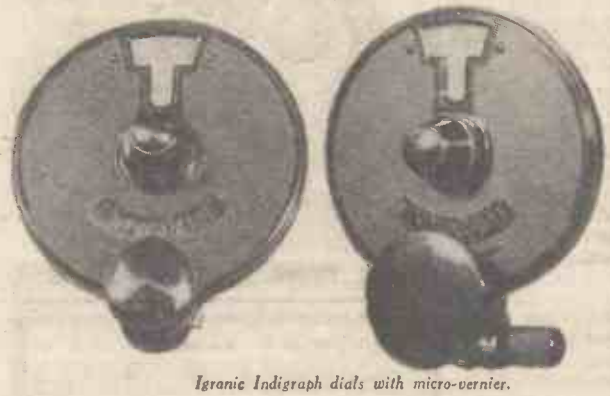
# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

### IGRANIC INDIGRAPH DIALS

SHORT Wave Receivers, experimental oscillators, and several other pieces of apparatus used by the keen radio amateur often call for exceedingly fine adjustments of the tuned circuit. For this purpose one can rely upon a small value of condenser and a very steady hand, but obviously much more satisfactory results are obtained when a tuning control capable of small adjustments is employed. In the illustration below may be seen two of the Igranic devices which have been produced for this purpose. On the left is the standard dial, which is of the friction drive type and has a reduction ratio of 10 to 1. This is obtained by clamping a large ivorine disc (the rotatable portion seen through the window) between two metal discs which are kept pressed together by a spring. This gives a smooth even movement, free from backlash, and is to be preferred to any form of toothed gearing. A transparent window is fitted to the upper part of the casing and a portion of the celluloid forming this window is cut away below the dial markings to enable records of stations, wavelengths, etc., to be marked direct on the ivorine dial. If these markings are made in pencil they may easily be removed when desired by an ordinary pencil rubber. Fixing is very simple and the dial will be found to function exceedingly well. The dial on the right is similar in its main construction but has the additional advantage of a micrometer vernier which gives a reduction of 500 to 1. This is carried out by a worm adjustment working on the rear of the large hand-tuning knob at the bottom of the dial, and the small knob which projects at the side may be disengaged by a simple movement to enable the coarse adjustment—approximately 10 to 1—to be employed for preliminary adjustment. For special apparatus this will be found a most useful device and may be used with every confidence. The prices of the dials are 5s. & 9s. 6d.



*Igranic Indigraph dials with micro-vernier.*

### ORMOND TRANSFORMERS

SAMPLES of two Ormond L.F. transformers have been received for test and are illustrated at the foot of this column. The particular model is R.531 and is of the nickel iron type having very small dimensions. It is made in two patterns, one of which is provided with a centre-tapped secondary for use with Q.P.-P. output stages. The ordinary model has a ratio of 3.5 to 1 and the Primary has a D.C. resistance of approximately 1,000 ohms. The ratio of the centre-tapped model is 8 to 1 so that it may be used to fully load two pentodes when used in the Q.P.-P. principle. Both transformers may be used with the customary anode connection, but as is usual with these nickel-iron transformers, better results are obtained with the parallel-fed method. On test they gave very good reproduction and no undue resonances were noticed. The volume handled was ample and they may be used with any normal circuit with splendid results. The prices are 7s. 6d. each.

*Ormond R.531 L.F. transformers.*

### NEW G.E.C. SOLDERING IRONS

AS a result of the practical advantages which are being obtained from the use of elements in which the element wire is embedded in refractory, the General Electric Co., Ltd., has now perfected the design of a new type of soldering iron in which this type of element is employed. The new patterns are being introduced forthwith to replace the standard patterns of this useful tool, and are approximately of the same weight and loading, namely, 300 watts, as the old. They are suitable (1) for medium to heavy duty, such as general repairs in a workshop and continuous soldering under factory conditions where the material to be soldered is not too heavy, (2) for heavier work and soldering seams in regular factory production. The practical tests which have been carried out on these new types have proved in the highest degree satisfactory, and it can be confidently assumed that with normal use these new irons will give a very much longer life than has been possible with irons manufactured on any of the present standard lines. To prevent overheating the same precaution should be observed with regard to switching them off, when not actually in use, but it has been found that this new type of iron will withstand even this common form of abuse provided it is not too prolonged or too frequent, whereas irons with mica wound elements undoubtedly fail very speedily under such treatment. Another feature of this new iron is the improved method of fixing the handle to the body of the iron whereby heat conduction to the handle is reduced to a minimum and an excessive temperature after prolonged operation is avoided.

The price of the new iron shows an appreciable reduction on that of the older pattern, the medium type (H.O. 5,966) being 36s., and the heavy 40s. as against 40s. and 44s. respectively.

### BLUE SPOT 29 P.M. SPEAKER

ONE of the most useful loud-speakers manufactured by the British Blue Spot Co., Ltd., is Model 29P.M. This is of the permanent magnet type, requiring a 7in. diameter hole in the baffle. It is of the simple claw-magnet type having two arms, and is fitted with an input transformer. This may be obtained for Power, Super Power or Pentode valves, and the different ratios are obtained by means of three terminals. For Q.P.-P. receivers a special model of this speaker has been produced, and this has a suitable transformer fitted. The sensitivity is of a high order, and it can handle a power up to 3 watts, which is more than is required for normal domestic use. Where it is not desired to make up a cabinet, this speaker may be obtained already fitted into an attractive oak cabinet, and this is illustrated on the right. The reference number in this case is 22 P.M., although the same speaker is fitted. The tone is particularly pleasing, giving a good balance throughout the normal frequency band. Speech is clear and crisp, and transients seem to be handled well. As is usual with all of the products of this firm, a twelve months' guarantee is given against faults or failure, and it may thus be purchased with confidence. Model 29 P.M. costs 32s. 6d., and Model 22 P.M. is 45s.

*Blue Spot 22 P.M. cabinet loud-speaker.*

### LISSEN I.F. TRANSFORMERS

WITH the increasing popularity of the Super-heterodyne receiver, a number of new components are appearing on the market which have been specially designed for this particular circuit. Messrs. Lissen have introduced some very efficient I.F. transformers, one of which is illustrated herewith. This is of very small dimensions (approximately three inches high) and is completely screened. As may be seen in the illustration, the coil is wound on a small double bobbin and the two halves are spaced apart by a piece of paxolin tubing. This enables the coupling, to be exactly the same for each coil, and provides uniformity. Holes drilled through the paxolin ends of the formers enable an almost air-spaced coil to be obtained, and the efficiency is thus quite high. A metal disc is fitted to the base of the coil, and a spindle is attached to this. When the metal screening cover is placed over the spindle and the locking nut affixed the coil is totally screened and if used with a metal chassis the screening is automatically earthed. When used on a wooden baseboard it is necessary, of course, to connect a separate earthing lead to the top of the screening can. The transformer is adjusted for 126 kc/s which is now the generally accepted standard for intermediate frequency transformers, and in its simplest form the curve obtained will be quite flat for approximately plus or minus 3.5 kc/s, but will cut off to less than one hundredth of the peak at 9 kc/s off resonance. A stage magnification of the order of 100 can be obtained with care when using a suitable A.C. screen grid valve. The price of this component is 7s. 6d.

*Lissen intermediate frequency band pass transformers.*

### DUBILIER SPARKING PLUG RESISTANCES

Complete satisfaction and purity of reception with portable radio receivers, etc., operating in motor cars or with vans fitted with public address amplifiers, talkie equipment and the like can only be obtained when all sources of noise originating from the motor car engine are eliminated. By far the greatest amount of noise caused by the ignition system of the car is produced at the sparking plugs and the distributors, and to eliminate effectively all such noises, the Dubilier Condenser Co. (1925) Ltd., have produced a range of "Sparking Plug Resistances" for the suppression of this form of interference. All the advantages and patented constructional methods of the standard Dubilier Metallized Resistance have been incorporated in these resistances to ensure that they are 100% efficient, the design being such that they will withstand severe mechanical shock and vibration and are unaffected by moisture or temperature (the latter being an important factor when it is considered that the resistances are fitted in close proximity to the hot engine). Further, they must be able to suppress ultra short waves such as are generated by the spark, otherwise all noise will not be eliminated. Attention in manufacture to these points has been given careful consideration and we have received samples of these resistances for test. We hope to give further information concerning them in a later issue.

(*Continued on page 346.*)

# Practical Letters from Readers.

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

### What is a Portable Set?

SIR,—In reference to your article in the April 29th issue of PRACTICAL WIRELESS, on "Solving the Portable Problem," it may interest you to know what is the weight of my home-made portable set. It is a three-valve set—o-v-2 with no coils and is quite effective.

| | |
|---|---|
| Case weighs | 5lb. 15oz. |
| G.B., 60v., and 66 H.T. | 9lb. 15oz. |
| Accumulator | 4lb. 0oz. |
| L-speaker | 0 10oz. (Lissen unit) |
| Set | 5lb. 6oz. |
| Total (say) | 26lb. 0oz. |

I cannot conceive that it is correct to say that the average commercial portable cabinet weighs 10 to 12lbs.—R. W. ROMANIS (Rochester).

### "Pigtail Connections"

SIR,—As the author of the article to which Mr. Faulkner refers in your issue for May 6th, may I be allowed to reply?

Mr. Faulkner questions the effectiveness of the pigtail connection on the grounds that its inductance is appreciable and, naturally, varies with the position of the condenser vanes. I do not think, however, that this assumes any importance on a normal short-wave receiver; the average short-waver employs a tuning condenser of about .0001 mfd. capacity, which is more than sufficient to swamp the effect of the very minute inductance occasioned by the pigtail; furthermore, the shunt capacity incidental to the metal bushes and end-plates is also bound to minimize the inductive influence. I have illustrated my point in the accompanying diagram, where L1 represents the pigtail inductance. Admittedly, on *ultra*-short-waves the point is worth studying, but in any case noises can hardly arise if the pigtail consists of rubber-covered flex.

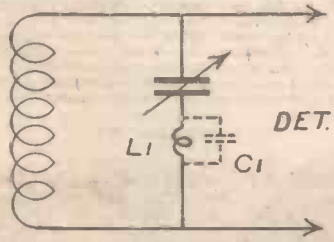



*Diagram illustrating Mr. Eric Johnson's letter.*

With regard to potentiometer noises, Mr. Faulkner is extremely fortunate in being able to dispense with this component. One *does* occasionally strike a detector valve which behaves well without one on short waves, but I am afraid it is a rarity.

The fitting of an untuned S.G. stage for the elimination of noise caused by intermittent stay-wire earthing, etc, is an expedient I strongly endorse. Stage gain is practically negligible, but is offset by the advantage mentioned, to say nothing of the removal of blind spots in the tuning. For those who cannot afford the necessary expenditure, however, the tip concerning the breaking up of stay-wires into odd lengths is worth remembering.—ERIC JOHNSON.

### "Push-pull" Detector Circuit

SIR,—I have thoroughly tested out the new Push-pull detector circuit, described in the March 4 issue, and must say the signals on powerful stations are very strong indeed and of splendid quality—generally reminding one, from all points of view, of "anode bend" results.

Rather better than the home-made coil with variometer I found a three-way coil holder with swinging reaction (using a centre-tapped reaction coil) gave more selective results. However, on long waves I could not obtain a very favourable result, but the circuit is well worth experimenting on, and I shall be glad to know if you intend carrying out tests with a view to incorporating a dual wave coil. Wishing your splendid paper the success it deserves.—G. LEACH (Hampstead).

### Of Great Value

SIR,—I have to thank you for my copy of the "Wireless Constructor's Encyclo-

*(Continued on page 346)*

**CUT THIS OUT EACH WEEK**

## DO YOU KNOW?

—THAT when using an anode-bend detector a milliammeter in the anode circuit will show a decrease when a station is tuned in.
—THAT if a detector valve works on the leaky grid principle a meter will show an increased reading under the same circumstances.
—THAT provided a receiver is adequately decoupled there is no reason why a partially discharged H.T. battery should not be used in series with a new one.
—THAT a non-inductive resistance inserted in series with a reaction coil will often enable better reaction control to be obtained.
—THAT the coupling condenser in an R.C.C. stage can introduce frequency distortion and so must be chosen with care where high-quality is desired.
—THAT a high-class L.F. transformer will give better quality reproduction than an ordinary R.C.C. stage.
—THAT the heaters of indirectly-heated D.C. valves are joined in series.

### NOTICE

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

(*Continued from page 345*)

pædia." That, and PRACTICAL WIRELESS, are the finest value on the market. Both the Encyclopædia and the weekly paper have been of great value to me, and to my wireless friends! I can assure you each issue is eagerly awaited and read from cover to cover. As a tribute to the clearness of your articles, it may be of interest to you to know that my wife, through the medium of PRACTICAL WIRELESS, is rapidly becoming quite an expert, assisting me in wiring up experimental sets. — L. B. BAKER (Maidstone).

### Short-wave Tuning Circuit

SIR,—I have often asked friends whether they ever listen to the amateurs working on the 160-metre band, and almost without exception am told they would only be too glad to, but their sets will not go down so low. The modern dual-range coil is not designed to operate below about 200 metres, and another coil is essential. Where six-pin coils are used, the remedy is obvious.

The wiring scheme shown in the accompanying diagram has been used with great success. There is no breakthrough, and in the case in point was installed on a set using a commercial dual-range coil. The diagram is deceptive, in so far as the practical result is not half so complicated. A second reaction condenser (.0003) will be required because, in the case of the coil used, the reaction condenser is inserted at a point above earth potential, which would render tuning (owing to hand-capacity effect) almost impossible on the lower band. The remaining material are some 24 D.C.C. wire, a 3in. length of 2in. cardboard former, a .0001 fixed condenser and a 3-pole double-throw switch. The aerial winding should be solenoid, but the reaction coil may be pile wound. The two windings in the same direction, but absolutely separate, spaced at about ¼in. I would add that after a little trial and error, it is possible to tune from 80 metres or so, bringing in the R.A.F. stations, through the amateur band, and on to Radio-Normandie, thus having a continuous range from 80 to 2,000 metres. I can vouch for these results.—ERNEST A. SAUNDERS (Beddington).

### From a Satisfied Reader

SIR,—It is with the greatest pleasure I acknowledge the receipt of my "Wireless Encyclopædia." I certainly think it is one of the finest books I have seen dealing with wireless subjects, from both a practical and technical point of view. I can definitely say it has far exceeded my expectations, and I think it will assist greatly, used in conjunction with PRACTICAL WIRELESS.—A. MCLEAVY (Barking).

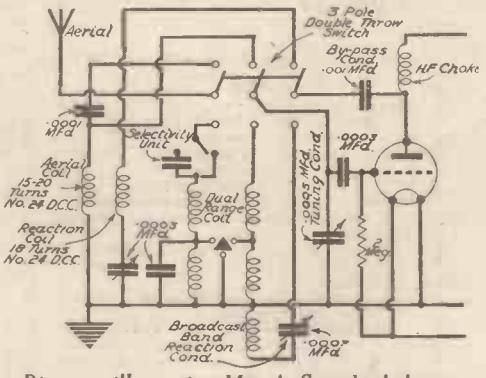



*Diagram illustrating Mr. A. Saunders's letter.*

### Another Reader's Appreciation

SIR,—I would like to express my appreciation of your wonderful weekly, PRACTICAL WIRELESS. All my wireless friends have placed orders with their newsagents for a copy every week. I also wish to thank you for the "Wireless Constructor's Encyclopædia" which I have just received. I am surprised at the quality and quantity of its contents, and am looking forward to many hours of useful and interesting reading. Wishing you every success.—A. K. KING (Folkestone).

## FACTS AND FIGURES.

(*Continued from page 344*)

### SMITH'S ANODEX H.T. BATTERIES

MESSRS. S. SMITH & SONS (MOTOR ACCESSORIES), LTD., of London, have produced some very efficient types of dry battery, and we have, as will have been seen elsewhere in this issue, decided to use one of these batteries for the latest PRACTICAL WIRELESS receiver. A patented method of construction is employed in these batteries, and such points as the connecting wires between adjacent cells, the method of packing the active elements into the cells, etc., have received very close attention. The result is a battery which stands up to a large amount of bad treatment, and which retains its activity for a longer period than most, and which delivers a very high current supply for a long period without distress. The zinc containers for the cells are electrically welded, and when the active element is in its place, they are hermetically sealed. This eliminates "local action" and ensures that the cell will have an exceptionally long "shelf life," or, in other words, it will not deteriorate through standing idle, but will remain active for long periods and may be expected to deliver its full voltage over a very long time. A special type is made for Class B operation, and this delivers the large current which is periodically required on peaks when a receiver using this principle is being used. The batteries are not expensive, a 120-volt battery costing only 11s., and a 99-volt battery 9s. This is the standard Anodex, but an extra power and a triple power is also manufactured, and the latter is the most expensive. In this range, the 120-volt battery costs 24s., and in the extra power range the 120 volt costs 15s. 6d. A special Anodex (for Q.P.-P.) costs 15s. for 150 volts, and may also be obtained in 120 volts for 11s. 6d.

On the left are two of the accumulators made by Messrs. S. Smith (M.A.), Ltd., the 2RGN7 and the 2RAN. The lower photo shows the Class B battery, the 9 volt Grid Bias battery, and the 16½ volt Grid Bias battery. The H.T. and 16½ volt Grid batteries are those which are specified for the Radiopax Class B Four receiver announced in this issue.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

# REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

## SPECIAL NOTE

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

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

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

### LOUD-SPEAKER REPLACEMENT CHOKE

**"On looking through some advertisements recently I came across the term 'loud-speaker replacement choke.' What does this mean? It seems to refer to a choke to take the place of a loud-speaker, and as I am new to wireless I should like to know the type of reproduction this gives."—(T. E., Newcastle.)**

Although the choke does take the place of the loud-speaker, it does not do so in the manner you imagine. The type of speaker it refers to is the mains-energized field moving-coil speaker, and in these the field winding usually has a D.C. resistance of 2,500 ohms, and is included in the mains part of a receiver in place of the customary smoothing choke. In this way the field is excited without any extra apparatus, and the only cost is a reduction in the H.T. obtained from the rectifier. To avoid inefficiency due to this drop, it is customary to arrange for the rectifier to deliver 350 volts, and this leaves approximately 250 volts for the satisfactory operation of the valves. When carrying out the construction of a receiver which specifies this method of field excitation, and if you are desirous of using a P.M. speaker, a special choke will be required having a D.C. resistance of 2,500 ohms. This is the choke referred to in the advertisement, and its purpose, therefore, is to take the place of the speaker field in order to obtain the equivalent voltage drop.

### UNCONTROLLABLE REACTION

**"I have made up a three-valve set, using a coil of more or less my own design and I cannot get the reaction right. When I switched on it oscillated all the time, and when I disconnect the leads from the reaction winding it still whistles. How can I stop this? There are only a few turns for the winding, and it is spaced away from the grid coil. I should like your assistance."—(F. J., Worthing.)**

The fault may not be due to the reaction winding at all. Assuming that there are only sufficient turns of wire to give normal reaction results, interaction between the H.F. and Detector stages would result in a whistle, and the output valve may also oscillate and produce a similar sound. You must, therefore, first assure yourself that it is the reaction which is at fault. If you disconnect all reaction leads and the noise persists, it is definitely not the reaction coil, and you would have to look elsewhere for the instability. Cutting out the L.F. stage will decide whether or not the output valve is at fault, and eliminating the H.F. stage will enable you to find just where the trouble arises. Remember to keep grid and plate wiring separate and well spaced, and use metallized valves for H.F. and Detector stages, or separate the complete stages by a metal screen.

### EARTH TYPES

**"I have just moved to a new district and I find that the sub-soil is very chalky and gritty, and I have come from a place where it was all clay. I found that this gave a very good earth, and I am dubious about the new material. Does the quality of the soil affect results? Is it worth while getting some clay from somewhere to put round the earth pot? I do not want a chemical earth because of the flowers."—(V. E. T., Watford.)**

The nature of the soil enters into the effectiveness of the earth only in so far as it enables the earth to remain in a damp condition. A low resistance is essential (as has been pointed out on numerous occasions in our pages), and clay retains the moisture and so enables the ideal condition to be maintained. Chalk and gravel, owing to the good drainage qualities they possess, will not enable a low resistance earth to be obtained, and you should, therefore, either surround the earth tube with some more suitable material, or obtain a chemical earth which is guaranteed not to have deleterious effects on flowers, etc. The majority of the proprietary earths employ metal in a very fine form, and this gives a better conducting medium when combined with ordinary soil or clay.

## DATA SHEET No. 35

*Cut this out each week and paste it in a Note-book.*

### INDEX TO DATA SHEETS ALREADY PUBLISHED.

No.
1—Drill sizes.
2—Copper Wire data.
3—Copper Wire data (contd.).
4—Letter Drill Sizes.
5—Tuning Coil Data.
6—Tuning Coil Data (Long Waves).
7—Impedance Matching Chart.
8—Frequency Bands.
9—Short Wave Tuning Coils.
10—Dielectric Constants
11—Capacity of Air Condensers.
12—Dielectric Strengths.
13—Litzendraht Wire.
14—Acid dilution for accumulators.
15—Eureka Resistance Wire
16—German Silver Resistance Wire.
17—Resistance of Metals and Alloys.
18—Percentage Errors Permissible in Electrical Testing Instruments.
19—Accumulator Solutions.
20—Frame Aerial Windings.
21—Morse Drill Sizes.
22—Resistance Colour Code.
23—Fixed Condenser Values.
24—Reactance.
25—Handy Formulæ.
26—Handy Formulæ (contd.)
27—Conversion Table.
28—Metric Conversion Table.
29—Weights of Materials.
30—Fractions of an inch and decimal and metre equivalents.
31—Units and their equivalents.
32—Fuse Colour Code.
33—Optimum load for Pentodes.
34—7-pin Valveholder connections.

### COLD VALVE PROBLEM

**"After reading the descriptions of the new cold valve, it seems that this would have a very good application in an ordinary simple crystal set. Would you advise it in place of a crystal detector? The connections would be the same, would they not?"—(S. T., Welling.)**

Whilst the cold valve is a rectifier, it is not recommended in a simple crystal receiver. It would work, of course, if a sufficiently strong signal was passed to it, and it could take its place, for instance, after two H.F. stages. It might prove of advantage in a receiver designed to give high quality reproduction for television purposes, provided sufficient H.F. input was employed. For the simple crystal set, however, it is not desirable.

### TELEVISION DISC PROBLEM

**"I have started to make the Televisor described in your wonderful little book, Twenty-five Tested Wireless Circuits. I cannot at the moment decide how to make the disc with the graduated holes, as I am not sure what degree the larger holes should be increased. Is there a definite relation between the larger holes and the ordinary ones—I refer, of course, to square holes? Can a suitable punch be obtained commercially?"—(W. L. K., Willesden.)**

The graduated disc is not now necessary. The transmitter used by the B.B.C. is of the mirror drum type, and there is no graduation on this. Therefore, if you use a graduated disc, the outside parts of your received image will be slightly distorted. You should therefore cut your disc with equal sized holes. We do not think a suitable punch can be obtained commercially, but the method described in the book may be successfully employed for obtaining a really square hole. Constructional articles on television receivers will shortly commence in these pages.

### CHARGING AN ACCUMULATOR

**"Could you please give me some practical and cheap method of getting low-tension from the Mains? I have two good accumulators, and I am tired of spending money getting them charged, or rather boosted. My current is D.C."—(G. A., Glasgow.)**

As you are on D.C., no actual apparatus is required for charging an accumulator, the only point being that the voltage must be sufficiently reduced. This may be carried out by inserting some apparatus such as a lamp, fire, etc., in one mains lead, and connecting the accumulator from the other mains lead to the remaining side of the apparatus. As, however, you are only requiring a few volts for the accumulator, the difference between your voltage and the required voltage must be wasted, and on D.C. mains this has to be paid for. If, however, you can arrange to connect the accumulator only in the evening, when a table lamp, etc., is required, use can be made of the lamp or fire and expense saved in this way. See the article on accumulator charging from D.C. mains on page 611 of PRACTICAL WIRELESS dated December 10th, 1932.

### HIGH NOTE LOSS

**"I am afraid that some of the high notes are being lost in my set, which gives beautiful reproduction of the bass. Is there any way in which I can replace the top, which I am afraid is due to the particular H.F. circuit I am using?"—(S. C., Highbury.)**

It is, of course, impossible to put back anything which is once lost in the wireless apparatus. It is possible, however, to arrange matters so that certain frequencies are boosted, and so a balance obtained. In the case of the high-frequencies, this may be carried out by arranging resonant circuits so that additional amplification is carried out, and the effect of better top note reproduction obtained, or the bass may be suppressed and the balance obtained in this manner. An article dealing with this question is already in preparation and will appear shortly.

### PENTODE SAFEGUARDS

**"I have been trying out some different types of loud-speaker with my set, which has a pentode valve. I have only tried out two, but it seems to have spoilt my valve as it is only half as loud now as it was at first. I have had the speakers tested and they do not short, so I wonder if I can have damaged the valve by using the wrong speaker. Could you tell me?"—(G. Y. B., Caerphilly.)**

No doubt the manner in which you carried out the test has resulted in the damage, and not the particular type of loud-speaker which you used. We would imagine that you simply connected the speakers in the anode circuit, one after the other, without first switching off. A pentode valve should never be switched on without a load in the anode circuit, as it suffers damage by so doing. The grid-bias plug, also, should not be removed without first switching off. You have undoubtedly damaged the valve and must obtain a new one.

### FREE ADVICE BUREAU COUPON

This coupon is available until May 27th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 20/5/33.


### NEW CLIX WALL PLUG

A SOLUTION to the troublesome problem of faulty plugs is to be found in the new Clix Wall Plug, full particulars of which are given in a leaflet issued recently by Lectrolinx, Ltd. The plugs are non-collapsible, and will return to their setting after they have been inserted, any number of times, in the smallest possible socket. The wire grip is specially arranged to eliminate all strain at the contact point, and the lead wires are firmly gripped in a vice-like contact, dispensing with the usual screw contact-grip. The range of Clix wall plugs include vertical, side entry, and earthing-pin models in all B.E.S.A. amp. ratings. A copy of the leaflet can be obtained from Lectrolinx, Ltd., 79a, Rochester Row, Westminster, London, S.W.1.

### FERRANTI CONSTRUCTORS' RECEIVER CHARTS

WE have just received copies of the seventh edition of the Ferranti Battery Band-Pass Screened-Grid Three and the A.C. Mains Band-Pass Screened-Grid Three receiver charts, recently issued by this firm. A special feature of this receiver, which has enjoyed considerable popularity, is that the band-pass tuning arrangements are supplied already trimmed and ganged, so that the band width is accurately arranged beforehand, a procedure which is extremely difficult on the part of the average constructor. Certain small modifications have been included in the battery set chart since it was first issued, and in the new A.C. mains band-pass chart, mains transformers are included with terminal panels, thus simplifying the connections. Readers requiring one of these charts should write to Ferranti, Ltd., Hollinwood, Lancashire.

### WB SPEAKERS

PARTICULARS of a useful range of their well-known moving-coil speakers are given in a new folder issued by Whiteley Electrical Radio Co., Ltd. The excellent results obtained from these speakers is largely due to the unique "Mansfield" magnetic system, developed by Messrs. Whiteley, which results in greater power from a smaller magnet. A popular model (P.M.5), which is priced at 27s. 6d., complete with tapped output transformer, will work from a small set, yet will handle volume more than enough for a large room. Two other permanent magnet models listed, the P.M.1 and P.M.2, priced respectively at £6 and £4 5s., complete with tapped output transformers, embody all the essentials of first-class speakers. A new energised model (E.M.1) is also listed for working on D.C. supply. Several speakers housed in attractive cabinets, either of polished oak or walnut, are also shown. The address is 109, Kingsway, London, W.C.2.

## Replies to Broadcast Queries

C. H. NOTHER (Dorset): OH5NG, Armas Wahlstedt, Pontuksenkatu 36, Viipuri, Finland; OZ2, Paul Poulsen, Thorsgrade 54, Odense, Denmark; SP3AR, Jan Ziembicki, Bielowskiego 6, Lwow, Poland. ALLWAVE (Liphook): G2RA, regret cannot trace; write to *Radio Society of Great Britain*, 53, *Victoria Street, S.W.*1; G6VK, A. E. Brookes, 19, Alexandra Road, Uplands, Bedminster, Bristol (Glos.); G6PY, L. W. Parry, 13, Huddersfield Road, Barnsley, Yorkshire; G6CY, A. S. Clacy, "Winwood," Portland Road, Hove, Sussex; G5RD, regret cannot trace, write to R. S. G. B. G5UI, J. E. Perkis, 67, Arthur Street, Ryde, Isle of Wight; G5ML, F. W. Miles, "Tudor Lodge," Gibbet Hill, Kenilworth, Warwickshire; G15QX, J. N. Smith, 73, Oakland Ave., Bloomfield, Belfast, Northern Ireland; GLS, commercial transmitter in Ongar, Essex, England; GPY, regret, cannot trace. SHORTWAVE (Torquay): VLK, Sydney, N.S.W. (Australia) on 30.75 m. working with London Terminal. MORSE (Leeds): G1K, Oxford; CKI, Drummondville (Quebec). P. HOWLETT (Tring): Do you not mean GBC, Rugby? GSWV is the call sign of a ship (Tug, *Swarthy*). LIFE READER (Colchester): G2AF is the call sign of C. Bryant, 5, Creffield Road, Colchester, Essex; G5RC is not in published lists; advise you to write to *Radio Society of Great Britain*, 53, *Victoria Street, S.W.*1. E. C. BEDFORD (Seven Kings): G2CD, regret cannot trace; write to R. S. G. B.; G6WG is the call sign of A. C. Webb, 10, Aberdour Road, Goodmayes, Ilford, Essex. D FAN X (S.E.5): (1) YVIBC, Caracas (Ven.) on 49.08 m. (6,112 kc/s); (2) G2GF is the call sign of P. E. A. Griffiths, 12, Glencoe Mansions, Chapel Street, Brixton, S.W.9.; (3) Cannot trace WIXAD in any published list; there is a WIXAV, Television transmitter on a lower frequency. SKIPPER (Blackburn): GBR, Rugby; GGD, cannot trace; possibly Coastal station; do not know wavelength. J. E. FULLER (Middlesbrough): G6CV is the call sign of T. S. Garrard, 50, Lambeth Road, Lenthorpe, Middlesbrough-on-Tees. SUPERHET (Kingston): This was Algiers; it gave a short concert "sandwiched" between two broadcasts of dance music.

## RADIO CLUBS & SOCIETIES

### OLDHAM MEN'S INSTITUTE WIRELESS SECTION

Will radio amateurs in Oldham please note that a class is in progress at Ward Street School? The lectures and demonstrations are in the capable hands of Mr. Baggs. To beginners, and those who wish to further their interest in wireless, we extend a welcome, and in Mr. Baggs will be found a most helpful and interesting lecturer. At present we are taking Class B amplification, and if you are an interested beginner please write to A. Wolfenden, 18, Stanley Road, Hollinwood.

### ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

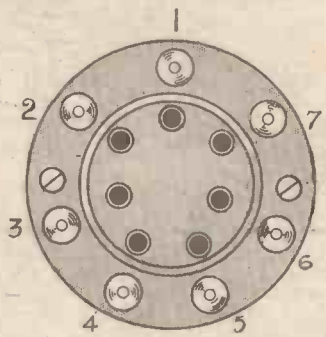
Readers who have never heard America (and those who have) are invited to a unique demonstration of recordings (made by Leslie W. Orton) of the following, and other, American stations: WCAU, Philadelphia; WPG, Atlantic City; W1OD, Miami; WTIC, Hartford; WGY, Schenectady; WJZ, Boundbrook; WJR, Detroit, etc. The records will be played over, with explanations, on Thursday, June 1st, at 7.30 p.m. Particulars may be obtained from Mr. Walter Cope, hon. secretary South London Branch, Anglo-American Radio and Television Society, 7, St. Alphonsus Road, Clapham, London, S.W.4.

### THE CATFORD AND DISTRICT RADIO AND TELEVISION SOCIETY

Members of this society listened with great interest to their chairman, Mr. H. S. Ryland, who gave them an informal talk on "Make-shift Meters" for use in radio. First of all, he explained exactly what we wanted to measure and why. Here he stressed the importance of the meaning of "Rate of Change" in electricity, and gave one or two very lucid examples of its meaning. The only meter required was stated to be an 0-100 Milliammeter, and also some electrical standard of electricity. For this the Daniel cell was recommended and the speaker explained very fully the construction of this simple cell. As regards taking actual measurements, the importance of taking average readings was dealt with. Various examples of using these home-constructed devices were given, and these were followed by methods of taking A.C. readings. The speaker also explained a novel method of using a carborundum crystal as a rectifier, also a modified form of the Wheatstone bridge. Hon. Secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23.

## DATA SHEET No. 33—CORRECTION

Data Sheet No. 33 in PRACTICAL WIRELESS dated May 6 gave the connections for the new 7-pin valves. Some doubt has arisen as to the correct numbering




of the valve pins, and the drawing herewith shows the *valveholder* numbering. The drawing on the Data Sheet in question shows the *base of the valve*, and, obviously, the numbering is reversed in this case.

## AN INEXPENSIVE VALVE TESTER

*(Continued from page 321)*

serious experimenter may like to approximately determine their characteristics. The most important characteristics are mutual conductance, internal resistance, and amplification factor, and these can be approximately determined in the following manner. Connect the tester leads to normal working G.B., L.T., and H.T. voltages. Increase the G.B. voltage 1½ above normal and note anode current as indicated on the meter, and then decrease the G.B. voltage 1½ below normal, and again note the anode current. The mutual conductance will be equal to the change in anode current divided by the change in G.B. voltage (3 volts). Restore the G.B. plug to its normal socket, and then increase the anode voltage 12 volts above normal, and then reduce it to 12 volts below normal, and note the anode current registered on the meter in each case. The internal resistance will be equal to the change in anode voltage (24 volts) divided by the change in anode current. The amplification factor may then be calculated by multiplying the mutual conductance by the internal resistance and dividing by 1,000.

**Components Required**

One milliammeter (0-20or 0-50 Bulgin).
One five-pin valve-holder.
One four-way battery cord.
One two-way cord.
Six terminals. One piece of ebonite 5in. square.

| Valve. | H.T. Voltage 120 |
|---|---|
| *No bias* | *Milliamps* |
| H. | 1—1.5 |
| H.F. | 1.5—2 |
| H.L. | 2—3 |
| S.G. | 2—4 |
| *With bias* | |
| L.F. | 2—4 |
| P. | 5—8 |
| S.P. | 10—15 |
| Pentode | 4—6 |
| P. Pentode | 12—15 |

*Fig. 4.*

## ADVERTISEMENT INDEX


| | Page |
|---|---|
| British Blue Spot | 341 |
| British Radiophone | *Fourth Cover* |
| Bulgin | 343 |
| Cossor | 329 |
| Graham Farish, Ltd. | 334 *and* 345 |
| Heayberd | 340 |
| Home Library | *Third Cover* |
| I.C.S. | 346 |
| Jackson Bros. | *Second Cover* |
| Lectro Linx | 334 |
| London Electron Works | 343 |
| London Radio | 339 |
| Lumen Electric | 343 |
| Mason, E.C. | 343 |
| Omnora, Ltd. | 345 |
| Pearl & Pearl | 339 |
| Peto Scott | 341 |
| Picketts, | 340 |
| Pioneer Radio | 340 |
| Reproducers and Amplifiers, Ltd. | *Fourth Cover* |
| Riverside Manufacturing Co. | 339 |
| Smith & Sons | 336 |
| Southern Radio | 339 |
| Varley | *Second Cover* |
| Vega | 336 |

P. W. Gift Stamp No. 34

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.

# Practical Wireless

3D.

Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 2.——No. 36.
MAY 27th, 1933.
Registered at the G.P.O. as a Newspaper

## Operating the "Featherweight" Portable Four

ALL ABOUT STROBOSCOPES

TROUBLES IN BATTERY-FED AMPLIFIERS

NEW IRON CORE COILS—AND REMOTE TUNING CONTROL

BUILDING THE RADIOPAX CLASS B FOUR,

Etc., Etc.


# ROUND *the* WORLD *of* WIRELESS

### Politics and the Microphone

PRESS and official stenographers in the Northern Ireland House of Commons have now seen their task facilitated in taking down the speeches of the members, as microphones have been installed in front of the speakers. The speeches are duly amplified by the Marconiphone public address system and broadcast, through loud-speakers, erected in the Press Gallery.

### New Studios for Leeds

ON account of its very satisfactory position and nearness to the more densely populated part of Yorkshire, Leeds has been chosen by the B.B.C. as the site for new broadcasting studios, which were opened a few days ago in Woodhouse Lane. The B.B.C. intends to co-operate with the various activities which will take place in Yorkshire during the months of June and July. Another interesting fact is that these studios will serve as a repeating station between London and the provinces.

### Relays *via* Liners

FOR the relay of a running commentary on the Tripoli (North Africa) Grand Prix Automobile Race to the Italian broadcasting stations, the Rome studio authorities utilized the services of one of their liners, S.S. *Conte Biacamano*. The re-transmission was carried out on short waves and passed on *via* Coltano (Pisa) to the Italian broadcasting net, including Rome (Prato Smeraldo), operating on 25.4 m.

### New German Interval Signals

INSTEAD of the metronome signal listeners may now hear between items from Breslau and Gleiwitz a musical signal consisting of the first few bars of a famous German military march (*Hohenfriedberger*), which commemorates the victory of Frederick the Great over the Austrians in Lower Silesia, on June 4th, 1745. Frankfurt-am-Main and Cassel have also adopted a short melody as a signature tune, namely, the first notes of a popular local song: *Zum Rhein, Zum Rhein, Zum Deutschen Rhein.*

### Louder Signals from Grenoble, PTT.

ON the upper channels of the medium waveband broadcasts may soon be picked up at better strength from Grenoble (PTT) France, as the power of the station within the next few weeks will be increased to 15 kilowatts. The transmitter is an old one, dating back to 1925, when its first broadcasts were made on 500 watts.

### Additional Fécamp Studios

RADIO Normandie, in its endeavour to provide a broadcasting service for the North Western districts of France, in addition to its existing studios at Fécamp and The Havre, has also opened others at Dieppe, Eu, Le Treport, Mers-sur-mer, Berck-plage and Boulogne. The Calais Radio Club is also taking steps to install a studio to link up with the Fécamp transmitter. Programmes during the summer months will be drawn from these different seaside resorts.



### Private Microphone Broadcasts

DURING the period of the annual International Trade Fair at Budapest, at specified hours of the day visitors, on payment of a small fee, will be allowed to broadcast messages and greetings through the studio microphones. These private communications will be relayed to the provincial transmitters.

### European Radio Statistics

EXCLUDING Russian stations at the end of 1929, forty-eight broadcasting stations were operating in Europe; on January 1st, 1933, the number had increased to 206, for which the Prague Plan was able to provide 105 exclusive channels and ten common wavelengths. To-day, if the full list of transmitters is examined, it will be found that, including Russia, there are nearly three hundred stations on the air every evening. In three years the number of transmitters erected by the Soviet Government has increased from forty-eight to eighty-five!

### Vienna's Super Transmitter

AUSTRIA'S new 120 kilowatt station will be officially launched on the ether at 12 noon (B.S.T.), on May 28th. Until that date listeners will hear it testing daily outside programme hours, namely, in the early morning and when the Rosenhügel transmitter has closed down for the day. For experimental purposes, the Vienna entertainments are also rebroadcast on 1,255 metres with a power of 3 kilowatts. The new station will take over its duties with a series of performances from the Vienna State Opera House; these include relays of Wagner's Ring (*Rhinegold, Valkyrie, Siegfried*, and *The Twilight of the Gods*). Several open-air broadcasts by massed military bands playing on the Heldenplatz, Vienna, are also contemplated. The bringing into operation of Austria's new high-power station will be made to coincide with an extension and improvement of the wireless programmes.

### Tessin's Unfavourable Wavelength

RECENT tests of the new 20 kilowatt Monte Ceneri (Switzerland) transmitter, on 680 metres, having caused interference with shipping services in the 600 to 800 metre-band, further trials are to be made on 720 metres. The latter channel is the one at present used by the local low-power Geneva station, which, during the period of the tests, will work on 680 metres.

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

### Ultra-short Waves

IN common with the United States of America, Germany and Great Britain, Italy has also decided to study the possibilities of transmissions on ultra-short waves and to this end has erected a special technical laboratory and transmitter at Torre Chiaruccia. Experiments are to be carried out in broadcasts on channels below 5 metres.

### Payments in Kind

IN view of the economic conditions prevailing in the Argentine Republic, where broadcasting stations are solely maintained by revenue derived from microphone publicity, the studios have been hard-put to secure payments in money from their advertizers. In an endeavour to solve the problem, in many instances, the bills have been settled by payment in goods and some stations have been compelled to accept live-stock and food products in lieu of cheques. A New York paper reports that at Rosario the broadcasting station was offered a jaguar, owned by the proprietor of a travelling circus, in settlement of an account. After some negotiation, the studio agreed to accept domestic animals to the same value and the bill was receipted in due course.

### Two New U.S.A. Giants

THE 50 kilowatt transmitter, KPO, erected at San Francisco (Cal.) is expected to be ready for work this month; it operates on 680 kilocycles (440.9 m.). The cost of the plant is said to amount to 250 million dollars. KPO is the key station of the Pacific Coast network of the National Broadcasting Company of America; its previous signals on 5 kilowatts have been picked up on this side of the Atlantic. KFI, another 50-kilowatt transmitter, at Los Angeles, also affiliated with the N.B.C., has now been working for some time on 640 kilocycles (468.5 m.).

### Development of Canadian Radio

THE Canadian Radio Broadcasting Commission, which now has more than one-and-a-half million dollars derived from licences at its disposal, is projecting a complete reorganization of the Canadian broadcast system. It has purchased the main stations of the CNR chain and will reconstruct their plant to secure increased power. In addition, the new plan calls for the erection of a 50 kilowatt transmitter at Montreal. The call signs of the old CNR stations will be altered; the letters NR (National Railway) being exchanged for RB (Radio Broadcasting). CRBO, late (CNRO) Ottawa will become one of the main stations of the network.

### High-power Stations in Mexico

D.X. searchers may shortly be given good opportunities of tuning in Mexican broadcasts at good strength for, according to a report published by the U.S.A. Department of Commerce, two high-power transmitters installed in the province of Coahuila, on the Mexico-United States border, are now ready to function. XER-XEF, at Villa Acuna, has been licensed by the authorities to use 500 kilowatts on both 735 kc/s. (407.9 m.) and 665 kc/s. (450.9 m.); XEPN, Piedas Negras, rated at 22 kW., works on 885 kc/s. (338.8 m.). These are privately owned stations of which the programmes destined to the border towns are broadcast in both the Spanish and English languages.

## INTERESTING and TOPICAL PARAGRAPHS

### CHARMING THE NIGHTINGALE

*Bluebell Woods at Foyle Riding. Miss Beatrice Harrison is seen with her 'cello, which the singing birds love to acccompany.*

### Jamming Propaganda Broadcasts

LISTENERS may have noticed that during the past few weeks all propaganda broadcasts carried out by Moscow transmitters in the German language have been jammed to the extent of making them partly, if not wholly, incomprehensible. It would appear that this has been done by the countries to which these addresses were destined. Many European States are taking measures to counteract, by special broadcasts, the possible effect of the Moscow news or other topical bulletins; Prague, for instance, proposed to transmit a series of lectures for broadcast in the Russian language. A report from Nagasaki states that at the cost of over £100,000 the Japanese Government is erecting at Kurume a 100 kilowatt transmitter with the intention of causing interference to both the Russian and Chinese stations which have been putting out anti-Japanese propaganda. Kurume is a small town situated at about fifty-five miles to the north-east of Nagasaki.

### The Nightingale Again!

WHEN the song of the nightingale was first relayed from Oxted, home of the musical Harrison family, nine years ago, the little bird was put off his note time and time again by the raucous noise of motor horns and exhausts of the curious-minded who discovered the spot from which the relays were being attempted and motored down to Surrey for no other purpose, presumably, than to be able to say afterwards: "Did you hear the nightingale broadcast? I was there."

One useful purpose was served by these intruders. Listeners who stayed at home and tuned in to 2LO heard not only the song of the bird, but the noise of motor-car engines, and knew that there was no fake about the B.B.C.'s effort. When, however, the scene was changed in later years to the Berkshire woods, rumour had it that the B.B.C. wasn't really relaying the song of actual nightingales, but was using a gramophone record. Even the striking of midnight by the village clock and the sturdy song of a reveller wending his homeward way, which were heard on the first occasion after the remove, as a background to the full-throated, joyous song of the birds, were not sufficient to discourage the rumour.

Two or three years ago, the O.B. Director crawled through the bushes to the microphone and asked the listening world to take his word for it that he was actually speaking from the scene of the relay and that it was no fake. Listeners may accept again this year a similar official assurance that in the third week in May the nightingale's song will come to them, with the help of the B.B.C. engineers, from Berkshire woods.

## SOLVE THIS!

### PROBLEM No. 36.

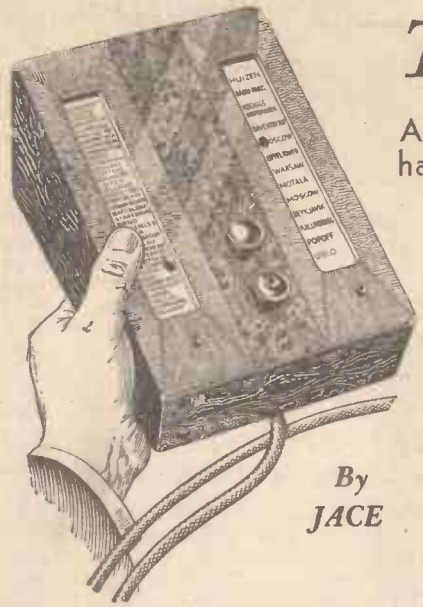
Franklin's home-made receiver employed simple plug-in coils of his own construction. He found that the wavelength range covered by the largest coil only just received the Northern Regional, and he decided that a further 20 turns could be added to the coil. He therefore wound a small coil containing this number of turns and connected it in series with the existing coil. Instead of increasing his tuning range, however, matters were worse. Why? Three books will be awarded for the first three correct solutions opened. Address your solutions to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and post to reach here not later than May 29th.

### SOLUTION TO PROBLEM No. 35.

The effect was due to what is known as "modulation hum," and may be cured by connecting a centre-tapped condenser of suitable value across the secondary winding of the mains transformer. The centre-tap is earthed.

The following three readers received books in connection with Problem No. 34.

F. Lawson, 25, Brougham Street, Skipton, Yorks.
A. G. Bennett, 13, Florence Road, London, N.4.
G. E. Partington, 27, St. Andrew's Road, N., St. Annes-on-Sea.



# The Very Latest Developments

## Advance Information regarding Three Interesting Inventions which have reached the final stage.—The Halford Remote Tuning Control; The Igranicore Iron-core Tuning Coil, and Cathode Control

By JACE

IT is quite possible that the reader has by now become so used to the announcement that something new has been produced in the radio world that he ceases to be interested in new developments. This year has seen the most remarkable strides that have yet been made in wireless practice. It is not necessary to recapitulate, as the reader cannot have forgotten anything so soon. The iron-core tuning coil has been introduced, and we have already described a receiver in which a set of these coils was incorporated. I have had the privilege, however, of operating a receiver on the 13 to 80-metre wave-band in which the aerial coil was of the iron core type *and was enclosed in a metal can.* In addition, the intermediate frequency transformers were also of this type. Such a thing was thought almost impossible not so very long ago. What is more important, the results obtained by these coils were really remarkable. Background noises were conspicuous by their absence; tuning was simplified; range was increased; hand-capacity was removed, and the receiver was built on the lines of an ordinary broadcast set with no elaborate spaced lay-out or extension spindles for control purposes. The coils, which are not yet ready for the market, are of a new type, and require no air-gap in the core for matching purposes. They are known as "Igranicore" coils, and are manufactured by Igranic, Ltd. The core is so accurately designed that it is sufficient to wind on the required number of turns, and the coils are almost identical. The removal of one turn or so enables matching to be accurately carried out, and this is a great advance on the majority of methods of iron-core construction. Furthermore, the method of manufacture permits of a coil which is very robust and is unaffected by heat. A receiver is undergoing tests in the PRACTICAL WIRELESS laboratories which employs these coils, and it will be released to our readers as soon as the coils are obtainable by the man in the street. The coils will be available in several types

Type A—Simple aerial coil with reaction and coupling winding covering 210 to 510 metres on one band and 950 to 2,200 on the long wave-band. Any standard circuit is suitable.

Type H.F.—Similar to Type A, but intended for coupling H.F. valve to a detector valve. Types A and H.F. are accurately matched before leaving the factory to enable ganging to be effectively carried out.

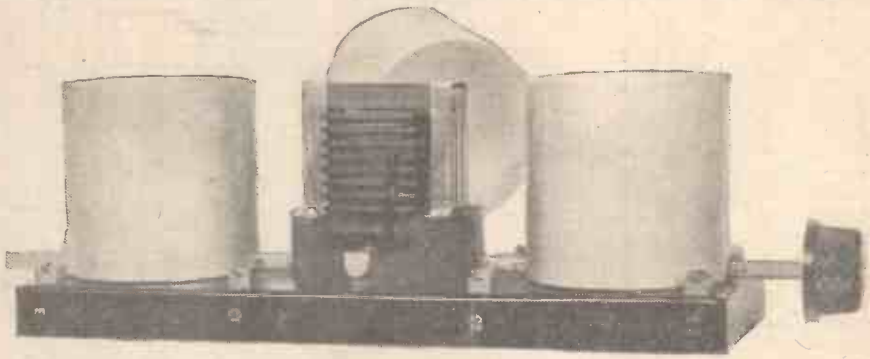
A further type consists of a Dual Range Band-Pass and H.F. Coil Unit, ganged on a base plate with wave-change switch. To complete the band-pass circuit an external .01 coupling condenser is required. The band width is approximately 8 to 10 kc/s, and a photograph of these three-gang coils is reproduced below.

### Cathode Control

With the ordinary method of automatic volume control, although the loud-speaker is only permitted to reproduce a broadcast station at a certain level, the intervals between stations become very noisy, and the operation of a receiver fitted with this form of control is not pleasant, owing to this background effect. With the "quiet automatic volume control," the receiver is certainly silent in between stations, but the total anode current consumption of the receiver remains constant even during silent periods. The latest development, which bears the name Cathode Control, gives the advantage of Q.A.V.C., plus the advantage of Q.P.-P., and a little extra besides. This sounds almost too good to be true, but it is, nevertheless, a fact. The output valve—preferably of the pentode variety, is connected to a driver valve, which is wired in such a way that unless a signal is received, the output valve is "dead." When the signal arrives the output valve becomes operative, and the signal which can be handled is very much in excess of that normally employed by the valve. The grid current is utilised to make good the balance, and by suitably arranging certain resistances, the total undistorted output becomes a very large percentage of the actual anode wattage. When two valves are connected in push-pull on this method, the output is more than doubled, and nothing is heard from the speaker unless a transmission is tuned in. To simplify matters for the amateur it is highly probable that the output valve and the driver will be combined in one glass envelope (as in the case of the Class B valve), and we shall have more to say of this feature in later issues.

### Tele-controlled Radio

Whilst a certain well-known wireless "dreamer" (Why are there so many high-falutin, non-productive, nondescript, dead-head nonentities all posing as radio experts?—Ed.), was spending his time visualizing the radio receiver of the future, and recording his dreams in the public Press, the wide-awake engineers of the Halford Radio Company were spending sleepless nights developing, for present-day use, one of the objects of the dreamer. No longer will it be necessary to disfigure a room with a large wireless cabinet (for it is a disfigurement no matter how ornate the cabinet-work), but to-day the listener may remove the wireless receiver to the cellar, the spare-room, or even the attic and forget all about it. Suitable leads from room to room, and a simple, small device will enable the distant receiver to be operated from any room, and the volume to be controlled better than the receiver itself can be operated. This is made possible by the new development known as Tele-control, which is a device which enables the tuning condenser of a ganged receiver to be rotated through the medium of a small motor, and the gearing is such that it is possible to find a finer setting than is possible by hand on the best slow-motion device. A further and more important feature is that as soon as the operating knob is rotated the receiver is "paralysed" and no sound comes from the loud-speaker until the condenser has been accurately tuned to the station selected, when the valves again become operative and the signal may be heard to rapidly build up in the speaker to the volume desired. The illustration shows the small control panel, and this is carried from room to room as desired. The small push button at the foot of each panel is pressed to bring into operation short or long waves, and the pointer is adjusted to the required setting. A special model is available in Braille for the blind. The device works very smoothly and satisfactorily, and may be attached to any receiver gang-tuned.



*The new triple ganged Igranicore Iron-core Tuning Coil.*

# The "Featherweight" Portable Four

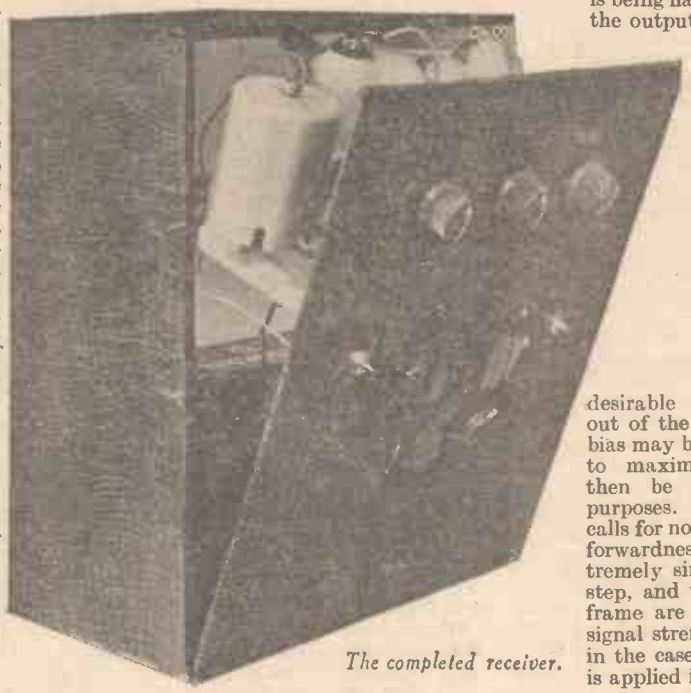
by F.J.CAMM

One or Two Important Points Which Must Not be Overlooked if it is Desired to Get the Best from This Remarkable Little Receiver, Which Carries My Personal Guarantee!

ALTHOUGH all the constructional and operating notes have been given regarding the Featherweight Portable, there are one or two little details which might be stressed, and some finer points which might be brought to the operator's attention in an endeavour to get the last ounce out of this receiver. First of all the wiring. Although there is very little actual wiring in this type of receiver, there is a tendency to run those wires close together. As the circuit consists of an H.F. and detector circuit, each of which is tuned, there is a risk of instability due to unwanted couplings between these two stages. Obviously, it is not possible to screen the aerial side of the receiver, but by the use of a metallized valve and a screened H.F. coil the interaction may be reduced to a negligible quantity. If, however, the wiring is badly carried out the good work which has been done in the designing of the circuit, and the experiments which have been carried out with regard to the actual layout, etc., will be undone. Therefore, watch the wires when making the connections, and see that those leads which are concerned with the H.F. stage are kept well separated from those of the remainder of the circuit. If you find, when first trying out the receiver, that the receiver bursts into oscillation, even with the reaction condenser at zero, you will know that the wiring is responsible for it.

### The Frame Aerial

The winding of the actual frame aerial should occasion no difficulty, and the only point which requires attention is to see that sufficient tension is applied to the wire whilst winding is in progress, to prevent the turns slipping out of the grooves in the little bakelite spacers. A simple way out of this is to get a friend to help you and to hold the front of the cabinet whilst you wind on the wire. He can keep his fingers over the spacers and just remove them while you insert the wire, and you may proceed from corner to corner in this way. It is not difficult to carry out the winding on your own, however, provided you keep sufficient tension on the wire. Afterwards, Chatterton's compound, or ordinary sealing wax will prevent any trouble.



*The completed receiver.*

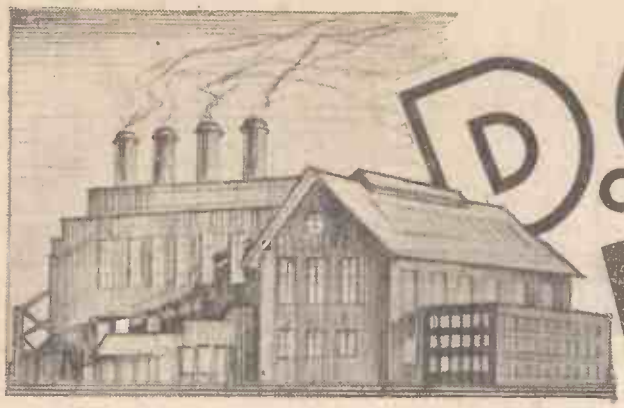
### The Class B Valve

Much has already been written in these pages regarding the output stage which is employed in this receiver, and, although the output is tremendous, you must bear in mind that the current taken from the battery will vary in accordance with the volume at which you permit the receiver to operate. When the maximum volume is being handled, the peak voltages taken by the output stage will quickly discharge the H.T. battery. If, therefore, the receiver is required for the whole of the season, and it is desired to make one H.T. battery last, the volume must be reduced. Where the nearest station is so close that the receiver gives out a very large signal, the cabinet should be turned so that the strength is reduced, and this will result in a saving of battery current. The maximum grid bias voltage should also be used for the same purpose, although in some cases—tennis dances for instance—it may be found desirable to get the very last ounce out of the receiver. In this case the grid bias may be reduced and the volume turned to maximum. Sufficient volume should then be obtained for outdoor dancing purposes. The operation of the receiver calls for no further comment as the straightforwardness of the design makes it extremely simple to keep the two knobs in step, and the directional properties of the frame are used to produce the maximum signal strength, or act as a volume control in the case of excessive volume. Reaction is applied in the ordinary way (through the medium of the centre knob), and no difficulty at all should be experienced in this connection.

I would repeat the suggestion made last week with regard to the actual construction of this receiver. If you feel unable to carry out this yourself, you can have the assembly done for you by either Messrs. Peto Scott or Messrs. Burne Jones. It should hardly be necessary to emphasize that, if you wish to take advantage of my guarantee it is essential that not the slightest departure be made from the specified components.

### SPECIFICATION OF FEATHERWEIGHT PORTABLE

Two Utility Bakelite Condensers, .0005 Type, W. 297.
One Wearite H.F. Choke, Type H.F.P.A.
One Lissen Dual Range Shielded Coil.
One Graham Farish Litlos Condenser, .0003.
One Graham Farish Ohmite Spaghetti Resistance, 10,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 50,000 ohms.
One Graham Farish Ohmite Spaghetti Resistance, 100,000 ohms.
Three Clix 4-pin Chassis Type Valve-holders.
One Clix 7-pin Chassis Type Valve-holder.
One Bulgin On/Off Switch, Type S. 38.
One Bulgin Wave-Change Switch, Type S. 36.
Four Bulgin Frame Aerial Spacers, Type I.12.
One Bulgin Senator Transformer, Type L.F. 12.
One Lissen Class B Driver Transformer.
One 2-megohm Grid Leak, with wire ends, Lissen.
One T.C.C. .01 mfd. Fixed Condenser, Type M.
One T.C.C. .0002 mfd. Fixed Condenser, Type M.
One T.C.C. .002 mfd. Fixed Condenser, Type M.
One T.C.C. .1 mfd. Fixed Condenser, Type 50.
One T.C.C. 1 mfd. Fixed Condenser, Type 50.
One T.C.C. .001 mfd. Fixed Condenser, Type M.
One Cossor 220 S.G. (Metallized) Valve.
One Cossor 215 P. Valve.
One Cossor 210 H.F. (Metallized) Valve.
One Cossor 240 B. Valve.
One Rola Loud-speaker, Type F.5-PM-14-Class B.
2 ozs. 24 D.C.C. wire and 2 ozs. 34 D.S.C. wire for frame.
One Ediswan 120-volt H.T. Battery, ref. 69706.
One Ediswan 9-volt Grid Bias Battery, ref. 69807.
One Ediswan 2-volt accumulator, E.L.M.2.
Four Wander Plugs (H.T.+, H.T.—, G.B.+ and G.B.—).
Two Spades (L.T.+ and L.T.—).
One coil Glazite, flex, screws, wood for case, carrying handle, etc.



# D.C. MAINS PROBLEMS

2nd ARTICLE

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

TOWARDS the end of the last article I introduced the question of the wireless receiver as applied to the man who wishes to derive all the power for feeding it from the D.C. mains. I propose now to go a little deeper into the question.

First of all, what types of valves are available? There are really four of them, the differences arising from the various filament ratings. Initially, we have those with filaments taking 0.5 amp. at 6 or 8 volts; secondly, the 0.25 amp. at 16 volts, thirdly, the 20 to 30 volt filaments consuming 0.1 amp., and, finally, the full mains voltage valves.

These last named are of foreign origin, but have the advantage that they are of the indirectly heated type, and can be connected straight across the mains without any breakdown resistance in series. They make circuits possible which can be used on either A.C. or D.C. mains at will. The principal disadvantage arises from the fact that the full mains potential lies between one end of the heater and the cathode, and in consequence, the insulation must therefore be of the highest quality to get sufficient length of service out of the valve. In spite of this, the valves appear to be capable of producing really first-class results, and no doubt more will be heard concerning this class as the types available in the range increase, so as to embrace all requirements.

### Consumption

Coming now to the first three sets of valves mentioned, they are essentially similar, but naturally those of the highest filament current consume the greatest power. Assuming, for the purposes of comparison, that the mains are rated at 200 volts, and allowing, of course, for the anode current, we can say that with the half-amp. class the consumption is about equal to that of two 60-watt incandescent lamps to one 60-watt lamp for the 0.25 amp. filament, and to just under half this value when we come to the 0.1 amp. range.

As far as the anode feeds are concerned, the circuits used for D.C. mains sets follow similar lines to that employed for A.C. receivers, and a reference to Fig. 1 will show you where the difference lies with the filaments. For grid-bias there are, of course, several alternatives of the automatic scheme. In the case shown, the bias to the high-frequency valve is obtained by using the fall of potential across the resistance R1 in the negative lead. R2 is merely an orthodox decoupler. With a grid-leak detector, we have one end of the grid-leak resistance taken to the cathode, which is earthed, while for the last valve there is the usual decoupled automatic bias scheme.

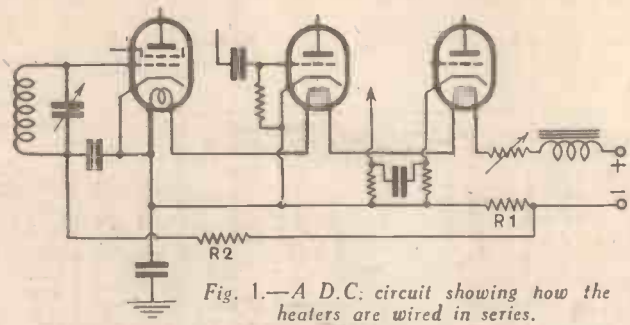



*Fig. 1.—A D.C. circuit showing how the heaters are wired in series.*

### Filament Smoothing

The valve heaters are wired in series as stated earlier, with a breaking down resistance to limit the current to the required value. It is a very sound policy to include an ammeter in the filament circuit, so that the resistance can be adjusted to give the exact current value. In addition, it is essential to incorporate an iron cored filament smoothing choke, this component being wound with wire capable of carrying continuously the full filament current without any overheating. A suitable rating for, say, the half amp. valves is 0.5 henry.

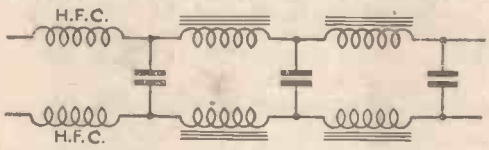



*Fig. 2.—An elaborate smoothing circuit for a D.C. mains supply.*

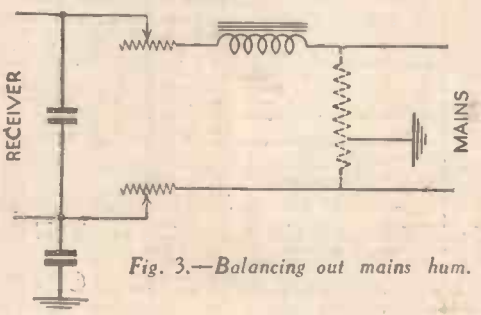



*Fig. 3.—Balancing out mains hum.*

Of course, in the feed to the anodes another choke is necessary, and this should have an inductance of about 30 henries

It should be apparent to readers that the use of indirectly heated filaments minimizes considerably any trouble arising from mains interference, but districts vary so considerably and some supplies are so "raw," that audio-frequency ripples are introduced into the set, and affect the grids of the valves. Adequate filtering generally will overcome this, for nothing is a more unpleasant background than mains hum, when listening to any broadcast item.

### Overcoming Mains Hum

On the other hand, cases arise where mains hum is still present even after filters have been incorporated. These demand special treatment, and one of the following suggestions usually will overcome the difficulty. If there is the slightest doubt as to the hum being introduced directly through the mains, it is advisable to add another filter, to that already present. This is shown in Fig. 2, two high-frequency chokes being incorporated for reasons to be explained in a moment.

When an additional filter fails to clear the trouble, the hum is brought about by some external source. For example, direct induction between the receiver (especially if it has one or more high-frequency stages) and one or both of the mains. This ripple often has a high-frequency component as well, and it is for this reason that high-frequency chokes are added. These chokes can be bought, or alternatively, the old-fashioned plug-in coils will often be of service, provided they are wound in such a manner that their self-capacity is a minimum, and in addition, the wire is of sufficiently heavy gauge to carry the mains current continuously without overheating.

### Another Source of Hum

Occasionally it is found that there is a substantial difference of potential between the earthed main and the earth itself, and this can be a fruitful source of hum. A scheme which has been suggested for dealing with this difficulty is shown in Fig. 3. As will be seen, it is, in effect, a method of balancing such as one would use in a "bridge" circuit. The negative end of the receiver proper must be adjusted so that its position from the relative potential point of view is identical to that of the so-called earthed main.

*(Continued overleaf)*

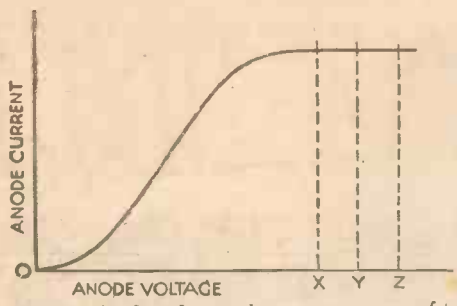



*Fig. 4—Anode-volts anode-current curve of two-electrode valve.*

(Continued from previous page)

This is effected by having variable resistances at each end of the filter, and by adjusting them carefully, it is possible to arrange matters so that each side of the "bridge" is similar (if resistance in negative side is increased, that in positive side must be decreased, and vice versa) and the hum, in most cases, will then vanish.

Naturally, every possible precaution should be taken in the wireless receiver itself to shield what are commonly termed vulnerable points. The detector and high-frequency circuits need special attention. All coils should be "canned," and the tuning condensers also, and the leads, if necessary, run in metal braiding which must be earthed. Keep the mains leads passing to the filaments as distinct from other parts of the circuit as possible, and as a further tip, remember that it may be advisable to use twisted or lead-covered cable for the actual loud-speaker leads, as they are liable to be victims of hum due to induction.

### Another Smoothing Device

Before finishing this article, I think it will be of interest to recall to readers a method for smoothing D.C. mains ripple, which was suggested some years ago, before mains valves, of the indirectly heated type, had come into general use. This idea made use of the saturation effect produced in a two-electrode valve, or three-electrode valve with plate and grid joined together. In Fig. 4 is shown the usual anode voltage-anode current characteristic, and it is seen that after a certain anode voltage is reached the plate current remains constant at its saturation value.

If the plate voltage is adjusted, say, to the point Y, then any voltage fluctuation YX or YZ will make no difference to the current flow. Very well, then, suppose we connect a resistance in series with the positive main and the valve anode, as in Fig. 5. When the resistance is adjusted to be *less* than a certain value, there will be a constant potential across it, provided the resistance is then not altered.

This will be understood if we take a simple example. Imagine the lowest saturation voltage for the valve of Fig. 4 is 80 volts. Then, increasing this value by the figure of 20, to allow for the most excessive ripple, and assuming the current flowing from the valve under these conditions is 10 milliamperes, we have a voltage of 200 minus 100 available across the resistance, when 200 volt D.C. mains are connected. The resistance value will be 100 divided by 10 milliamps, that is, 10,000 ohms. Provided the "ripple" does not exceed 20 volts, this voltage across the resistance cannot alter, for the valve may be looked upon as absorbing the fluctuation, and the current flowing through the valve and resistance does not alter. Reducing the resistance value will not alter the current flow, but, of course, the voltage available across the extremities of the resistance becomes less. On the other hand, if the resistance is increased beyond a certain limit, the valve saturation condition no longer holds, and the voltage fluctuations will be noticed.


*Fig. 5.—The anode resistance in circuit.*

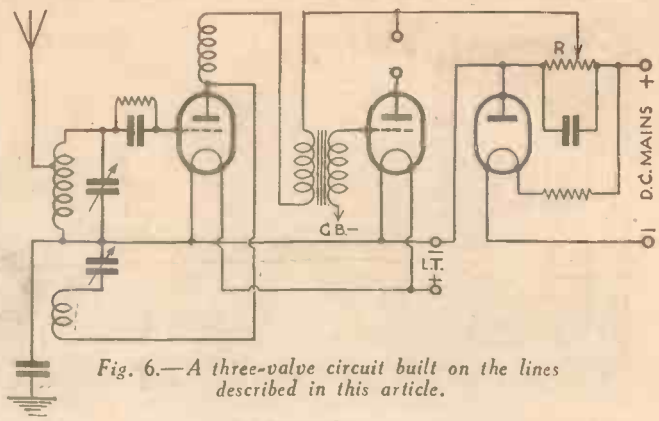



*Fig. 6.—A three-valve circuit built on the lines described in this article.*

### An Example

The prime objection to the scheme is the limitation of the voltage and current available for receiver working, but by choosing a valve which has a large anode current saturation value for a relatively low anode voltage, the scheme can be made operative, using, in the receiver proper, directly heated filaments of the 100 milliampere class. As an example, a simple circuit is shown in Fig. 6. Here we have a two-valve set with the valve filaments fed from a two-volt accumulator (which, incidentally, will be kept in a charged condition from the D.C. mains, the charging current being limited by, say, a lamp resistance). L.T.— is taken to the negative end of the "absorbing" valve anode resistance R, across which is a reservoir condenser. The H.T. positive feed is a tap on this resistance as shown, while the filament of the valve is fed from the mains directly through a voltage breakdown resistance.

Schemes such as this were used on many occasions in the past, but obviously they do not find favour now that special mains valves are available, but it is interesting to see what ingenious ideas were exploited at that time to get radio reception at any cost, and yet make use of the mains where possible.

Having dealt with the D.C. mains problems as a whole, the next point of importance to readers is to study an actual design of a complete receiver, and this will form the subject matter of my next article.

# CENTRING THE MOVING-COIL

## With Some Hints on Cleaning the Magnet Gap.

By C. R. GREEN

FOR the proper operation of a moving-coil speaker, it is essential that the coil should be able to move freely in the gap.

It sometimes happens that the centring device works loose, and the coil-former touches the side of the pole piece, or an iron filing finds its way into the gap, resulting in a loss of volume with unpleasant jarring on some notes.

It is not always easy to get the coil-former correctly centred, especially as the gap is so small in present-day speakers. The following suggestion will make the operation a simple matter.

First, remove the loud-speaker from the baffle or cabinet and lay it on a horizontal surface with the diaphragm facing upwards, Remove the clamping ring which holds the edge of the diaphragm and unscrew the centring device. Sometimes this is held by a nut on a threaded rod fixed in the centre of the pole piece.

Other types have three or four clamping screws holding extension pieces at the back of the diaphragm. Now remove the diaphragm, taking care to disconnect the flexible wires coming from the moving-coil.

### Cleaning the Magnet-Gap

To remove iron filings from the magnet gap, the writer has found that the best way is to use a pipe-cleaner smeared with a small quantity of vaseline.

Insert the pipe-cleaner to a depth of half an inch and gently work it round the gap when it will be found that filings and dirt will adhere to the cleaner. This procedure should be repeated until the gap is clear of all possible obstructions. Give the coil-former a very careful wipe over.

Replace the diaphragm and all screws but do not tighten the latter. Obtain three pieces of cigarette paper or very thin card and cut into strips, about ¼in. by 1½in. long. Now insert these between the coil former and the centre pole piece equidistant round the circle.

If the correct thickness of paper strip is used it will be found that the former will be correctly centred.

All that now remains to be done is to tighten up all screws and terminals and then gently withdraw the paper slips. Make certain the former can be moved in and out of the gap by holding the diaphragm at opposite sides. Listen carefully during this movement, when there should be no sound of rubbing if properly carried out.

What it is, how to make one, and its uses for the Radio Amateur

By W. J. DELANEY

# Stroboscopes

THE stroboscope is a most interesting instrument, possessing, apart from its utility, a source of what one might call "scientific amusement." The word is derived from two Greek words *strobos* a whirling, and *skopeo* to view, and means "an instrument for noting velocity by the intermittent lighting of the rotating object." It consists in its simplest form of a disc of paper with a number of light and dark segments arranged round the periphery, and it is fixed to some object which has to rotate at a definite speed. A source of intermittent lighting is arranged close to it, and the segments appear to remain stationary at the correct speed. The reasons for this, and the method of marking out will be described later on, as it is necessary here to state where such a device can be of use to the keen radio experimenter. It might be asked at this point; "What does a wireless man use which has to rotate at a speed and which can require accurate measurements?" There are two such subjects, and they do not require much seeking. The first is the gramophone turntable, and the second the scanning disc used for television reception. Probably the majority of listeners have the former and quite a large number the latter, but there is a very good reason for dealing with the latter for those who have not yet taken up the fascinating branch of wireless. However, more of that anon.

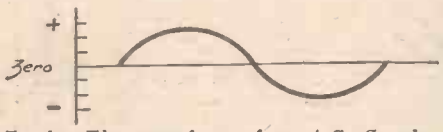



*Fig. 1.—The wave-form of an A.C. Supply.*

### The Gramophone Turntable

Whether you use a clockwork motor, or a simple electric motor, it is essential that it should be capable of rotating the turntable at the same speed as was used when the subject of the disc was recorded. This is now, for the majority of records, seventy-eight revolutions per minute (r.p.m.). Most clockwork motors have a small speed indicator which is screwed to the motor-board, and when purchasng a separate motor this is a loose fitting. It may, therefore, be screwed into any position, and the figure eighty on it may actually correspond with a speed of only 65 r.p.m. Some hold that there is no need to play a record at its actual recorded speed, as the relation between notes is the same at any speed. Whilst this is true, the pitch is definitely altered with speed as is only too apparent when a clockwork motor commences to run down. The gradual fall in tone to an indistinguishable noise, or the fall in pitch of a man's voice, is, no doubt, well-known. If, therefore, the record does not rotate at the same speed as was used for recording the pitch of a person's voice, or the correct musical key of the instrument will not be reproduced. When it is desired to accompany a gramophone singer on an instrument in the home this is most essential. How can we get this accurate speed then? This is where the stroboscope comes in, and the only essential is an alternating current supply. From articles which have already appeared in these pages, our readers know that A.C. (alternating current) operates in a definite wave-form, having the shape shown in Fig. 1. This represents one cycle, and the ordinary electric supply mains in our houses are rated at a certain frequency, which means the number of complete cycles, or alternations, per second.

### The Formula

From the sine curve of Fig 1, it is clear that there are two opposite peaks in one cycle, and if an ordinary electric lamp is supplied from A.C., it will light at each peak and as the current falls to zero in the centre, it will go out once per cycle. This may seem strange to many, but owing to what is known as "visual persistence," and the sluggishness of the ordinary lamp filament, the lamp appears to glow steadily the whole time. It will be shown later that this is not so, and the lamp actually flickers. As the lamp is therefore fully illuminated twice per cycle, we can multiply the frequency of our supply (which means the number of cycles per second as stated above) by two, and this will give us the number of times the lamp will light in a second. Now look at Fig. 2. This shows a disc having eight equal segments marked on it, four black and four white. If this were fitted to a shaft and gently turned the segments would appear to go round in the same manner as the spokes of a wheel. If, however, when in the position shown in Fig. 2, the disc was covered from our sight for a fraction of a second, and the disc turned so that segment A occupied the position now occupied by segment B, and then we were permitted to view the disc again, provided every segment was identical, we should not realize that there had been any movement, and the same thing could be carried out right round the disc.

*Fig. 3.—The gramophone equipped for speed identification.*

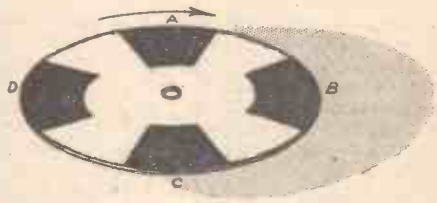



*Fig. 2.—The simplest illustration of a stroboscope.*

This is how the stroboscope works. The disc is rotated, and the light which is operated from the A.C. supply is used to illuminate the disc. When the light is on, the disc can be seen, but when the light is out the disc makes a movement, and upon being illuminated again the segments are once more visible. By suitably arranging the number of segments—according to the number of revolutions which have to be made, in conjunction with the flickerings of the lamp—the disc will appear to remain stationary, due, as shown above, to the fact that one segment moves round to the position occupied by another segment during the time there is no illumination. The formula, therefore, becomes, twice the frequency with which the lamp is illuminated, multiplied by sixty to convert it to minutes, and divided by the number, or revolutions per minute which are required. As the sixty of our numerator, and the doubling of the frequency will always apply it is simpler to take the frequency and multiply this by 120 (which is twice sixty), and divide this by the revolutions required. In mathematical form this becomes $\frac{F \times 120}{R}$, where F is the frequency of the supply, and R the revolutions per minute.

### The Gramophone Stroboscope

It was stated that the gramophone turntable must rotate at 78 r.p.m. The majority of electric supply mains have a frequency of fifty cycles, and, therefore the formula for this is $\frac{120 \times 50}{78}$, which gives us approximately 77. It is necessary, therefore, to arrange 77 segments of contrasting colour on our disc, and this is

(Continued on page 356)

(*Continued from previous page*)

easily carried out with compasses and a protractor. It must be borne in mind that there must be 77 segments of *each* colour. To illuminate this disc, one of the small gramophone lights may be used. The Bulgin lamp, shown in Fig. 3, has been found most useful, and if the lamp in this is operated from the heater winding of an A.C. set, it serves two purposes. It enables the needle to be placed on the first groove easily, and if the stroboscope is cut a

*Fig. 4.—A stroboscopic disc for a television scanning disc—eight segments are required.*

little larger than a standard record label, it may be placed over each record in order to ascertain that the record remains constant throughout the whole of its playing time. If an ordinary battery-operated receiver is in use, an ordinary table lamp may be held close to the turn-table for the purpose, or the normal room lighting may be used if the segments on the disc are sufficiently well defined. If it is desired to get a very marked impression (due to rather poor eyesight or other cause), a neon lamp should be employed. One of the well-known Osglim or beehive night-lights will give a most definite impression owing to the fact that the neon answers so rapidly to the alternating current. The normal electric light will be found quite good enough, however, for ordinary purposes.

**The Television Stroboscope**

It has repeatedly been mentioned that practically any type of motor may be

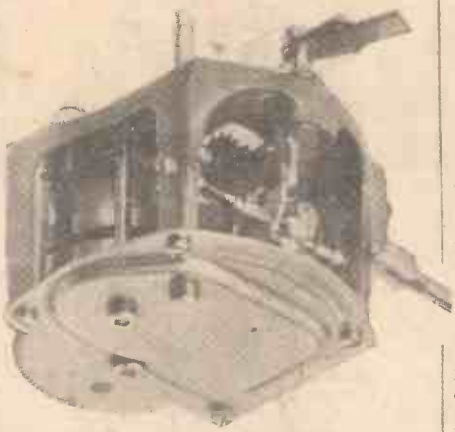


*Fig. 6.—The governor mechanism which should be adjusted to regulate the speed to coincide with the speed control index.*

used to rotate the scanning disc of the televisor, provided it is capable of rotating at the correct speed of 750 r.p.m. Perhaps many of our readers have got an old motor handy, but have hesitated to commence television experiments owing to doubt as to the capabilities of the motor. From the formula given above we see that $\frac{120 \times 50}{750}$ gives us 8 exactly, and this number of divisions is easily marked out on a circle. As the television disc should be 20ins. in diameter, it is a simple matter

*Fig. 5.—The appearance of the gramophone disc shown in Fig. 3.*

to cut out a piece of card to this size and mark out eight black and eight white segments and connect this to the motor to see whether it is capable of developing sufficient power to turn the disc at the correct speed. My own scanning disc is permanently marked in this way as I employ the principle to run up the motor before the transmission commences, and it is much easier to use this visual indication of correct speed than to rely upon the sound of the motor. It also enables you to make sure whether or not the motor runs steadily. With any form of stroboscope, if the segments appear to travel in the direction of rotation the speed is too great, and when travelling in the opposite direction the speed is too slow.

# LITTLE — BUT IT MUST BE GOOD

FEW modern radio receivers will function satisfactorily if a high frequency choke is not fitted at some part of the circuit. For example, the inclusion of an efficient H.F. choke will render a Rienartz reaction control practically independent of the vagaries of the valve plate impedances, but do not let it be a case of curing one evil to incur another, and that is why emphasis is given to the qualitative term *efficiency*.

That being the case, it is useful to see what factors must be complied with before a high frequency choke can really be regarded as efficient, and these will be taken in turn, although this does not necessarily indicate the order of their importance.

**Special Factors**

(1) There must be a large enough number of turns to produce sufficient inductive reactance, that is, the impedance to the flow of the high frequency current even at the lowest frequency which is likely to occur in the circuit. If it were possible to make a perfect choke, that is, a pure inductive coil without any D.C. resistance or self-capacity, the impedance would be directly proportional to the product of the frequency and the inductance. The so-called skin effect of the current flow at high frequencies, the resultant H.F. resistance, and the shunting self-capacity will introduce modifying factors which may upset anticipated performance. Even so the choke, when well designed, should have an adequate choking effect well above the oscillation threshold for a wide band of frequencies (or wavelengths).

(2) The winding should be executed in such a manner that there is an absence of any pronounced resonant peak. Preferably the choking effect should be reasonably even over a wide frequency band, and this is where the points mentioned in (1) have a marked bearing.

**Self Capacity**

(3) The self-capacity of the choke should be kept down to a very low value, it being appreciated that the balance between the inductance and the shunting capacity is what determines any peak effect, and changes the choke into a rejector circuit.

*A group of first-class chokes.*

(4) While the choke generally is more efficient when wound on a slotted former, it must be borne in mind that there should be adequate mutual induction between neighbouring coils to maintain the high impedance.

(5) Unless the insulation between turns and layers is of the highest quality, serious dielectric losses will be introduced by the shunting self-capacity, quite apart from any likelihood of a high frequency short circuit. As an instance of the last named I can recall a case where a dope of incorrect composition was used to impregnate the choke which, at high frequencies, produced a short circuit, and yet at low frequencies the insulation resistance appeared perfect.

(6) The ordinary D.C. resistance must be kept low so as to reduce the voltage drop in the plate circuit, otherwise the actual operating voltage between plate and filament may be inadequate for the successful working of the circuit.

(7) Where possible the internal magnetic field should be of small dimensions, or, alternatively, the choke must be screened, since invariably the choke has to work in juxtaposition to other components where magnetic interaction would upset the receiver's performance.

ALL ABOUT—

# THE HEXODE VALVE

## The Latest American Introduction Which Will Shortly be Introduced Over Here

THAT necessity is the mother of invention has been demonstrated to a marked degree in the improvements which have been made in wireless valves. First of all the triode was used in receivers, the first really important improvement being the introduction of the screen-grid valve, followed shortly afterwards by the pentode.

Quite recently there has been a deluge of improvements; the variable mu, Class B, double-diode, double-diode-triode for receivers with A.V.C. and H.F. pentodes.

That these valves perform a useful and necessary function in a receiver is indisputable. The tendency appears to be, not merely for different valves for different positions in a receiver, but quite distinct valves for different circuits.

The Class B valve meets the needs of constructors who desire to operate a moving-coil loud-speaker, but have only H.T. batteries available. Improved reception is thereby obtainable with modest H.T. consumption.

Now, according to reports, a new valve has been produced in America for superhet receivers, specially designed to combine the functions of first detector and oscillator, and also embodying the feature of the variable mu valve —volume control by variation of the grid bias potentials.

Although these valves are not yet available readers will no doubt be interested in details of this latest development and the claims put forward in respect of it. A great step forward has apparently been made, as at present, with few exceptions, superhet receivers employ at least five valves, but with the new valve there will be a distinct advantage in the reduction of one valve with its associated components, thus placing the superhet with its excellent features within reach of considerably more constructors than at present.

The ordinary one screen grid H.F. stage receiver unfortunately suffers from lack of selectivity in comparison with the needs of to-day, and this is where the superhet circuit scores.

If a listener resides in close proximity to a local station, some alternate type of circuit is desirable and for listeners at a distance, the superhet combines the advantage of selectivity with its excellent sensitivity.

With the superhet it has been necessary to employ an additional valve for the process of frequency changing, this, of course, has meant more valves than a straight set, and although attempts are being made, apparently with considerable success, to combine these functions in one valve, there is no doubt that a valve specially designed for the job will undoubtedly pave the way for greater success in this direction.

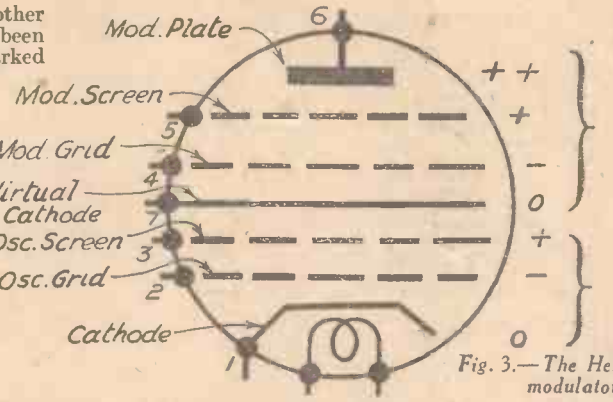



*Fig. 3.—The Hexode oscillator-modulator valve.*

## FIRST DETAILS TO BE PUBLISHED IN THIS COUNTRY

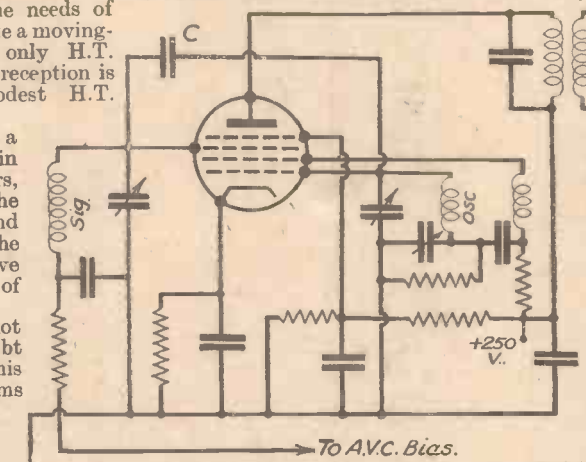



*Fig. 2.—Superhet circuit employing new Hexode single valve frequency changer.*

In American circuits the screen-grid valve has been used, but if single dial tuning is employed, the interaction between oscillator and single-frequency circuit and also the risk of radiation, has made this type of circuit unsuitable for the home constructor owing to the difficulties involved in ganging.

Various circuits employing the screen-grid valve have been tried, but all suffer more or less from the same defect.

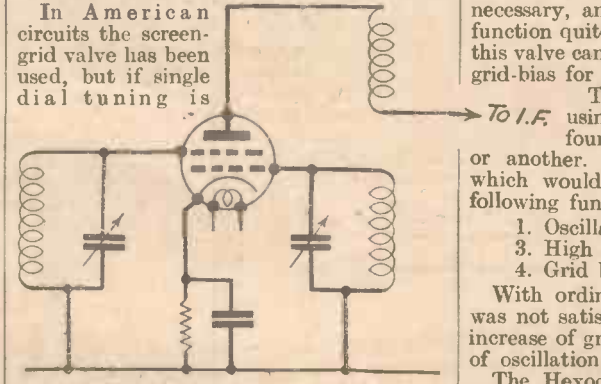



*Fig. 1.—Circuit arrangement of bi-grid valve.*

### Bi-grid Valve

The bi-grid valve has been fairly extensively used in superhet circuits, particularly on the Continent. It is quite satisfactory, but, unfortunately, its efficiency is rather low.

One advantage of the bi-grid valve is that the grid-anode capacity is of the same value as the control grid oscillator-grid capacity; in the screen-grid valve, however, the control grid-anode capacity is much less than the control grid-screen grid capacity.

Equal inter-electrode capacities automatically neutralize each other, owing to the potentials being of opposite phase difference voltages developed across the inter-electrode capacity of the valve are therefore cancelled out and the valve is self-neutralized.

What we require is a valve with :—

(1) High mutual conductance between control grid and anode circuits.

(2) Approximately equal control grid-anode and control grid-oscillator grid-inter-electrode capacities to secure freedom from interaction.

Unfortunately the bi-grid valve is ruled out owing to its low mutual conductance and the screen-grid valve is hardly suitable because of the large difference in the inter-electrode capacities.

The most useful valve at the present time appears to be the pentode with its high mutual conductance. As in some cases the inter-electrode capacities were practically equal, it was considered possible to employ this valve. Special coils were necessary, and the pentode was found to function quite satisfactorily, but, of course, this valve cannot be employed with variable grid-bias for volume control.

Therefore, all of the circuits using the available valves were found to be lacking in one way or another. The ideal circuit was one which would perform with one valve the following functions :—

1. Oscillator. 2. 1st Detector.
3. High amplification.
4. Grid bias control of amplification.

With ordinary valves grid bias control was not satisfactory and in most cases an increase of grid bias resulted in a cessation of oscillation.

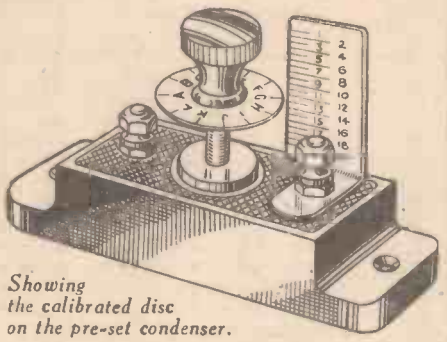
The Hexode valve has been developed

(Continued on page 371.)

# READERS' WRINKLES
## The HALF-GUINEA Page

### Calibrating a Pre-set Condenser

OWING to the difficulty of quickly finding the required setting of pre-set condensers, I devised this scheme for

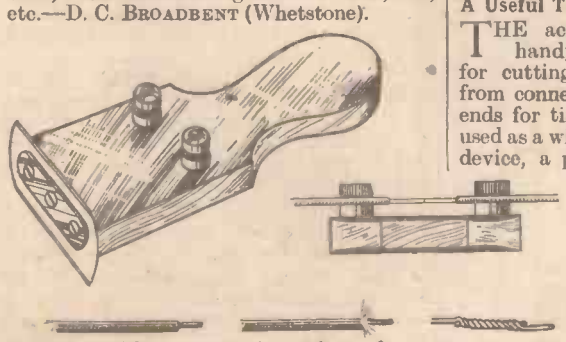


*Showing the calibrated disc on the pre-set condenser.*

accurately determining any position of the adjusting knob. This is especially useful when adjustments have to be made frequently, as on wave-trap systems. The upright scale is made of aluminium, on to which is pasted a piece of cartridge paper with scale divisions marked 1, 2, 3, etc. The distance between each of these divisions is determined by measuring the amount the knob rises or falls for one revolution of the knob.

The best way to do this is to measure the total distance between maximum and minimum settings of the condenser, and at the same time noting the number of times the knob rotates in this distance. Then by dividing the distance by the number of turns, the distance between each division is obtained.

The circular scale is also made from thin aluminium, pasted with white paper, the face of which is divided into 12 equal divisions, marked A, B, C, etc. The disc is bored in the centre, a clearance diameter over the thread, and clamped by means of the locknut on the underside of the knob. When fixing the upright scale in position, set the dial to its maximum height, turn the dial so that point A is at its nearest position to the scale, and then set the upright scale, so that this point "A" coincides with the No. 1 division. All readings taken subsequent to this setting will read 1A, 1B, 1C, etc., until the dial has rotated once, when the reading becomes 2A, 2B, etc.—D. C. BROADBENT (Whetstone).



*A handy tool for removing the insulation from connecting wire.*

### A Useful Tool

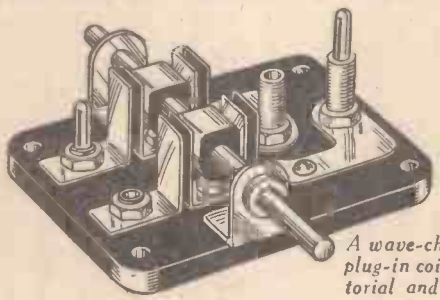
THE accompanying sketches show a handy little tool which can be used for cutting and removing the insulation from connecting wire, and for scraping the ends for tinning purposes. It can also be used as a wire soldering clamp. To make the device, a piece of wood measuring 6in. by 3in. by ¼in. thick is shaped to join a handle to the end of which a razor blade is screwed, using a piece of perforated metal strip as a clamp. By arranging two terminals, as shown, two pieces of wire can be clamped so that the ends butt together, thus leaving both hands free to manipulate the soldering iron.—J. MOONEY (St. Helens, Lancs.).

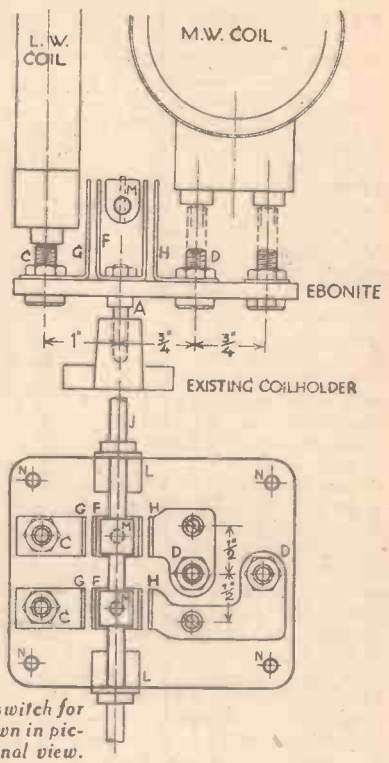
**THAT DODGE OF YOURS!**

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us, addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

### Wave-change Switch for Plug-in Coils

HERE is a switching arrangement which I have installed in my set for switching directly from long to medium waves, with ordinary honeycomb coils. The advantage of this arrangement is that connecting wires are eliminated. In the accompanying sketch (A) are the two coil-pins from the original set. Two of these were fixed in an ebonite plate, which has





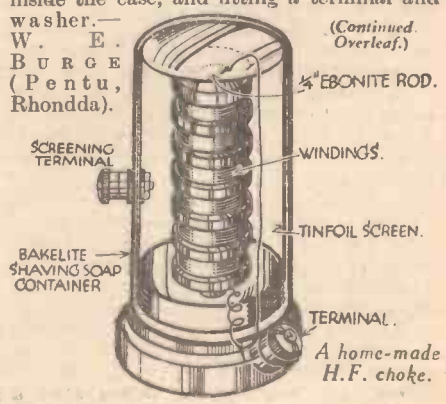

*A wave-change switch for plug-in coils shown in pictorial and sectional view.*

two holes for the bushes C, two holes for the bushes D, and two holes for the shaft-holders L. From a piece of spring brass are made the two U-shaped contacts F, the two marked G, and also the two marked H. The latter are different in shape, as the sketch illustrates. A piece of brass rod is used for the switch spindle J. In order to insulate the axle, two pieces of ebonite (M) are fastened on the axle with small pins. One side of the axle is long enough to permit the axle to project through the panel for a control knob. The four holes N are intended to secure the ebonite to the baseboard of the set.—H. J. HUIJGEN (Rotterdam).

### A Well-finished Home-made Choke

MOST home-made components have the disadvantage of looking obviously home-made. The scheme here described enables one to turn out H.F. chokes, etc., equal in appearance to the commercial component. Many brands of shaving soap are supplied in handsome bakelite cases, which may easily be turned to excellent account with the aid of a drill, screws and scrap ebonite. The diagram illustrates an efficient H.F. choke of professional appearance. Screening, if necessary, is easily provided by glueing tinfoil inside the case, and fitting a terminal and washer.—W. E. BURGE (Pentu, Rhondda).

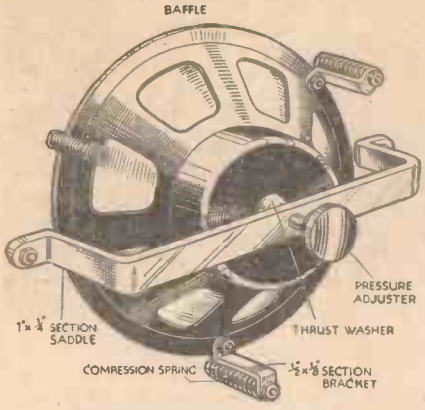
(Continued Overleaf.)




*A home-made H.F. choke.*

## RADIO WRINKLES

(Continued from previous page.)




*Eliminating cabinet resonance.*

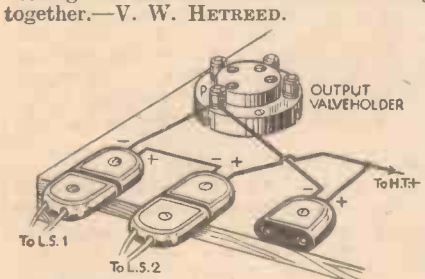
### Eliminating Cabinet Resonance

THE accompanying sketch shows a scheme for eliminating cabinet resonance when using M.-C loud-speakers with a heavy bass response. The adjustment is by a screw which can be made to protrude through the back of the cabinet. Three or four springs are used, as shown, according to the number of holes drilled in the chassis. I use this device when listening to talks, etc., as I find that it eliminates the boominess which usually accompanies speech. —JOHN OLIVER (West Kensington).

### Connecting Speakers in Series or Parallel

HERE is a method of connecting up two loud-speakers either in series or in parallel. Three plug and socket connectors are needed, costing about 6d. each. On referring to the diagram, which is self-explanatory, it will be seen that to put the speakers in parallel the short-circuiting plug is inserted in the centre sockets and the two loud-speaker plugs in the other sockets. To put them in series the short-circuiting plug is removed and the L.S.2 plug put in.

The plug and sockets for L.S.1 can be replaced by a permanent joint, but I find the former arrangement more convenient. The three socket parts can be mounted neatly on the baseboard by using wood screws in place of the usual set screws holding the halves of the bakelite casing together.—V. W. HETREED.




*Connecting two loud-speakers in series.*

### Preventing Accidental "Shorts"

TO avoid adjusting the G.B. plugs whilst the H.T. is switched on and to prevent accidental "shorts" owing to the G.B. plugs fouling a "live" part of the set, the following contrivance will prove very useful. A piece of ebonite, 1in. wide and 2ins. longer than your G.B. battery, is cut as shown at A, Fig. 1 (the number of slots to equal the number of G.B. plugs used). On each shoulder piece, "X" and "Y," bind a piece of brass strip round and solder together at the same time connecting "X" and "Y" electrically with a piece of insulated wire. Two springy pieces of brass are bent and secured to the back of the cabinet with two long bolts, as in Fig. 2. The distance apart of the clips should coincide with "X" and "Y" on ebonite strip "A." The height is determined by placing the G.B. battery in position so that the ebonite strip "A" rests on the top of the plugs in the G.B. battery, as in Fig. 3. Having fixed the clips, join one clip to H.T. negative on H.T. supply, and the other to H.T. negative terminal on terminal strip. Now place G.B. battery in position, insert plugs in battery, place ebonite strip "A" between both clips and trap G.B. wires in the slots on the strip. The plugs now cannot work loose and the strip must be removed before the plugs can be readjusted, thus breaking the H.T. negative circuit. If the plugs are accidentally pulled out and the receiver is switched on, the valves will not be harmed for the reason that the H.T. will be switched off automatically.—C. M. STRONGBERG (Hull).

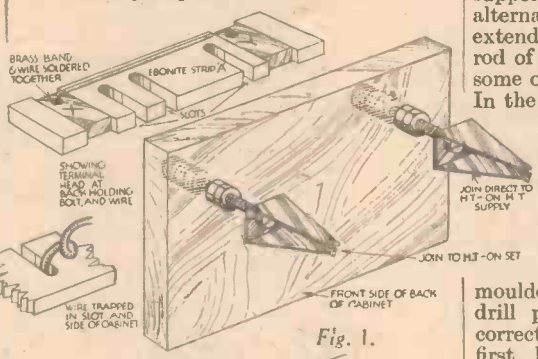



*Fig. 1.*

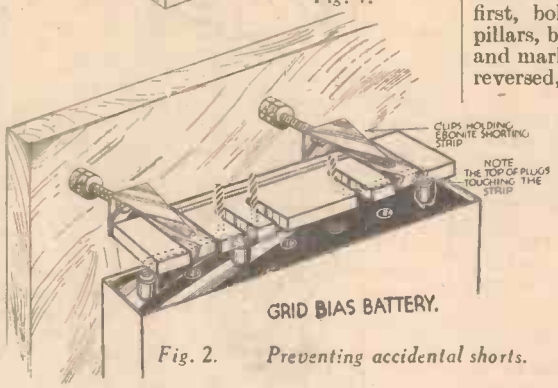
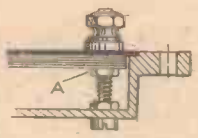
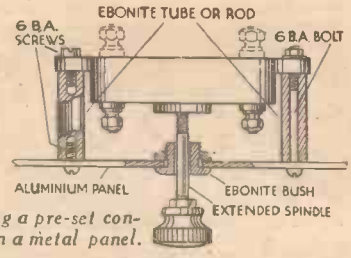



*Fig. 2. Preventing accidental shorts.*



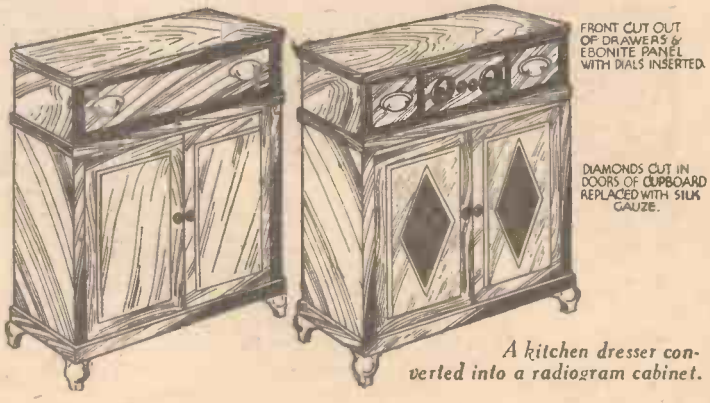

*Mounting a pre-set condenser on a metal panel.*

### Mounting a Pre-set Condenser

RECENTLY, when constructing a short-wave receiver, on an aluminium chassis, I mounted the series aerial pre-set condenser on the panel below the chassis line, in the manner shown by accompanying sketch. As the majority of commercial pre-sets are not fitted with a "one hole fixing bush," this method should prove useful to other readers. The condenser is supported on two ebonite pillars (two alternative methods are shown). The extended spindle was an old vernier control rod of the single vane type to be found on some of the earlier type tuning condensers. In the case of an aluminium panel this has to be bushed with ebonite, to prevent an earth-aerial short, or a large hole drilled to clear. With ebonite panels this is obviously not necessary. The constructor may like to dismantle the condenser and reverse the terminals to facilitate wiring, in which case the shell, or moulded case can be used as a jig to drill panel, and so get the spindle in correct alignment. Drill the outside holes first, bolt temporary in position without pillars, bringing central bush down on panel and mark central hole. If the terminals are reversed, long screws will be necessary when re-assembly is commenced, as shown. The nut "A," should be given a tap with a centre punch in the hole to make it a tighter fit on the screw, and adjusted to bring back of base flush with moulded case.—E. E. BALDWIN (Leyton).

### A Useful Conversion

I WAS thinking of buying a cabinet to house my set and wireless gear, when I thought of a way of saving money by converting a small kitchen dresser, in the manner shown in the accompanying illustrations. It will be seen that the receiver and batteries occupy the top drawer space, the centre part of the drawer front being cut away to take the panel. The cupboard space below is sufficient to house the speaker, wireless books, tools, etc.—J. R. JEFFERY (Plymouth).




*A kitchen dresser converted into a radiogram cabinet.*

# TROUBLES in Battery-fed Amplifiers

Introducing a Novel Unit which will Enable You to obtain Longer Useful Life from the H.T. Battery

By J. H. WATTS

IN Fig. 1 is shown the L.F. portion of the type of receiver which many of our readers are still using. Many queries have reached these offices which refer to faults which develop in sets of this type, and they are usually traced to the L.F. section.

### Instability

The commonest fault appears to be that of a constant whistle. Tbis is not affected by any of the controls, and many readers have found that the only way to cure it is either to remove one of the grid-bias plugs, or replace the H.T. battery. Of course, removing the grid-bias plug is absolutely the wrong method, while in many cases the H.T. battery could have been made to give a little more extra life. The trouble is usually caused by the rising of the internal resistance of the H.T. battery. This resistance becomes common to the anode circuits of the valves, and causes instability in the form of "feed-back."

Measuring the battery with a voltmeter does not always show a serious drop in voltage, but, if it does, it should be replaced. When the battery still shows a useful voltage it may be assumed that it is not entirely to blame, and that a few modifications to the receiver may prolong its life, until its useful voltage is at an end. These conditions can be attained by decoupling the anodes of the valves. It is a mistaken assumption that decoupling applies only to mains-driven receivers: that idea leads to many batteries being discarded while still capable of further use. The connections for decoupling with a resistance and condenser are shown in Fig. 2. It is usual to decouple the detector valve (V1, Fig. 1) first. If this valve is of the H.F. or detector type, the decoupling resistance should have a value of about 25,000 or 30,000 ohms, but if an R.C. valve is employed, the resistance necessary might be as high as 50,000 ohms. It is a wise policy to insert decoupling in the lead to the first L.F. valve (V2, Fig. 1), especially if, as is often the case, V2 and V3 are fed from the same tapping. In this case the resistance should have a value of 15,000–20,000 ohms. These values apply equally to those receivers that employ transformers in both stages.

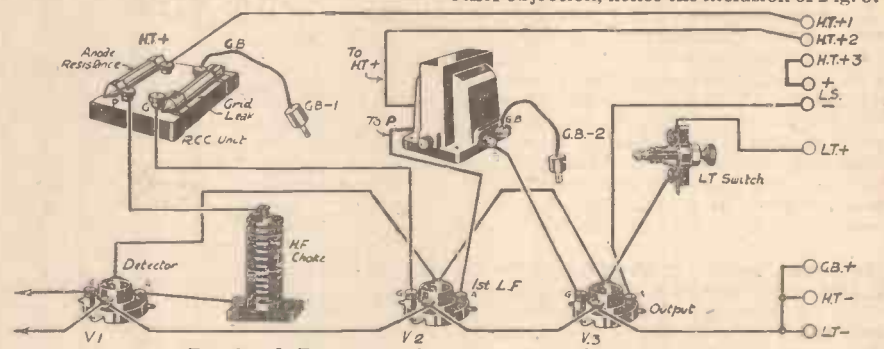



*Fig. 1.—L.F. portion of typical battery-fed receiver.*

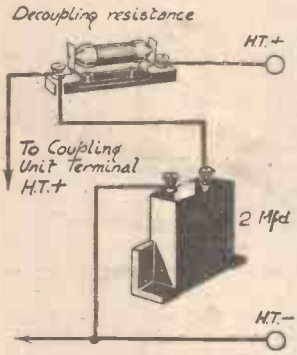



*Fig. 2.—Decoupling connections.*

### A Simple Decoupling Unit.

It is often found inconvenient to insert decoupling in the receiver itself. Perhaps it is of commercial make, and the wiring cannot be traced with certainty; there may not be enough baseboard room or some other objection, hence the inclusion of Fig. 3. This shows a little unit which can be separate from the receiver itself, and effectively decouples the valves. Not only does it accomplish this, but it will be noticed that only two leads go to the H.T. battery (negative and maximum positive) and this ensures the battery being "run down" evenly. In cases where V2 and V3 are fed from the same lead, the connection from this lead to "H.T." terminal on transformer should be removed, and a separate lead attached to the transformer in its place. This will be H.T.2. Nothing need be said of the construction, as this is made self explanatory by the diagram. R1 is the decoupling resistance for the detector and R2 for the first L.F. valve. The separate H.T. leads from the receiver are taken to the appropriately marked terminals on the unit.

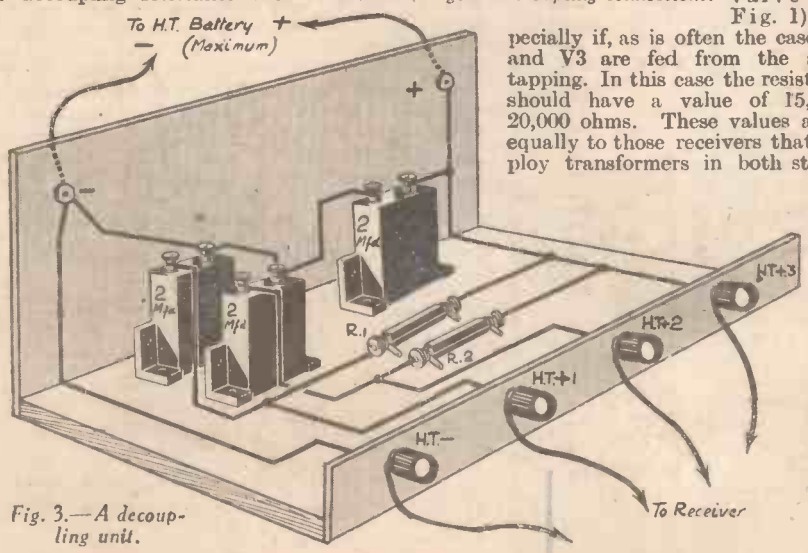



*Fig. 3.—A decoupling unit.*

### Trouble With Transformers

Another cause of this whistle is due to the transformer causing instability. This happens especially in receivers employing two transformers, and is a commonly encountered fault in portable receivers. It is usually due to the high value of the step-up ratio, or to H.F. oscillations present in the primary being transferred to the grid of the L.F. stage.

The first trouble can usually be cured by connecting a high resistance, say ¼ megohm, across the secondary. To do this, connect one side of the resistance to terminal "G" on the transformer and the other to terminal marked "G.B." This resistance can be of the grid-leak type. Actually this reduces amplification, but no appreciable loss of volume is discernible to the ear. To cure the trouble caused by H.F. oscillations, it is sometimes sufficient to reverse the "phase" of them in

(Continued overleaf.)

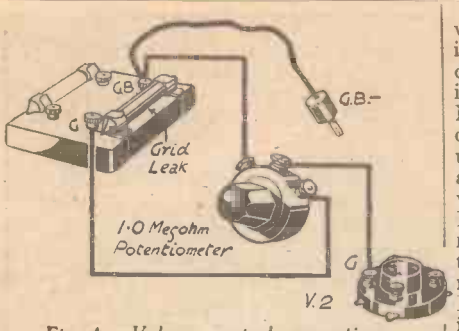



*Fig. 4.—Volume control connections.*

(Continued from previous page)

the windings by reversing the connections to the secondary. In other words, transfer the connection on "G" to "G.B." and vice versa. If this does not stop the trouble, it is obvious that these will have to be stopped before the transformer.

An effective way is to by-pass them. This can be done by connecting a condenser across the primary, one side of the condenser is connected to "P" and the other to terminal marked "H.T." on the transformer. These oscillations will also develop a voltage drop across the anode resistance in the R.C.C. unit, which will be handed on to the following valve as an amplified signal, and a condenser connected across the same terminals on this component, or from anode of V1 to H.T. negative may be necessary to completely stop the trouble. When the condenser is used in the anode circuit of V1, it should have a capacity not exceeding .0003 mfd, while in the case of V2, not higher than .001 mfd. *Care must be taken to ensure that the smallest effective condenser is used, otherwise the reproduction of the upper register will be seriously affected.*

Another method of preventing the H.F. interfering with the L.F. section is to insert a "grid-stopper" resistance in series with the grids of V2 and V3. The lead from the preceding coupling component to the grid of the valve is broken, and one end of the resistance is connected to the terminal "G" and the other to the grid of the valve. For the same reason as explained for the condenser, the resistance must not have too high a value. Between 100,000 and 250,000 (¼ megohm) will be found suitable.

## Distortion

Distortion due to overloading is very common with these receivers, and if in evidence a volume control should be fitted in the grid circuit of V2. Many articles dealing with volume controls have appeared in previous issues of PRACTICAL WIRELESS, but for the sake of new readers Fig. 4 has been included to show the connections. Where the grid leak in the R.C.C. unit can be removed, the potentiometer should be of the same value as the grid leak, and the latter should be removed when the potentiometer has been connected. It must not be forgotten that V2 can be overloaded, and any distortion here is amplified by the output stage.

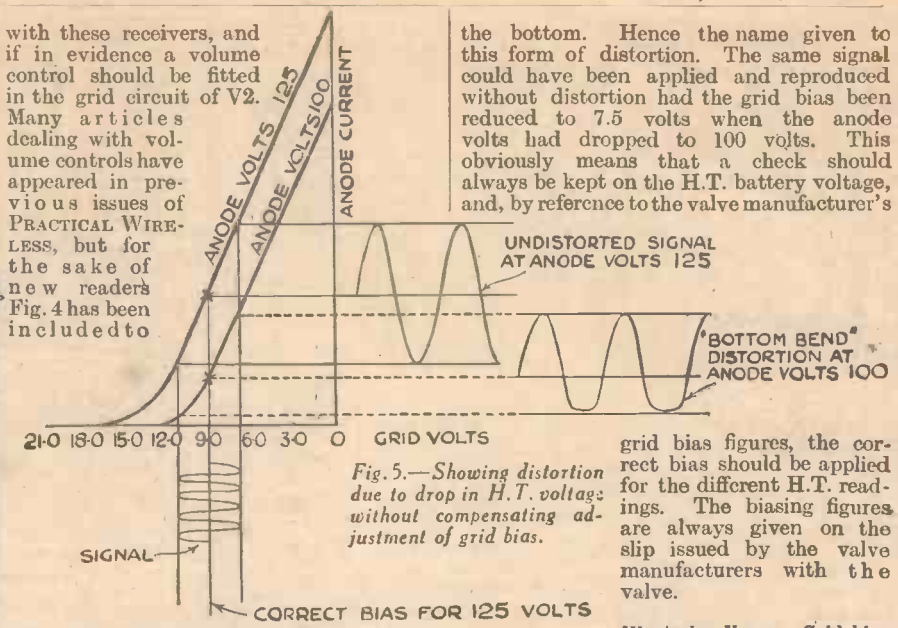



*Fig. 5.—Showing distortion due to drop in H.T. voltage without compensating adjustment of grid bias.*

"Bottom bend" distortion, which is a form of overloading, is often caused by a drop in H.T. voltage, without a corresponding adjustment to the grid bias being given. Reference to Fig. 5 will show how this distortion occurs. It shows the grid volts/anode current curve of a typical small power output valve. With 125 volts on the anode and 9 volts grid bias a grid signal is applied having a peak voltage of about 2 volts. As shown, when amplified there is no distortion (the reproduced signal, though larger due to the amplification is an exact replica of the original). If, however, the anode voltage is reduced to 100 volts, and 9 volts grid bias is still applied, reference to the illustration shows that the reproduced signal has been cut off or "bent" at the bottom. Hence the name given to this form of distortion. The same signal could have been applied and reproduced without distortion had the grid bias been reduced to 7.5 volts when the anode volts had dropped to 100 volts. This obviously means that a check should always be kept on the H.T. battery voltage, and, by reference to the valve manufacturer's grid bias figures, the correct bias should be applied for the different H.T. readings. The biasing figures are always given on the slip issued by the valve manufacturers with the valve.

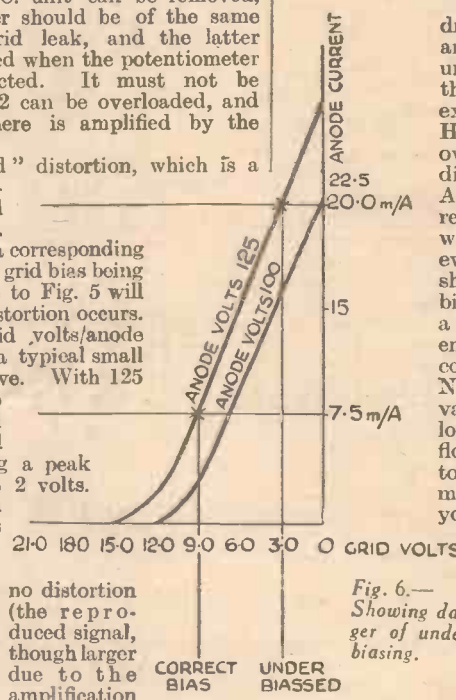



*Fig. 6.—Showing danger of under-biasing.*

### Watch Your Grid-bias Voltage

In your eagerness to drop the grid bias with the anode voltage never under-bias the valve, as this not only will cause excessive consumption of H.T., but will defeat its own ends by introducing distortion of another kind. Also, do not forget to readjust the grid bias when the H.T. battery is eventually renewed. Fig. 6 shows the danger of under-biasing. In this example, a drop of 6 volts grid bias entails an increase in anode consumption of 12.5 mA. Not only this, but if the valve should be fully loaded grid current will flow, causing terrible distortion. Therefore, you must check the voltage of your grid bias battery and never let it drop at all. It is a mistake to leave it connected indefinitely, and it should be changed every six months. After all, it is not an expensive item, but the damage done by neglecting it might quite possibly run into a lot of expense, even that of a new valve, as well as waste of H.T. These remarks concerning G.B. and H.T. voltages are applicable to both V2 and V3. *Never remove a grid-bias plug while the receiver is in operation; always switch off when making adjustments!*

*(To be concluded next week.—Ed.)*

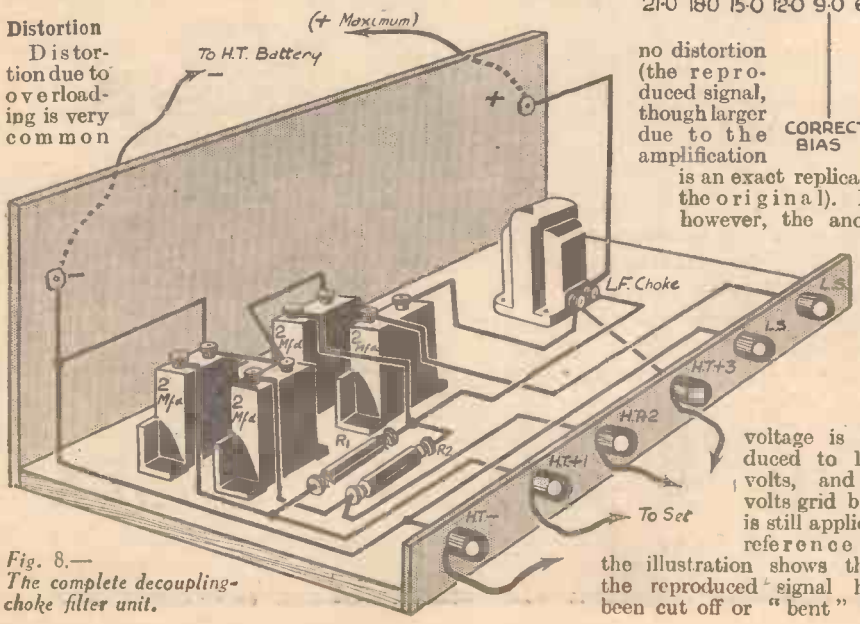



*Fig. 8.—The complete decoupling-choke filter unit.*

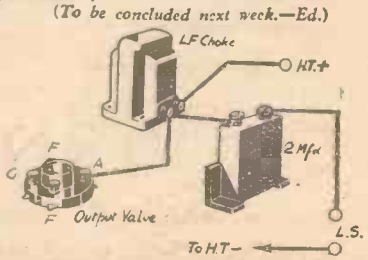
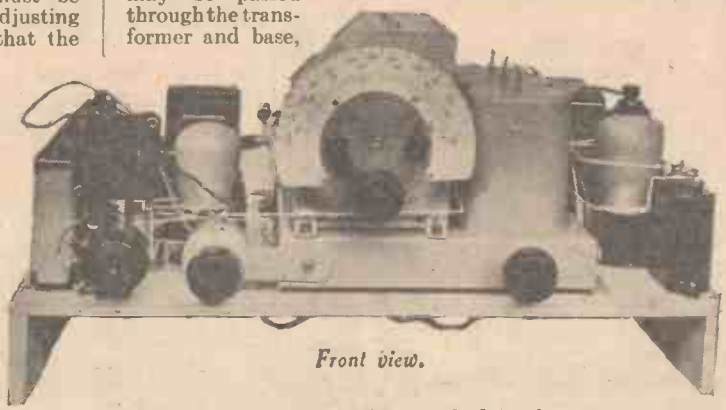



*Fig. 7.—Choke output connections.*

# The RADIOPAX

## How to Assemble the Latest "Practical Wireless" By Our Tech

THE construction of this receiver will be found somewhat easier than the majority of receivers, chiefly owing to the unit which is incorporated in it. As has already been pointed out, this includes the tuning coils, the ganged condenser, the on-off switch, the potentiometer and the wave-change switch, all of which are mounted on one substantial metal chassis and are completely wired for you. The great advantage of this is not so much in the time which is saved, but in the fact that the complete unit is matched up with all wiring and the ganging therefore holds over the entire wave-band. The first part of the constructional work consists in drilling the wooden baseboard, and for this purpose the centre line should be marked, and the full-size template of the Radiopack chassis should then be placed in position so that the screw holes may be accurately positioned. The thickness of the cabinet front must be taken into consideration when adjusting the front edge of the chassis, so that the knobs will not project too far in front of the panel. When the correct position for this has been found, the holes for the valve-holders should be marked, and all wiring holes, as shown on the wiring diagram, should then be marked. These latter holes need only be about ¼in., whilst the holes for the three four-pin valve-holders are 1in. in diameter. The hole for the seven-pin holder is slightly over 1in., and if preferred a 1in. hole may be drilled and afterwards enlarged with a file. Cut the two side runners from ½in. ply wood, and attach these with substantial screws.



*Front view.*

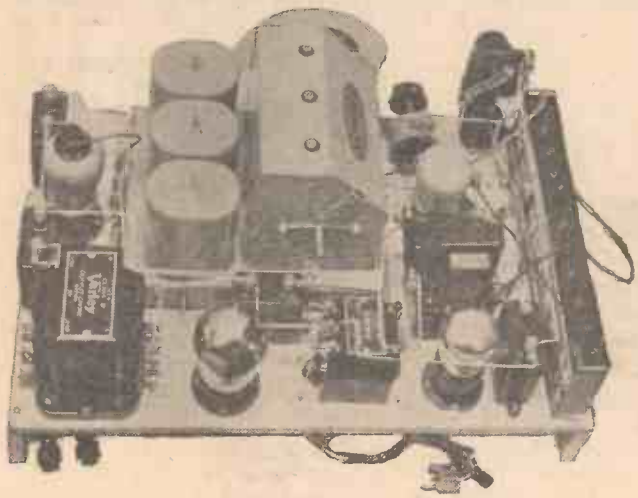
### Mounting the Components

When the runners are in position, you can commence the construction of the receiver by mounting the valve-holders and the remaining baseboard components. It is preferable to lay these out first in the position they are to occupy and then to check the arrangement carefully with the blueprint of the wiring diagram on page 366 When you are certain everything is in order, screw down the fixed condensers, the H.F. choke, the grid bias clips and the two L.F. transformers. The tone control transformer is mounted on a small base supplied by the makers and it is essential that these should be accurately in register. The base will be found to have the letters P, H.T., G, and G.B. engraved on its upper surface, and these should be arranged to correspond with the same markings on the transformer itself. Long wood screws may be passed through the transformer and base, or the base itself may be attached to the wooden baseboard, and the transformer held in position by means of the metal strips attached to the tone control base. Leave the output choke till most of the wiring has been finished, as this is a weighty component and will probably get in your way whilst the wiring is being carried out.

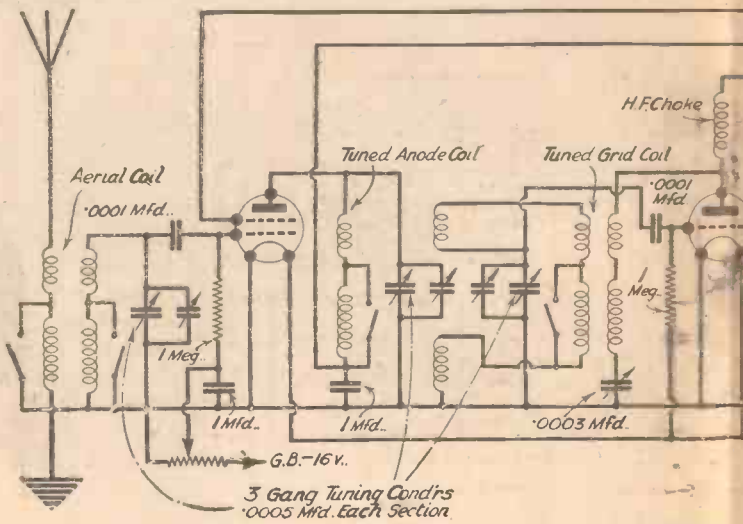
### The Wiring

Before attaching the band pass unit, carry out as much of the wiring as is possible. You will see from the wiring diagram that there are a number of wires which may be inserted without the necessity of fixing the unit, and the constructional work is greatly simplified with this out of the way. When this part of the construction has been completed the unit may be screwed into position, and the small component bracket mounted on the left of it. It should be noted that the small bracket which holds





*Rear top view.*

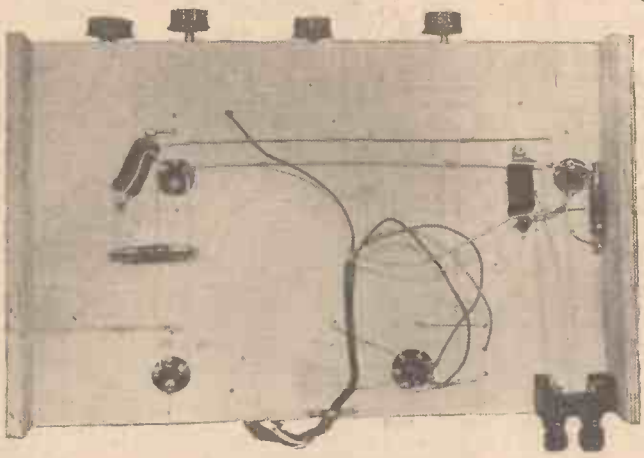



*Theoretical*


## Components for the ." Four-Valve Receiver

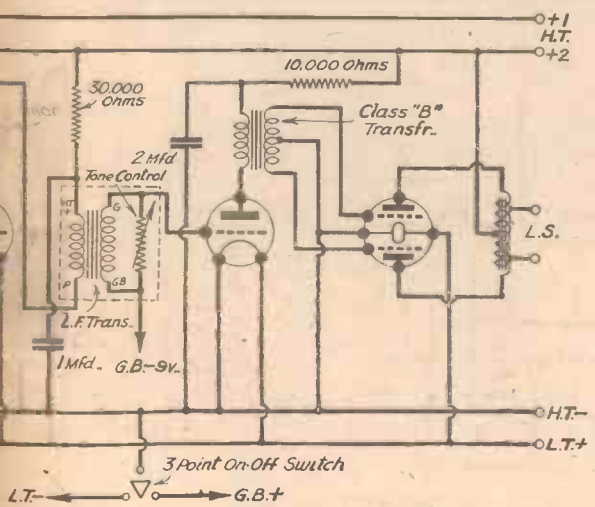
## nnical Staff

the combined switch and potentiometer must be attached to the metal chassis before the unit is fitted to the baseboard. If the radiogram switch is also required, this must be attached in a similar manner to the rear of the metal chassis. Make quite certain that the nuts are well locked, as it is not possible to get at them, should they become loose, without removing the metal chassis completely. Fit the reaction condenser and the tone control potentiometer to the bracket and then complete the wiring. The Ohmite resistances are held in position simply by the Glazite wire which is attached to the ends. The output choke should be the last part to be fitted, and it should be noted that there are no leads attached to the output terminals of this component. The loud-speaker must be attached direct to this choke when the receiver is finally installed in its cabinet, and the correct pair of terminals (according to the desired ratio) must be employed.



*The sub-baseboard wiring.*






*circuit.*

### Battery Cords

The five-way battery cord is attached direct to the valve-holder and other components, as shown, and no fuse has been fitted in this particular receiver. If it is desired to take this precaution, a small Bulgin fuse-holder should be mounted on the under-surface of the baseboard, and the H.T. negative lead attached to one side of it; the opposite terminal should then be joined to the filament leg, which is used in the present receiver for the H.T. negative lead. The grid bias flexible leads are joined to the three-point switch and the potentiometer, and it is important to note that the positive lead is attached to the switch and the negative lead to the potentiometer. The remaining grid bias negative lead is attached to the G.B. terminal of the tone control transformer. The receiver is now completed and is ready for its preliminary test. Instructions regarding this will be deferred until next week.

For the benefit, however, of those readers who have most of the components already to hand, or who are able to complete the receiver before our next issue is on sale, the following brief notes will enable the receiver to be installed and the programmes received sufficiently well to enable the receiver to be used in the meantime. As with all ganged receivers, the operation of trimming is of primary importance. When three circuits have to be tuned at one and the same time through the medium of a single knob, each circuit must be varied by the same amount or weaker stations will not be heard at all. This receiver employs, as already stated, a completely assembled ganged unit, and therefore the only adjustment should be on the aerial section of the ganged condenser. In order, however, to avoid any risk of unequal tuning, the three trimmers should each be adjusted, only the smallest movement being required. Set the condenser scale to a low reading, say 10 or 15 degrees. Advance the reaction and variable-mu potentiometer so that the receiver is on the border line of oscillation. A slight movement of the tuning coil should enable a station to be received near this point. Now carefully adjust the small screws on the top of the ganged unit and see if any adjustment in one direction or the other results in an improvement in signal strength.

More complete details will be given next week.

(*Continued on page 366*)

*Rear view of the Radiopax Class "B" Four.*

## BOOKS RECEIVED

**"Photo-electric Cell Applications,"** by R. C. Walker, B.Sc.(Lond.), and T. M. C. Lance, Associate I.R.E. (Sir Isaac Pitman & Sons, Ltd., price 8s. 6d.)

In this book which is written by two well-known authorities on the subject, the practical application of photo-electric cells in industry and commerce are dealt with in a simple and clear manner. There is an absence of mathematical formulæ and theoretical aspects of the subject are limited to a minimum, although a helpful chapter is devoted to a simple description of the photo-electric effect and the characteristics and properties of the photo-cell. The book deals exclusively with alkali metal cells, but the circuits described can, in most cases, be adapted for use with other types of light sensitive devices. Amongst the subjects covered in the ten chapters are Counting and Timing Gear; Alarms, Inductors and Safety Devices; Advertizing, Talking Films; Television and Scientific Instruments. The book runs to one hundred and ninety pages and is well illustrated in half tone and line.

(Continued from previous page)

### COMPONENTS FOR THE RADIOPAX B.4.

One British Radiophone Band-Pass "Radiopak" with Gramophone Switch.

Three 1 mfd. Dubilier Type B.B. Fixed Condensers.

One 2 mfd. Dubilier Type B.B. Fixed Condenser.

Two .0001 mfd. Dubilier Type 670 Fixed Condensers.

Two 1 meg. Graham Farish "Ohmite" Resistances.

One 30,000 ohm Graham Farish "Ohmite" Resistance.

One 10,000 ohm Graham Farish "Ohmite" Resistance.

One .0003 mfd. Graham Farish "Litlos" Reaction Condenser.

One Bulgin Standard H.F. Choke.

One Varley Type D.P. 40 Class B. Driver Transformer.

One Varley Type D.P. 42 Class B. Output Transchoke.

One Lissen Tone Control Hypernik Transformer and Resistance.

Three Clix Chassis Mounting 4-pin Valve-holders.

One Clix Chassis Mounting 7-pin Valve-holder.

One Pair Bulgin No. 3 Grid Battery Clips.

One Peto Scott Baseboard Mounting Component Bracket.

Two Belling-Lee Terminal Mounts.

Four Belling-Lee Type B Terminals—Aerial, Earth, and Pick-up (2).

One Belling-Lee 5-way Battery Cord.

Two Belling-Lee Wander Plugs marked G.B.+ and G.B.—.

One Blue Spot, Type 45 P.M. Loud-speaker.

One 220 V.S.G. Cossor Valve (metalised).

One 210 Det. Cossor Valve (metalised).

One 215 P. Cossor Valve.

One 240 B. Cossor Valve.

One Smiths 2RGN7 2 Volt Accumulator.

One Smiths Anodex 120 volt Class B H.T. Battery.

One Smiths Anodex 16.5 volt G.B. Battery.

Two Coils Glazite, Length of Flex, Screws and Sundries.

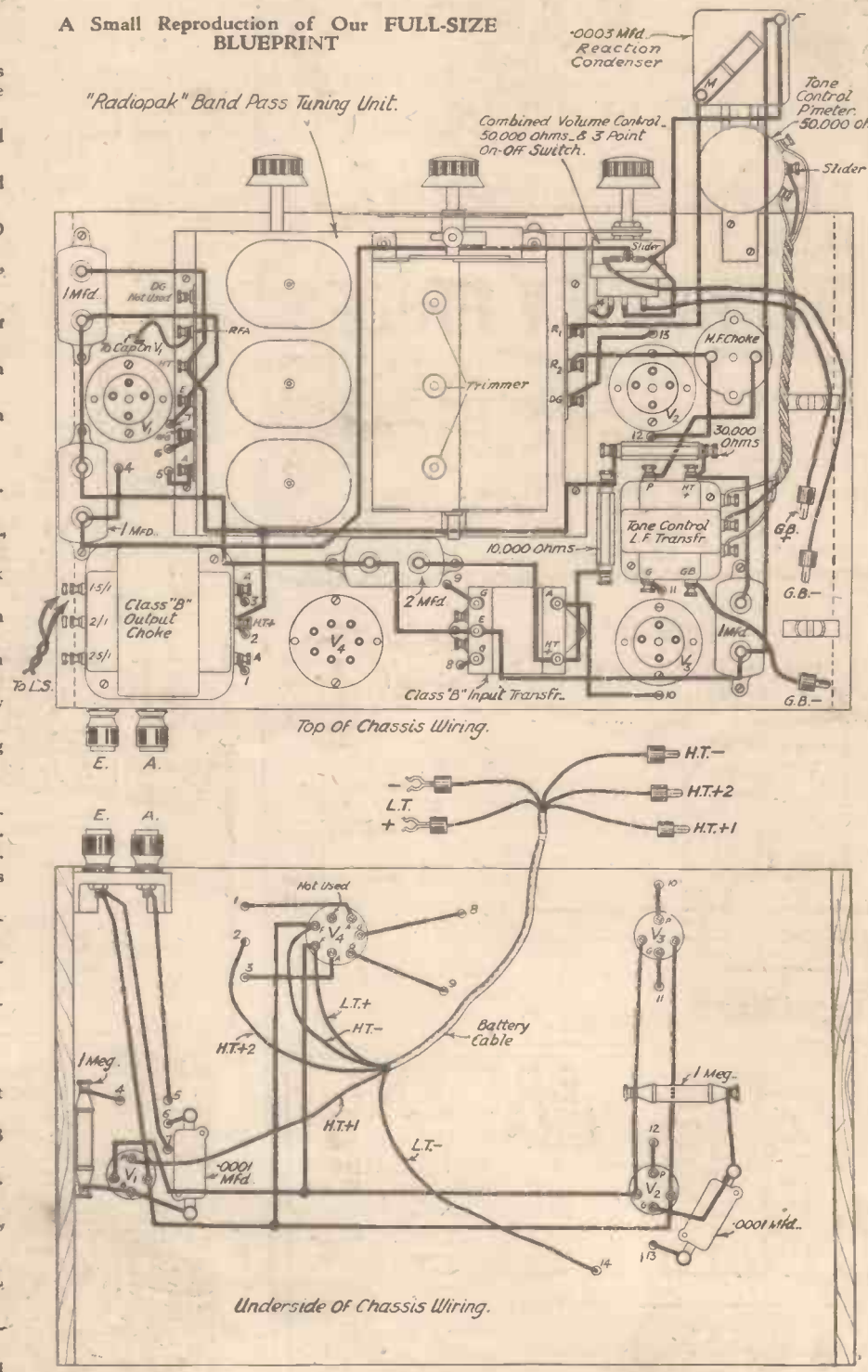
### AERIAL AND EARTH EQUIPMENT.

One Graham Farish "Filt" Percolative Earth.

One "Goltone" "Metocel" Screened Down Lead.

One Graham Farish Gard Lightning Arrester.

**A Small Reproduction of Our FULL-SIZE BLUEPRINT**




**Top and Sub-baseboard Wiring Diagram of the Radiopax "Class B" Four. A full-size Blueprint can be obtained for 1s. post free from George Newnes, Ltd., 8-11, Southampton Street. Strand, London, W.C.2.**

# TELE-TALKIE TOPICS

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

SEVERAL readers have written to PRACTICAL WIRELESS asking for information concerning some of the standard data which must be known before reception of the television signals now sent out by the B.B.C. can be successfully accomplished. Much of the material was furnished during the course of the series of television articles I wrote a short time ago, but in the space at my disposal I propose now to give, in more or less summary form, the important points in so far as they concern the receiving apparatus.

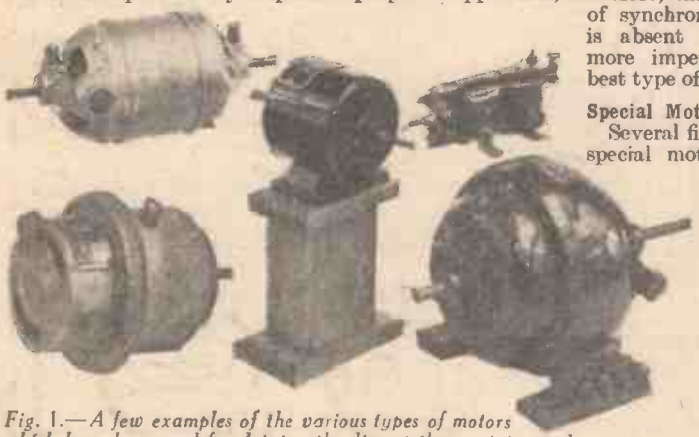


*Fig. 1.—A few examples of the various types of motors which have been used for driving the disc at the receiving end.*

Assuming that the reader is obtaining his television "baptism" with the simple disc type apparatus, the essentials required are:

(1) Motor.
(2) Scanning Disc.
(3) Neon Lamp.
(4) Magnifying lens or lenses.

Taking the items in that order, the motor should be of the best quality the "looker" can afford, and it must be capable of running at a speed of 750 revolutions per minute for long periods at a stretch. This is the Baird standard speed used by the B.B.C. giving twelve and a half pictures per second. Small differences of speed from that of the transmitter will cause the picture to drift up or down, and, unless well designed automatic synchronizing apparatus is incorporated in the vision apparatus, the control of speed must be effected by electrical or mechanical control. The reader should appreciate, therefore, that when any form of synchronizing mechanism is absent it becomes even more imperative to use the best type of motor.

### Special Motors

Several firms have designed special motors for television purposes, and as a general rule they are of two classes — universal or shunt wound. The first named is more expensive, being suitable for alternating or direct current (hence its name), while the other is a shunt machine giving very good speed regulation. In their quest for apparatus I have known amateurs acquire in the second-hand market motors from klaxon horns, sewing-machines, vacuum-cleaners and even toy outfits, and, when suitably overhauled and, if necessary, rewound, they have proved quite satisfactory for the purpose.

In Fig. 1 will be seen a few different types of motors, all of which have been used for television purposes. Choose a machine as silent running as possible, and one which eschews sparking at the brushes, as this latter item causes bad interference in the form of "splashes" of light which can be seen in the television image, a most disconcerting feature. Another point to watch is the length of spindle. Two inches generally is quite suitable for allowing the disc boss to be accommodated and held in place by a grub screw. Furthermore, if the amateur is far-seeing, he will obtain a motor which has a double-ended spindle, so as to be ready for the time when he can make or purchase a cogged-wheel synchronizing outfit, for this is arranged at the motor end remote from the disc (as a rule), and the shaft is necessary for fitting on the cogged wheel.

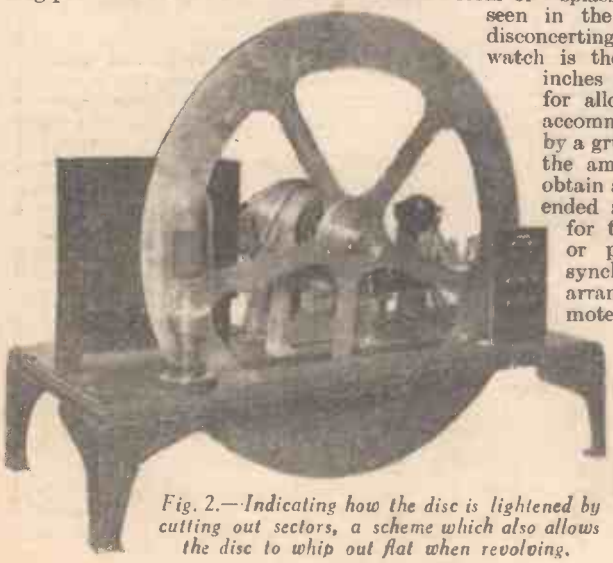


*Fig. 2.—Indicating how the disc is lightened by cutting out sectors, a scheme which also allows the disc to whip out flat when revolving.*

### Scanning Disc

Comes now the scanning or exploring disc. This has to be attached to the end of the motor shaft and rotated at the standard speed of 750 revolutions per minute, this corresponding to twelve and a half pictures per second. The disc should, therefore, be light and made from thin sheet aluminium, about 32 S.W.G., or celluloid. Thick paper or cardboard can be employed, but this is seldom very satisfactory in practice, owing to the fact that it easily tears or breaks.

To add to the lightness of the disc, and also to allow it to "whip" out flat when revolving, five or six large sectors should be cut out, thus leaving the same number of spokes and a reasonably wide rim, such as is indicated by the disc in the apparatus portrayed in Fig. 2. A heavy disc acts as a flywheel, and speed adjustment then becomes difficult owing to the extra mass that has to be moved, that is, either accelerated or decelerated. Quite a suitable size of disc is twenty inches in external diameter. It enables an image to be formed that can be satisfactorily enlarged by a lens or lenses.

### That Spiral of Holes

Now we come up against the factor that invariably proves the biggest stumbling block as far as amateur television constructors are concerned. I refer to the spiral of holes which have to be marked off and punched out of the disc. The whole problem is wrapped up with a number of other points that must be understood correctly if accuracy and an image devoid of mechanical distortion is desired. Referring to Fig. 3, if we are facing the disc, the neon lamp is mounted *behind* the disc on the right-hand side so that its area of glow takes up the position A, but cannot be seen

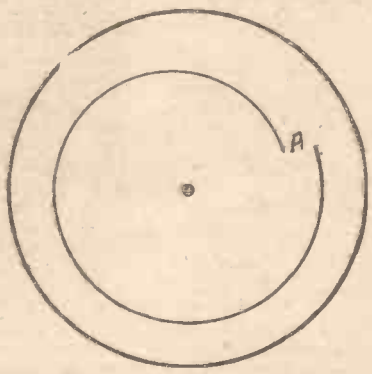



*Fig. 3.—The scanning disc and hole spiral. The direction of rotation is anti-clockwise.*

except through any disc holes. The direction of rotation of the disc is anti-clockwise, but the series of apertures which have to be made lie on a single-turn spiral which is clockwise, the spiral turning towards the centre of the disc, as shown by the drawn line.

This brings me to the question of the number of holes we require, how they should be marked off to conform to present broadcasting standards, what shape they should take, that is—whether round, square, hexagonal, rectangular and so on—and finally how they can be punched out so as to leave a "clean" aperture. As it is impossible to dismiss this side of the question in a few lines, it will be necessary to hold over the data I have prepared until the next "Tele-Talkie" article.

# The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

*Conducted by F.J. CAMM*

### Dielectric

THE insulating substance separating the plates of a condenser. In a fixed condenser this is usually either mica or waxed paper, while in movable condensers it is either bakelite or air. The nature of the substance used as the dielectric has an effect on the capacity of the condenser. For instance, the mere substitution of mica for air would increase the capacity of a condenser

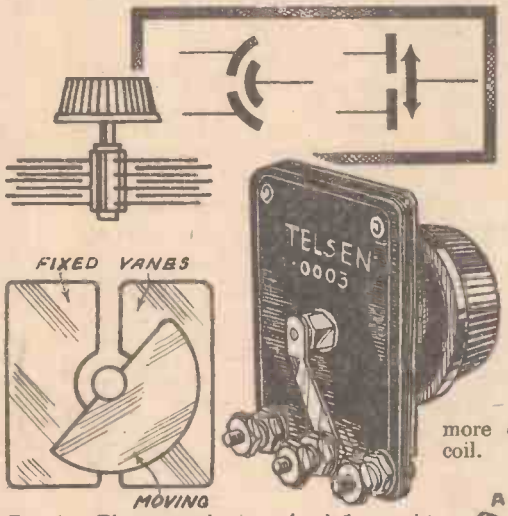



*Fig. 1.—The essential parts of a differential condenser (left) and the actual component (right). Inset:—The conventional signs used to denote a differential condenser.*

six or seven times, although the size of the plates and their distance apart remain the same. Waxed paper does not give such a large capacity as mica, but gives about twice that of air. This difference in the properties of various dielectrics has been carefully tabulated. Air, as it gives the lowest capacity, is said to have a *dielectric constant* of unity, and all the other substances are compared with this. The dielectric constant of a substance, therefore, is the figure which tells us how that particular substance compares with air when used to separate the plates of a condenser.

Although a high dielectric constant is desirable in that it assists in the production of a compact component, yet it is not the only property necessary in a dielectric. It must also be a good insulator and be able to stand a large strain without puncturing. A dielectric without these latter properties is liable to leak or to become punctured by a spark and so

## THE BEGINNER'S A B C OF WIRELESS TERMS (*Continued*)

allow the current to pass between the plates of the condenser.

### Differential Condenser

A condenser having one set of moving plates and *two* sets of fixed plates. It is so constructed that as the moving plates are brought nearer to one set of fixed plates so they interleave less and less with the other set. This is represented by the two diagrams on the left of Fig. 1, while on the right is shown a typical condenser as it appears in commercial form.

The chief use for a differential condenser is as a reaction control. The moving plates and one set of the fixed plates are connected in series with the reaction coil in the usual way. Thus when the moving plates are moved nearer to the fixed ones more current can pass to the reaction coil. This is, of course, exactly the same as with an ordinary condenser. However, with the differential instrument we have still another set of vanes to connect up. These are joined direct to filament or cathode of the valve. This means that, when the condenser is turned in the opposite direction so as to give minimum reaction, the current, instead of having to find some other path, simply returns to the filament *via* the second set of vanes, thus it does not matter in what position the moving vanes are placed, there is always an easy path for the reaction currents. When the moving vanes entirely overlap the one set of fixed vanes nearly all the current will go through the reaction coil, whereas when they are moved in the opposite direction to overlap the other set then most of the current goes straight to the filament. The advantage of offering an alternative path to the current in this way is so that it will have no tendency to wander in illegitimate channels and so cause possible distortion or howling.

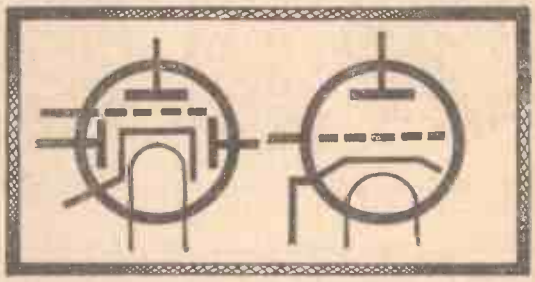


*Fig. 3.—Circuit diagram of double-diode-triode compared with that of an ordinary triode.*

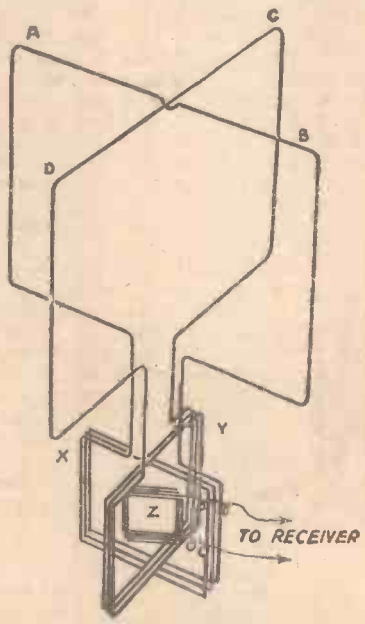



*Fig. 2.—Diagram showing the essential parts of a direction finder.*

### Diode

A valve with only two electrodes—filament and anode. The original wireless valve designed by Dr. Fleming was a diode. This type of valve has recently come into favour again as a detector, since it gives practically distortionless rectification. It has the disadvantage, however, that it does not amplify the signals as does a valve containing a grid. An ordinary valve can be made to work as a diode by connecting the grid and anode together and using them as an anode only, or alternatively either the grid or anode can be used as the anode and the other one left free.

### Direct Current

A current which flows in one direction only. Cf. *ALTERNATING CURRENT.*

### Direction Finder

A receiver incorporating a special type of aerial by which it is possible to tell

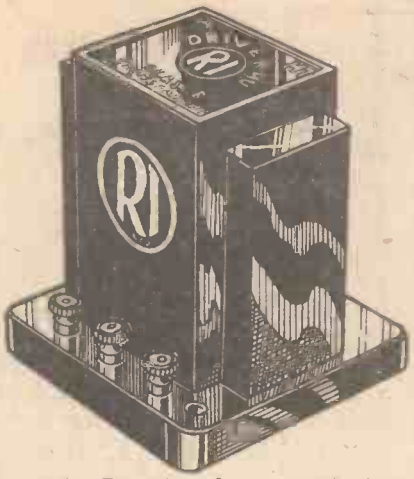


*Fig. 4.—Example of a typical driver transformer.*

the direction from which any transmission comes. The simplest arrangement consists of a frame aerial mounted on a spindle so that it can be revolved. As you know, a frame aerial is strongly directional and when it is pointing in the direction of the station being received the signals are loudest. For commercial work turning the aerial round is too slow and cumbersome a method so the type of direction finder known as a radiogoniometer was devised. The principle of its working is shown in Fig. 2. Two loop aerials AB and CD are arranged at right angles and connected to two tuning coils X and Y as shown. Mounted inside X and Y is a third coil Z, known as the *search coil*, which can be rotated.

Signals arriving from a station in line with loop AB will cause strong current to flow in it and in coil X, but only weak currents in loop CD and coil Y. By rotating Z until it is in line with X maximum signals will be received. The position of Z then shows the direction from which the transmission comes. In the same way if the sending station is in the direction in which CD points then most current will be developed in coil Y and to receive the signal in full strength Z will have to be turned until it is in line with it.

Any transmitter which happens to lie in a direction somewhere between the two loops will naturally cause some current to flow in both X and Y, the amount in each depending on the exact direction. By rotating the search coil again a position will be found which will give maximum signals as before. It will not be dead in line with either X or Y, but somewhere between the two. This position corresponds with the direction of the transmitter. Thus the direction of any station can be found by merely rotating the search coil.

**Double-Diode-Triode**

A valve recently invented which combines an ordinary three-electrode valve and a diode valve in one tube. It has a number of different applications, one of the chief being that of an automatic volume control. The difference between the arrangement of a double-diode-triode and an ordinary valve of the mains type is shown diagrammatically in Fig. 3. See also *VALVE*.

**Driver Transformer**

A special type of L.F. transformer used for Class B amplification. Its chief features are a *step down* in ratio between the primary and secondary and a secondary winding capable of standing heavy currents. These characteristics are practically the opposite of those found in the ordinary type of L.F. transformer where there is a step up in ratio and the secondary has to handle only the smallest currents. See *TRANSFORMERS, AUDIO-FREQUENCY TRANSFORMER, etc.*

**Dry Battery**

A battery in which the electrolyte or active substance between the electrodes or plates is of a comparatively dry nature as distinct from a liquid. Strictly speaking the cells are not dry as the electrolyte is in the form of a paste or jelly. A section through a single cell of a dry battery such as an H.T. or G.B. battery is shown in Fig. 5. A number of such cells go to make up the complete battery. They are separated from one another by divisions of waxed cardboard and connected together by wires so that the zinc case of one is joined to the carbon rod of the next. This leaves one zinc unconnected at one end of the chain and a carbon rod at the other end. The zinc is the *negative* end of the battery and the carbon is the *positive* end. See also *BATTERY, CELL, etc.*

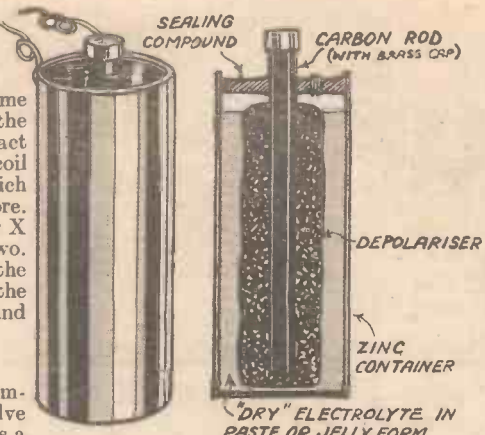



*Fig. 5.—Cell of a dry battery showing construction.*

**Earth Plate**

Normally for the efficient working of a wireless receiver it is necessary that it should be connected to the earth as well as to an aerial. A very good way of effecting this is to bury a zinc or copper plate a foot or so below the soil and to connect it with a wire to the earth terminal of the set. This is shown in Fig. 7. Other metals also make good earth plates but iron is the least efficient.

**Earth Tube**

Another popular way of making an earth connection is to drive into the ground an iron-shod copper rod as shown in the same illustration. One of these can be purchased for a few shillings and is provided with a terminal at the top to which to attach the wire from the receiver. In dry weather it greatly helps if a little water is poured in the top of the tube occasionally. As you see, holes are drilled in the side so that the water can trickle out and percolate through the soil. This enables the tube to make better contact with the surrounding soil and so in effect increases its area and therefore its efficiency.

**Earth Wire**

The wire from the receiver to the earth.

**Dual Range Coil**

A tuning coil having two sets of windings—one for tuning to the medium-wave band, and one for the long waves. A reaction coil is sometimes included as well. A typical example of such a coil is illustrated in Fig. 6. The cover is placed over the coil when it is connected in the receiver so as to shield it from interaction with other coils or components See *COIL*.

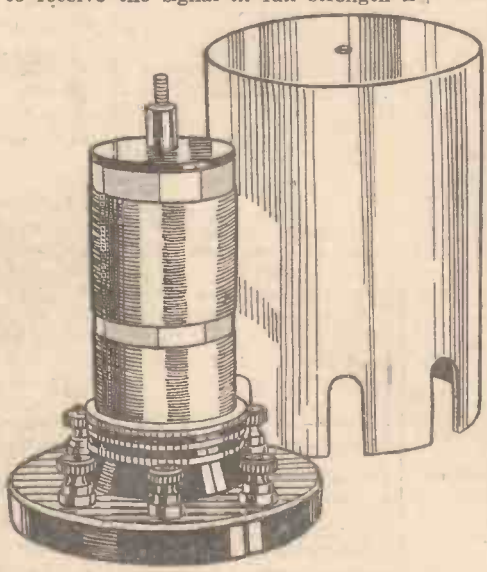


*Fig. 6.—A screened dual-range coil.*

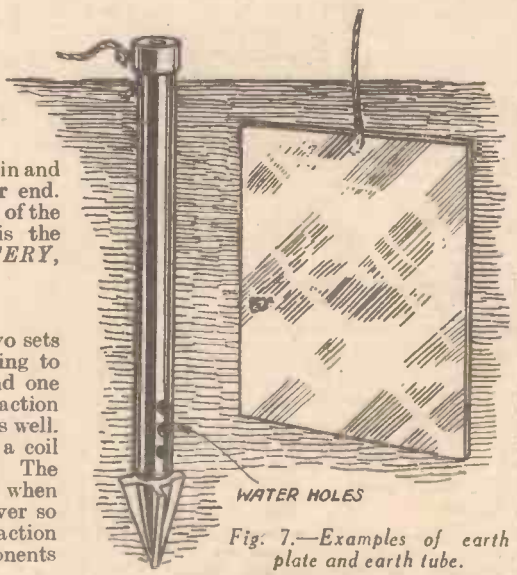



*Fig. 7.—Examples of earth plate and earth tube.*

Scientific

# THE HEXODE VALVE

(*Continued from page 358*)

to combine the characteristics mentioned above and, although these valves are not yet available, it would appear to be ideal for this purpose.

In this valve, two separate grids are located in the same electron stream, but each designed to perform its own particular function. The ordinary grid as employed in normal oscillator valves which gives a sharp cut off was used for the oscillator, and the grid with a trailing characteristic similar to that employed in variable mu valves was used for the signal and grid bias control. Fig. 3 gives a diagrammatic representation of the new valve.

You will notice that the electrodes in the diagram are numbered 1 to 6 on the left hand side, No. 7 is actually not included in the valve and will be explained later. On the right hand side the various relative potentials of the electrodes are indicated.

Let us commence with the cathode No. 1. The electrons which are being emitted are attracted to the positive screen 3 passing through the meshes of the negative grid 2. The electrons approaching the screen are travelling at a high speed, so that the majority of them shoot through the screen 3 and approach the negative grid 4. Here they are attracted back to the screen 3.

Now between grids 3 and 4 we have a cloud of retarded electrons and, therefore, this space is called the virtual cathode. Actually, as mentioned previously, a cathode does not exist, but in order to illustrate the action of this valve, a dotted line has been drawn, marked No. 7, showing its relative position. From this virtual cathode electrons can be drawn in the same manner as they were attracted from the actual cathode.

The other portion of the valve includes the modulation control-grid 4, the modulation screen 5 and the plate 6 in addition to the virtual cathode 7. Some of the electrons arriving at the virtual cathode 7 are attracted toward the positive screen 5 and the plate 6, being still more positive, electrons are also attracted to it through the meshes of the negative grid 4.

The modulator grid 4 has been constructed to have a gradual cut off action, as in the variable mu valve, so that a variable bias can be applied to control the amplification without distorting strong signals.

An important feature claimed for this valve is that the negative bias applied to the Tetrode portion has practically no effect in the functioning of the oscillator portions because the modulation grid cannot cut off the greater portion of the oscillator screen current.

Fig. 2 shows a typical circuit using the new valve. Coupling of the oscillator to the modulator is accomplished by the emission valve action. The capacitative coupling between oscillator screen and modulator grid causes appreciable reaction between signal and oscillator tuned circuits, this coupling is readily neutralized by a small neutralizing condenser shown as C, of very low capacity. This also prevents radiation from the oscillator.

A high gain is claimed for this valve and this opens up interesting possibilities for a four valve superhet receiver with automatic volume control employing:—

1. Hexode detector-oscillator.
2. H.F. pentode I.F. amplifier.
3. Double-diode-triode.
4. pentode output valve.

What a combination!

# RADIO RAMBLINGS

By JACE

*Jottings from my Notebook*

### Yet Another Kind of Interference

THE problem of interference with broadcast reception seems to assume greater proportions every day, despite the praiseworthy activities of the P.O. engineers. I have previously made a good deal of reference in these notes to atmospherics, man-made static and the like, but last week my attention was drawn to an entirely new (to me, at any rate) source of trouble. Unfortunately, the sufferer was an invalid who has been confined to his room for several months with "the wireless" as his only recreation. On returning from hospital a year ago his family presented him with a new three-valve band-pass receiver. He immediately developed a craze for globe-trotting, and soon had compiled a log of nearly 150 stations, every one of which he was able to identify by the aid of charts that he had carefully prepared.

But last time I visited my friend he was very despondent because one day his set appeared to have developed a most peculiar fault. During certain hours of the day the local Regional covered the whole tuning dial, and, more peculiar still, at other times it was the National that swamped everything. The change-over from Reg. to Nat. always took place at the end of some particular programme and never at odd times, as one would expect if interference was being caused by a nearby receiver. Enquiry revealed that one of those now-popular relay or rediffusion services had lately been established in the town, and supply wires had been run over the roof of my friend's house. On comparing the times of interference with the relay programme there was no doubt whatever regarding the source of trouble.

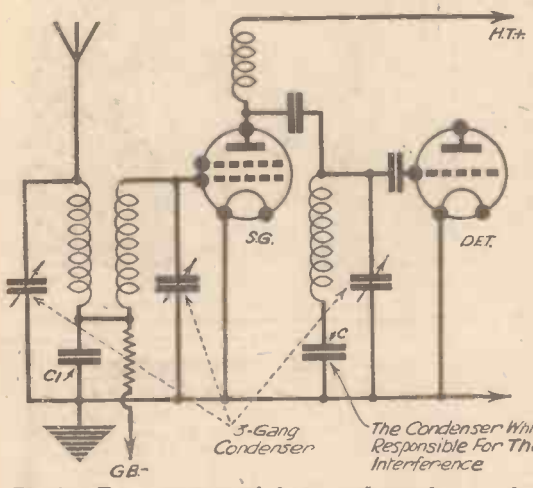



*Fig. 1.—Tuning circuits of the set with which a peculiar form of interference was experienced.*

### Finding the Cause

THE relay engineers were called in, and they examined their lines for leakage, put up various aerials, and tried different earth leads, but all to no avail. Eventually the set was examined, and, strangely enough, interference persisted when the aerial was entirely removed. Taking the S.G. valve out of its holder had no effect, but interference vanished when the detector was removed. Clearly, then, the detector was picking up the interfering signals. Examination of the tuning circuits showed that they were arranged, as shown in Fig. 1. A three-gang tuning condenser was employed, and the fixed condenser marked C was included in series with the tuned grid coil to match the B.-P. coupler C.1. Immediately C was short-circuited the trouble ceased. Of course, that upset the ganging, so instead of shorting it directly, a 1,000-ohm resistance was connected across its terminals. This certainly reduced, but did not entirely eliminate the interference, but on replacing the resistance by an H.F. choke, everything was well.

### The Reason

DO you see how the interference was caused? In the first place the wiring of the set picked up the L.F. oscillations from the overhead supply wires, and these developed a voltage across condenser C (which had a high impedance to them), and they were therefore applied to the detector valve, and amplified in the ordinary way. By shunting the condenser with the H.F. choke an easy L.F. path was provided so that no L.F. voltage could develop across C. Incidentally, the above dodge has been tried in quite a few cases of "ordinary" interference, and it has often proved a satisfactory cure. We live and learn!

### H.T. Batteries for Class "B"

AS you know, one of the principal advantages of Class "B"—or any other push-pull arrangement for that matter—is that very good "quality" is obtained due to the "balancing effect" of the two valves (the two halves of the same valve in the case of Class "B") connected in "opposition."

I was thus rather surprised yesterday to be called upon to look over a new "B" amplifier which was distorting badly. The components, valves, and speaker seemed all right, and I could find no fault with the wiring. Turning to the H.T. battery, I noticed that it was of the small cell type, and my suspicion fell on this, despite the fact that it registered a full 120 volts. As a check, the battery was temporarily replaced by one of the super-capacity type, when reproduction was as good as might be desired.

It took me a long time to explain to the owner that although his battery was in good condition, and easily capable of supplying the *average* anode current of 8 milliamps it was unable to cope with the "*peak*" current of perhaps 30 or 40 milliamps. The whole idea of Class "B" and Q.P.-P., of course, is that the H.T. current fluctuates rapidly between about 3 and 30 milliamperes according to the changing sound intensity given out by the loud-speaker. Consequently, if there is a high resistance in series with the H.T. supply the current is prevented from changing as much as it should. And every high tension battery has a certain amount of "internal resistance," although this becomes much less as the battery is increased in size. For this reason it is always better to employ a "double-capacity," or at least, a really good quality "single-capacity," battery with a Class "B" amplifier. I hear, by the way, that one firm is shortly to market a special battery for the purpose. It will have a low internal resistance, and will be capable of supplying a "peak" current up to 50 milliamps.

### The "Neon Stabilizer"

A FEW weeks ago I pointed out that special eliminators would be required for Q.P.-P. and Class "B," since existing types were incapable of providing the necessary fluctuating current whilst maintaining a constant voltage. I suggested that it might be desirable to devise a new kind of rectifier and low-resistance smoothing chokes, but the problem has been solved in a much simpler manner by the introduction by Messrs. Cossor of a "Neon Stabilizer," as it is called. This is really a modification of the neon lamp used for luminous signs and for television purposes.

Now a neon lamp has the interesting property of passing a current which is proportional to the voltage applied between its two electrodes, so that if it is connected across the output terminals of an eliminator it holds the voltage almost perfectly constant irrespective of the "load." Normally the voltage supplied by an eliminator varies considerably with the current drawn from it. For example, a well-known model of good make gives a voltage of 320 at 5 milliamps and of 160 at 50 milliamps. When the stabilizer is connected to the same instrument, however, the voltage remains almost perfectly constant at 130 whether it is giving 5 or 50 milliamps. A similar effect can be obtained by connecting a resistance across the positive and negative eliminator terminals, but this does not give such accurate regulation as the neon stabilizer.

### More Economical Class "B" Valves

WHILST still on the subject of Class "B" I am reminded of some further developments in this field which will shortly be made known to the public. At the present moment there is only one type of Class "B" valve on the British market and this is designed to a signal output of some 2 watts for an average H.T. current, including that of the driver, of 11 milliamps. Although this type of valve has already proved extremely popular it is thought by some manufacturers that its

output is greater than many people require, and its current consumption higher than some of us can afford. As a result, I understand that one or two smaller types will soon come on to the market. It appears that these will be designed for a 1 watt output and will require only about 5 or 6 milliamps of anode current. Eventually, I suppose we shall have a range of "small," "medium" and "super" Class "B" valves, just as we now have the three varieties of power valves.

### Comparing Coil Efficiencies

IF you make your own tuning coils you must often have wondered how the efficiencies of two or three different types could accurately be compared. Of course you can always try them in a set, but that method is very slipshod and does not furnish you with any reliable data. A much better system is represented by the circuit diagram of Figure 2, where the coils under test are connected in the grid circuit of an anode bend rectifier, in whose anode lead is included a milliammeter reading up to 2 mA., and a pair of 'phones.

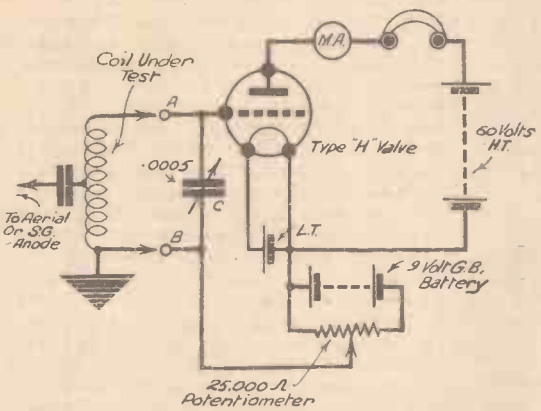



*Fig. 2.— A simple method of comparing the efficiencies of coils.*

First of all, points A and B are short-circuited and the 25,000 ohm G.B. potentiometer adjusted until a reading of exactly zero is shown on the milliammeter. Next a coil is connected to A and B and also to the aerial, or anode of an S.G. valve. The local station is then tuned in on condenser C and the milliammeter reading carefully watched. It will be noticed that the current increases as the tuning circuit is brought to resonance with the transmission, and it is the maximum deflection of the milliammeter needle which must be observed. Other coils can then be substituted for that already tested. Each must carefully be tuned to the same transmission and the maximum deflection noted in each case. The coil which produces the greatest increase in anode current is the most efficient at the wavelength of the particular transmission tuned in.

### Selectivity Comparisons

INCIDENTALLY the selectivity of different coils and circuit arrangements can be compared in the same way, by observing the number of degrees through which the dial of C must be turned to increase the milliammeter reading from zero to a maximum. The greatest amount of rotation will be required with the least selective coil, and *vice versa*.

### How It Works

THE principal underlying these tests is very simple and depends upon the fact that the more sensitive a coil is, the greater is the voltage developed across its ends when tuned to a given transmission. And the H.T. current passed by an anode bend rectifier is proportional to the voltage between its grid and filament; consequently the change in anode current is a measure of the voltage between the ends of the coil, and hence, of the coil's efficiency.

### Using Electrolytic Condensers

ELECTROLYTIC condensers do not seem to have met with the popularity they deserve. Having a much larger capacity for any given size than ordinary fixed condensers, they are much better for smoothing circuits, where efficiency is largely governed by the number of microfarads available. Besides this, electrolytic condensers cost only about half as much per microfarad as paper ones. Why is it, then, that they are not being used in very great numbers by the home constructor? I imagine it is because they are primarily designed for mounting on metal chassis, whilst most amateurs prefer to use wood. Nevertheless, these very efficient condensers can quite easily be mounted on a wooden baseboard by using a brass or aluminium bridge as shown in Figure 3. The negative connection is made to the containing case so that in wiring up the set a common negative lead for all the condensers can be taken from one of the screws used for securing the bridge to the baseboard.



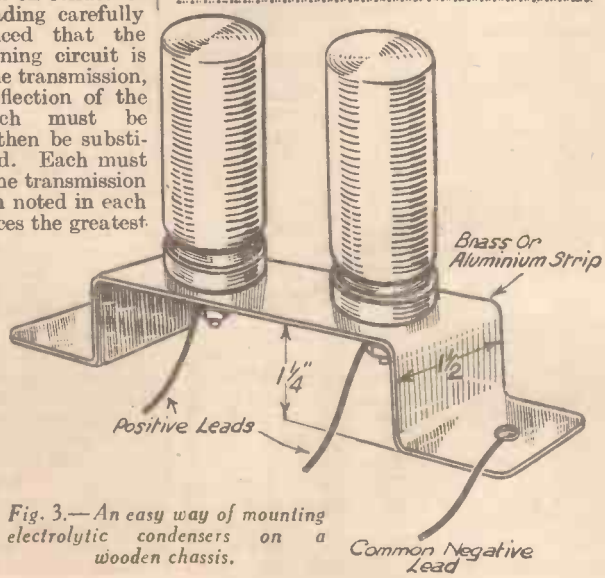



*Fig. 3.—An easy way of mounting electrolytic condensers on a wooden chassis.*

# OUR VIEWS ON RECEIVERS

## FERRANTI 7-VALVE BAND-PASS SUPERHET. (A.C. MAINS)

FOR many years the name of Ferranti has been a household word in the electrical world, and components made by this firm have become world famous for their quality. It is not surprising, therefore, to find that a firm enjoying such a reputation should launch on the wireless market an ultra-modern version of the superheterodyne circuit embodied in a receiver capable of coping successfully with reception conditions of the present day. The daily increasing number of transmitters, to be housed in an already congested broadcast band, offers serious problems to the manufacture of radio receiving instruments. With its exceptional selectivity, wide range and excellent quality of production, the "Ferranti 7-Valve Consolette" reaches a high degree of perfection and, without doubt, conclusively establishes the supremacy of the superheterodyne circuit to meet the demands made by listeners who expect a clean reception of the majority of worth-while programmes offered by the Home and Continental studios. In this the receiver sets its own standard; it is in a class of its own.

The "Ferranti Superhet" employs seven valves, including the mains full-wave rectifier (Ferranti Type R4). For the preliminary high-frequency stage, an indirectly heated variable-mu screen-grid valve (Mazda A.C. SIVM) is used: it is embodied in a single tuned aerial circuit and transformer coupled to the first detector, a valve of the same type arranged for anode-bend rectification. (Preliminary H.F. amplification of this description possesses the advantage of preventing radiation and consequent interference with your neighbour's reception; in addition, it cuts out mush, etc.) Following this stage, we find a similar valve as an intermediate amplifier with band-pass coupling to ensure a high degree of selectivity without loss of quality. The second detector (Ferranti D4) is of the grid-leak type, and coupled to the power-output valve (Mullard AC/044) by a transformer in such a way as to permit the last valve to overload before the detector.

The oscillator valve (Type D4), an indirectly heated triode, is coupled to the first detector through a coil in its cathode circuit; its grid circuit is tuned, the correct potential being secured by a grid condenser and leak. The power valve, through a suitable output transformer, feeds approximately 1 watt undistorted power to a low impedance Ferranti moving-coil D.C. energized speaker, of which the field winding provides part of the smoothing of the high-tension current supplied to the receiver. Ample decoupling arrangements have been incorporated in the circuit, and the result is a negligible mains hum which can only be detected when the set is not actually tuned to a broadcast. As will be seen from the illustration, the walnut-finished cabinet is of an exceedingly pleasing appearance; its lines are simple but well proportioned. Although the back is left open to allow easy dissipation of heat and to allow unrestricted operation of the loud-speaker, most of the components, including valves, coils, etc., are enclosed in rustless cadmium-plated steel, thus completely protecting all parts and making any unpleasant "live" contact impossible. The chassis is of a particularly robust construction, and to overcome microphonic noises is carefully mounted on resilient rubber pads. There can be no vibration of the tuning condenser or of any other components (valves, etc.).

*The Ferranti Seven-Valve Superhet.*

The "on" and "off" and wave-change switch is a combined one and operated by one knob. On the left is the volume control and, on the right, the knob working the triple-ganged condenser. The volume control (left) is highly efficient; it acts on the grid-bias of the variable-mu valves, and it is possible to reduce sound to almost a whisper without in any way affecting quality of production. Although rotating nearly one revolution, it must be set well back for the reception of strong broadcasts, as if this is not done, owing to enormous H.F. amplification, there is a risk of overloading the second detector and distortion results.

In addition, a small knob has been inserted in the speaker grille. It has four positions which place a filter across the speaker to cut off unwanted high-frequencies. Much interference can be cut out in this manner when listening to foreign broadcasts which are affected by heterodyne whistles, mush, morse, etc. It is possible to vary the tone from "brilliant" to "mellow" by gradual steps, and thus suit it to individual tastes or to the particular transmission tuned in. Moreover, all background noises are effectively reduced to a minimum.

The "Ferranti Superhet" is designed for use only on A.C. current having pressures from 200 to 250 volts (40 to 100 cycles), and a very ingenious arrangement permits the setting of the mains transformer to suit any individual supply within these limits.

For the best results to be obtained, a good outside aerial and earth should be adopted, but the mains-aerial device, with which the receiver is equipped, will give excellent results in most localities, not too far distant from a broadcasting station. The mains aerial is automatically brought into action when the aerial plug is withdrawn; the re-insertion of the aerial plug disconnects it. Provision has also been made for the connection of a gramophone pick-up with external volume control. It will give an electrical reproduction of records to suit the most critical ear at very great volume, if desired.

The selectivity is such that it is possible to clear each individual station from its neighbour, providing the kilocycle separation is a workable one: a higher degree of selectivity would not be practical if quality is not to be impaired. The tuning control is smooth and gives that sharp cut-off effect on the passage of one carrier wave to another; except in rare instances, no side-band splash was noticeable, and then only in the most congested portions of the broadcast band. It is possible to tune in stations throughout the scale from, roughly, 200 metres to 550 metres in the medium wave-band, and from Leningrad on 857 m. to Kaunas (1,935 m.) on the longer wavelengths. The sensitivity of the circuit is very high, and reception at good volume can be obtained of such comparatively small transmitters as Magyarovar, Salzburg, Cork, Kiel, Juan-les-Pins, etc., etc. It is an easy task to separate Mühlacker from London, Königs Wusterhausen from Radio-Paris and Daventry, and even Warsaw can be received without background twitter from Eiffel Tower. In the course of two hours over sixty stations were identified and logged; many more were heard, but were not considered of entertainment value. As a conservative estimate, it would be safe to affirm that any purchaser, however unskilled in the use of a wireless set, could be given daily, with the "Ferranti Superheterodyne," *the choice of some thirty or forty* different programmes. If there is any portion of the receiver which can be considered subject to adverse criticism it is the illuminated station dial, inasmuch as the names of the stations—possibly with a view to clarity—have been printed in somewhat large letters. By so doing such studios as Gleiwitz, Frankfurt-am-Main, Turin, Bordeaux Lafayette, Breslau, Strasbourg, Munich, although heard at full strength, do not appear in the list. It is a small matter which could be remedied in later models.

# IMPRESSIONS ON THE WAX

## A REVIEW OF THE LATEST DISCS

By E. REID-WARR.

MANY items from each week's broadcasts are well worth hearing again and again. I have carefuly selected some which should go into everybody's record collection with the assurance that they will retain their popularity for a very long time. The recordings mentioned are the outstanding ones in each case.

### Napoleonic Drama in Song

*The Two Grenadiers* is probably Schumann's most famous song, the words of which are by Heine. It was sung by Harold Williams on April 9th, but unfortunately the English translations are not as good as they might be. The story is of French soldiers returning from Russia with only one thought—the Emperor. It is a moving theme. There is a fine rendering by the German bass, Schlusnus, on a recently issued *Decca-Polydor*, *CA*8144. This will be greatly enjoyed if you just "get" the story and then hear this great singer tell it.

### A Sparkling Light Overture

The Overture to *If I Were King* was played on April 10th. Now this is in no way "great" music, but it has much dainty charm and some very tuneful phrases. Its appeal, moreover, is greatly enhanced by a really splendid performance and impeccable recording on *Columbia DX*361. The Orchestra Symphonique de Paris are the players. I strongly recommend a hearing for this record.

### An English Musical Item

Did you hear Quilter's *Children's Overture* on April 11th? This is one of the most delightful miscellany of children's old songs strung into a beautiful chain of melody. Test this by hearing *I Saw Three Ships* on one of the (two) *Columbia* records *DB*951–2. (Second side 951.) Anybody who can resist the wholly lovely playing of the London Philharmonic Orchestra is a hopeless case.

### A Standard Popular Classic

No collection is complete without Coleridge-Taylor's *Petite Suite de Concert* played on April 12th. It is such a very complete picture throughout. Without undue elaboration, very tuneful, and yet an accomplished piece of composition. Definitely in the school of popular *good* music, you will find the best records in *H.M.V. C*.2372–3, on which the suite is played by the London Symphony Orchestra.

### Wagner's Best-known Piece

No excuse is needed for mentioning Wagner's *March from Tannhäuser*, played on April 13th. Everybody knows it well enough to whistle. Of course, everybody one day will buy a record of it. If you want a really opulent performance, one showing drilling with the Teutonic thoroughness Wagner loved, try *H.M.V. DB*1557, done by the Chicago Symphony Orchestra. It is rather expensive, but the backing of the famous *Prelude to Act* 3 "*Lohengrin*" makes it really extraordinary value for money.

### Another Jolly Popular Classic

The *Overture to the Barber of Seville* played on April 14th, is one of those bubbling, high spirited things which will enliven any party. It is quite easy to follow and keeps up the fun throughout. (Rossini really ought to be advertised as a tonic!) There is an excellent record of it in *Parlophone E*11148 on which the Berlin State Opera Orchestra excel themselves.

### Palm Trees and Romance

Hawaii has perhaps been a little overdone, but its "national anthem" *Aloha Oe* came up quite fresh again on April 15th. Those peculiar wailing guitars are quite essential, and you will find a very pleasant few minutes with the Waikiki Serenaders on a little *Broadcast* (807). *One* of these guitar records will satisfy most, and this should please.

### The "Unfinished"

The B.B.C. Orchestra gave a good performance of this, the most popular of Schubert's compositions on April 16th. Why this was never completed by the composer will never be known. It is strange that the two movements which *were* written were never heard until almost forty years after Schubert's death. But these make glorious music and are beautifully handled by the New Queen's Hall Orchestra (under Sir Henry Wood) on *Columbia DB*9513–5. Also hear the version of the Covent Garden Royal Opera Orchestra on *H.M.V. C*1294–6: this is also exceedingly good.

### Insect Antics

One of the best pieces I know of the "characteristic" type is Bucalossi's. *Grasshoppers' Dance*, played on April 17th. Quite jolly, distinctly clever, ideal for the lighter moments and wears extremely well. The best record is *Columbia DB*1007 on which a picked number of instrumentalists from the Regal Cinema (Marble Arch) play it. You'll like this immensely.

### Sounding Brass

The season of bands in the open air is coming and some fine issues have anticipated it. *Columbia*, right in front, present some really tip-top records. One of the best military band records for a long time is *Marching With Sousa* (*DX*455), played by the band of H.M. Grenadier Guards. Could anything be more appropriate? The world's finest military band, and a selection of the best marches. Recording and playing are alike perfect, and here is a splendid chance to listen to

(*Continued on page* 380)

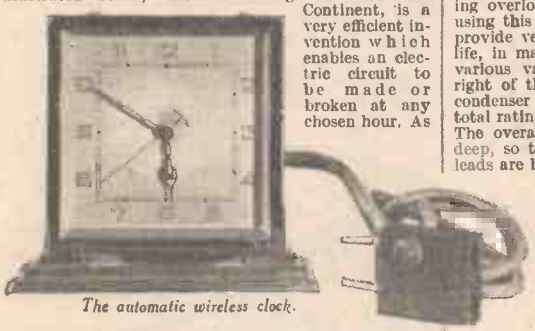
# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

### AUTOMATIC WIRELESS CLOCK

THERE appears to be a great demand for some automatic device which will bring a radio receiver into operation (or disconnect a receiver) at some pre-determined hour, and several schemes have already been proposed for carrying out this idea. The clock illustrated below, and which originates from the Continent, is a very efficient invention which enables an electric circuit to be made or broken at any chosen hour. As



*The automatic wireless clock.*

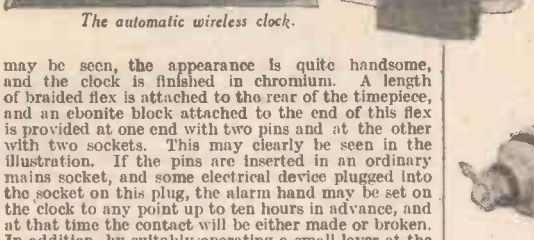
may be seen, the appearance is quite handsome, and the clock is finished in chromium. A length of braided flex is attached to the rear of the timepiece, and an ebonite block attached to the end of this flex is provided at one end with two pins and at the other with two sockets. This may clearly be seen in the illustration. If the pins are inserted in an ordinary mains socket, and some electrical device plugged into the socket on this plug, the alarm hand may be set on the clock to any point up to ten hours in advance, and at that time the contact will be either made or broken. In addition, by suitably operating a small lever at the back of the case an ordinary alarm bell may be rung. The method in which the switch operates may be seen from the enlarged view at the bottom right-hand corner of this page. A simple rocking plate is depressed when the alarm striker is released and, according to the preliminary setting of this plate, the contact is either made or broken. The apparatus was used for test purposes with a radiogram, a table lamp and an ordinary electric kettle, and it was found to function most satisfactorily. The contact is of the Q.M.B. type and no arcing took place on the highest current which was employed. The numerous applications of this clock will be obvious to the reader, and it will no doubt find great favour with listeners. The price is 45s.

### BULGIN CONTROLATONE

THE instrument shown at the foot of this column is a very neat tone-control device, manufactured by Messrs. A. F. Bulgin, and is called a Controlatone. It consists of a condenser and a variable resistance connected in series. Two types are made, Type A and Type B, the differences being in the values of the components employed. It is intended for connection across a loud-speaker, outpnt choke or from anode to cathode of the output valve. Type A is for use with triode valves, and Type B for use with pentodes, in which case it takes the place of the usual tone filter. It works very smoothly and gives fine control of high-note response, enabling heterodyne whistles to be removed, needle scratch to be reduced, and the tone to be otherwise modified. The component is one-hole fixing and occupies very little space at the rear of the panel. The price is 5s.

### HELLESEN CONDENSERS

A REPRESENTATIVE group of Hellesen condensers is shown in the centre of this page, and these are of the wet and dry electrolytic types, and one of the small mica fixed condensers. The cylindrical condenser is, of course, the wet electrolytic type, and this is of the standard pattern, having a metal casing which is the negative pole. The positive electrode is brought out at one end through an insulating bush, and this is surrounded by a large one-hole fixing nut. The condenser is intended for mounting in a vertical position on a metal chassis, in which position the casing becomes automatically connected *via* the metal chassis. A large soldering tag is fitted to the remaining electrode and the connection of this type of condenser is thus very simple to carry out. The makers' advice regarding overload, etc., must be strictly adhered to when using this type of condenser, and it will be found to provide very efficient smoothing, combined with long life, in mains-operated receivers. It is obtainable in various values. The large square assembly on the right of the condenser is one of the dry electrolytic condenser blocks. In the case of the illustration, the total rating of the component is 8, plus 8, plus 1 mfd. The overall dimensions are only 2in. square by 1in. deep, so that it is a most compact unit. Three red leads are brought out at the upper end, and one black lead at the lower centre. The latter is the common negative, and the upper leads are used to make connection to each or all of the condensers. For mains receivers this will prove a most useful accessory. The small black object is a neat fixed condenser of the mica variety, measuring less than 1in. square, and is obtainable in a number of different values.



*Bulgin Controlatone.*

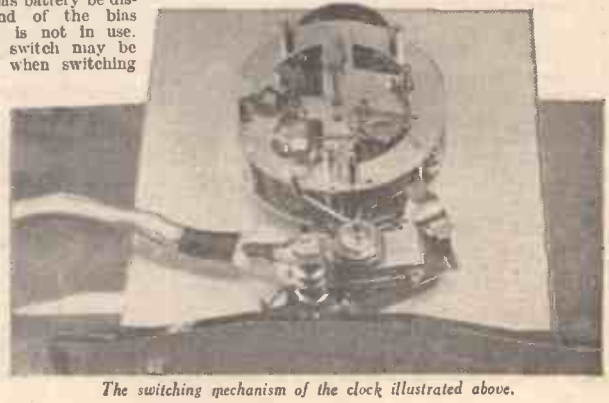
*A group of Hellesen condensers.*

### NEW BRITISH RADIOPHONE PRODUCTS

TWO interesting new lines are announced by British Radiophone, and advance samples are undergoing test. One of these is a combined reaction condenser and potentiometer and has received the name "Duovol." It will be stocked with standard values of 10,000, 25,000, and 50,000 ohms, but will also be made to order in any value up to 100,000 ohms. Its uses are apparent. The price will be 10s. The other component is a very neat chassis-type single tuning condenser of quite small dimensions. This has a solid base fitted with screw holes so that it may be bolted to a metal chassis or attached to a wooden baseboard by means of ordinary screws. The most interesting feature of this condenser is the fact that two small fixed condensers are mounted on the base and may be used for series-aerial condensers, grid condensers, etc. Separate terminals are provided for these fixed condensers. The price is 8s., and the spindle is fixed to the front metal plate in such a manner that the standard disc drives may be fitted with no trouble.

### LEWCOS POTENTIOMETER AND SWITCH

WHEN using the variable-mu type of battery valve, it is essential that the grid-bias battery be disconnected from at least one end of the bias potentiometer when the receiver is not in use. An ordinary three-point battery switch may be used to carry out this operation when switching off the L.T. supply, but an alternative method is to use a potentiometer which is fitted with an automatic switch. The Lewcos component, shown on this page, is built on these lines, and is of the standard potentiometer style, having a swash-plate adjustment with the addition of a small switch enclosed in the bakelite casing. When the control knob is turned to the minimum position the switch is operated and breaks the connection to one end. The price of this component is 6s. 6d. which is, of course, very cheap when it is realised that it combines two separate components.



*The switching mechanism of the clock illustrated above.*

### MAGNUM CONTROLS

THE various types of volume controls manufactured by Messrs. Burne Jones and Co. will be found to be suitable for almost any type of circuit. One of the most interesting is the Magnum Dissolver. This is actually a potentiometer with a fixed tapping at the centre of the resistance element which is of the composition type. The slider is of the rocking disc type and the total resistance of the unit is 500,000 ohms. The device is intended for changing over from radio to gramophone and avoids the annoying click in the speaker which arises when using an ordinary type of circuit breaking switch. The two halves of the resistance are used as volume controls across an L.F. transformer and a pick-up, and the movement of the slider from one end to the other results in the fading out of radio reproduction and the gradual fading in of gramophone music. It is quite noiseless in operation and provides a most useful form of control. The price is 7s. 6d. The volume controls are exactly similar in construction, without, of course, the centre-tap. The rocking plate makes a very smooth form of variation, and avoids the grating or scratching noises which usually result from a rubbing or rolling contact point. Two values are obtainable, 500,000 ohms and 2 megohms, the price being 5s.

*A combined potentiometer and switch manufactured by Lewcos.*

### EELEX PLUGS

WANDER plugs can be the source of much trouble, and many and varied are the arrangements which have been introduced in order to ensure perfect contact through the medium of a plug and socket. The new Eelex plug has novelties, and certainly enables a very firm anchorage to be made as well as a firm contact in the socket. The metal plug is split through its whole length, and a small bakelite end is threaded to receive the plug. The bakelite and the metal plug are drilled transversely and tapped to accommodate a small grub screw. The flex or wire to which the plug is to be attached is inserted in the open end of the bakelite and when pushed right home the grub screw in the side is tightened up. After a few turns the wire is firmly gripped, and then the patent locking device comes into play. The pressure of the grub screw on the opposite face of the metal forces the two halves of the metal plug apart and thus increases its size so that it may be forced into practically any size of socket and give a firm contact. The device is very simple and the attachment of leads takes only a second. Furthermore, there are no loose parts to be mislaid when wiring up, which is a very important point. The plug costs 1½d., and is obtainable in red or black.

### E. D. C. C. ROTARY CONVERTERS

THOSE readers who are supplied with D.C. mains often feel the need for a good A.C. supply either to operate a Mains receiver or for experimental purposes. A rotary converter is of course necessary, and those manufactured by the Electro Dynamic Construction Co., Ltd., are very efficient pieces of apparatus. When designing this type of apparatus particular care has to be taken to avoid interference either from the H.F. side or from irregularities in the supplies. Hum and whistles must be completely avoided. Robustness is also very important as it may be necessary to run the machine for long periods without attention. The E. D. C. C. converters have been designed on very sound lines and the voltage regulation is of a high order—not exceeding 2½ per cent. on the largest radiogram. The armature is dynamically balanced and it is very silent in operation. The temperature rise is very small, and the bearings are of the silent wool yarn lubricated type. Prices vary according to the rating, from £6 10s. to £35 5s.

# Practical Letters from Readers.

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

### What a Gift!

SIR,—I have received my copy of the "Wireless Constructor's Encyclopædia" quite safely, and wish to offer my very grateful thanks. Really, I cannot find words to express how indebted I feel to you, for I have only glanced through the book as yet, but what a gift! As I am a beginner, you will readily understand how I shall treasure such a work. I shall continue to look forward each week to my copy of PRACTICAL WIRELESS.—HERBERT B. STOTT (Rochdale).

### Another Bouquet

SIR,—I have received my copy of the "Wireless Constructor's Encyclopædia" this morning, and I feel I must congratulate you on your excellent work. It greatly exceeds my highest hopes, and it is a volume I shall treasure for years. The binding and printing leaves nothing to be desired. And now a word about PRACTICAL WIRELESS. Having been a wireless "fan" for two or three years, I have tried every journal about wireless, but yours beats them all. Wishing you even greater success.—N. V. G. WYATT (Redhill).

### Speakers and Overloading

SIR,—Will you kindly inform me why it is that the large majority of speaker manufacturers neglect to state the exact load the speaker will handle without distress? Many amateurs think that so long as they have a moving-coil instrument they can use the largest output valve procurable, and when they get serious overloading and consequent distortion, they of course blame the amplifier, believing that it is impossible to overload their speaker.

Most people, when the moving-coil boom came, bought the cheapest possible speaker. With the larger anode voltage and valves now used, coupled with the poor power handling capabilities of these units, the amateur is sorely puzzled as to the source of his trouble. I suggest that if this information is given by the manufacturers and stamped on their products, they would assist in removing a real worry from the minds of many radio enthusiasts.—CHARLES SNEADAWAY (Tooting, London, S.W.).

[*Now then, Speaker Manufacturers!*—ED.]

### Another Reader's Thanks

SIR,—Many thanks for "The Wireless Constructor's Encyclopædia," which I received quite safely. I must say that it is a fine book and just what I have been looking for this last few years. Besides being bound very nicely, it has a great number of illustrations in it, which I think are a great help to the wireless amateur regarding his little wireless problems and worries.

Regarding PRACTICAL WIRELESS I must say that it is a really fine weekly. I follow with interest your articles on short-waves and must say they are very good, in fact, I think that they are about the best I have ever read.—F. G. SADLER (Stamford Hill).

### "An Excellent Production."

SIR,—I have just received the Encyclopædia, and I feel it my duty to write and congratulate you on such an excellent production. It exceeds by far all my expectations, and is a book which no wireless enthusiast should be without. I have always found in PRACTICAL WIRELESS a long-felt need supplied, and shall continue to take it as long as it keeps up to its present standard.—PERCY NORMAN (Newark).

### Overflows with Good Things

SIR,—Please accept my sincere thanks for the splendid "Wireless Encyclopædia" which I received last week, and also the Wireless Data Sheet Self-binder. I have taken PRACTICAL WIRELESS since last November, after first seeing a copy quite casually, and I think the paper overflows with good things. It ought to have been out years ago. Thanking you once again and wishing PRACTICAL WIRELESS every success.—J. GIBSON (Ravensthorpe).

**CUT THIS OUT EACH WEEK**

## DO YOU KNOW?

—THAT new multi-valves are obtainable in America, and will soon be obtainable in this country, which enable a 4-valve superhet to be built.

—THAT the circuit of such a receiver is similar to a present 7-valve superhet.

—THAT some startling developments may be produced in time for the Radio Exhibition at Olympia.

—THAT Tele-Control radio enables the receiver to be stowed away and practically forgotten.

—THAT changes in grid bias or anode voltage should never be made without first switching off the filament or heater supply.

—THAT chokes, resistances, etc., should not be short-circuited for test purposes without first cutting off the current flowing through them.

—THAT alterations should not be made to commercial components unless you thoroughly understand the nature of the proposed alteration.

—THAT care should be exercised when earthing metal parts in a receiver in case short-circuits occur.

### NOTICE

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

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

### A South African Reader's Appreciation

SIR,—As a regular reader since the first copy of your splendid PRACTICAL WIRELESS, accept my thanks and best wishes for the continuation of the good work. I am always looking forward to my copy.

What about a first-class long and short waver?—R. J. BOTHA (Cape Province, South Africa).

### Ekco Superhet Receiver

SIR,—I note with great interest your test report of our Superheterodyne Model SH.25, which was published in the April 29th issue, and am gratified to find that most of its features met with your unqualified approval. There is one point, however, to which we should like to draw attention. This is in reference to our Station Dial, which has proved so immensely popular that we are rather naturally disconcerted to hear that your technicians are unable to subscribe to its merits.

In a spirit of friendly controversy, we ask your leave to present a counter-argument to that contained in your test report. Vide, the latter:—

"There are over two hundred and thirty stations in Europe alone, and it is evident that no dial of reasonable size could possibly show all their names. Providing, say, twenty or thirty names were given on that portion of the dial allotted to the medium band, and which, with their corresponding wavelengths, would act as landmarks, it would be better practice to calibrate the rest of the dial in degrees *only*."

We heartily agree that it is a practical impossibility to include the names of all transmitters, but we decided, after an extraordinary amount of discussion, to include as many of the high-class stations as was compatible with clarity and neatness of design. Curiously enough, this decision was reached by a process of reasoning not dissimilar to that given in the quotation above. The final decision as to the stations to be engraved was their suitability as landmarks for the lesser lights, but instead of confining them to a minimum, as suggested by your viewpoint, we took the opposite course and expanded them to the maximum.

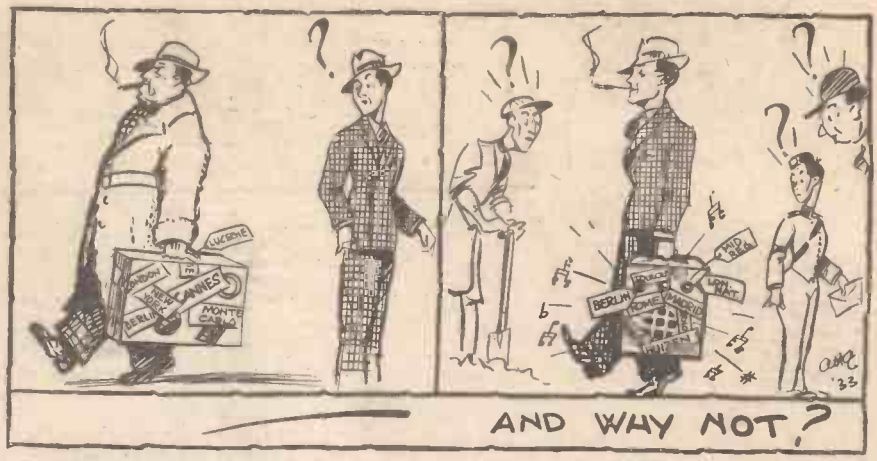
To justify this is comparatively simple, as you yourself have provided us with a stonewall argument! Many of the sets on the market to-day—including some of our own—have the dials engraved with wavelengths.

On these dials, to modify your statement:—

"There are over three hundred and fifty separate 'metres' on the medium waveband alone, and it is evident that no dial of reasonable size could possibly show them all, etc., etc."

Your argument would seem to infer that the fewer the landmarks, the easier the operation of tuning, and, therefore, that wavelength-engraved dials should be marked at, say, every 50 metres instead of at every five or ten. If this really is the case, our striving for accuracy in calibration is not only unnecessary, but undesirable. We should not like to think that this is so!—Apart from this small grievance, we are very satisfied with your report, but we are sure that those of your readers who have been attracted by this model will be glad to hear that its price now stands at 19 guineas, as against the 24 guineas inadvertently mentioned in your final paragraph. A correction notice to this effect would be greatly appreciated.—E. K. Cole, Ltd. (Southend-on-Sea).

*(Continued overleaf)*




(*Continued from previous page*)

### Quality of Reproduction

SIR,—I wish to acknowledge receipt of the "Wireless Constructor's Encyclopædia," for which you have my sincere thanks. I consider it one of the greatest books that anyone interested in wireless could have, and we ought to take our hats off to PRACTICAL WIRELESS for making such a splendid gift possible. May I also endorse the plea for quality of reproduction, as put forward by H. S. Bassett in his letter in March 25th issue? In voicing his own opinion upon the matter, I think he will have voiced the opinion of thousands, and I'm sure a circuit where quality of reproduction was the first consideration would be, as he puts it, "phenomenally popular." I hope PRACTICAL WIRELESS will take the lead once more, and give us such a circuit. —J. L. CRAIGS (Hendon).

**FACTS WHICH SPEAK FOR THEMSELVES!**

Home Constructors the whole world over always await the test reports and the PRACTICAL WIRELESS seal of authority! *Verb. sap.!!*

# RADIO CLUBS & SOCIETIES

### INTERNATIONAL SHORT-WAVE CLUB LONDON CHAPTER

We wish to thank you for publishing recent notices about this organization. The applications for "New World Time Charts" have been enormous. It gives proof of your enormous circulation. This radio weekly has surely become first. We should like, at this time, to pay a tribute to the publishers for bringing out such a fine paper. A very interesting demonstration of a Mavox, Type B6S All-Wave Superhet, was given at the London Chapter of the International Short-Wave Club meeting held on Friday, May 12th, at the R.A.C.S. Hall, Wandsworth Road, S.W.8. This receiver was designed specially for use overseas for the purpose of receiving the British Empire stations. This receiver is the first British All-Wave receiver to incorporate quiescent push-pull, which makes the H.T. consumption very low.

Members were interested in the ease of control, world-wide reception being obtained.

The next meeting, which will be open to non-members, will be held on Friday, May 26th, 8.0 p.m. A lecture entitled "The Atomic Theory and Ionisation." will be given.—A. W. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

### PROPOSED RADIO CLUB FOR CARDIFF AND DISTRICTS

All radio enthusiasts, especially amateur transmitters, are invited to write to A. W. Robertson, 9, Pitman Street, Canton, Cardiff, concerning formation of the above. A meeting will be held as soon as a number of members are got together.

### SLADE RADIO

A lecture, entitled "The acoustic side of Reproduction," was given by Mr. A. S. Radford at the meeting last week. After referring to the mechanical reproduction of sound and the methods used he went on to describe frequency response.

How sound is transferred from a studio to the listener was described, also amplitude distortion and acoustics of halls, etc.

Development of measuring instruments and measurement of sound intensity, use of decibels, and why they were adopted were described.

The construction of the ear was explained, after which came the question of reverberation. An apparatus was then demonstrated by means of which an echo can be traced. The studio at Budapest was described, and also the acoustic qualities of Broadcasting House. Another D.F. test took place on Sunday last, when fifteen competitors set out to track down a hidden transmitter (Mr. C. H. Young, G2AK).

The area was a ten-mile radius from the starting point at Morton Bagot. Three competitors were successful: Messrs. G. T. Peck, T. Kingscote (Gloucester Club), and J. Curtis. At the conclusion a happy party of forty-three members and friends sat down to tea, and recounted their experiences. The cup and prizes were than awarded, and this concluded a very enjoyable and interesting test.

### BURTON-UPON-TRENT AMATEUR RADIO SOCIETY

At the meeting of the above society, held on May 2nd, Mr. G. H. Perry gave a lecture on television: he described the various forms of apparatus used at both the transmitting and receiving end, and gave a practical demonstration by means of a gramophone record which he himself had recorded of Jack Payne and his band. He then went on to describe the apparatus used for talking pictures, and explained that although the two subjects seemed totally different, he himself believed that they were closely allied, and said that he thought in the near future only one copy of a film would be made, and this would be televised and picked up in various picture houses all over the country simultaneously. The society would welcome new members, and applications for membership should be sent to the hon. sec., W. A. Mead, G6YY, 189, Burton Road, Burton-on-Trent.

### THE CATFORD AND DISTRICT RADIO AND TELEVISION SOCIETY

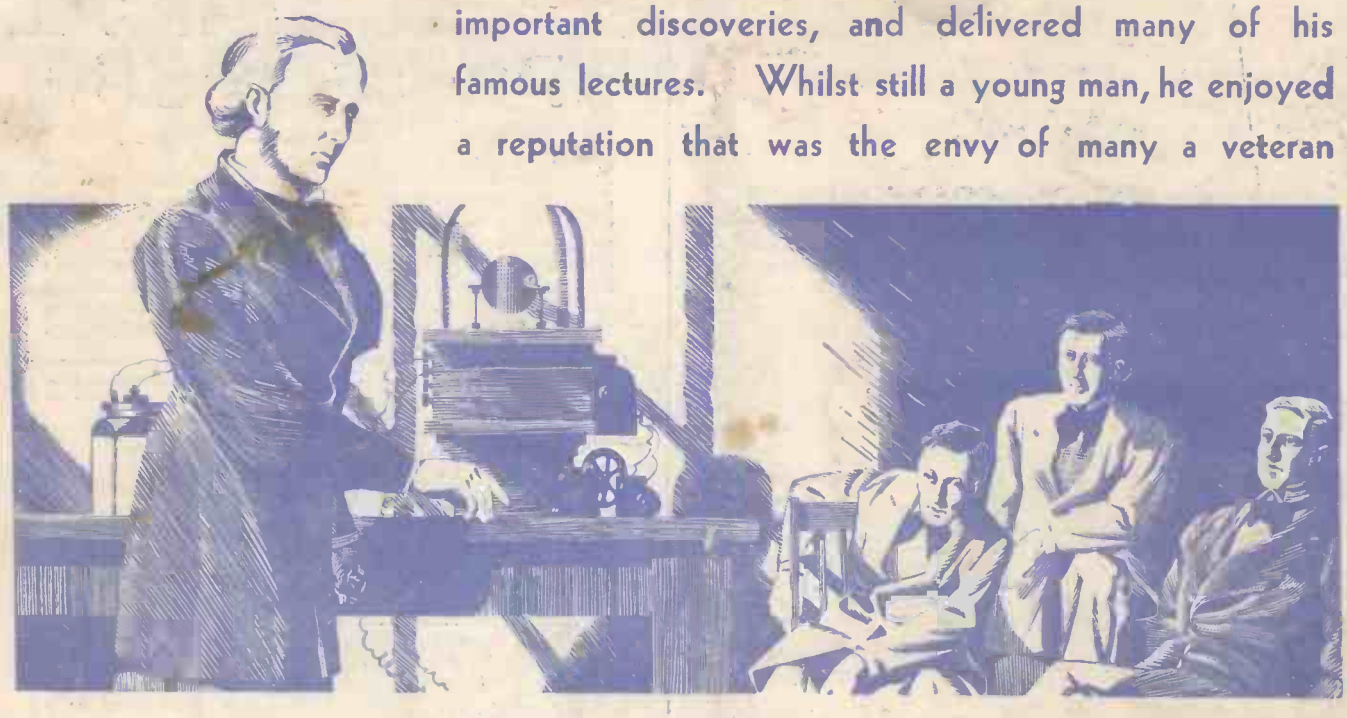
"Electric Condensers" was the subject of a talk given by Mr. C. D. Gwinn, of the Telegraph Condenser Company, Ltd., to the members of the Catford and District Radio and Television Society at their last meeting. First, Mr. Gwinn explained the theory of the condenser and gave one or two practical examples of calculating the capacity. Next the question of the best dielectric was discussed, and here a large condenser was dismantled to show the construction. Then followed a very detailed description of the construction of condensers and also the method of drying and insulating. As regards the final testing it was explained that every batch of condensers, before leaving the works, was subjected to four distinct tests: Voltage test, Insulating test, Capacity test, and Power Factor test.

Next the principle of the inductive condenser was explained and how a non-inductive condenser differed from one of the ordinary type. A.C. and electrolytic condensers were also explained in Mr. Gwinn's talk. In conclusion, some very interesting lantern slides were put on the screen showing views of the T.C.C. factory and some of their special products.—Hon. Secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23.

*Parallels of History No. 1*

# LORD KELVIN

It was in a badly lit, disused wine cellar that Kelvin first began his scientific research. Converted into a laboratory, it was here that he made many of his important discoveries, and delivered many of his famous lectures. Whilst still a young man, he enjoyed a reputation that was the envy of many a veteran



scientist, a reputation that was earned, not by reason of his intellectual gifts alone, but because of his amazing capacity for tireless research.

The same might also be said of the Dubilier Condenser Company. Their present prominent position is due not to resting on laurels won many years ago, but to consistent and untiring research through 21 years of successful trading. The result of this research is seen in the high standard of dependability for which Dubilier Condensers and Resistances are to-day famous the world over.


DUBILIER CONDENSER CO. (1925) LTD.,

DUCON WORKS, VICTORIA RD.,

NORTH ACTON, W.3

**DUBILIER CONDENSERS**

**P. W. Gift Stamp No. 35**

Printed by NEWNES & PEARSON PRINTING CO., LTD., Exmoor Street, Ladbroke Grove, W.10, and published by GEORGE NEWNES, LTD., 8-11, Southampton Street, Strand, W.C.2. Sole Agents for Australia and New Zealand: GORDON & GOTCH LTD. South Africa: CENTRAL NEWS AGENCY, LTD. *Practical Wireless* can be sent to any part of the world, post free, for 17/4 per annum; six months, 8/8. Registered at the General Post Office for Transmission by Canadian Magazine Post.