Have you seen the All-Electric A.C. Safety Skyscraper?

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To make SUCCESS AND SAFETY CERTAIN unique features and right up-to-the-minute technical developments are incorporated in the All-Electric "Skyscraper" which you could not get even in very expensive factory-built Mains sets. THAT IS WHERE YOU SCORE BY BUILDING YOURSELF. You get a receiver that will bring you every receivable programme at full entertainment strength on a fine moving coil loudspeaker.

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THE FIRST COMPLETELY SAFE-COMPLETELY PRACTICAL-ALL-ELECTRIC RECEIVER FOR THE HOME CONSTRUCTOR

KIT COMPLETE
WITH 4 VALVES
£7.19.6
Roumania's Super Power Station

BLAJ, in Transylvania, where a 1-kilowatt experimental transmitter has been installed, is the possible proving ground of the future super-power station for which a contract has already been placed with 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 Budapest 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, Galati or Braila.

Italy Offers Radio Prizes

IN order to encourage the sale of licences the E.I.A.R. offers to all listeners a prize of from 500 to 15,000 lire can be won. In addition, a radio lottery has been launched in which a prize of 20 lire on proof that they have induced a friend to register his wireless receiver with the authorities.

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 authorize the State to monopolize 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.

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 Effel Tower. The actual weight of this steel tower will exceed 230 tons. It is hoped to have the station ready by next autumn.

Greek Broadcasting System

THE Greek Broadcasting system has been opened for full-time operation. The transmitting station is: 1,870 metres, and the call, Radio Roma - Napoli. It is a simple melody repeated in flute-like intervals, and the interval signal a bell.

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 Bromley-by-Strangford, 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 76lbs., and stood nearly 4ft. high; it is designed for use in a 500 kW. transmitter.

building the Feather-Weight Portable Class B FOUR Page 266

Cut the Crackle

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Tone Volume Control

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ROUND the WORLD of WIRELESS

Blimp versus Mast Aerial

To study ways and means for the reduction of interfering effects 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 decided that in the case of sponsored broadcasts by business or other concerns not expecting a sale of wireless components, 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

A listening-tax signal which the station has used for some considerable time, the Berlin studio has adopted, between items, the tune of one of Germany's favourite military marches Volks Songs (People's March for Arms). This, together with the broadcast of better expresses Germany's nationalist movement. The long-wave König Wustraumann (Deutschland-sender) transmitter will continue to use the first notes of the Potsdam regular. In the case of sponsored broadcasts the firm responsible for the broadcast will place their name at the beginning of each item, if they wish.

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 P.S.T. 9.00 and midday and again between 12.30 and 1.30 a.m.

Morocco and Radio Pirates

The Office Chiffrein 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 increase of 3,499,700 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. 32.

Robins had an All-mains receiver, home-built. The circuit was the conventional Screen Grid, Detector and Pentode valve, and the main section employed a 6L6 rectifier, which delivered 250 volts at 60 ma. As he wished to use larger output valves he purchased a pair of Manda PPI400 valves and a new rectifier, a Cossor 400HB. This should (according to the catalogue) deliver 500 volts at 150 ma., but when the receiver was switched on, the meter showed only 40 ma. 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, Southamptom Street, London, W.1, and mark your envelopes Problem No. 32. 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 should be corrected.

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

A. Burgess, 196 Gutterbury Road, W. C. G., and W. H. Williams, 1, Croftlands Terrace, Dalton-in-Furness, H. Roux, 69, St. Johns Road, Waterlo, Liverpool.

A Japanese Programme

May 4th (National) and the 6th (Regional) of the B.B.C. proposes to broadcast an adaptation of three of Japan's most famous No Plays which date from the 12th to 16th century. The 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 transmitter 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 supported by eight two-inch bridge cables, and when complete will weigh nearly 450 tons. It is hoped that this ultra-modern mast may be ready by June when, until the new station is built, it will be used by the present WLYV, 50 kilowatt transmitter.

The New French Wireless Bill

The French Financial Commission has adopted certain paragraphs of the new Budget which calls for a broadcasting 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 licensed listeners with the general population. Some idea may be conveyed by the following figures which show the number of licences issued per thousand of population.

Denmark (150); Great Britain (149); Sweden (102); Austria (78); Germany (72); Belgium and Norway (48); Hungary (36); Czechoslovakia (35); Poland (10); Italy (7); Yugoslavia and Spain (4). Here, 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 stations 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 1,459 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 200 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 Coneri) has begun its experimental transmissions, and can now be heard on the air in the early hours of the day.
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 tone 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 of which it is made. Thus, 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 decreasing the losses.

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 material of the core or the alloy, and they vary considerably with different grades of materials. 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 50 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 exists. 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 our 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
binding material is used, the quantity of strength.

Accordingly, every endeavor is made to keep it down to a small space. When taking the photomicrographs, I employ a special magnification 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 is easily 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 bulk enormously 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 endeavor is made to keep it down to a minimum.

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 upon, 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 fifth thousandth of a millimetre, and if we assumed that the grains were all circular, a representative small ring core would 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 of iron and binding agent type. The material is pressed into a small moulding which acts as a complete mechanical protection. Under these conditions the binding material can be reduced very considerably.

The individual insulation of these grains acts as a complete insulation between the adjacent 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 exactly the extent of 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 with a rectangular cross section. These rings are usually about 14 in. in diameter, while the centre hole is about 1 in. in diameter. A core of this type at radio frequencies may very well have a permeability of the order of 13. 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 produced into small balls which are used in the 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.

Torroidal Winding

In order to take full advantage of the core material, it is general to use a closed core or to use one 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 and connecting the sections so that one or two torroid windings are made into a single channel and into a square. The four sections are wound separately on an ordinary machine, and the wires are joined from the sections which are connected in series.

One of the difficulties in winding a torroidal coil lies in the accurate matching of the sections. Slight misalignment could result in a considerable increase in the inductance. The turns are then subsequently fixed by some form of sealing compound.

(Continued on page 277.)
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 ohm 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.

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.

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.)
As a matter of fact, runtab/e of insulating tape. Made by soldering, and afterwards the braid. Connected to the shielded wires and the metal-braided shield; connected to the metal parts and to the pick-up proper, whilst the latter is one black and the former two come from as shown in Fig. 5.

There are three wires in 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-braded 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 joint 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 is also shown in Fig. 5.

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 lead 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.

**Details of construction of the set itself were given last week, and the process of completing the radio-gramophone is as follows.**

By FRANK PRESTON, F.R.A.

**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, 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 anticlockwise movement produces a greater response to the bass.
A useful multiple connector

A very handy multiple connector, suitable for a variety of purposes where it is necessary to join several wires 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 HUBB (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 on next page)

Improving Long-wave Reception

Many listeners using a dual-wave coil receive only comparatively weak signals on the long-wave band, although the increase in the volume of long-wave stations.—T. THORNTON (Doncaster).

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Many listeners using a dual-wave coil receive only comparatively weak signals on the long-wave band, although the 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 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 HUBB (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 on next page)
Deflector for Speaker Cabinet

A speaker cabinet should not be boxed in at the back, as this produces 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 to the back, as this produces a hollow sound. The deflectors are cut as shown in the sketch and are fixed, and cost practically nothing. - Mervyn Knott (Reading).

Plywood Panel Brackets

These brackets, as described here and shown in the sketches, can be fitted to any cabinet type of speaker, utilise to the full the vibrations emanating from the back of the cone, deflecting them away and without producing resonance within the cabinet. The deflectors are made of thin plywood, which is screwed to each side of a central upright about \( \frac{3}{4} \) in. 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 \( \frac{3}{8} \) in. by \( \frac{3}{4} \) in., screwed across the backs. The curves of the boards should be as indicated in the diagrams. The increase in the total volume of sound from a cabinet of the same size and shape could, of course, be altered to suit individual requirements. They can be stained or polished to match the other finish of the cabinet. - Mervyn Knott (Reading).

Method of using loud-speakers as microphones.

When a broadcast is being received it will be necessary for that to be tuned out before No. 1 speaker is converted into 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. This 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 microphone, and it should be noted that having the broadcast will be transferred to No. 2 speaker and the message might not be heard. - W. Sullivan (Merthyr Tydfil).

A deflector for a speaker cabinet.

A weatherproof casing for an aerial earthing switch.

Using Loud-speakers as Microphones

As 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 speech 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. This 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 microphone, and it should be noted that having 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, sleet, 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 copper tubes, \( \frac{1}{4} \) in. long, with nuts, and one cocoa-tin lid. Firstly, fill in the back of the box with a piece of tin. With the switch has been screwed, and then drill a \( \frac{1}{4} \) in. hole in the top, bottom and one side of the box. Take the lead-in tubes to pieces and cut off about \( \frac{3}{4} \) in. of the ebonite tubing, and then cut the remainder in half. Bind some sealing tape around the centre of the brass rods to prevent it touching the sides of the hole, and reassemble the lead-in tube after threading the rod through a hole in the box and tightening up the lock nuts. This serves to throw off any rain which may settle at the base of the tube. - Ernest Taylor (Bristol).

Plug Switch for Loud-speakers

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 speech 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. This 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 microphone, and it should be noted that having the broadcast will be transferred to No. 2 speaker and the message might not be heard. - W. Sullivan (Merthyr Tydfil).

Driftwood Panel Brackets

These brackets, as described here and shown in the sketches, can be fitted to any cabinet type of speaker, utilise to the full the vibrations emanating from the back of the cone, deflecting them away and without producing resonance within the cabinet. The deflectors are made of thin plywood, which is screwed to each side of a central upright about \( \frac{3}{4} \) in. 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 \( \frac{3}{8} \) in. by \( \frac{3}{4} \) in., screwed across the backs. The curves of the boards should be as indicated in the diagrams. The increase in the total volume of sound from a cabinet of the same size and shape could, of course, be altered to suit individual requirements. They can be stained or polished to match the other finish of the cabinet. - Mervyn Knott (Reading).
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 variety; but with one of the air dielectric variety there is always some chance of the vanes touching each other. This possibility can easily and effectively be guarded against by connecting a fixed condenser in series with the reaction condenser (either by withdrawing 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 by withdrawing the high tension battery or by maintaining the H.T. supply - hence its expression as "safety first") rules which apply to the operation of our set, if not, 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.

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 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, 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.

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 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.

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, if dry, with demand no especial precautions by way of insulation. The only other items are:—One condenser, 0.1 mfd.; one choke, 0.3 henry (Weartle); 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 "spare" 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 22 all-covered copper wire round a 2in. former. About 1l. 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 reduction 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 5ft. 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 range.

To operate the Unit

For volume only, leave S3 and S5 depressed, withdraw S1 and S2 slowly and 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 S3 and S5 depressed, withdraw S1 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 S1 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 decreases 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 units it may be necessary to add 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 control choke, therefore, may be remedied by turning up the volume-control of the receiver 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. Note that the news 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 falling adequately to produce notes below a certain frequency.

May 6th, 1933

(Continued on page 260)
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.

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 113 in. x 131 in. x 104 in. Balanced-Armature Loud Speaker. Provision is made for fitting Gramophone Pickup Socket and Plug.
Price Hire Purchase Terms: 17/- 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 113 in. x 131 in. x 103 in.
Price Hire Purchase Terms: 15/- deposit and 9 monthly payments of 13/-

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 Hire Purchase Terms: 15/- deposit and 9 monthly payments of 13/-

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, 181 in. x 174 in. x 103 in., Loud Speaker and all parts. For A.C. Mains only 100-125 or 200-250 volts (adjustable), 40-100 cycles.
Price Hire Purchase Terms: 20/- deposit and 9 monthly payments of 18/-

ALL-ELECTRIC MODEL 336
Kit of Parts, similar to All-Electric Model 337 except that no loud speaker is supplied. Handsome cabinet 181 in. x 174 in. x 103 in.
Price 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 Hire Purchase Terms: 28/- deposit and 6 monthly payments of 16/-

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

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 Melody Maker.

*Strike out type not required.

Name
Address
City

My usual Retailer
Address

PRAC. GUIDES
To Restrict the Higher Notes: Control of Heterodyne Whistles

Depress S1 and S2, and withdraw S3. 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.

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 effects, 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 usually a considerable permit of a certain amount of reduction without serious loss of "brilliance." 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 turntable 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 quite 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 the same record and the same pickup.

A certain amount of reduction without serious loss of "brilliance" is a condition of balance in the radiogram operation. The subject does not call for discussion here.

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.

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 effects, 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.

Fig. 1.

Fig. 2.

Table: Fuse Location

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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.

Actually, it was confirmed that the valve filament was operative, but the set still appeared "dead," so a few quick tests were made with a voltmeter in order to locate the fault. It was soon found that an H.T. fuse, in this ease a low con-

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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.

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.

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 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 cracks 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 of acid or fumes. 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).
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. 8) 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 scaled 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.

An intermittent or poor earth connection (Fig. 7) will often produce both loss of volume and a greatly increased tendency to oscillation. The 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 same time.

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 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 the metal panels due to 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 radio-rooms, 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 cracking. The only remedy is to dismount the condenser 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 inspected 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 the 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 variation of the 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 scraping may be due to the coil being cut out and the vibration of valve elements under the influence of a powerful loud speaker. The vibration may be conveyed from the speaker to the cabinet, or through the air. Mounting the valve holder on a sorbo pad, and damping bulb vibration with plastic or rubber, 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 truest electrical centre of the radio 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.
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
elegant 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 wave-
length or the frequency reading appropriate
to the station. In place of the customary
pointer a beam of light is employed for
traveling round 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 un-
necessary 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 selec-
tivity is slightly improved as the re-
action 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 valu-
able 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 Controls
The front of the cabinet, as has
already been stated, is occupied princi-
pally 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 pro-
vided with a fuse-plug.

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revolution switches the receiver off.
The right-hand control is the reaction device,
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 diffi-
culty was soon overcome, however, by
connecting two condensers in series across
the mains and taking the "aerial" con-
nection 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 under-
lying 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 irregu-
larity in the supply leads is cancelled out.

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 con-
sideration the three-valve circuit shown in
Fig. 2 was evolved. Our quest for such a
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 a grid of 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 DC2/AH. for detector
and a DC2/P in the power out-
put 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 resista-
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
Messe's Balgum, or can easily be con-
structed 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 useful 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 " uni-
versal" 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 condensors in both aerial and
earth leads and by using grub screws in the various control knobs.

Incidentally it might be mentioned that
detectors which are illustrated are very popular in America just now,
and we can see no objection to their
adoption in this country. They are not
economical to build, and have a very modest
current consumption— that described takes
about 25 watts per hour.

Class "B" and Tone Correction

The Class "B" valve, like pentodes,
have a tendency to give a distortion
to the higher audio frequencies so that in
most cases some form of tone-compen-
sation is called for. When using pentodes
the usual thing is to connect a fixed con-
denser and a resistance in series across the
primary terminals of the output trans-
former, and although this 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
shillness 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
affects 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 superheterodyne 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 Autoradiogram 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.

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. Brilliance 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.)
A view showing the partly assembled receiver.

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 lin. wide by lin. 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 andplaning 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 MOST IN PORTABLE FREE BLUEPRINT WITH THIS THE LIGHTEST YET!

Gather 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.

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ORIGINA
May 6th, 1933

**PRACTICAL WIRELESS**

267

**F.J. CAMM**

Complete Constructional Details of my amazing Light-weight Portable employing for “Practical Wireless” Readers a free-advice Guarantee.

**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 5¼in. wide variety, lye only. Its 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 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.

(Written and illustrated by F.J.CAMM. Full-size blueprints given with this issue.)

The "FEATHERWEIGHT" PORTABLE FOUR

Designed by F. J. CAMM.

END OF LONG-WAVE WINDING.

START OF SHORT-WAVE WINDING.

PRICE 1'

FULL CONSTRUCTIONAL DETAILS ARE GIVEN IN PRACTICAL WIRELESS May 6th, 1933.
SPECIFICATION OF FEATHER-WEIGHT PORTABLE.

Two Utility Baxtele 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.22.
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 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.
Two Spades (L.T.+ and L.T.-).
One coil Glazite, flex, screws, wood for case, carrying handle, etc.

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

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 shrunken and considerably braced up the framework.

Next, attach the leather cloth, cutting the entire covering in one piece and leaving about lin. margin all round to glue inside. But of this I shall have more to say next week.
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. Delivered, Carriage Paid on first payment of £5/8.

KIT "B"

As Kit "A" but with valves only. Delivered, carriage paid, on first payment of £12/6.

KIT "C"

With valves, cabinet, panel, and baseboard, but less speaker. Delivered, carriage paid, on first payment of £21/3.

KIT "D"

As Kit "C" but with Universal swivel, ready-drilled, panel, and chassis. Delivered, Carriage Paid, on First Payment of £12/6.

CASH, C.O.D. or EASIWAY

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KENWELL POWER PACK

Electricity your present Battery Set. For A.C. Mains. With Matched Moving-Coil Speaker in Cabinet, as illustrated. Normal Price, £17/10/0. Our Price, £4/9/0, or 12 monthly payments of 7/6.


MARCONIPHONE RADIOGRAM. A.C. only, Model 330. List Price, 22 Gns. Our Price, 13 Gns., or Deposit £5/6, and 24 monthly payments of £1/6.

ALL-ELECTRIC RADIOGRAM with Gerard Automatic Record Changer, A.C. only, 3-valve S.G., Detector, and Pentode. Moving-Coil Speaker. Our Price, 22 Gns., or Deposit £5/6, and 12 monthly payments of £2/6.

ALL-ELECTRIC RADIOGRAM with Electric Motor, A.C. only, 3-valve S.G., Detector and Power. Moving-Coil Speaker. Our Price, 22 Gns., or Deposit £5/6, and 12 monthly payments of £2/6.

KENWELL ALL-ELECTRIC 2-VALVE SET. Detector and Pentode complete with Speaker, ready to play. For A.C. or D.C. Usual Price, £2/1/0. Our Price, £4/0/0, or 12 monthly payments of £3/6.


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Pilot Author Kit. Complete with 4 valves and constructional chart in sealed Lissen Box. Carriage Paid, £7/10/6. Our Price, £3/19/6, or Deposit £2/6, and 11 monthly payments of £1/6.

PRACTICAL WIRELESS

FREE

PILOT GUARDIAN 4-VALVE KIT

KIT "A" Complete Kit of Parts including Send ready-drilled panel, less Valves and cabinet. CASH or C.O.D. Carriage Paid, £7/6. 7/6 Deposit and 11 monthly payments of £1/2.


SEND FOR FULL SIZE BLUEPRINT AND CONSTRUCTIONAL CHART. Usual price 1/- - Send FREE to "PRACTICAL WIRELESS" readers.

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


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SIEMENS

FULL O'POWER RADIO BATTERIES

FOR CHECKING THE QUALITY OF RECEPTION AS RECEIVED IN VARIOUS DISTRICTS

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BUY Full O'Power by SIEMENS

As used by the B.B.C.

They cost no more than ordinary batteries.

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Used and Specified Exclusively for the "PRACTICAL WIRELESS" FEATHERWEIGHT PORTABLE

EXTENSION SPEAKERS

Only by using Rola Speakers can you get the utmost realism combined with the greatest sensitivity.

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THE BEGINNER'S ABC OF WIRELESS TERMS

Continued from April 29th issue, page 234.

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 effect, the skin effect, occurs. 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.

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 between 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 amperes was passing through a certain conductor, the temperature being 100 degrees, and also that if the current were increased to 4 amperes the temperature would go up to 120 degrees. Also again that a current of 6 amperes would mean a temperature of 140 degrees. 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 amperes. 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 amp." crosses the horizontal line corresponding to 100 degrees. In the same way the position where the 4 amperes line crosses the 120 degrees line is also marked.

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

By following along horizontally we see that this point is opposite "130 degs.," on the vertical scale. The temperature at 5 amps., therefore, is 150 degrees.

Incidentally, this particular curve happens to be a straight line, but it is never thus, and the radio amateur is likely to find and make use of many curved ones, some very complicated. As an example of what is possible, the phenomena which is known as the "skin effect" becomes more marked as the frequency of the current increases. In the same way the position where the 4 amperes line crosses the 120 degs. line is also marked.

Fig. 2.—Example of a cut-out.

The last point to be plotted is where the vertical line from "6 amp." crosses the horizontal line representing 140 degrees. 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 amperes. By following along vertically from the 5 amp. position on the base line we strike the curve at the point P.

Fig. 3.—The Fleming Cymometer.
I jump between the points.

The scale mounted on the cymometer.

I in the neon tube placed between the two and reduce the number of turns in circuit, thus reducing its effective inductance.

Working it can be more easily understood if the same control.

They can be both increased with one and a long tubular condenser and a long small-

This type of wavemeter is not used now -

A type of wavemeter invented by Dr. J. A. Fleming. It consists essentially of a long tubular condenser and a long small-

A fine handbook for 1s. each, post free. When ordering, quote the number. Copies of the paper containing descriptions of the particular receiver cost 6d. each. Address Orders to: The Publisher, George Newnes, Ltd., 6-11, Southampton Street, Strand, W.C.2. Blueprints. Receiver. Described in issues dated:

Transmissions in the morse code. For telephony such as broadcasting un-

Damping is a term used to indicate the gradual falling off in amplitude of a periodic vibration or train of oscilla-

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-

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(Dept. 192), SHEFFIELD
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 not more than amplified 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 to the "screen" grid, thus reducing the effective anode-current and rendering the valve useless as an output valve.

To overcome this secondary emission, yet another grid was proposed. This time between the "screen" grid and the anode, and by connecting this "suppressor" grid to the control the effect of the secondary emission was reduced sufficiently to enable a very high amplification factor to be retained when handling large grid-swing.

In short, therefore, the pentode is really a high-frequency valve with a fairly high magnification factor, applying it to the grid-swing of some 36 volts, will produce a grid current 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 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.

The first is that by using three-to-one the transformer to the detector by means of a transformer and not by a resistance-capacity coupling, 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 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.

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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 loud-speaker. 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.)
impedance in the anode circuit increases, and there is no point where the power output becomes constant as in the triode. The anode current of this valve is constant; the impedance, therefore, remains fairly constant regardless of any change in the anode voltage. In the pentode most of such a point—the impedance 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 as long as the anode voltage increases. However, in a triode, the impedance of the output transformer remains constant, regardless of the impedance of the anode circuit.

**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 choke coil and a variable condenser, 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 loudspeaker 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 of the bass 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变压器。
The question of coupling the loud-speaker to the tone circuit of a pentode valve is not a simple one. There are quite a number of points to be watched, and the load at which is the question of impedance matching. The choke illustrated on the right is manufactured by the well-known firm of H. M. Clarks of Manchester, and is a most substantial component. It is approximately 6 in. 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 tapping points so that it is possible to obtain ratios of

\[
\frac{1.5}{1.8} : \frac{1}{1.6} : \frac{3}{1.1} : \frac{2.7}{1} : \frac{1.2}{1} : \frac{2.1}{1}
\]

It is therefore possible to match practically any make of pentode with any type of speaker. The winding is a very substantial, having a D.C. resistance of only 250 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 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.

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The price of the model illustrated is 21s., and it is found admirable for high-quality mains receivers.

**R.I. CLASS B COMPONENTS**

**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 4-110, and a panel instrument, Type 4-14. Both of these are of the moving-electron 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 1s., and 6s., according to the range, and the double-reading meters cost 6s. for a 0-45 volts, 0-120 volts, and 6s. for a 0-9 volts and 0-140 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 1s., whilst the ordinary types are only 6d. The cases of both of these types of instruments are finished in black crystaline, and measure only 5 in. 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.

**J.P. CLASS B TRANSFORMERS**

**RADIO INSTRUMENTS** have now produced their new range of Class B components, and there are those divided into two classes—driver transformers and output choke. There is only one output choke, but this is tapped to provide ratios of 1 : 1.2 : 1.4 : 1.6 : 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 18s. 6d. The DY.37 and DY.38 are of the single-ratio type of transformer, and the two other transformers are of the double-ratio type. 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, and the power efficiency of the drivers being in no case lower than eighty-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.

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**W.B. CLASS B SPEAKERS**

W.B. CLASS B SPEAKERS

W.B. CLASS B SPEAKERS

A.N interesting small type of driver transformer has been received from Messrs. McDaniel and Co. of Roumfield. This is of the unshrouded type, having a core clamped in a metal skeleton casing, and the windings are only protected by a small box which is secured 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 800 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 Cosier 240.B valve. As this is the only Class B valve at present available the primary windings are strictly needed for the present-day requirements. The price is 8s. 6d., and it therefore compares favourably with other driver transformers at present on the market.
IRON CORE TUNING COILS  
(Continued from page 232.)

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, 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 changes in permeability produce 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.

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To men who want careers in Radio

PRACTICAL WIRELESS
May 6th, 1933

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 be identified. The call by which this transmission may be recognized is phonetically:-

Hillo Parie (Hello Paris)

The station with which telephony is worked being St. Assise, which is located near Paris.

France

The French transmitter located at St. Assise, P.T.M., will often be heard on 15.50 metres from 9 p.m. onwards, calling L.S.G Buenos Aires; the latter, replying on 15 metres:-

alley tay alley

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 15.95 metres, and is sometimes heard working P.C.K Holland around about 11 a.m. one or two mornings during the week. Another station working P.C.K is P.M.B on 14.55 metres.

Rio de Janeiro

A correspondent informs me that he has heard a number of ship's 'phones, the transmitters of which are located in Rio de Janeiro, P.S.K on 36.6 metres, and P.S.H around about 11 to 11.25 a.m. The wavelength being 36.6 metres, V.K.M.E may sometimes be heard calling G.B.X.; the latter transmits on 27.85 metres.

Ship to Shore Telephony

The wavelengths assigned to ship and shore telephony are 17.05 metres, 22.68 metres, 28.50 metres, 30.75 metres, 37.75 metres, and 41.00 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. Oriana (call C.I.S.O.),

s.s. Lusitania (call W.S.B.N.),

s.s. Ringpress of Britain (call G.M.B.J.),

s.s. Bely Island (call G.I.L.Q.).

Argentina

Station L.S.M., 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:

- s.s. Belgenland (call G.I.L.Q.).

Another station of the South American group is L.S.G, which has been heard transmitting on 16.07 metres. This wavelength, however, is sometimes used by

station L.S.Y. A definite schedule seems to be the rule, and the 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:-

M-ai'mey.

International Correspondence Schools, Ltd.


May 6th, 1933

The I.C.S. Radio Courses cover every phase of radio work, from the requirements of the youth who wishes to make wireless engineering his career to the man who wants to construct and maintain a broadcasting set for his home.

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We will be pleased to send you details of any or all of these subjects. Just fill in, and post the coupon, or write in any other way, stating which branch of Wireless interests you... the information you require will be forwarded at once.
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, transmitted 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.

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 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 heard recently, has been universally admired, while its composition with variable money prices is a special feature.

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1. 7-Pin (Floating Type) 2. 4-Pin (Standard Type)

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As receiver and valve design advances, the design and construction of CLIX Components advance also to meet the most modern requirement. Experienced designers, realising the excellence of CLIX valveholders, continuously specify them.

CLIX new 7-pin model incorporates an entirely new and patented "Floating" principle which allows the sockets to automatically align with incoming valve pins and prevent jamming.

Turned resilient sockets guarantee full-surface contact with ANY type of valve-pin and without fear of collapse.
SOUTHERN RADIO Wireless Bargains; Ready Radio Construction Kits; 20/- 2-valve battery kit, 12/-; 30/-, with 3 Mullard valves (P.M.12F, P.M.2DX, P.M.9); 16/- (free kit, 9/-, with 3 Mullard valves (P.M.22A, P.M.22D, P.M.25D); 8/-, 15/-, 18/-, with 3 Mullard valves (P.M.22A, P.M.22D, P.M.25D). The Ring for Wireless, Walthamstow, London, E.17. A.C. Receiver with Mullard valves and Moving Coil Speaker (using pot as choke). For callers only at any branch—Hunters. 1111, 41, (114) 280. Phone: Trade Enquiries to 175, Fleet Street, E.C.4.

GUARANTEED COMPONENT AND RECEIVER BARGAINS

Regentone 2-valve A.C. Receiver with Mullard valves. Original price £15 0 0. Bargain price £9 9 0. Three-screened condensers (made for Zavato Receivers) Guaranteed accurately matched. With trimmers...

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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 Encyclopaedia, 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 difficult for potential to be considered in it written in a style easy for the earliest novice to understand and yet ev... S.W. experimenters in the Stretford district.

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 at 1 meter up- and down-lead 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 to act as a filter, thus causing acoustic noise as much as noise as when without a pigtail.

Also, there is no pigtail fitted to the front bush of the average condenser, and as the distance 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 a skele- none end plates and no metal bushings. 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 connecting the leads directly to the front plate and rear plate. 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.

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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.—E.D.

An Appreciation : and a Criticism

Sir,—I beg to acknowledge receipt of the “Wireless Constructor’s Encyclopaedia,” 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 methods enabling even the most ignorant person to grasp the fundamentals of this newest of sciences. I am also the author 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 ones. If the press buttons are 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.).

An Excellent Work

Sir,—I wish to acknowledge receipt of your book the Wireless Encyclopaedia,” 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 find it a most useful tool for all who are interested in the subject. I am writing to you with a view to obtaining an example in the future.—W. G. Vale (Stroud).

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 Wireless, I am more than delighted with your “Wireless Constructor’s Encyclopaedia” and wishing Practical Wireless every success.—Ernest L. Briner (Liverpool).

“An Invaluable Work”

Sir,—I have just received my copy of your “Wireless Encyclopaedia,” and here with tender my very best thanks. 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 Encyclopaedia 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 your work, it is first-class. Thanking you again, with best wishes for the future of Practical Wireless.—R. W. Artingstall (Stalybridge).

(Continued overleaf.)
HEAYBERD for the latest receivers!

Confident in the knowledge that Heayberd mains apparatus cannot be beaten, Pratical WIRELESS columnist engineers have exclusively specified the following components for their two latest circuits:

FOR THE "A.C. TWIN," Heayberd "A.C. Twin" Transformer, Secondary Outputs: 0.100, 0.235, 0.500, and 1.000 micromho, 100, 250, and 500 ma. Price

FOR THE "SELECTONE A.C. RADIOGRAM," Heayberd W/25 Transformer, Secondary Outputs: 0.100, 0.235, 0.500, and 1.000 micromho, 100, 250, and 500 ma. Price

Large stocks available. For price list write - G.B. Pioneer Radio, Coptic St., W.C.1.

"Hints and diagrams Technical Tips, Service Equipment. Packed with Limited number."

THE COSSOR NEON STABILISER

When a battery eliminator is used to operate a receiver employing either a Q.P.P. Valves for 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 apparatus are not designed to cope with this effect. The positive load to reduce the mains voltage to that normally required by battery valves, namely 100 to 150 volts, in the case of a D.C. mains unit this will be quite a large value of resistance, and in the case of an 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 a current, say 1 an, 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 amperes and resistance in ohms). A feature of the Q.P.P. or Q.P.P.-C output set is that the output 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, 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 valves varying with the volume of intermediate and S.G. valves in the receiver, and latter fact may cause serious instability of the receiver when 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 which 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 is reduced and vice versa. Therefore, by connecting this device across the mains unit the total output remains sensibly constant.

The Stabiliser, known as the S.190, costs 7s. 6d., and a further article describing its application will be published in a future issue of Practical WIRELESS.

May 6th, 1933

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 in the required band of frequency without a valve was also shown. Overload or distortion was then dealt with, also load and harmonics. From these discussions a most satisfactory design of an instrument was evolved, and how to measure from the output. The lecture programme was intended and was enjoyed by the members. Hon. Sec., 110, Hillaries Road, Gravely 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 write to the address given on the following page.


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 of which is the handover of the new committee to be arranged for the ensuing weeks. Local readers of PRACTICAL WIRELESS are invited to inquire further about this as the above.

May 10. Valve Characteristics—Mr. G. Deal. Mr. A. Twiss, 10, St. Mary's Place, Rotherhithe, London, S.E.1.

"Back to Basics"—Mr. A. Twiss.

Valve Characteristics—Mr. G. Deal.

29. Valve Charact

6. 12. 19. 29. 10. 15. 19. 29. 10. 15.

12. QL'S, Push-Pull Class B, and other types of output stages.

10. Adding a S.G. Valve to D. and one L.F.

29. Remote Control—Mr. Cole.

29. Regenerative Amplifiers and Measurements—Mr. Cole.

29. The Use of Chokes.

12. Universal High Voltage Mains Valves—Mr. A. Twiss.

A. F. Robinson, Hon. Secretary, 10, Breadway Street, Clapham, S.6.
SPECIAL NOTE

We wish to make a special reference to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of apparatus described in our pages, from articles appearing in our pages, or on general wireless matters.

We regret that we cannot, for obvious reasons—(1) Answer all inquiries 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.

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MADZA VALVES

When choosing or using a valve it is essential to know all the facts in the characteristic of that valve, and although the majority of manufacturers supply a printed chart with the valve, this generally restricts itself to the principal working voltages. The Madza 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; complete values for all components employed; notes generally restricts itself to the principal working voltages. The Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.

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

MAINS TRANSFORMER CONNECTIONS (Continued from page 233)

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 resistance in J and 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 4-volt flash-lamp bulb was connected across L and M and 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. A.—Theoretical diagram of the mains transformer.

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

ADVERTISMENT INDEX
No reproducer to compare with the "Challenger" is obtainable at or near its price. It is the ideal instrument for small receivers which employ the average super power or pentode valve, and also for large receivers with outputs up to 3 watts undistorted A.C.

Ask your dealer to demonstrate and refuse any others, which may be offered "as substitutes. There is no substitute for the R. & A. "Challenger."

"PRACTICAL WIRELESS" states:

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PRACTICAL WIRELESS

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THE GREATEST BATTERY VALUE - at any price!

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The Edison Swan Electric Co. Ltd. guarantees that Ediswan Batteries are of full voltage and capacity. Should any Ediswan Battery fail to give satisfactory service, we undertake to deal with customer's complaint within 24 hours of receipt of defective battery.

When you buy an Ediswan battery you don't have to take it on trust. It has run the gauntlet of the most exacting tests. It has been passed as fit to bear the Ediswan Guarantee. It's ready for a long life of good service.

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EDISWAN - the Better Service Batteries
"CLASS B" TRANSFORMERS
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The still more power and still less H.T. consumption for battery set development has reached an extraordinarily high peak of efficiency with the advent of 'Class B' valves used with R.I. 'Drivermu' Transformers and D.Y.40 Output Chokes.

THE R.I. WAY TO GREATEST AUDIO POWER & H.T. ECONOMY

In 'Class B' amplification, the 'Class B' valve must be correctly matched with the particular type of preceding valve which is employed as a driver. The success of the system depends upon this matching of the valves, and the 'Drivermu' Transformer is the most efficient method of coupling available. 'Drivermu' Transformers have been designed in conjunction with the principal valve manufacturers, and are guaranteed to give maximum power, minimum H.T. current consumption, and complete freedom from distortion, which are the principal claims made for the system.

'DRIVERMU' COVERS ALL COMBINATIONS OF 'CLASS B' & DRIVER VALVES

No matter which 'Class B' valve and driver valve is chosen for the particular output required, there is a 'Drivermu' of correct ratio to match them most perfectly.

R.I. 'CLASS B' OUTPUT CHOKE

Provides most satisfactory output coupling between every type of 'Class B' output valve and loudspeakers normally suitable for use with any type triode or pentode valve in normal or push-pull arrangement. Over 90% efficiency.

HOW TO SELECT THE VALVES & CORRECT COMPONENTS FOR 'CLASS B' SET CONSTRUCTION OR CONVERSION

The R.I. Brochure explains 'Class B' and contains tables for easy selection of right valves and components, also diagrams for application of 'Class B' to new receivers or existing models.

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