Practical Wireless, July 22nd, 1933.

CUTTING OUT STATICS!

Practical Wireless

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POINTS ABOUT POWER UNITS

AUTHORITATIVE — PRACTICAL — UP-TO-THE-MINUTE — FIRST!

Practical Wireless

EDITOR:
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ROUND *the* WORLD *of* WIRELESS

Anti-Fading Aerial Towers

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

Holland's New High-Power Station

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

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

Another Military Tattoo

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

When Greek Meets Greek

APPARENTLY, to-day, when two Greeks meet, the conversation soon turns to the necessity of a broadcasting system in that country. The Lucerne Plan provides a shared wavelength (499.2 m.) for Athens, one for Salonica (373.1 m.), and another for Southern Greece (233.5 m.), yet for the moment there are but few signs of any move being made by the Government in the matter of the construction of stations. A small transmitter was erected a year ago by a group of amateurs at Salonica, but its broadcasts have not been of a regular nature. An attempt is now to be made to induce the authorities to provide capital for the installation of a 20 kilowatt transmitter in or near that city, or alternately, to grant a concession to a native or foreign company to erect and operate such a station. The actual power of 20 kilowatts is limited to that channel by the Lucerne conference.

New Relay for Dublin Listeners

FOR the benefit of owners of crystal sets residing in the Dublin area, the old 1 kilowatt station has again been brought into operation. It relays throughout the day and evening the Athlone broadcasts on 217.1 m. (1,382 kilocycles). It is not expected that any alteration will be needed in the Cork wavelength, as it is anticipated that the separation, namely, 45 kilocycles, will be sufficient to prevent mutual interference.

A Café Chantant Dance Band

DURING the past year, many famous orchestras, including those of Marek Weber, Dajos Bela, and the Bal Musette, have performed before the B.B.C. microphones. On July 18th, an opportunity will be given of comparing them with a new visiting dance band of the *Café Chantant* variety. Its un-jazzlike rhythms will recall pleasant memories of evenings spent on the "continong."

Vienna's Extra Special Programmes

DURING the period of the music festival, held annually at Salzburg, the Austrian station will relay a number of special operatic performances and orchestral concerts. These will open on Saturday, July 29th (7.0 p.m., B.S.T.), with a broadcast of Beethoven's opera *Fidelio*, conducted by Richard Strauss, sung by an almost all-star cast. Rossini's *Stabat Mater* will be found in the programme advertised for Saturday, August 5th (8.30 p.m.), and on the following evening listeners may hear Gluck's *Orpheus and Eurydice*, for which many well-known continental artists have been engaged. Mozart's *Magic Flute* is down for transmission on Saturday, August 12th (7.0 p.m.), and the same composer's *Cosi Fan Tutte* on August 18th. Finally, in addition to a number of concerts, *Helen of Egypt*, a lesser known work by Richard Strauss, will be relayed at 7.0 p.m. from the Vienna Opera House on August 24th. Although so far unannounced, it is expected that a number of Continental stations will take some of these Austrian programmes. Such an arrangement would prove an excellent alternative for listeners in the British Isles, as long as signals from the Vienna-Bisamberg transmitter remain below par.

Radio Svizzera Italiana

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

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

This channel will be retained, barring unforeseen eventualities, until January 15th, 1934, when broadcasts are to be made on 257 metres.

Why Germans Give Up Licences

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

INTERESTING and TOPICAL PARAGRAPHS

but they failed to secure this greatly coveted privilege. Although Luxembourg refused to sign the agreement the transmitter

JACK AND "MRS. BARTHOLOMEW."

Jack Hulbert watching Cicely Courtneidge's record of "Mrs. Bartholomew," from her new film "Falling for You," being made in the "His Master's Voice" studios. This record, H.M.V. B 4475, is considered to be one of the best performances this famous broadcasting star has recorded.

Broadcasts from Dutch and Belgian Coasts

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

Salvage Ship and Submarine Telephony

THE salvage steamer *Artiglio*, which achieved fame through its recovery of gold ingots from the sunken s.s. *Egypt*, has now added submarine wireless telephony to its diving equipment. A specially constructed bell is lowered from the steamer and contains an observer, who by ordinary telephony and wireless apparatus can communicate simultaneously with both ship and divers at work. This novel observation post is capable of giving valuable information and assists greatly in the search for the treasure. It is reported that an attempt will also be made to film the wreck through the massive glass portholes of the diving bell, in which powerful electric searchlights can be installed.

The Future of Radio Luxembourg

AT the Lucerne Conference five delegates fought hard to secure a longwave channel for the 200 kilowatt super-station, is expected to give up the 1,191 metre wavelength and work on 240.2 (1,249 kilocycles) after January 15th, 1934. It is unfortunate that the power in that position of the waveband should be limited to 60 kilowatts, as such a restriction completely hampers the organisers who were planning publicity broadcasts throughout Europe.

SOLVE THIS!

Problem No. 44.

Samuels rebuilt his receiver, using components which had already been in use and which were undoubtedly good. When the new receiver was completed one of the variable condensers was found to be of no use at all. It made no difference to signals when rotated through the complete scale, and yet, from the circuit, it should have been quite critical in its tuning. As already mentioned, all components were in order. What was the cause of the trouble? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark your envelopes Problem No. 44. Last date for entry July 24th.

SOLUTION TO PROBLEM No. 43.

Gibson had worked out all the figures correctly, but he had overlooked the transformer losses. The resistance should therefore have been slightly smaller than that which he chose, and consequently there would have been a smaller voltage drop across the mains primary.

The following three readers received books in connection with Problem No. 42:—
Mr. H. S. Francis, 179, Nelson Street, Norwich; Mr. O. C. Ulthoff, Littlefield, Marlborough; Mr. Theo. Dutton, 7, Brookfield Park, N.W.5.

Germany's Music Censorship

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

The Hilversum-Huizen Change-Over

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

France and the Lucerne Plan

THE only longwave channel given to France is that of 1,796 metres, which will be used by Radio Paris, now included in the State broadcasting net. French listeners are not satisfied with this allocation, inasmuch as their high power broadcasts will only be separated from those of the Moscow 500 kilowatt station by 8 kilocycles. In the medium waveband all transmitters foreseen by the Ferrié Plan have been allotted fairly favourable positions, namely, Lyons PTT (436 m.); Paris (PTT) 431.7 m.; Marseilles, 400.5 m.; Toulouse PTT (386.6 m.); Limoges, 328.6 m.; Grenoble, 309.9 m.; Rennes-Thouries, 288.6 m.; Bordeaux PTT, 278.6 m.; Nice-La Brague, 253.2 m.; Lille, 247.3 m. and Montpellier, 224 m. All stations except the last named, of which the power is limited to 30 kilowatts, may transmit with an energy not exceeding 60 kilowatts.

Manchester Airport

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

American Amusement Tax

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

Wireless for the Blind

FURTHER orders have been placed with Messrs. Burne-Jones and Co., Ltd., of 296, Borough High Street, London, S.E.1, for wireless sets for the use of the blind. These comprise single valve, two-valve headphone, two-valve loud-speaker, two-valve screened grid, and three-valve screened grid sets.

AUTOMATIC TONE COMPENSATION

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

By FRANK PRESTON, F.R.A.

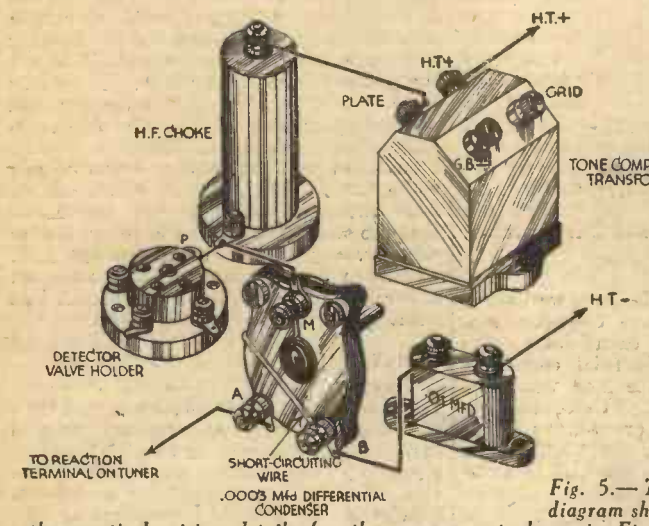

Fig. 5.—This diagram shows the practical wiring details for the arrangement shown in Fig. 4.

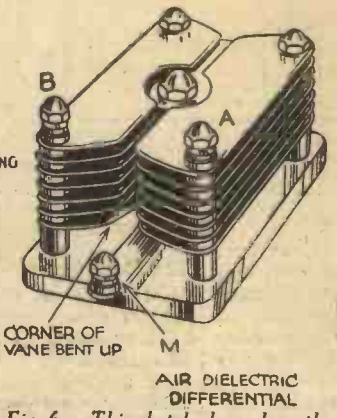

Fig. 6.—This sketch shows how the moving vanes of an air-dielectric reaction condenser can be made to short-circuit with one set of fixed vanes when the condenser is set to its zero position.

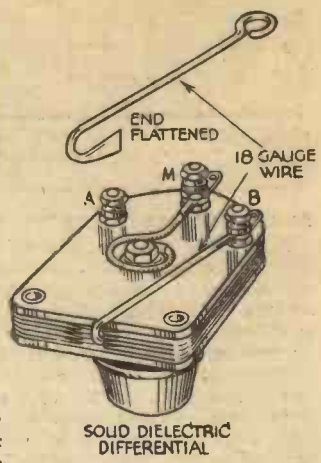

Fig. 7.—A method of short-circuiting the vanes of a solid dielectric reaction condenser.

IN this machine age, as it is sometimes called, every possible operation must be performed automatically and without effort. In radio we have automatic volume control, automatic grid bias, automatic tone compensation, and so on.

It is the last-mentioned device I wish to deal with in this article, for it is one which has received a great deal of publicity recently. The scheme is intended to prevent the distortion brought about by using reaction, particularly when listening to distant stations. It has been explained in these pages before that as more reaction is applied to a set, selectivity is increased and, in consequence, there is a certain loss of the higher musical notes. This point is illustrated in a simple manner by the graph of Fig. 1, where curve "A" shows the percentage response of a good receiver to various musical notes from 32 cycles to 6,400 cycles per second (this is approximately the range of frequencies covered by a first class loud-speaker) when no reaction is used. Curve "B," on the other hand, represents the response of the same set and speaker when reaction is "pushed" to its limit. It is obvious that in the latter case the higher notes, especially those having a frequency of more than 1,000 cycles, are very much reduced in intensity. This explains the reason why distant stations, for which it is necessary to apply a full measure of reaction, are often badly "muffled" or "boomy"—the higher notes cannot be heard.

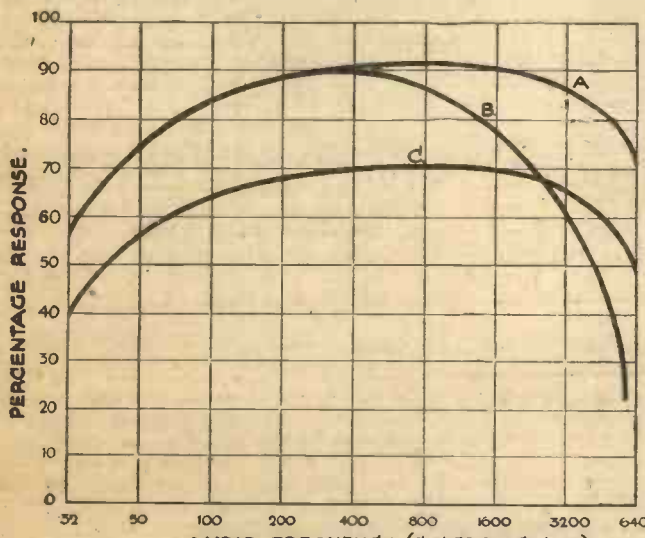

Fig. 1.—Curves which show the response of a receiver to various audio-frequencies; they are fully explained in the text.

Tone Control

In a recent article in PRACTICAL WIRELESS, entitled "Tone Correction and Tone Control," it was pointed out that the above-mentioned difficulty might quite easily be overcome by the use of a special tone control transformer or other device which could be arranged to reduce the strength of low notes so as to make the response of the receiver more uniform to the full range of audio frequencies. The result of using a tone-control device is represented by curve "C" in Fig. 1, from which it can be seen that the set's response to the lower frequencies is reduced so that the overall response is similar to, but less than, that given when reaction is not employed. It is inevitable that there should be a certain loss in volume, but this is more than off-set by the better quality of reproduction or, more accurately, by the better tone-balance, obtained. The loss can, however, be very largely made good by the substitution of an L.F. transformer of higher step-up ratio.

The method of tone-control just referred to is perfectly satisfactory in practice, but has the slight disadvantage of requiring an extra knob for its operation. Moreover, a certain amount of T.C. adjustment is necessary for each position of the reaction condenser, and the correct setting is dependent to a large extent upon the "ear" of the operator.

(Continued overleaf)

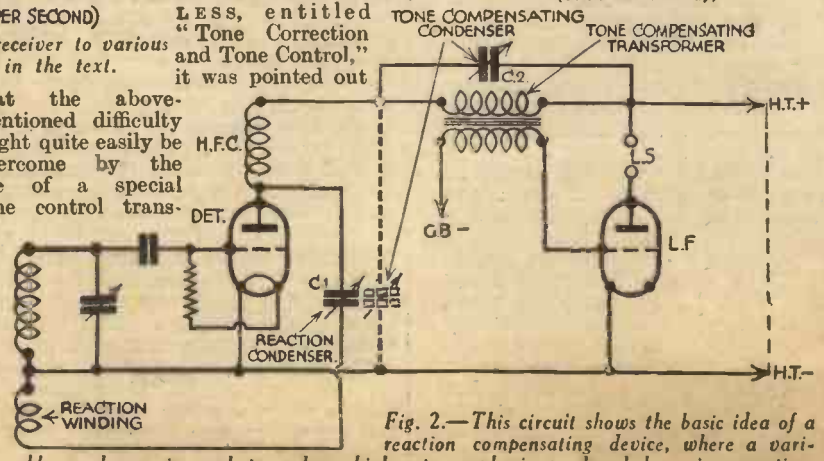

Fig. 2.—This circuit shows the basic idea of a reaction compensating device, where a variable condenser is used to reduce high-note emphasis produced by using reaction.

(Continued from previous page)

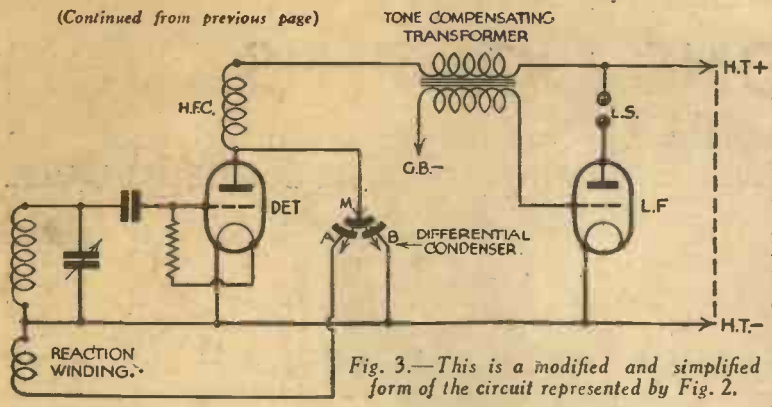

Fig. 3.—This is a modified and simplified form of the circuit represented by Fig. 2.

Automatic Compensation

Automatic tone compensation, or tone balance, to which reference was previously made, aims at simplifying the latter scheme so that the correct degree of compensation is automatically provided by the reaction condenser without the necessity for any further control. For its proper functioning it depends upon the use of a special Tone Compensating Transformer which has lately been put on the market by Messrs. Varley, and also by Messrs. Radio Instruments. This component is designed to give emphasis to the higher notes, and so to compensate for the loss in this direction caused by applying reaction. Thus, when reaction is advanced almost to the point of oscillation the transformer ensures that the frequency response shall be like that represented by curve "A," or, in other words, the same as obtained with a normal transformer when reaction is not used.

The Basic Idea

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

This would be a workable arrangement *if* we could obtain a suitable two-gang condenser, but we *can't*, so a different scheme must be worked out. Peculiarly enough, the final arrangement brings us back to the usual differential reaction circuit of Fig. 3. It is not difficult to see that this is precisely the same as Fig. 2, because one half of the condenser (comprising the moving vanes M and the fixed ones B) is actually in parallel with the L.F. transformer primary, the circuit being completed on the one hand through the H.F. choke, and on the other, through the H.T. battery. We can see that as reaction is increased by rotating the moving vanes M into mesh with the fixed ones A, the capacity between M and B is reduced. Conversely, when reaction is slacked off, the capacity between M and B is increased.

The Final Circuit

In the circuit of Fig. 3, then, we have a system of automatic tone compensation, and, provided that the capacities on the two halves of the differential condenser were suitably chosen, the idea would be perfectly satisfactory. Unfortunately, though, the capacities are always equal in practice and, whereas, about .0003 mfd. is correct for reaction control, it is quite insufficient to reduce the high-note response of the special transformer when reaction is completely "off," the capacity actually required being about .01 mfd. A further modification is therefore necessary, and is shown in the circuit of Fig. 4; a fixed .01 mfd. condenser is inserted in series with the fixed vanes B of the differential condenser and earth, whilst the differential condenser is made to short-circuit when in the "full-off" position. In consequence of this the .01 mfd. condenser is put in parallel with the transformer primary when the reaction condenser is reduced to its "minimum" setting.

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

Differential Condenser Modifications

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

Operation of A.T.C.

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

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

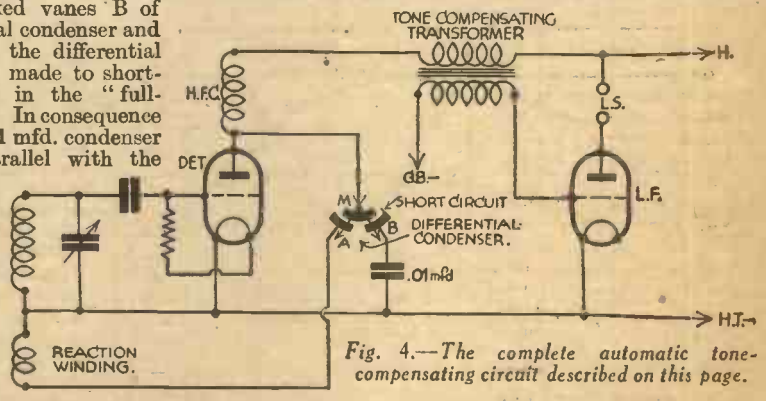

Fig. 4.—The complete automatic tone-compensating circuit described on this page.

The Ferrié Plan.

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

"Ostar Ganz Valves": Change of Address

AS and from June 24th all communications for Mr. Eugen Forbat, Sole Distributor for the "Ostar Ganz High Voltage Mains Valves" and Rectifiers should be addressed to: 28-9, Southampton Street, Strand, London, W.C.2.

CUTTING OUT STATICS

Precautions to Take Effectively to Cure the Trouble.

By R. P. COLE

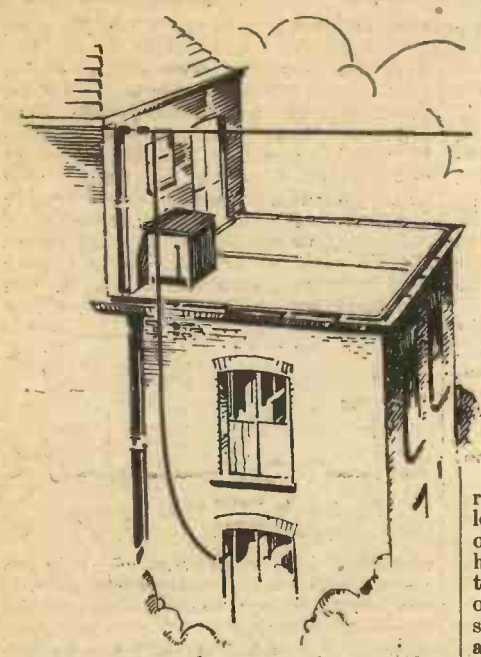

Fig. 2.—An aerial arranged close to a lead roof and guttering.

A FEW years ago when a valve set was a luxury and the majority of listeners were content with a crystal set, outside interference was practically limited to atmospherics, unless you were unfortunate enough to be situated close to a badly-adjusted electric motor or flashing lights. Nowadays, using the modern super-sensitive valve set, interference picked up from outside sources has increased tremendously. Quite apart from atmospherics, with their terrific crashes or low grumblings, according to the time of the year, some listeners are continuously receiving crackles, bangs, frying, and a multitude of other unwanted noises.

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

'Ware Fractured Wires

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

Of course, there are many unwanted noises over which one has very little or no control. If you are unfortunate enough to live near trams or electric trains you are almost certain to have a series of crackles each time a tram or train passes that you cannot entirely get rid of. In some districts the tramway companies have fitted a device to each tram to obviate the trouble, but the majority of trams in the country still disturb the ether to a greater or lesser degree. Noises from trams or trains can sometimes be considerably lessened by running the aerial at right angles to the wires or lines. Always remember that a large amount of pick-up of R.F. energy comes from objects in close proximity to the aerial.

Aerial and Lead-in Hints

Three or four years ago it was the recognized practice to make the aerial as long as possible within the prescribed limit of 100 feet, including the lead-in. Now, however, in order to attain greater selectivity the length is seldom more than 50 or 60 feet, and very often considerably shorter than that. In erecting these short aerials with their comparatively long leads-in the same care is not always taken as previously. The result is that long leads-in run close beside metal pipes and aerials often extend over metal roofs or alongside gutters, as shown in Figs. 1 and 2, and the pick-up from these conductors of disturbing H.F. currents, which produce the crackles, is greatly increased. The lead-in should therefore be kept as short as possible consistent with a high aerial.

Faulty Electric Light Fittings

It sometimes happens that a persistent crackle or frying noise will be heard at definite periods, while at other times reception is free from interference. After making certain that the trouble is not due to a loose wire or faulty component in the set, the search for the source of the interference must be continued outside. When there is a loose contact somewhere in the mains circuit, a small spark keeps jumping across the loose points. This sets up a series of damped oscillations very much like a miniature spark transmitter of no very definite wavelength. The receiver responds to these shock signals in the same way as it does to atmospherics. A badly-fitting electric-light bulb or a faulty contact in a switch will create quite an annoying noise in the loud-speaker, although the light may apparently be burning with its usual brilliancy. The spring-loaded contact pins in a lampholder are apt to become stuck up, and the connection with the lamp is then very loose or not made at all (Fig. 3). In damp buildings the contact springs of tumbler switches often become corroded. This corrosion tends to prevent good contact being made when the current is switched on. In some of the cheaper makes of switches the spring contacts become loose, or are easily bent, with the same result. The only way of tracing such faults is by the process of elimination.

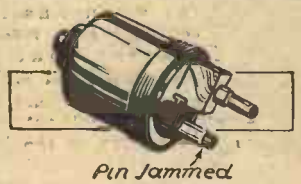

Fig. 3.—A jammed contact pin causes bad contact.

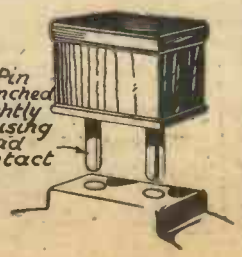

Fig. 4.—A faulty split pin.

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

Due to the comparatively heavy current taken by electric radiators, the spark taking place at a loose contact in this circuit can be quite large, and will in time probably burn the insulation of the plug or switch, as the case may be. Sometimes a switch or plug will be found to be quite hot after the radiator has been in use for a long period.

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

Should the contact become very bad through corrosion or for other reasons, a variable resistance is produced and when a light is switched on the sudden rise in current will cause any other lamps that may be alight to momentarily drop in brilliance.

(Continued overleaf)

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Eliminator Hum

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

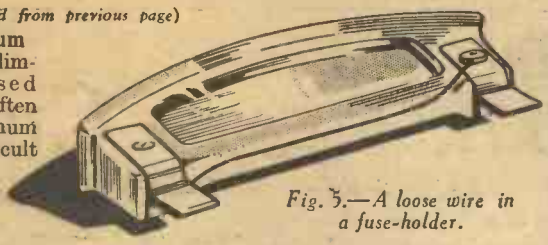


Fig. 5.—A loose wire in a fuse-holder.

Apart from mains interference caused by hum, a large amount of H.F. interference is induced into the set *via* the mains. It has been estimated that this is as high as 90 per cent. of the total H.F. interference. The smoothing equipment of the eliminator will in many cases be sufficient to prevent these currents from reaching the set, and will effectively short them to earth. It is extremely important, therefore, to have as efficient an earth as possible. The earth lead should be of heavy gauge wire, insulated for preference, and whenever possible soldered to a buried earth. The wire should be kept short.

By paying careful attention to the efficiency of the earth much of the H.F. interference can be kept from the set. If the trouble is still excessive it may be necessary to insert an interference filter in the mains. In some houses the metal conduits are not properly earthed, or not earthed at all.

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

No hard and fast values can be set down for the construction of the filter. The constructor will have to decide the best values in each individual case by the trial and error method. The following details will give some idea to work on. For the chokes wind 80 or 90 turns of No. 20 gauge enamelled copper wire on 2½in. diameter paxolin formers. The fixed condensers must be of the non-inductive type, and to commence with try a capacity of 2 mfd, but again the best results may be attained with condensers of considerably less or even twice this capacity. (See Fig. 6).

Finally, prevention of interference at the source is better and usually simpler than attempted cure in the set. If you can trace from whence your interference

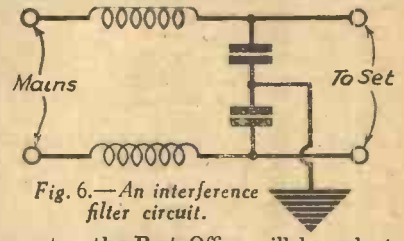


Fig. 6.—An interference filter circuit.

emanates, the Post Office will be only too pleased to give advice regarding its prevention. Always be suspicious of such electrical equipment as motors, lifts, illuminated advertizing signs and in fact anything that makes and breaks the circuit during its operation. The Post Office automatic telephone dials have even been the cause of trouble.

IRON-CORED COILS

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

By W. J. DELANEY.

QUITE a lot has already been written regarding the new types of coils, but it seems that some confusion exists as to the differences between them. It must be apparent to everyone that Ferrocart is a registered name, and a material which is used, at the moment at least, for only those coils manufactured by the Colvern Company. This material, the invention of Hans Vogt, was the original core for modern iron-core wireless coils, although by no means the first "dust-core." The composition of these cores, as already pointed out, consists primarily of powdered iron, and in the Ferrocart material a most interesting manufacturing process is employed. A narrow strip of paper is passed through a machine, and the iron powder is deposited on this paper. By means of combs and magnetic devices the iron powder is distributed in such a way that the iron particles are "lined up" and so arranged that eddy currents are completely avoided, and all the particles point one way. Finally, the core is built up to the required thickness by placing the paper in layers and binding with a suitable medium. The finished core is thus laminated and consists, in effect, of alternate layers of paper and iron.

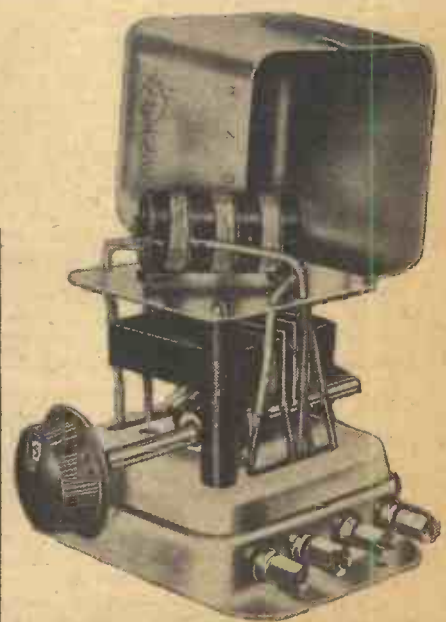
The new Varley Nicore tuning coils; they are available as single, double, and triple-gang units.

Igranicore

In the Igranic coils an entirely different method is employed, and the finished core material is of a more solid nature than the Ferrocart. It is, in fact, indistinguishable in appearance from ordinary bakelite. In this case the iron powder is mixed, in a most complete manner, with ordinary insulating material, and the process employed ensures that the mixing is so complete, and the iron so equally distributed, that when finally "cooked" and ready for assembly into a coil, an individual strip may be removed and replaced without any variation in the inductance value of the coil. This is certainly a very high standard, and assists greatly in the manufacture of accurately matched coils.

Nucleon

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



The new Wearite Nucleon iron-core tuning coil.

Varley Nicore

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

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

FOR LIGHT RAY EXPERIMENTS:

MAKING A SELENIUM CELL

NEXT WEEK: USING SELENIUM CELLS

By J. R. FENNESSY and H. WELTON

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

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

The Chemistry of Selenium

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

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

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

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

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

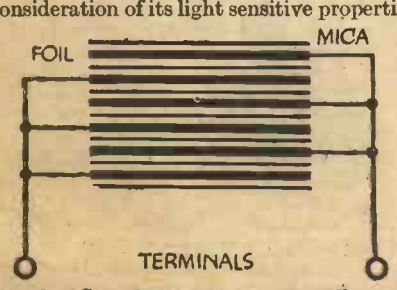


Fig. 3.—So called condenser type cell (coating omitted for clearness).

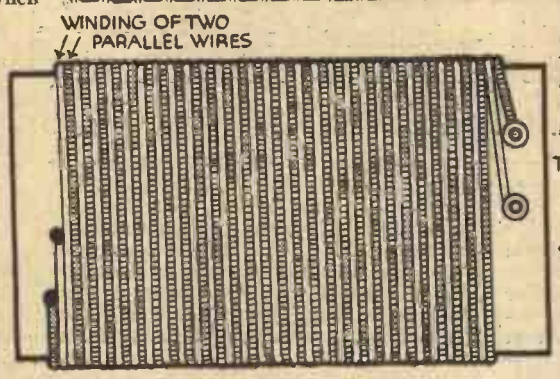


Fig 1.—A cell ready to receive its selenium coating.

—properties which for years attracted research workers who sought to turn them to account in television systems.

Light Sensitivity

Many years ago an engineer engaged in development work at a cable station discovered quite accidentally that the selenium rods he was using as high resistances in the cable system showed large

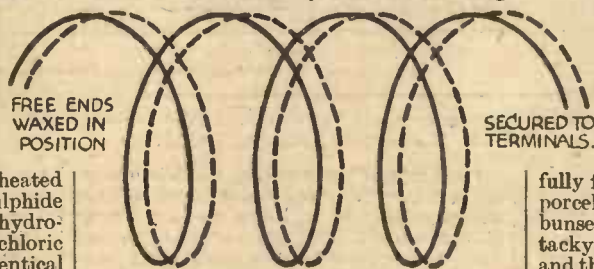


Fig. 2.—Sketch showing system of parallel winding employed.

variations in total resistance when light fell upon them. It is claimed that the discoverer was Willoughby Smith. There can be no question that Smith was well informed on the subject as we find him experimenting with selenium in the year or two which followed. The effect of the discovery and subsequent investigations was to prove that light was capable of producing an electrical effect of far reaching possibilities. In view of more recent knowledge regarding selenium and its limitations it is evident that the early hopes of its future applications have in many instances proved unjustified for reasons shortly to be discussed.

How to Make a Selenium Cell

A selenium cell is easily made and requires little outlay, in fact with the exception of the selenium which must be purchased, the remainder of the kit will be found in any amateur's junk box. Obtain a little selenium from a chemist. It is preferable in the form of black powder although either the stick or crystalline form may be used. The next step is to cut a rectangular piece of thin slate about 1in. by 1½in. with a smooth surface. The two longer sides are notched throughout their length to a depth of about 1/32in. with a three-cornered file, as many notches as possible being cut, the number being the same on each side. It is a good plan to mark off the slate panel first with a needle and ruler as this will ensure the notches being in line and equal in number on each edge. The panel is now wound from end to end with two wires always running parallel but at no point coming into contact with each other. The purpose of the notches is to facilitate the winding process and to prevent a short circuit between the two wires (or more technically—the electrodes). Fig. 1 shows a cell ready for coating and Fig. 2 the parallel winding.

The best wire to use is either gold or platinum but as the price of these is prohibitive, copper must suffice for the modest amateur. The thickness is not critical—between 34 and 40 s.w.g., and the surface must be clean and bright. Two terminals are attached to one end of the cell and to these are connected one end of each winding. The two loose ends of the winding at the opposite side of the cell should not be left free but should be secured by means of wax or some similar non-conducting substance. It now remains to apply a coating of selenium to the article, and as the successful operation of the cell depends on the manner in which this process is carried out, the following instructions must be carefully followed. The selenium, placed in a porcelain basin, is gently heated over a bunsen flame until it becomes a molten tacky mass. At this stage the flame is lowered and the heating continued very gently indeed until the consistency of the selenium is such that it may be spread thinly and evenly with a glass spatula over the wires on one side of the cell. A thick, patchy surface is useless and, if this is the result on the first attempt, the best course is to rewind the cell and coat it afresh. A good surface having been spread, the cell must be annealed. This is accomplished

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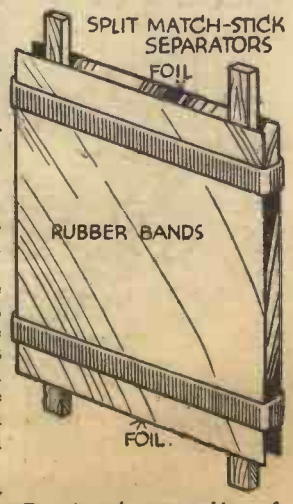

Fig. 4.—An assembly of electrolytic cell elements.

TESTING By SHORT-CIRCUIT

A Simple Method, for which no Instruments are Necessary, of Quickly Ascertaining the Cause of Faults in a Receiver

By W. J. DELANEY

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

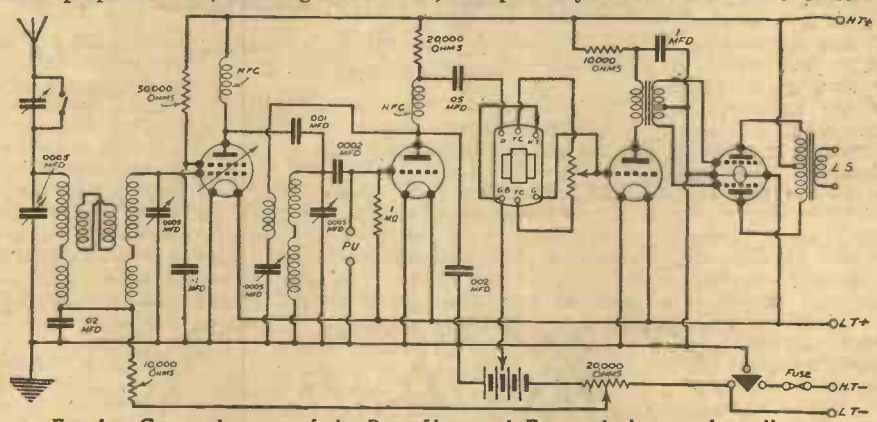

Fig. 1.—Circuit diagram of the Beta Universal Four, which is used to illustrate the short-circuit method of testing.

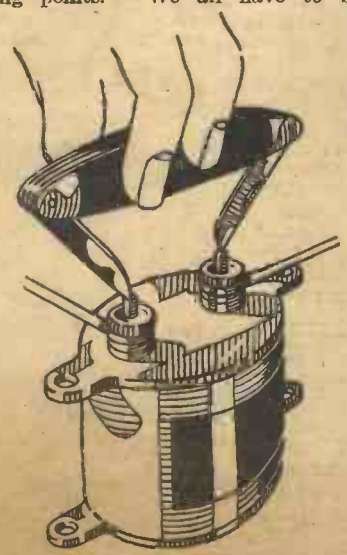

Fig. 2.—An ordinary pen-knife may be used as a temporary short-circuiting device.

Continuity Tests

Electrical knowledge is not necessary, but is very useful when testing components, but from articles which have already appeared in these pages it should by now be obvious that a condenser, for instance, cannot be tested for continuity by any very simple means. Resistances, chokes, inductances, transformers, coils, etc., should all show up when tested by such simple means as a battery and pair of 'phones in series, and this point has already been mentioned. When the contact is made a click will be heard in the 'phones. If the resistance of the component under test is very high, the click will be faint, and a low resistance will result in a loud click. The arrangement is illustrated in Fig. 4. Unfortunately, this method of testing will not show whether the component is short-circuited inside its case or whether there is a much greater resistance than there should be, and therefore a receiver may be built up from components which have all passed this test and yet fail to perform satisfactorily. We will assume, therefore, that the receiver has been built and fails to perform as you have been led to believe from the reports given in our article. What can be done? A pen-knife, or a piece of insulated wire (flex, for instance) may be used to carry out a test taking not longer than, perhaps, a quarter of an hour, and which will, in nine cases out of ten, locate the faulty component.

How to Test the Receiver

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

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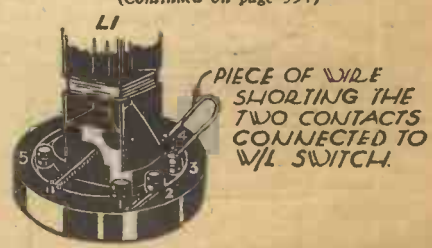

Fig. 3.—To test the switching of Dual Range Coils, the coil should be adjusted to the Medium Wave Band, and the terminals connected to the switch contacts shorted.

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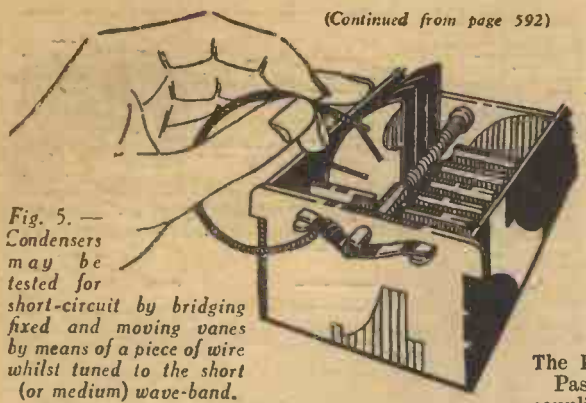


Fig. 5.—Condensers may be tested for short-circuit by bridging fixed and moving vanes by means of a piece of wire whilst tuned to the short (or medium) wave-band.

wave-band to another. Where two or more coils are employed, it sometimes happens that one coil changes whilst the other does not, and the symptom is that the long waves only are obtainable at good volume, whilst when switching over to medium waves difficulty is experienced in obtaining good signals. An examination of the pamphlet accompanying the coils will show to which two terminals the switch contacts are joined. When on medium waves, the coil between these terminals is (or should be) short-circuited, and therefore a test is made with the coil switched to medium-wave position and the two terminals in question joined together with a piece of wire or a pen-knife. In Fig. 2 is shown how a pen-knife may be used for this short-circuit method of testing, the two blades of the knife being quickly adjusted to the necessary width. Fig. 3 illustrates the coil-shorting test. If weak signals, or a complete absence of signals, is obtainable when the terminals are not shorted, and they are heard when the short-circuit is introduced, it is obvious that the coil switching is faulty. In some cases, the variable condenser plates get bent, with the result that at some point in the setting a short-circuit is introduced. The effect of this is usually a click in the speaker.

Oscillation sometimes produces an exactly similar effect, and, therefore, our short-circuit test will differentiate between these two causes. Rotate the dial until the click is heard. Now with the piece of wire or the pen-knife short-circuit the two sections of the variable condenser (or each separate portion of it if a ganged condenser is in use). To do this simply attach one end of the wire (or one blade of the knife) to the chassis of the condenser, and with the other end touch the moving and fixed plates in turn. If no difference in the sound emitted from the speaker is obtained in any position of the shorting contact, then the condenser is shorting, and the vanes should be examined, and when the faulty one has been traced it should carefully be bent. In the case of a ganged condenser it is to be expected that this will result in the matching being upset, and it is desirable to return the condenser to the makers for matching.

The H.F. Chokes

Passing to the anode circuit, the coupling component is an H.F. choke, and a broken connection here will result in no signals being received, whilst a short-circuit between pig-tail (or pig-tail screening) and the case will result in a similar effect. For the latter cause a close inspection is all that is necessary with most makes of choke, and carefully moving the pig-tail in all directions will result in clicks if a short-circuit is taking place. If, however, the component is disconnected, either internally, or owing to bad wiring a short-circuit with our piece of wire from anode to H.T. positive will result in signals being restored. They will be weak, of course, owing to the lack of sufficient resistance in the anode circuit, but they will serve to prove the existence of the defective choke. The grid circuit of the next valve should be treated in the same manner as the aerial circuit for defective coil or tuning condenser, and the anode circuit choke (used in the example for reaction purposes only) should similarly be tested. In the latter case, the shorting of the choke will result in maximum signals being received if the component is defective.

Shorting the primary and secondary of the transformer will remove crackling noises in the event of a partial breakdown, and in the possibility of a complete disconnection, a noise may be obtained in most cases from the loud-speaker when the faulty winding is shorted. Signals will not, in most cases, be obtained by this method, but the character of the sound which will be heard from the speaker will enable even the beginner to decide whether or not the winding is disconnected. The decoupling resistance may be shorted, but this should be carried out very quickly, in order to avoid damage to the valves through the application of too high a voltage. If the component has broken down, the shorting will re-introduce signals, and the short-circuit need only be applied for the merest fraction of a second to ascertain this. Even if the receiver is not tuned to a station, the extra amplification introduced by the valve in the anode circuit of which the faulty resistance is included will result in a larger volume of "noise" from the speaker, and consequent verification of the broken resistance.

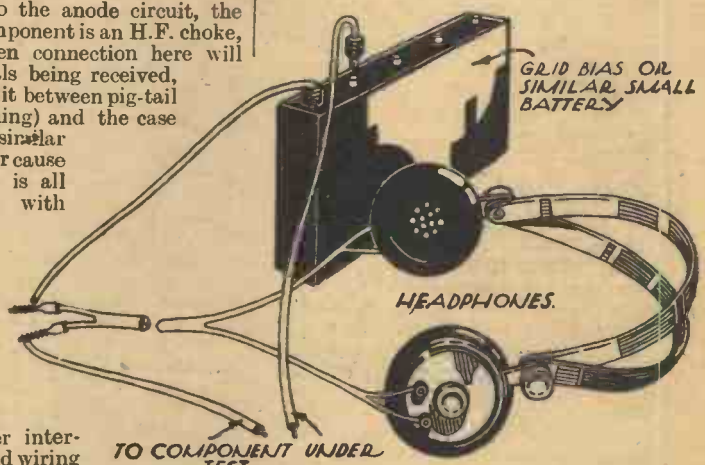


Fig. 4.—Testing components for continuity

It would not be right to complete this article without giving a word of warning as to those components which must, on no account, be short-circuited. Roughly these may be summarized as follows:—

Decoupling condensers.
Reaction condensers.
Grid-bias batteries and resistances.

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

MAKING A SELENIUM CELL

(Continued from page 591)

by baking it over a bunsen flame in a metal box or oven for not less than two to three hours during which time the temperature of the work must lie between 180° and 200° C., but at no time must the cell come in contact with the naked flame. After this baking the duration of which may be prolonged with frequently improved efficiency, the cell temperature is very gradually reduced to normal by slowly turning down the flame.

On inspection, the cell coating will now appear grey and metallic and is preferably protected from dust and the atmosphere by enclosing the cell in a glass fronted box which, as a further refinement, may be provided with a shutter.

Such a cell as described was found to have a "dark resistance" of 20,000 ohms and a "light resistance" of only 3,200 ohms. The amateur may find however that his cell characteristics coincide with the above figures only within very wide limits due to differences in size of cell, treatment, and so forth. The figures instanced show this particular cell to have an efficient light-dark ratio of comparative resistance. Experiments should be made with voltages lying between thirty and eighty, which are conveniently supplied by the household H.T. battery or a tapped mains unit. During the course of these experiments care should be taken not to apply excessive voltage or the cell will be ruined. In any case voltages in excess of a certain value (dependant on the cell characteristics) do do not improve the efficiency factor.

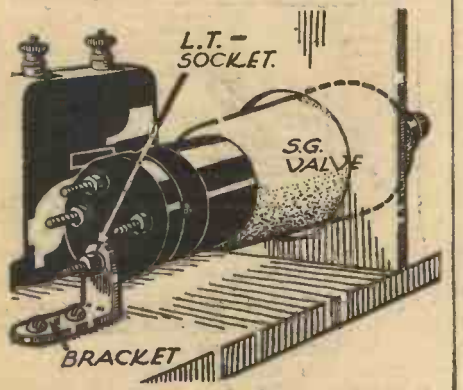
Another type of selenium cell erroneously known as the "condenser" type consists of a bank of alternate layers of mica and copper foil. One edge of this bank is made perfectly smooth and coated with a thin layer of selenium in exactly the same manner as the parallel wire type of cell described above. A simple condenser type cell is shown in Fig. 3.

(To be continued.)

READERS' WRINKLES
The HALF-GUINEA Page

Mounting S.G. Valve Holder

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

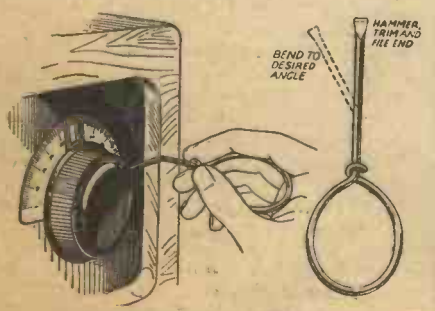


Mounting a screened-grid valve holder.

the negative leg of filament is secured to bracket, and automatically becomes an earth connection. The bracket is of metal, and rests on the baseboard screen. The illustration makes the point clear.—E. DAVEY (Plymouth).

Handy Tool for Grub Screws

THE control knobs on both home-made and commercial portable receivers are often placed on a sunken pancl to prevent their accidental damage, and in time, use and vibration will loosen the small supporting grub-screws, causing endless annoyance and erratic operation. Apart from completely removing the receiver from its case, it is usually impossible to effect a cure; the edge of the case will prevent a screwdriver being held at the correct angle. An ordinary steel cycle spoke, fashioned as shown below and bent to the required angle, will refix the most inaccessible grub-screw. The "shank" end should be held on some firm metal object, hammered flat, trimmed with cutting pliers and finished off with a small file. Many uses will be found for screwdrivers of this type, owing to their flexibility and easy adaptation.—F. J. Gough (Ellesmere).



A handy tool for grub screws.

THAT DODGE OF YOURS!

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

Automatic Paralleling Device for Reaction Circuit

IT is often found when using a .0003 mfd. condenser in the reaction circuit that for the higher long-wave stations it is impossible to supply sufficient reaction. This occurred in my set, and I found it necessary to employ a paralleling switch to add a .0002 mfd. condenser. Finally,

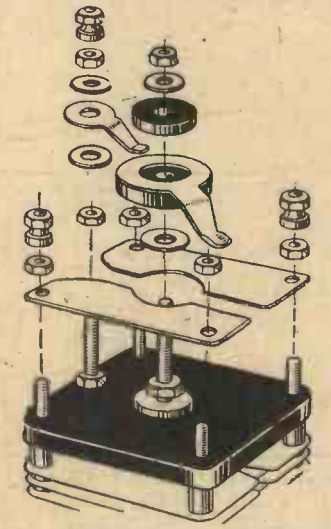


Fig. 1.—Component parts showing order of assembly for reaction switch.

I have incorporated this switch into my reaction control, giving a choice of either .0003 (through 180°) and .0005 (*i.e.*, .0003+.0002) through about 160° rotation of the spindle. It will be evident that a certain amount of angular rotation is taken up by the one fixed stop.

My reaction condenser happened to be a .0003 mfd. of the differential type, built up with oblong fixed vanes, distance tubes and ebonite end plates, etc. A pair of plates similar in contour to the fixed vanes were made and bolted down to the ebonite end plate under the nuts fixing the fixed vanes, thereby ensuring a good electrical contact with them. A contact arm (as shown in Figs. 1 and 2) was made, and secured to—but insulated from—the spindle of the reaction condenser. This rotating arm was then connected to an insulated terminal mounted upon the ebonite end plate by means of a bush. This terminal was connected to the reaction winding of the aerial coil: a .0002 mfd. condenser was placed across one side of the .0003 mfd. differential condenser, thus giving .0005

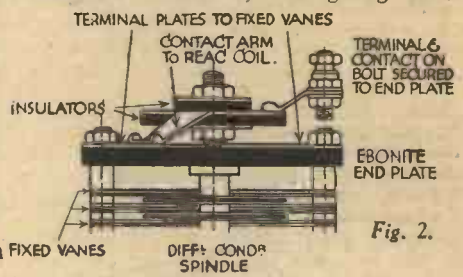


Fig. 2.

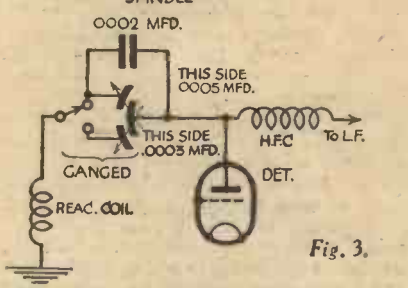


Fig. 3.

Figs. 2 and 3.—The complete reaction switch and circuit diagram.

mfd. when this side was in circuit. The position of the contact arm would decide whether the .0003 mfd. or the .0005 mfd. side were placed in the reaction circuit, a diagram of which is given in Fig. 3.

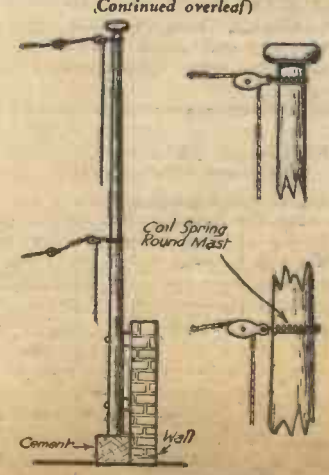
It is necessary to remove one of the stops from the ebonite end plate to ensure a complete rotation (nearly 360°), instead of only the usual 180° rotation.—W. S. HARRISON (Aintree).

An Aerial Hint

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

Stretch a spring coil tightly round the

(Continued overleaf)



A useful aerial hint.

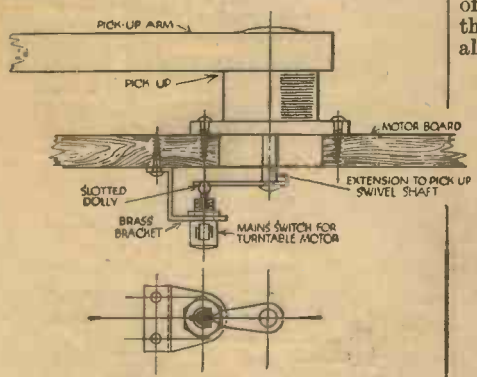
RADIO WRINKLES

(*Continued from previous page*)

pole (Fig. 1) as high as it is possible to reach, secure its ends and attach the pulley to the spring. Pass the hoisting wire through pulley and attach to aerial insulator. With thin props tied together and a cane on the end, the spring is pushed up the post contracting and gripping the post as it rises (Fig. 2), and remains at the top while the aerial is hoisted. My mast is 40ft. in height, and the actual spring used was a copper one.—J. S. NICHOLSON (Sunderland).

Automatic Switching for Radiogram

THE accompanying sketch shows a dodge for simplifying the operating of the gramophone part of a radio-gramophone. I fixed an extension shaft to the



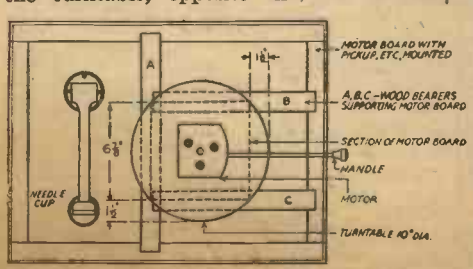
A radiogram switch.

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

An Improved Motor Board

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

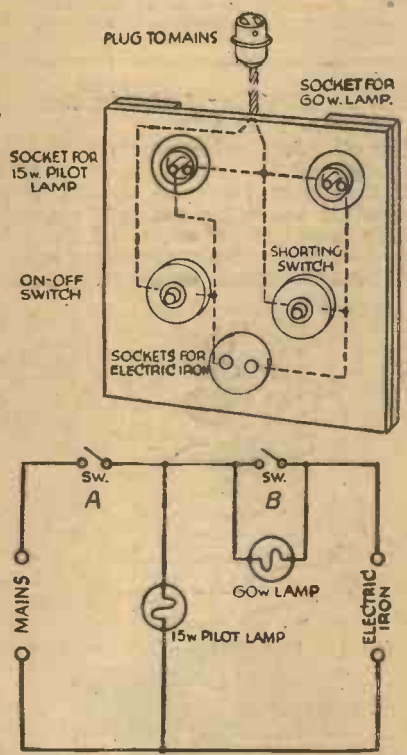
The turntable arrangement shown in the accompanying sketch I have fitted on my own set, and only a small section of the motor board needs to be removed. Measure approximately 1½in. towards the centre of the turntable, opposite the side of the cabinet where the winding handle is situated; this gives the position of the bearer (A). Then measure 6⅞in. along the bearer (A) where the position of the turntable is to be; this gives the positions of the centres of cross bearers B. C. The next step is to cut a piece of wood 6⅞in. square, and mount the motor on it, and when in position no joins can be seen as the turntable covers them. A good dodge is to place the needle cup directly under the pick-up.—T. SOMERVILLE (Edinburgh).



An improved method of mounting a radiogram turntable.

Protecting An Electric Soldering Iron

THE makers of electric soldering irons state that the current must not be left on when the iron is not in use, otherwise a burnt out element will be the result. The small switchboard, shown in the illustration, was designed to obviate this risk of the iron being accidentally left on if the user happened to be called away; also to prevent the iron overheating or



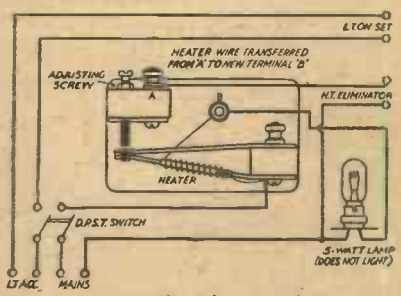
Switchboard arrangement for protecting an electric soldering iron.

cooling, whilst soldering work was in progress.

The plug from the mains end of the switchboard is plugged into the mains, and the electric iron is plugged into the other end. Switch A controls the supply to the iron, while, at the same time, a 15-watt pilot lamp shunted across the iron also lights, which draws attention to the fact that current is flowing through the iron. The extra 15-watt being consumed can be considered as almost negligible. Now if one is constructing a piece of apparatus, necessitating the making of soldered connections intermittently, the iron is liable to overheat if left switched on; and if left off would cool and so delay work. To remedy this, a lamp-holder is connected in series with the iron, into which is placed a 60-watt electric lamp. As we all know, this is a resistance, and so the iron is kept hot, during the intervals when it is not actually being used, without the risk of it overheating. Of course, when it is being used, the resistance lamp is shorted by switch B, allowing the full power of the mains to reach the iron. Lamps of different wattage can be tried in this holder to suit particular requirements. The greater the wattage the cooler the iron will keep and conversely.—A. J. (Kenton).

Simple Delay Switch

HERE is a dodge which is suitable for accumulator-eliminator sets either A.C. or D.C. The object of the device is to

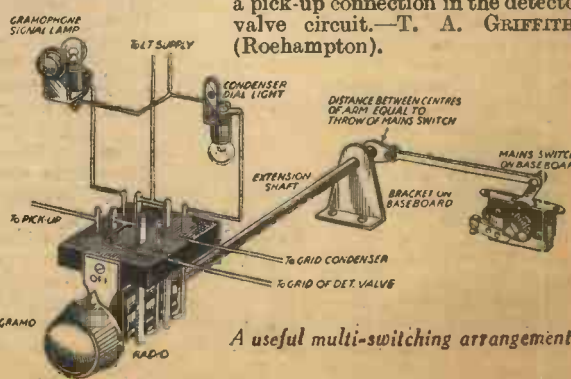


A simple delay switch.

switch on L.T. first, and it is serviceable where the 4 volts winding of a transformer is not available to work a Thermal delay switch. The apparatus required is a Thermo-Blink No. 00, used for small flashing signs, which can be purchased for 6s. 4d. This requires a slight alteration. The heater wire should be taken off the terminal that is connected to the contact screw and brought to another terminal, which can be set in the hole provided in the porcelain base. The accompanying diagram shows the connections. This switch can also be used in place of the usual thermal-delay switch in cases where 4 volt A.C. current is limited. In this instance, both ends of the heater are isolated and fed with the main in series with a small lamp (20 watt or under). The contact screw goes to the rectifier, the strip to H.T. winding of transformer. In this case the contact screw will have to be screwed out to increase the delay to half a minute.—R. OLIVER —(Wanstead).

A Multi-Switching Arrangement

THE accompanying sketch shows how a double-pole change-over switch can be adapted as a radiogram and panel lighting switch, and to work the mains switch of an all-electric set. It will be noticed that movement of the control knob to either radio or gramophone switches on the main supply. The switch is wired for a pick-up connection in the detector valve circuit.—T. A. GRIFFITHS (Roehampton).



A useful multi-switching arrangement.

Operating the D.C. ACE

By H. J. BARTON CHAPPLE,
Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

ALL the value of skilful craftsmanship expended on the building of a brand new set can be discounted, if manipulation of the necessary controls is not thoroughly understood. Acquiring this knowledge is not a matter of reading a few notes, but comes from an intelligent interpretation of the set's functioning together with a few hours spent in becoming quite at home with those panel knobs.

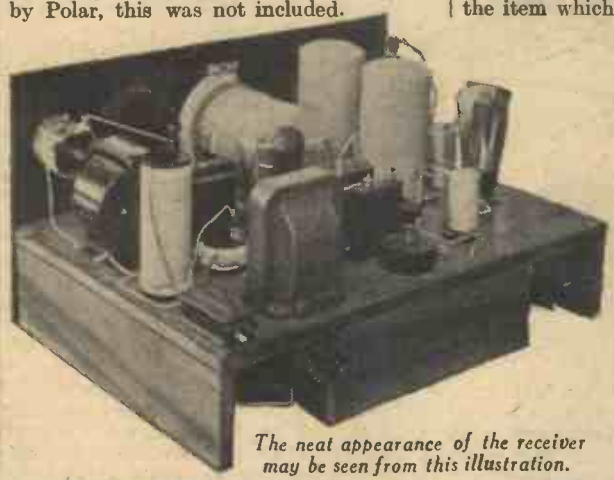
Do not be disappointed, therefore, if the set fails to please you 100 per cent. straight away; give the receiver a fair chance and it will return the compliment. As far as this particular receiver is concerned, there is really only a little knowledge that must be assimilated originally—the flair for "running round the dial" comes quite soon.

First of all insert the three mains valves into their correct positions, D.C./S.G. in socket on left nearest the panel, D.C./H.L. just behind, and the D.C./PEN. in the remaining holder. Do not forget to add the connections from the flex leads to the S.G. anode and the pentode screening grid. Your aerial, earth, and loud-speaker to the terminals so marked, clip on the twin fuse cover and connect the set to the mains supply *via* the lead made up for the purpose. Before switching on see that the coil covers are firmly registered in place with the base, and cover slots connecting.

Set your coil switch to either long or medium-waves as desired for the first test, the reaction control at minimum, and the volume control potentiometer about midway, as also should be the tone control potentiometer and filament current resistance knob. With your eye on the ammeter, switch on the mains, note whether the meter needle moves in its correct direction, that is, to the right. If it moves to the left switch off immediately and reverse the mains-plug, for obviously with D.C. mains working we have to consider positive and negative polarity, a factor which does not arise with A.C. mains working.

Speedily adjust the variable filament resistance so that the ammeter correctly registers the filament current, that is, half an ampere, and you will notice that as the "breakdown" resistances warm up slightly, the current drops somewhat owing to the corresponding increase in resistance. It will be a matter of a few minutes for this slight fluctuation to settle down, but the set will be "fully alive" after the passage of some thirty to forty-five seconds from the moment of switching on.

Your local station can, therefore, be tuned in after this lapse of time by turning the larger of the pair of tuning knobs. When tuned in, a fine adjustment is made by a slight movement of the smaller knob. This alters the capacity value of a single plate vernier condenser on the aerial side, and is sufficient to correct any irregularities that might be present in the ganging. I found no necessity for an extra trimmer in the second condenser section, and, in the special condenser made up for me by Polar, this was not included.



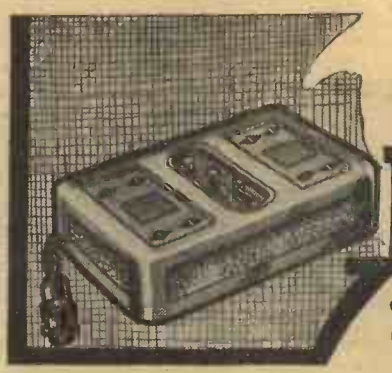
The neat appearance of the receiver may be seen from this illustration.

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

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

COMPONENTS FOR THE D.C. ACE.

One .0005 mfd. Polar Uniknob Variable Condenser (Special type, with insulated rotor).
Two .0001 mfd. Type 34 fixed condensers (T.C.C.).
One .0003 mfd. Type 34 fixed condenser (T.C.C.).
One .001 mfd. Type 34 fixed condenser (T.C.C.).
One .01 mfd. mica condenser (Lissen).
One .25 mfd. Type 50 fixed condenser (T.C.C.).
One 1.0 mfd. Type 50 fixed condenser (T.C.C.).
Two 2.0 mfd. Type 50 fixed condensers (T.C.C.).
One 2.0 mfd. Non inductive fixed condenser type LDAA (Dubilier).
Two Type BE88 Block condensers (2 and 2 mfd.) (Dubilier).
One .0003 mfd. Polar reaction condenser, compact type.
One .001 mfd. (max.) Lewcodensor (Type O).
One 4 mfd. Power Mansbridge Type Peak Condenser (800 volt D.C.).
One 50,000 ohm Lewcos potentiometer.
Three 50,000 ohm Varley tag resistances.
One 15,000 ohm Varley tag resistance.
Two 50,000 ohm Lissen wire wound resistances.
One 10,000 ohm Lissen wire wound resistance.
One 5,000 ohm Lissen wire wound resistance.
One 1 megohm grid leak with wire ends (Lissen).
One 330 ohm Heavy duty resistance (Bulgin).
One 3 ohm resistance (special type, see last week's issue) (Wearite).
One 200 ohm resistance (special type, see last week's issue) (Wearite).
One 250 ohm 50 watt variable resistance (Rotor Electric).
One 4 megohms graded potentiometer (Multi-tone).
One General Purpose L.F. Choke (Lissen).
One Hypercore smoothing and output choke (R.I.).
One ½ henry ½ amp L.F. Choke (special type, see last week's issue) (Lewcos).
One Bulgin Screened Grid H.F. Choke.
One Wearite H.F. Choke Type HFPA.
Four Type B Belling Lee Terminals marked aerial, earth, input, and output.
Two Belling Lee Terminal Mounts.
One Colvern KTF Coil.
One Colvern KGR Coil.
One Multitone L.F. Transformer.
One Panel Mounting moving coil Ferranti ammeter O.D. 0.75 A range.
Three (W.B.) Sub baseboard valve-holders.
Two Belling Lee S.G. anode connectors.
One Belling Lee mains plug 1 amp fuse.
One ebonite panel 18in. by 9in. by ¼in.
One baseboard (see last week's issue), screws and Glazite.



Point

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of Special Interest
Operating Battery S

By AS

IN the course of my daily round, it falls to my lot to deal with large numbers of queries from users of mains-units, and some to these queries are frequently repeated.

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

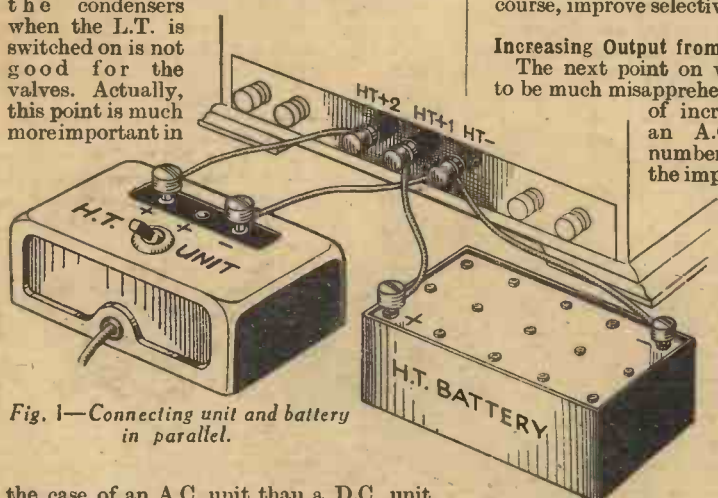


Fig. 1—Connecting unit and battery in parallel.

Another point regarding D.C. units is the fact that, upon connecting the unit to the set, the metal parts of the set often become "live" to the touch. This is merely due to the fact that the supply-main to the house in which the unit is used happens to be on the positive-earthed side of the D.C. three-wire system, the consequence being that the negative side of the set is at a potential above earth equal to the mains input voltage. If, therefore, you find that you can get a slight shock from the metal panel or grub-screws of the slow-motion dials, this does not indicate a fault in the unit—it is merely due to a peculiarity in the supply and has no bearing whatever upon the electrical performance of the unit. Furthermore, on D.C. mains, a small condenser, should be connected between the set and the lead-in to prevent damage in the case of the aerial falling to the ground. The condenser should be a good-quality component, and if a capacity of not less than .005 is used, tuning will not be affected—a smaller condenser may, of course, improve selectivity also.

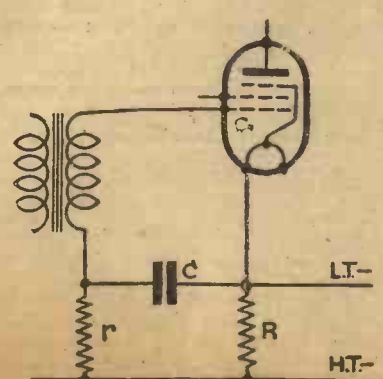


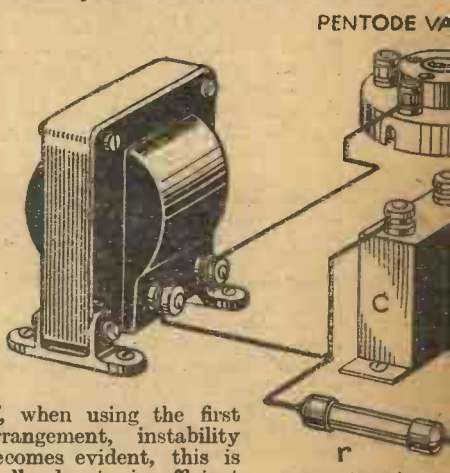
Fig. 2a.—Theoretical circuit of Fig. 2.

Increasing Output from an A.C. Unit

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

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

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



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

Increasing Output of a D.C. Unit

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

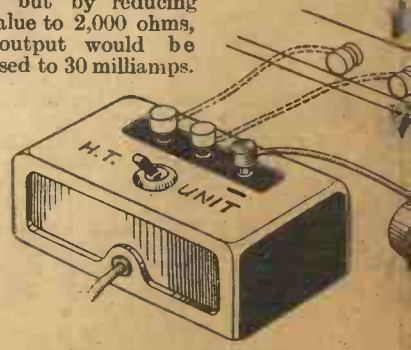


Fig. 3.—Variable "free

ts About UNITS

o Those Readers ets from the Mains

TRAL

The actual resistance required is arrived at by dividing the surplus voltage by the required current. For example, assume the mains input to be 230 volts and an output of 150 volts at 30 milliamps is required, the equation is $R = \frac{80}{.03}$ amp. which is about 2,650 ohms from which must be deducted the D.C. resistance of the smoothing choke.

The question of choke induct-

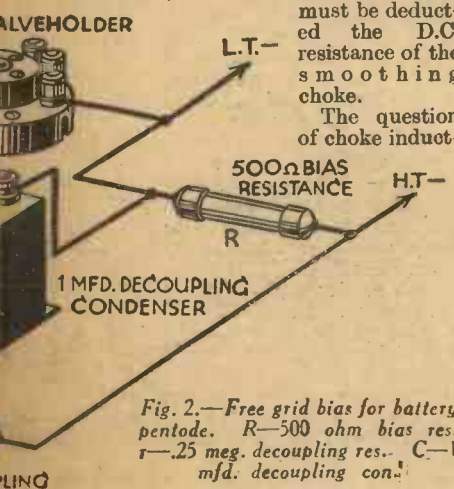
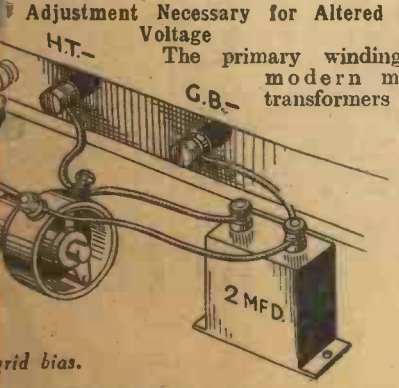


Fig. 2.—Free grid bias for battery pentode. R—500 ohm bias res. r—.25 meg. decoupling res. C—1 mfd. decoupling con.

ance still has to be taken into consideration, and, therefore, before altering the resistance value, the manufacturer of the unit should be approached regarding the question of whether the existing choke will carry the additional current without saturating. A better choke may be necessary, but as the choke possesses D.C. resistance it must be born in mind that if the new choke has a higher or lower D.C. resistance, the effect will be similar to altering the value of the mains resistance. In other words, the use of a lower D.C. resistance choke will in itself increase the output to some extent.

Adjustment Necessary for Altered Mains Voltage



rid bias.

The primary windings of modern mains transformers are, of course, tapped so that the unit can readily be adjusted for use on various voltages, usually between 200 and 250 volts. Many people who possess units wound for 100-volt and 200-volt mains are now faced with the difficulty that their mains have been, or are going to be, changed to the universal 230 volts, and consequently their units must be modified for use on the higher supply. There are two ways of overcoming this difficulty—one is to return the unit to the manufacturer, who will replace the transformer and charge accordingly, and the other is to insert a voltage-absorbing resistance in one side of the mains-lead, so that although the mains are 230 volts, the actual input to the unit remains at the original 100 or 200 volts. It is a simple matter to work out resistance values where the supply is direct current, but where the supply is A.C. the matter is not quite so simple. However, the method given here will give a sufficiently accurate value for all normal purposes.

The first step is to find the total wattage of the secondary windings. Take, for example, the case of a unit employing valve rectification, having a D.C. output of 20 milliamps at 150 volts. Wattage is the product of voltage and amperage, and therefore the wattage of the filament circuit is 4 volts at 1 amp., which is, of course, 4 watts. The H.T. circuit will be $\frac{150}{1}$ volts × $\frac{1}{50}$ amps., which is three watts, i.e., a total load of 7 watts. We must, however, make allowance for transformer losses, and this is where there is possibility of some error as this is an unknown quantity, but, generally speaking, it is safe to assume this figure at 30 per cent., which brings the total secondary wattage to about 9 watts.

The next step is to determine the current which should flow through the primary, and this is computed by dividing the secondary wattage by the mains voltage. In our assumed case, the primary current is given by the fraction $\frac{9}{230}$ amps. which, boiled down, comes to about 39 milliamps. Now the value of the resistance required to absorb the surplus voltage is arrived at by dividing the surplus voltage by the primary current. The primary is wound for, say, 100 volts, and the mains input is 230 volts, therefore we require to drop 130 volts, which has to be divided by the primary current thus: $\frac{130 \times 1,000}{39}$ which is about 2,500 ohms. If the unit were already wound for 200 volts, then the resistance would obviously require to be only about 750 ohms.

Here is another point which is continually cropping up, automatic grid bias with a battery set and a mains unit. Some units are provided with special tappings for grid bias, but where these are not fitted, it is not a difficult matter to arrange for free G.B. Unfortunately, so-called "free" grid bias is not actually free, as any volts which may be used for this purpose are deducted from the H.T. volts.

Free grid bias is merely the use of the voltage difference between the ends of a resistance in the negative lead. The resistance should be connected between the grid circuit of the output valve and H.T. negative as shown in Fig. 2. The correct value for the majority of battery pentodes is 500 ohms. A condenser must in all cases be shunted across the resistance to prevent instability. If you do not wish to interfere with the wiring of the receiver, then a G.B. tapping can be provided direct from the unit, by connecting a variable resistance between H.T. negative on the set and H.T. negative on the unit as shown in Fig. 3.

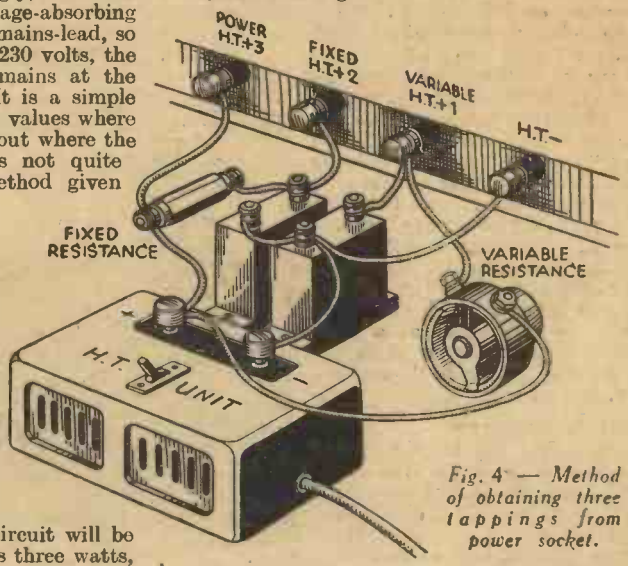


Fig. 4 — Method of obtaining three tappings from power socket.

Another query is how to provide additional tappings from a unit, either variable or fixed. This is a simple matter, the output from the power socket can be split up into three tappings, variable or fixed as desired. The connections are shown in Fig. 4; two additional tappings are shown, one fixed and one variable. The condensers should be at least 2 mfd. each.

Many of the units now on the market incorporate trickle-chargers for charging L.T. accumulators from the mains. If the accumulator is allowed to become completely discharged, the trickle-charger cannot be expected to charge it up again in a few hours. The usual trickle-charger rate is .5 amp., and it will be obvious that in the case of a discharged 30 actual-amp.-hour accumulator, the trickle-charger will take 60 hours to charge it up, or allowing for losses in the accumulator, about 80 hours. The trickle-charger is not intended to be used in this way. The accumulator should first of all be fully charged from some external source.

The result of a test which I recently took on several representative makes of units, revealed the average current consumption of a 20 milliamp A.C. unit to be six watts, a 20 milliamp D.C. unit four watts, and a .5 amp. trickle-charger twelve watts. As there are one thousand watts to a unit of electricity, obviously, the A.C. unit would give about 170 hours for one unit, at an average cost of, say, 4d.

OUR VIEWS ON RECEIVERS

IT is an undoubted fact that the superheterodyne receiver is daily increasing in popularity, and with the increasing chaos in the ether, this is the only type of receiver which can be relied upon to furnish "perfect" reception of many stations at any time of the day or night. The time has now gone when the quality claims of the superhet could be questioned. Provided the design is correct the old-fashioned whistles all round the dial can also be completely eliminated. In fact, in handling a really well-designed, modern receiver of this type, it should be impossible to tell whether or not an ordinary "straight" receiver is being used. The latest receiver of this type to be placed on the market is shown on this page, and we have had the pleasure of examining it in detail and seeing just how far the good manufacturer can go in the way of producing a receiver which can justly be called the last word, at a price which will undoubtedly soon render the so-called "straight" receiver obsolete.

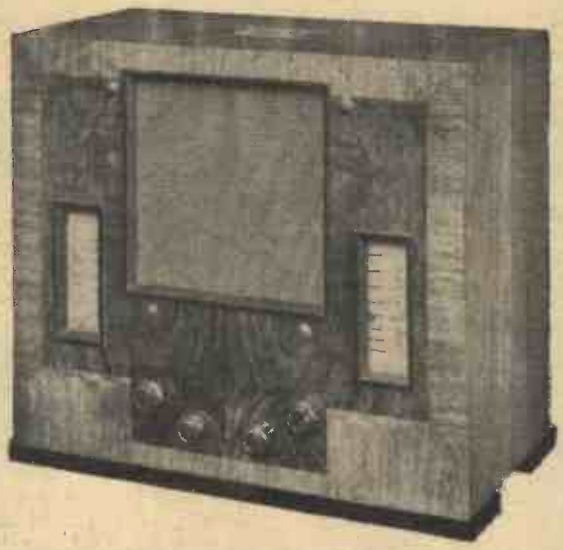
H.M.V. SUPERHET SELECTIVE FIVE (Model 438 A.C.)

Attractive Appearance

Before passing on to the actual circuit design of this set it is essential to remark upon the really good design which is incorporated in cabinet work, actual layout, and design of controls. As may be seen, there are two tuning scales, one for the medium waves and one for the long waves. Each of these is separately illuminated, and operation of the wave-change switch illuminates the appropriate scale. This is of the only really useful type, namely the straight-line. This type of scale, when engraved with the names of stations or frequency in kilocycles, enables the tuning point for a station to be seen at a glance, and the pointer adjusted to that spot in the shortest possible time. We venture to prophesy that by next season the partially-obscured dial, showing through a small window, will have passed out of existence. However, this receiver also employs a clean loud-speaker grille, no old-fashioned fancy fretwork being employed to harbour dust or give rise to rattling. From the back, the layout of the coils, valves, etc., is just as modern, and with the choice wood which is employed for the cabinet work the receiver may take its place in any home without being obtrusive or out of place.

The Circuit

Now to proceed to the circuit, which employs only five valves, including the rectifier. The manufacturers inform us that the first experimental models of this receiver were produced as far back as March, 1932, so that it is quite conceivable that there is nothing which can be done to improve this particular circuit. When a firm spends over twelve months in perfecting a design the user can rest assured that every refinement has been included, and that, provided no revolutionary new developments come along, he has a receiver which will take some time to go out of date. The circuit consists of an S.G. combined first detector and oscillator, variable-mu I.F. stage, linear grid rectifier, and Pentode output stage. A gramophone pick-up may be left permanently connected to the receiver, and the operation of the mains selector switch will enable record music to be produced when desired without the necessity of making extra connections. The input circuit is of the band-pass type, which ensures the almost complete absence of second-channel interference when not using a signal H.F. stage. In addition, a patented feature is incorporated which acts in a different manner on both long and short waves, so that in this particular model it is possible to tune right through the scale on either wave-band, and unless the user is an expert he would not hear a single "second-channel whistle." In any case, the ordinary listener will be unaware of their presence. Orthodox arrangements are employed to couple the I.F. stage and second detector stage, but in the anode circuit of the latter are no less than four resistances in series. These are arranged not only as voltage droppers and decouplers, but with the condensers which are chosen complete isolation of the H.F. currents has been obtained, and the L.F. stage rendered immune from troubles which often arise in a superhet circuit with inadequate H.F. filtering. The L.F. coupling is by means of a parallel-fed auto-transformer, in series with which is a clever tone-control circuit. This operates to give a really sharp cut-off at about 5,000 cycles, and thus reduces needle-scratch when using gramophone records, and heterodyne whistles which sometimes are received with a signal.



The attractive lines of the H.M.V. Superhet Selective Five (Model 438 A.C.), is apparent from this photograph.

Actual Results

When tested, we used the mains aerial, which is of the usual "condenser in the mains lead" type, and several continental stations were received by this aerial alone. When connected to a good outside aerial, practically all of the worth-while stations may be heard, many of them in broad daylight. Tuning is, of course, of the utmost simplicity, and there are no knacks or tricky adjustments to be carried out. The tone control acts in a most interesting manner, enabling any tone to be produced to suit the requirements of the individual listener. The volume control, too, produces a very smooth control over the output, which may be varied from the full 2 watts to a mere whisper, although in the latter position, on the particular mains which were used, the hum was louder than the signal. It is, of course, never necessary to cut down the volume to this extent. The particular loud-speaker which is fitted gives a very well-balanced output, free from boominess and characterized by that "forwardness" which is associated with the receivers produced by the H.M.V. factory. In spite of all the above good points, there is still one other which will interest every reader, and that is the price. Fifteen guineas is all that is asked for this complete receiver, and when it is remembered that less than a year ago a battery receiver, exclusive of batteries cost as much, it will be appreciated that the manufacturers have endeavoured and succeeded in producing a receiver which will find a most ready market.

For those who require it this chassis is also obtainable in a radio-gram cabinet, and the pick-up and other gramophone apparatus is already mounted and connected in circuit. Details concerning this radio-gram will be given on this page in due course. The performance is, of course, of the same order as is obtained with this particular receiver.

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

MAKERS: The Gramophone Company, Ltd.

SPECIFICATION: Four valve Superhet., with valve rectifier. S.G. combined detector-oscillator; variable-mu I.F. stage; linear grid detector and Pentode output stage. Adjustable tone control, and combined volume-control, acting on either radio or gramophone. Mains energized loud-speaker. Second-channel whistles reduced to an absolute minimum. Straight-line scales for each wave-band, each separately illuminated.

TEST REPORT: Reception of dozens of stations, with the greatest facility, on either wave-band in daylight and practically any worth-while station at night. Quality of reproduction adjustable to suit any requirement characterized by "forwardness" and complete absence of resonances. A de-luxe instrument.

PRICE: 15 guineas.

The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

Conducted by F.J. CAMM

Neutrodyne Circuit

A receiving circuit designed to neutralise the inter-electrode capacity of high-frequency valves and so prevent H.F. howling. It is now no longer used owing to the introduction of the screen-grid valve, in which the neutralizing is carried out in the valve itself by internal screening. See *INTER-ELECTRODE CAPACITY.*

Nickel Iron

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

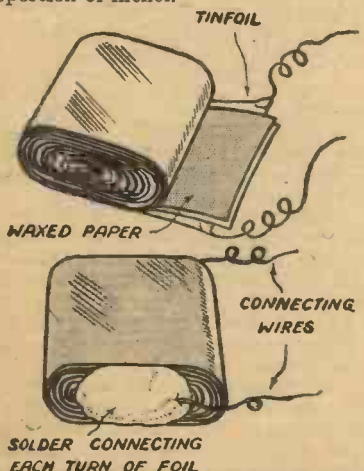


Fig. 1.—(Top): A paper condenser which would be inductive, the connections being taken from the ends only of the foil. That shown below is non-inductive since each turn of foil is connected.

One of the chief advantages of nickel iron over ordinary iron as the material for the cores of transformers and chokes is that less turns of wire are necessary for a given inductance. This means that the whole instrument can be made smaller than when iron is used. (See *TRANSFORMER.*)

Nodon Rectifier

A chemical rectifier consisting of an aluminium rod and a lead plate immersed in a solution of ammonium phosphate. It is used for converting alternating current into direct current and is chiefly employed for charging accumulators from alternating current mains. Usually four of these rectifiers are used connected in the form of a bridge circuit.

Non-Conductor

A substance which will not permit the passage of an electric current. An insulator is a non-conductor. (See also *CONDUCTOR.*)

THE BEGINNER'S A B C OF WIRELESS TERMS (*Continued*)

Non-Inductive Condenser

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

Non-Inductive Resistance

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

Ohm

The practical unit of resistance.

Ohm's Law

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

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

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

There are many other cases where *Ohm's Law* is used, such as in the working out of the value of voltage dropping resistance, anode resistances, the current in the anode circuit of a valve, and the voltage dropped across grid-bias resistances, etc., etc.

Open Circuit

A circuit which is not continuous and therefore, one through which current cannot flow.

Oscillations

When wireless waves strike the aerial of a receiver they set up electrical oscillations in the aerial circuit (the aerial tuning coil and condenser). These oscillations are simply electrical currents moving backwards and forwards very quickly, or at a high frequency, as it is called. They are dependent for their maintenance on the energy supplied by the transmitting station, in other words, on the incoming waves and also on the aerial circuit being tuned to those waves. Of course, if the transmitter stops radiating then the circuit ceases to oscillate. The fact that the oscillations die down in this way as soon as the outside source of energy is removed is due to the resistance of the circuit. There is a way, however, of overcoming the resistance. It consists of utilising some of the energy in the anode circuit of one of the valves. This is transferred to the aerial circuit by a reaction coil, or some such device. The circuit will then oscillate continuously, whether the outside source of energy be continued or not.

When a receiver is said to be oscillating it means that the energy supplied by the reaction device is more than sufficient to overcome the resistance of the aerial circuit, so that the surplus energy is radiated from the aerial in the form of wireless waves. In other words, the

Fig. 2.—Above: Type of resistance which is inductive. Centre: How the wire is wound in a non-inductive wire resistance, and Below: Two other non-inductive resistances.

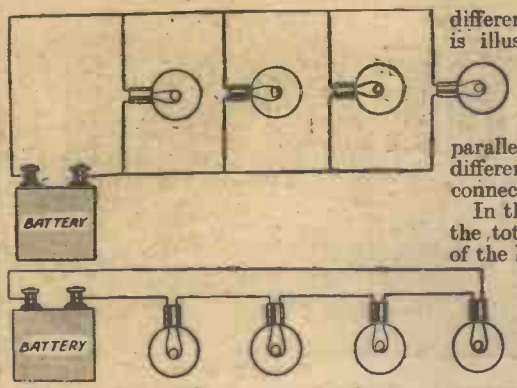


Fig. 3.—Above: Shows a set of lamps connected in parallel. Below is shown the series arrangement. See Parallel Connections.

receiver acts as a miniature transmitting station.

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

See also *REACTION*.

Oscillator Valve

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

Oscillograph

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

Pancake Coil

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

Parallel Connections

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

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

Pentagrid

A valve having five grids.

Pentode

A valve with a total of five electrodes, namely, filament, plate and three grids. It is remarkable for its amplifying properties, having a very high rate of mutual conductance.

The commonest type of pentode is a low frequency valve, its use being limited almost entirely to the output stage of the receiver, where it may be connected either alone or in push-pull with another similar valve.

The H.F. pentode is a recent introduction, and is a modified version for use in H.F. circuits. It has certain advantages over the more orthodox screen-grid valve.

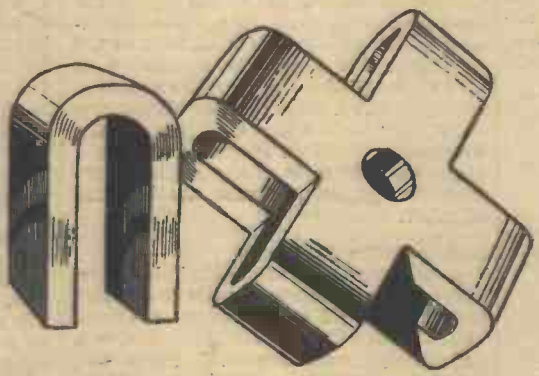


Fig. 4.—Two examples of permanent magnets. *That on the left is as used in a moving-iron loud-speaker, while the one on the right is from a moving-coil speaker.*

Permanent Magnet

A magnet which retains its magnetism indefinitely. Usually a special steel such as cobalt steel is employed. Permanent magnets tend to lose their magnetism if the gap between the poles is very wide. If a "keeper," which is merely a piece of soft iron, is placed across the gap this loss is greatly minimized. Blows with a hammer, dropping the magnet, or heating the steel will cause rapid deterioration. For this reason it always pays to handle permanent magnet loud-speakers with the utmost care, as apart from other damage, dropping them may demagnetize the magnet.

Permeability

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

Phosphor Bronze

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

Photo Electric Cell

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

Pick-Up

See GRAMOPHONE PICK-UP.

Plate

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

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

Plate Circuit

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

Plate Voltage

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

Fig. 5.—Valve cut away to show the plate.

OUR SHORT-WAVE SECTION

Converting a Short-Wave Receiver—How to Adapt it to the Super-Regenerative Principle

By D. P. TAYLOR

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

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

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

The Super-regenerative Principle.

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

A point is reached where the positive resistance present is equal to the negative resistance injected into the circuit by the feed-back and the effective resultant resistance will be zero.

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

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

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

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

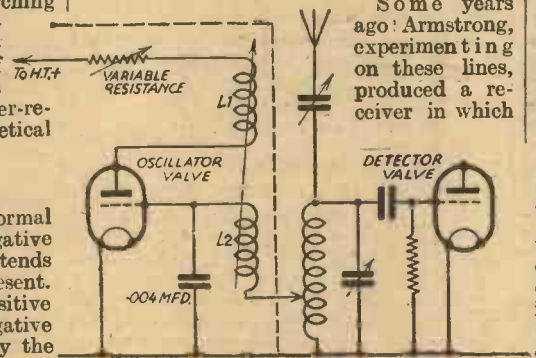


Fig. 1.—A simple regenerative arrangement.

Some years ago Armstrong, experimenting on these lines, produced a receiver in which the effective resistance was varied from a positive value to a negative value at a supersonic frequency.

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

It is found that the super-regenerative effect is more pronounced (*a*) The lower the value at which the value of the resistance is changed, although it is necessary that this shall be accomplished at a supersonic rate so that it shall not be audible, (*b*) The higher the signal frequency, as under these conditions the signal builds up to a larger value in the intervals when the effective resistance is negative.

This variation of grid circuit resistance can be accomplished by several methods, but the means which we shall consider at present are :—

(1) Variation of the grid circuit damping by tapping the grid circuit return of a supersonic oscillating valve to the tuned circuit of the receiver.

(2) Variation of the amount of negative resistance feed-back by the variation of anode volts of the detector valve at a supersonic frequency.

It is possible to arrange for the detector valve to perform the dual purpose of detector and supersonic oscillator, but in doing so a certain amount of efficiency is sacrificed, and we will consider at the moment methods which entail the use of an extra valve. Let us now consider the conversion of a straight short-wave receiver to the super-regenerative principle using the method described in (1) above.

The circuit diagram is shown in Fig. 1, all the apparatus shown enclosed in the dotted lines being the supersonic oscillator. The inductances used are two coils each of 1,000 turns, the grid coil being shunted by a .004 microfarad fixed condenser.

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

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

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

(*Continued overleaf*)

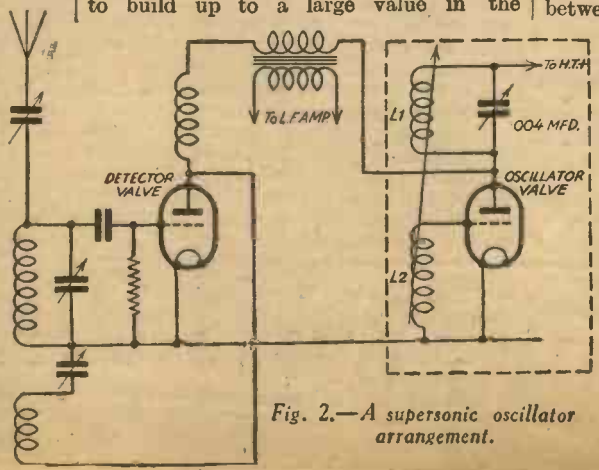


Fig. 2.—A supersonic oscillator arrangement.

RADIO RAMBLINGS

By JACE

Jottings from my Notebook

That Cheap Commercial Set!

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

"Standard" and "Manufacturers'" Models

IT might be added that one firm of transformer manufacturers at least do sell their products in two types—"Standard" and "Manufacturers'." The latter are a good deal cheaper as you can tell from the following specification taken at random. "Mains Transformer, giving outputs of 250–250 volts, 60 m.a. and 4 volts at 1 amp. Price, Standard Model, 26s.; Manufacturers' Model, 22s. 6d." Both models have identical characteristics, but whilst the first mentioned is fitted with terminals, the second has wire connections.

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

To Solder or Not to Solder

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

The "Westector"

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

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

Super-Power Transmitters

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

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

CONVERTING A SHORT-WAVE RECEIVER

(Continued from page 603)

The Supersonic Oscillator

As will be seen from Fig. 2 the supersonic oscillator is inserted in the anode feed to the detector valve causing the anode potential of this valve to be varied at a supersonic frequency.

The oscillator in this case is identical to the one previously described, with the exception that in this case the anode coil is tuned by the .004 condenser instead of the grid coil.

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

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

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

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

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

It will be found, too, in practice that whilst the noise level may be high when not tuned to a station the receiver becomes quieter when tuned to a carrier wave.

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

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

MAKING A FRAME AERIAL

By H. J. JONES

NOW that the summer months are here portable sets are very popular. Most portables have the frame aerial combined in the case for reasons of compactness, although some prefer to have the frame aerial separate, as it gives one more room inside the case for the other components, and in some cases it is more efficient.

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

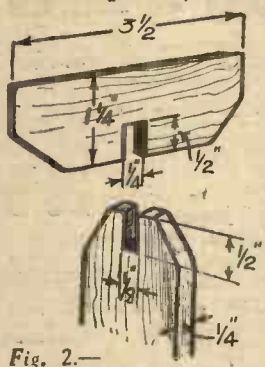


Fig. 2.—Method of fixing fibre pieces for holding the wire.

Constructional Details

The frame is constructed from 1in. by ½in. section hardwood, readily obtained from any fretwood store. Two pieces 9in. long and one 1ft. 10½in. long are required. The cross pieces are fixed 12in. apart on the main piece by means of glue and small nails. The joints are made as shown in Fig. 1.

Fig. 3.—Alternative method of fixing base.

Six pieces of fibre (or ebonite), ⅛in. thick, are then cut to the shape shown in Fig. 2, and glued in position for holding the wire. It will be necessary to cut a slot ⅛in. wide by 3½in. long at the foot of the frame to take the bottom piece of fibre. A base of ½in. hardwood 4in. square is then fixed to complete the frame.

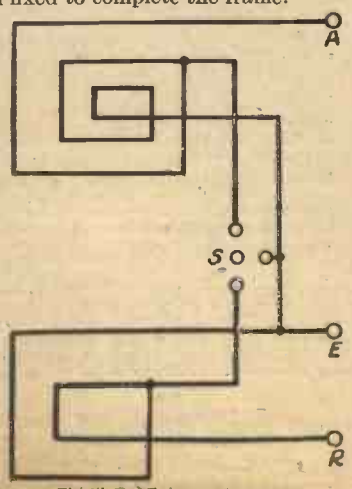


Fig. 6.—Circuit diagram.

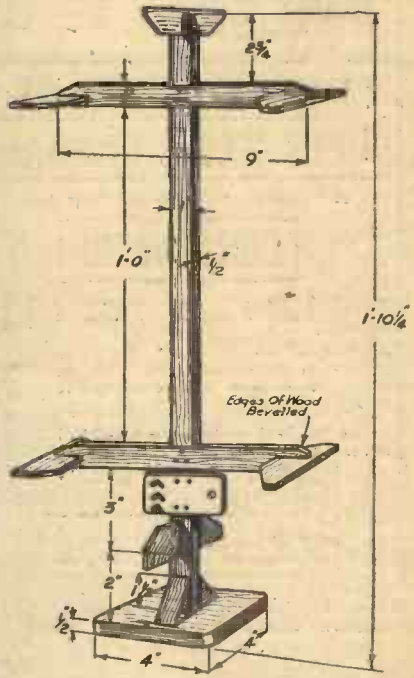


Fig. 1.—View of the complete frame ready for winding.

Two triangular brackets of wood are glued and nailed in place to steady the upright. If preferred, metal brackets can

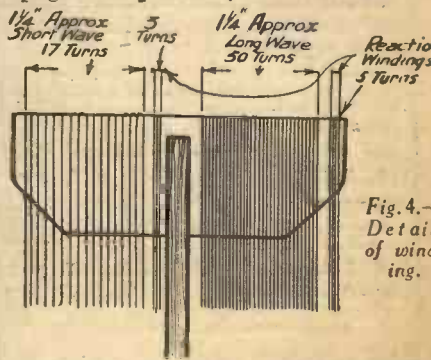


Fig. 4.—Details of winding.

be used, as in Fig. 3. A coat of varnish stain will improve the appearance of the completed frame.

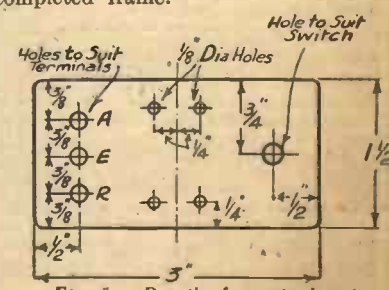


Fig. 5.—Detail of terminal strip.

The Windings

The wire required for the aerial is 24 s.w.g., d.s.c. for the medium-wave

(Continued on page 610)

IMPRESSIONS ON THE WAX

A REVIEW OF THE LATEST DISCS

By E. REID-WARR

MOST of the music issued on the latest records still remains light in character. Even the London Philharmonic Orchestra, under Sir Thomas Beecham, trip delicately about with Rossini's *Scala di Seta*, finishing with Handel's *Entry of The Queen of Sheba* from *Solomon* (*Columbia LX*255). There are no "deep depressions" in Rossini, but this overture has, I fear, too close a likeness to the *Barber of Seville* to send one *quite* frantic. It is marvellously played and the contrast of Handel is clever: it "goes" so well with it. Hear this, by all means. Then come back to Town and hear Eric Coates conducting a Symphony Orchestra in his *London Suite* (*Columbia DX*470). First—Covent Garden, which is a symphonic arrangement round "Cherry Ripe." Then Westminster, very soothing and contemplative. Lastly—Knightsbridge with martial glitter and pomp. Very, very English—and three very attractively drawn sketches of London. Henry Hall's B.B.C. Dance Orchestra have made a good record in *Viennese Memories of Lehar* on *Columbia DX*472. A number of the most popular airs are selected and played in most attractive manner. This band is capable of turning out good music in a higher plane than dance tunes.

Play of Butterflies and *Fairy Tale* are two new titles by Heykens, played by Albert Sandler's Orchestra, on *Columbia DB*1131. True to type (the Serenade, that is) but the second title need scarcely have been renamed. The first is deliciously played almost as a minuet, and Sandler himself is especially good. Of similar simple strain are *Ecstasy* and *Golden Kisses*, on *Parlophone R*1533. Here Edith Lorand's Orchestra give a straight, well-balanced performance of two orthodox waltzes.

Those who like Hawaiian guitars as a judicious seasoning to a piece will like Gino Bordin and his Hawaiians, on *Parlophone R*1532. They play *The Blue Bird* and *In Vienna One Night* most attractively, letting the violins (and the melody) have their share.

For something rather more full-blooded and festive *Regal-Zono* have two records which are excellent. The first is *Marching To A Military Band* and *It's The Band* (MR954), by an anonymous Marine Pavilion Band. Very vigorously played, but the vocals would have been better omitted. The second—*Rhapsody in Blue* (*MR*957), by Billy Cotton's Band, is played with any amount of confidence. This piece really is clever, however much one may dislike jazz effects. It is a syncopated symphony *de luxe*, and nothing, since it was written, has looked like dethroning it. The heavy piano part is got through with only one or two tiny errors, a very clever accomplishment.

Really the next is a dance record, but it is so very good as to be treated and bought as an orchestral piece. (We have minuets by Mozart and Beethoven, anyway!) Hear *For You, Rio Rita* and *I Want Nothing But Your Love*, on *H.M.V. B*6342. South American stuff by Marek Weber's Orchestra, grandly played. The first, a paso doble, is packed with infectious gaiety. The very thing for the summer evenings.

One from the classics to end this section. on no account miss *Columbia DB*1133, on which the Lener String Quartet play a transscription of Bach's *Air From the Suite in D* and the finale of the *Quartet in D Major* (*Dittersdorf*). If all the chamber music we heard were as lovely as these (especially the first) there would be no more caustic postcards to the B.B.C. Hear it; I think you will agree.

Mostly Ballads

Poetical fancy flies high in the first of Lawrence Tibbett's pair on *H.M.V. DA*1313. These are *And Love Was Born* and *The Song Is You*. The first is a charming little song, and the way in which it is sung is a model to imitate (if one could!) Tibbett is a magnificent singer, especially in this sort of song. How many times *Border Ballad* has been done, I know not, but there is a satisfactory version by Irving Naismith on *Decca F*3478. He is a good baritone, and this is happily done with a nice Lowland dialect. *Fairings* backs it, but he is not quite at home with it.

Here is one for the votaries of the open road. Sit and listen to Harold Williams singing *My Sheep Dog and I*, and then continue to tramp *With A Song* on *Columbia DB*1134. Neither is original in theme or music, but for the camp or caravan they will fit the occasion to a nicety. By the way, another which might also be taken along for a sing-song is *The Ratcatcher's Daughter* and *Botany Bay*, by the Victorian Quartette, on *Regal MR*945. These absurd, attractive mixtures of bathos and pathos always seem to come up as fresh as ever.

For those who like the modern pseudo sentimental song, Morton Downey fills a need. He has *Remember Me* and *Farewell To Arms*, on *Broadcast* 3207, and the orchestra shines brilliantly in the accompaniment to the first—a pretty piece of work.

Hilarities

We can laugh heartily, and keep on laughing at four very funny records just issued. First, our old friend Stanley Holloway. Listeners will remember in a recent appearance he gave us *Sam's Medal* and *Many Happy Returns*. *Columbia* were snowed under with requests for a record of these two, and here it is—*DX*474. Sam Small didn't get the V.C. for saving the Sergeant-Major's life, but the telling of his encounters with the great ones is humour to the *nth* degree. I believe this is the best Sam Small yet, thanks also to Mabel Constanduros and Michael Hogan, who wrote it.

Then vocal humour. Try Ann Suter in *Jekyll and Hyde* and *Actions Speak Louder Than Words*, on *Parlophone R*1529. Dual

(*Continued on page 612*)

Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

WARD & GOLDSTONE MAINS CHOKE

ALTHOUGH a D.C. Mains user considers himself lucky in not needing rectifying apparatus, it is still essential, in many cases, to smooth the supply, as there is very often a very distressing commutator ripple with this form of supply. This is especially the case for listeners who have D.C. operated valves of the indirectly-heated type. Messrs. Ward & Goldstone, makers of the well-known "Goltone" apparatus, have produced a most interesting form of H.F. choke for this purpose, and it will be found a very effective component. A paxolin former, 2in. in diameter, is wound with heavy gauge green-covered wire to an inductance of approximately 270 μH; and the D.C. resistance is .75 ohm. The former is attached to a moulded bakelite base fitted with two substantial terminals. The makers state that the choke will carry current up to approximately .6 ampere without an appreciable increase in temperature. They also claim that an increase of efficiency in D.C. mains sets of 10 to 25 per cent. is assured by using two of these chokes, in addition to the elimination of the hum. The price is 3s. 6d. To enable the Goltone coils to be conveniently mounted and ganged, metal chassis are now available in 2, 3 and 4 coil mountings. The 2 coil costs 1s. 6d., the 3 coil 2s., and the 4 coil 2s. 6d. The holes are arranged so that vertical or horizontal mounting is possible, and by means of the slots and special extension terminals provided under-baseboard wiring is possible. Thus two coils, with chassis, and the special sub-baseboard terminals will cost 13s. 10d. complete. This represents a saving of twopence over the purchase of the coils, chassis and terminals separately. Messrs. Ward & Goldstone also inform us that later in the season they intend to produce new types of chassis, complete with internal switching, thus completing their entire range of coils.

BRITISH RADIOPHONE GANG CONDENSER

THE Radiophone Condenser is very well known and for a long time has held a premier position in the field of variable condensers. In its re-designed form it is even more useful and efficient, and the illustration below gives some idea of the neatness and design of this new line. One of the difficulties which previously arose when constructing a receiver with the original model was the trimming. The adjustment for the trimmers was situated on one side, and therefore a screwdriver or other similar instrument had to be inserted in a horizontal position to accomplish the trimming and more often than not

The new British Radiophone gang condenser.

one of the receiver components was found to prevent ease of trimming. In the new model the trimmers have been arranged on the top so that they are readily accessible in practically any receiver or cabinet. The overall dimensions have also been substantially reduced, the two-gang model illustrated only occupying a back-of-panel space of about four inches. Fitting is now easier, as lugs, or feet, are provided on the base. The finish is in the popular battleship-grey cellulose, and the price of this model is only 15s. It may confidently be recommended.

"REGULAR" H.T. BATTERY

THE discharge rate of an H.T. battery is the most important feature which has to be considered, and with the now popular Class B types of receiver the battery must stand up to heavy rates of discharge over a fairly long period without developing noises. In addition, there is the problem of shelf-life, which concerns the purchaser who does not know whether the battery which he purchases has been on the shelf in the retailer's shop for one month or four. We have kept one of the Regular batteries in the laboratory for over four months without use, and with no particular care to protect it, and after this period it shows a most interesting voltage characteristic. Tested in a Class B receiver, it delivers its full voltage with no signs of distress, and has been in operation for some weeks with every satisfaction. Although not primarily designed for this heavy type of work, it is in every way satisfactory, and may be purchased with confidence.

CLARION VALVES

A CLASS B valve has now been produced by the Clarion Radio Valve Company, and this is made in two types. B.22 delivers an output of 1 watt and costs 9s., whilst type B.24 delivers double this power and costs 11s. 6d. The standard seven-pin base is fitted, and the results are extremely good when

The Clarion Class B valve and driver.

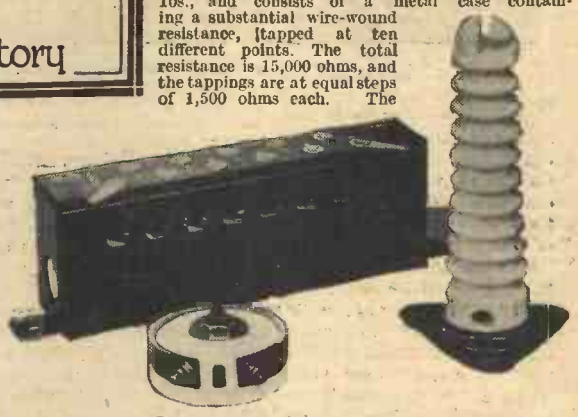
using the L.P.2 as a driver. This latter valve has an impedance of 5,500-ohms, with an amplification factor of 6, and costs 6s. 9d. The transformer must, of course, be correctly chosen when using the Class B valve, but when correctly matched the results are very good indeed.

BLUE-SPOT PICK-UP

THE Blue-Spot Pick-up illustrated at the foot of this page is the new Model 33. This is a handsome piece of apparatus, finished in a neat brown, the pick-up casing and the rear support being of bakelite with a walnut graining. The base of the foot contains a wire-wound resistance, and the control knob is fitted to the top of the foot, with a lengthened spindle passing down through the rear of the pick-up arm. Two leads are brought out for connection to the amplifying apparatus, with the addition of an earthing lead to prevent instability. Compensation is provided by a small weight at the rear of the pick-up arm, and the wear on a record is very small indeed. For best results, the Columbia "Talkie" or H.M.V. Loud Tone needle should be used. The D.C. resistance of the instrument is 2,900 ohms, with an impedance of 15,000 ohms at 1,000 cycles. The average output is 1 volt R.M.S. A very complete description is included with the pickup, together with circuit details. The price is 35s.

IGRANIC COMPONENTS

THE group of components illustrated here shows respectively a Potential Divider, a Stand-off Insulator, and a baseboard mounting Potentiometer. The Potential Divider costs 10s., and consists of a metal case containing a substantial wire-wound resistance, tapped at ten different points. The total resistance is 15,000 ohms, and the tappings are at equal steps of 1,500 ohms each. The maximum safe current-carrying capacity of the total resistance is 35 milliamps. There are numerous applications for a device of this nature, one of the chief of which is the inclusion of it across the output of a small mains battery-eliminator for providing different H.T. tappings to a small mains set. As may be seen, adequate ventilation is provided, and the device works very well. The Stand-off Insulator, whilst intended primarily for transmitting apparatus, is exceedingly useful for holding a down-lead away from a wall, or for other similar uses. It is made from the best white glazed porcelain, and although the overall length is only 5in., the corrugations provide a much greater leakage path than this. The peculiar slot at the end enables a wire to be firmly attached with little difficulty, and the surface may be cleaned instantly by simply rubbing with a damp cloth. At 2s. this is a very interesting device. The baseboard mounting Potentiometer is not so widely used in these days, but there are occasions when such a component is very useful indeed. For instance, in a short-wave receiver the grid leak is often returned to the arm of a potentiometer connected across the L.T. supply, and the arm adjusted to obtain the smoothest reaction control. One of these potentiometers mounted close to the valve-holder will obviate losses due to long leads, and it may be adjusted and left in position out of harm's way. For all purposes, therefore, where an adjustment has to be made and the control then left set, this type of potentiometer will be found useful. The price is 1s. 8d.



Some interesting Igranic components.

NEW OSRAM DOUBLE DIODE TRIODE.

THE General Electric Co., Ltd., announce the introduction of an entirely new valve type known as the double diode triode—Osram M.H.D.4. This valve has been developed with three objectives in view:

(1) To overcome distortion due to detector overload which is common with grid leak detectors when receiving loud signals.

(2) To overcome the drawbacks of fading which occurs on many stations, particularly at night-time.

(3) To simplify tuning by permitting reception of large numbers of transmitting stations of varying degrees of strength on the aerial at equal volume, the level of which can be manually adjusted to suit individual requirements.

The Osram M.H.D.4 consists of the usual double diode and triode electrode systems surrounding a common cathode. The great advantage of this form of valve over the ordinary grid leak detector is that the strength of signal which can be handled by the diode without overload is immeasurably greater, and also that the triode element is operating as a true L.F. amplifier with negative bias on the grid in place of part-rectifier, part-amplifier, as in a triode detector This makes for distortionless detection and greater sensitivity at the same time.

(Continued on page 610)

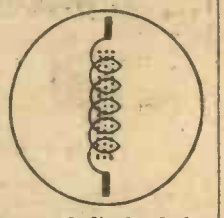
The Blue Spot pick-up.

Practical Letters from Readers.

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

Standardized Representation for Dust-Core Coils

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



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

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

From the East Indies

SIR,—As a regular reader from the first issue, accept my heartiest congratulations on your success in filling a long-vacant space in wireless literature.

Your articles on short-wave work and gram.-amplifiers have been particularly useful, and the next issues are anxiously awaited in the hopes of finding another improvement for my set or amplifier.

The number of your colonial readers must be very high, and I am sure they, like myself, are anxiously waiting a PRACTICAL WIRELESS short-waver. May I name it "PRACTICAL WIRELESS Colonial Four"? A battery set would be preferred to an "all-mains," as "juice" is only procurable in stored form in the "Ulu."

Wishing your paper continued success.—"OMBA PENDE" (Sungei Patani, Kedah.)

The Selectone Battery Three

SIR,—I have been a reader of PRACTICAL WIRELESS ever since I got a copy of January 14th, 1933, issue. I have been interested in wireless receiver construction for years, and I have rebuilt my set a good many times, but the Selectone Battery Three that was published in that copy of PRACTICAL WIRELESS is the best and neatest I have ever constructed. The circuit is a very good one, and I should like to tender my thanks to Mr. Frank Preston for the good design throughout. I did not follow it out exactly, because I did not want quite so much volume, as my room is small, so I followed the first tuning and detector stage; then I put the first L.F. transformer coupling on to a switch so that I can use it as a two-valve set. Then I made the third valve resistance coupling. I have an L.F. choke and two 2mfd. condensers for filter output across speaker terminals.—D. B. SMEDLEY (Ilkeston).

Volume No. 1: A Suggestion

SIR,—I wish to second Mr. H. A. Okley's suggestion in your issue of the 8th inst., with reference to the layout of your paper. I think it is a common sense suggestion, because Vol. 1 is on the bulky side, and would be more handy to use if the advertisements were deleted. As he rightly says, "about 50 per cent. of the advertisements are out of date in six months," and I wish to keep my volume for years. I have given up all other wireless weekly papers since your first number came out, and if Mr. Okley's suggestion was carried out it would make it a perfect reference book on wireless matters. I have your data sheets and binder, also your Encyclopædia; the latter especially is a wonder.—G. SOUTH (Waltham Abbey).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT over 5 watts undistorted output is obtainable with some single mains triodes.
—THAT the average battery triode only delivers an output of the order of 500 milliwatts.
—THAT loud-speakers are being made even smaller and yet still retain a fairly straight response curve.
—THAT an energized field type of loud-speaker is, generally speaking, more sensitive than one of the permanent magnet type.
—THAT a straight-line tuning dial offers many advantages, the chief of which is the ability to rapidly select a given tuning point.
—THAT a wooden baseboard may now be obtained sprayed with zinc (in the same manner as a metallized valve).
—THAT the efficiency of the above chassis is of a very high order.
—THAT Midget Universal Mains receivers will shortly appear on the English market.

NOTICE.

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

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

FACTS AND FIGURES

(*Continued from page 608*)

The advantages of the Osram M.H.D.4 double diode triode are still further extended when either the diode rectifier system alone or the diodes, in conjunction with the triode, are utilized in circuits for automatic volume control (A.V.C.).

There is no doubt that the double diode triode introduces a new phase to set designs. Without the "variable mu" the double diode triode would have an extremely limited field of usefulness: without the double diode triode the full advantages of the "variable mu" are not realized. The two valves together form a combination full of interesting possibilities to the set designer and constitute a marked step forward towards greater simplicity in operation.

PETO-SCOTT METALLISED CHASSIS

THE all-metal chassis has become the rule for all-mains receivers, and even for the battery set it possesses many advantages. The chief of these is, of course, the screening which is afforded between above and below-surface components, but in addition it is of great use in making earth return leads. These are simply taken down to any convenient fixing screw and thus automatically connected to earth. Hitherto we have utilised a wooden chassis upon which is mounted a sheet of aluminium foil, but Messrs. Peto-Scott have now developed a much more efficient arrangement. This is a wooden chassis upon which is sprayed a zinc deposit (in exactly the same manner as with the popular metallised valves), and the result is, of course, a film of metal firmly attached to the chassis. The advantages claimed are, firstly, any size of baseboard may be prepared, with holes cut out for valve-holders, etc., and the board then sprayed. Secondly, connections may readily be made by drilling a small hole in the board and inserting the end of a wire into the hole, afterwards running a small blob of solder round the wire, when it will attach itself firmly to metal covering and wire. In addition, insulation may be provided by scraping away the metal with a penknife, or alternatively the insulated parts may be masked when the board is sprayed. The board will be ready for distribution after August 1st, and will be known as "Metaplex." It will, no doubt, find great vogue.

MAKING A FRAME AERIAL

(*Continued from page 606*)

winding, and 28 s.w.g., d.s.c. for the reaction and long-wave windings. About 2ozs. of each will be sufficient.

Slots are filed about 1-16in. apart on the fibre pieces to take the medium-wave winding. Starting on the left-hand side a space of about ¼in. is left and seventeen turns of 24 s.w.g. wire are wound on. A space of about ¼in. is again left and three turns of 28 s.w.g. wire are wound on for reaction.

On the other side of the upright the long-wave winding is put on, fifty turns in the same direction as the others. Then come another five turns for reaction, as indicated in Fig. 4. These turns are shorted by means of a 3-point wave-change switch when receiving medium-wave stations. A piece of fibre or ebonite 3in. by 1½in. is drilled, as in Fig. 5, and fixed to the upright to hold the terminals and switch. (See Fig. 1.)

The connections are as follows: Beginning of medium-wave windings to terminal A; end of medium-wave winding and beginning of long-wave winding to one point of switch; end of long-wave winding to terminal E, and another point of switch; beginning of first part of reaction winding to terminal E; end of first part of reaction winding and beginning of second part to the third point on switch; end of second part of reaction winding to terminal R.

The reaction winding is in two sections, to give smooth reaction on medium and long waves. Perhaps the number of turns given will not suit all sets, but by varying the number of turns in each section until suitable numbers are found, smooth reaction can be assured on both wave-bands. The circuit-diagram of connections is given in Fig. 6.

The aerial is connected to the portable set by means of flex, and connections are made to suit the particular type of circuit.

MY OPINION! By the Editor

8-11, *Southampton Street, Strand, W.C.2.*

What's in a Name?

SEVERAL readers who have built my Fury Four have expressed curiosity as to the derivation of the name. The christening of any wireless set is a difficult task, for descriptive names are not easy to coin. I wanted a name which would in a word convey to the reader the rapidity with which you could tour the ether with the Fury Four, and which would indicate also its liveliness, sensitivity, and power. I could think of no better word than that which typifies the fastest military aircraft in the world—The Hawker Fury. Incidentally, the Hawker Fury was designed by my brother.

Red Flag Days.

I don't suppose many readers of PRACTICAL WIRELESS remember the plethora of restrictions which hampered the pioneers of the automobile industry. Certainly to-day the motorist is annoyed by oppressive legislation and a long list of technical offences, but they are as nothing when we remember that the speed limit was, once, five miles an hour, and that every automobile had to be preceded by a man *walking*, and carrying a Red Flag! Wireless is fortunate in that respect, for unbounded liberty has been given from a legal point of view, and its development is probably due in no small measure to the lack of bureaucratic attention it has received.

In this respect it is probably the only industry which has not had to wage the dual fight of breaking down public antipathy and, at the same time, restrictive laws; but undue liberty is always abused, and it is the abuse which eventually produces legislation. If your next door neighbour possesses some electrical device which interferes with your reception, there is no law at present to compel him to silence it. You must knock at his front door and ask him in a supplicatory manner which belies your real annoyance whether he would be so good as to try and do something about it. Legislation in this direction is urgently needed. Whilst the Post Office engineers are willing to co-operate, at present they do not possess the power to enforce their suggestions.

A Phantom Audience.

It has been suggested that because no licence figures are available as to the actual number of persons in possession of television receivers, the B.B.C. Television programmes may be appealing to a phantom audience. Apparently the argument is that first you must sell many thousands of televisors and then the B.B.C. may be induced by this numerical evidence to put over a television programme. On this argument we may yet expect the manager of a theatre to announce that he will not produce his play until he is assured that it will play to a packed house. People do not buy televisors in the pious expectation that a programme will be given. Now that the programmes are regular television will develop. The programmes should help to develop the new science, but until quite recently the science has developed the programmes.—C.

RADIO CLUBS & SOCIETIES

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

SLADE RADIO (Affiliated to the R.S.G.B.)

The programme of future meetings of this Society is as follows:—

July 27th ..	Visit to the works of Messrs. Wm. Bayliss, Ltd., Sheepcote Street. Time, 9 p.m.
Aug. 3rd, 10th	No Meeting.
,, 17th ..	Members' night.
,, 24th ..	"Olympia, 1933."
,, 31st ..	Lecture and demonstration, "5-metre work," by Mr. H. K. Bourne, B.Sc. (G2KB).
Sept. 2-3rd ..	Night D.F. Test.
,, 7th ..	Lecture: "Catkins, etc." Marconiphone Co., Ltd.
,, 14th ..	Lantern lecture: "From Nelson's day to the present," by Lieut.-Commander Brewster.
,, 21st ..	Lecture and demonstration. "Cathode ray oscillograph and its application to radio circuits," by Mr. G. Parr.

Entrance fee 2s. 6d. Subscription 8s. per annum. Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

INTERNATIONAL SHORT-WAVE CLUB, LONDON (London Chapter)

The topic of the evening at the London Chapter meeting, held on Friday, July 7th, was a discussion between Mr. A. E. Bear and Mr. P. J. L. Macfarlane, entitled "The Short-wave Listener" *v.* "The Short-wave Amateur." Mr. Bear, speaking for the short-wave listener, said that this particular kind of listener was someone who was not intent with listening to the ordinary broadcasting stations, but wanted to hear stations farther afield. He said there was a certain amount of thrill to hear VK2ME, or even America for the first time. Mr. Macfarlane, speaking for the amateur, said that the amateur was not interested so much in the actual short-wave broadcast stations as in the technical side, such as investigating short-wave propagation, the study of fading, etc. This discussion, which cleared the air as to the difference between the short-wave listener and the radio amateur, created great interest. A. E. Bear, secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

WHO WANTS AN EELEX BOWL?

THE Eelex Earth Bowl which has been on the market for many years is noted for its efficiency and lasting properties. When the bowl is well bedded down 3ft. beneath the surface of the earth its slightly conical shape causes it to make excellent contact with the earth. There is no air space along the bowl as frequently happens with a flat plate. This same conical shape ensures that the earth on the top wedges well down into the bowl.

The bowl collects moisture, whereas an earth tube conducts the heat of the sun to the surrounding earth, which contracts, thus leaving non-conducting air space. Capillarity ensures that the surrounding earth is kept moist from the water in the bowl. Both inside and outside of the bowl are in useful contact with the earth, and this surface is greater than that of any earth tube.

We will present one of these earth bowls to the six first applicants for them, the only stipulation we make being that the recipients must furnish to Messrs. J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, London, E.C.1., the name of their wireless dealer, so that the latter company may compensate the dealer for any loss occasioned by reason of these gifts.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

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

SPECIAL NOTE

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

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

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

TEMPERATURE OF RESISTANCES

"My mains set has been giving some funny sparking noises lately, and I find now that after the set has been on for a few minutes, one of the spaghetti resistances feels quite hot to the touch. Is this in order? I have not noticed it before, but found it out accidentally when feeling the connections. I do not know how these things operate and do not want to buy another unnecessarily."—(T. H. S. D., Aldershot.)

A spaghetti type of resistance should not be operated at such a temperature. Generally-speaking this type of resistance is only employed when small currents have to be carried, and if you find that the resistance gets hot, and the set is giving forth noises, you may take it that the resistance has been damaged. Remove it, and substitute it with one of the larger types of moulded, or wire-wound resistances. If you can find the current which passes through the resistance, you should work out the wattage dissipated and by that means obtain a resistance with the correct rating. There may be some fault which has arisen in the circuit and which has caused a much larger current to pass through the spaghetti than previously was intended, so that this point should be borne in mind when examining the set.

INCREASING WATTAGE OF FIXED RESISTANCES

"I am building up a receiver from a description in a magazine, and one of the resistances specified should be of the two-watt type. I have in my junk box several resistances, but none of the value specified. I believe it is possible to increase the wattage by connecting the resistances in series and I should like to know what ratio the increase takes."—T. Y. (Easthourne).

You have got the idea, but the method of expressing it is not correct. Resistances connected in series will still only have the same wattage rating, but if connected in parallel the current carrying capacity is apparently doubled. This is because the current is divided between the resistances, and if, for instance, two resistances (of the same value) are joined in parallel only half of the current will be passed through each resistance. Therefore, if a 20,000 ohm two-watt resistance is specified, you could use two 40,000 ohm resistances of the one-watt type in parallel, and the total resistance in circuit would then be 20,000 ohms and the resistances would not be over-run.

NOT DISTORTION

"Can you please explain my difficulty with my push-pull stage? I have built a most elaborate push-pull amplifier working from D.C. mains, and have fitted automatic biasing arrangements in the output arrangement with the inclusion of a good milliammeter in the combined anode circuits to enable me to trace overloading. I cannot by any reduction in signal strength keep the needle still. Even on the most weak passage I find that the needle jumps about in time with the music, and I am at a loss to trace the reason. What can you suggest?"—N. F. H. (Bromley).

The kicking may not be due to any form of distortion, but may simply be due to the fact that you have fitted biasing resistances which are overbiasing the valves, with the result that you are operating the valves at the bottom of their curves. Whilst this will give distortionless reproduction, the anode current will vary with the received signal, and therefore you should try the effect of a smaller resistance (unless you are certain that the values are correct), or leave the arrangement as it is if there is no audible distortion. Incorrect matching of the anode circuits will also lead to a continued jumping of the needle, either upwards or downwards according to whether the output load is lower or higher than that required by the valves. This is not quite so critical in the case of push-pull valves.

DATA SHEET No. 44

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

REACTANCE OF A CONDENSER AT RADIO FREQUENCIES

Condenser value	Reactance in ohms	Radio Frequency
.0001	1,350.0	250 metres
	1,600.0	300 ,,
	2,700.0	500 ,,
.0002	675.0	250 metres
	800.0	300 ,,
	1,350.0	500 ,,
.001	135.0	250 metres
	160.0	300 ,,
	270.0	500 ,,
.002	67.5	250 metres
	80.0	300 ,,
	135.0	500 ,,
.01	13.5	250 metres
	16.0	300 ,,
	27.0	500 ,,

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

SUBSTITUTE FOR SPEAKER FIELD

"My commercial receiver, which has been working for some time, has now broken down, and after examining it I find that the speaker is the cause. Unfortunately, the makers of the set are now no longer in the market, and I want to replace the speaker with a new one. I have a permanent magnet speaker standing idle, and should like to use this, but I do not know what to do regarding the substitution of the field winding. As far as I can trace, this was used for the mains smoothing choke and I appreciate that there was a voltage drop through it. Can you help me to use the P.M. speaker?"—G. T. (Scarborough).

It should not be difficult to replace the speaker. Special L.F. chokes are obtainable from one or two firms, and these have a fairly high inductance and are wound to the resistance generally used in such speakers. This is 2,500 ohms. One of these could, therefore, be used in your case. On the other hand, it is sometimes quite sufficient to replace the field by an ordinary L.F. choke of 20 or 30 henries, and to insert in series with it a fixed resistance of such a value that the total resistance of the choke and fixed resistance is equivalent to the speaker field winding. The resistance should be of a high rating (say 10 watts) to avoid overheating. This may prove the easiest method for you to adopt.

THE WRONG SPEAKER

"I am building the Featherweight Portable, but I do not want to go to the expense of buying the special loud-speaker. I have tried to connect my own speaker in circuit, but I cannot get any signals at all. I notice in the circuit there are three terminals on the speaker, but mine has only two. How can I fit the other terminal, or where must the lead go to in my set?"—S. L. A. (Watford).

The output stage of the Featherweight consists of a Class B valve, and the output arrangement must, therefore, consist of a centre-tapped choke or transformer. The two ends of this winding are joined to the two anodes of the Class B valve and the centre tap is joined to H.T. positive. As your speaker is fitted with only two terminals, it is obviously not centre-tapped, and therefore if you join the two terminals to the two anodes of the output valve you are getting no H.T. to that stage. Hence the absence of signals. You cannot tap the transformer, and therefore you must purchase a special Class B output transformer (or choke) to couple your speaker to the valve, or adhere to the specified components. We must remind you that our guarantee does not hold unless you use exactly the parts which are specified.

VALVE IMPEDANCE

"I was recently discussing valves with a wireless acquaintance, and the question of impedance came up. After some discussion my friend mentioned an impedance 'lower than 1,000 ohms.' I am of the opinion that it is not possible to obtain a lower value than this in an efficient valve, and as we finished by taking on a bet I should like you to let me know the correct answer to this problem."—T. B. (Dalston, N.1).

It is certainly possible to obtain an impedance lower than 1,000 ohms in an efficient valve. We would refer you, for instance, to the P.X.4 valve manufactured by the Marconi-Osram companies. This has an impedance of only 830 ohms and yet its conductance is 6. This is certainly an efficient valve, and you were therefore wrong in your statement.

L.S. BAFFLE AND DISTORTION

"My radio-gram has lately given off a nasty sort of rattle, and I have removed the chassis and had it tested. The maker's report is O.K. The speaker has also been tested and approved, whilst the cabinet has been tapped all over and found to be perfectly sound in every joint. I am at a loss to know what might cause the trouble, as I have (in my opinion) explored every avenue of possibility. I now fall back on you."—G. B. (Devonport).

Whilst you may have had every separate item of the radio-gram tested by itself, it is possible that the complete assembly may give rise to noises. This may be due to an overload of your speaker (which could not be identified by a separate examination of set and speaker), or what is more probable, especially if you have had the set working for some time previously, is the fact that the silk backing to the loud-speaker fret has worked loose, and is rattling at low frequencies against the rear of the fret. Examine this point, and we think you will find that this is the trouble.

HOME-MADE VALVE

"I have a Pentode valve which has become damaged due to being dropped on the floor. I should like to try and repair this, and should like to have your opinion as to the possibility of evacuating this of air. Is it possible in the home? I have not any expensive apparatus, or even any simple apparatus, but should like to try the experiment."—S. H., (Exeter).

We certainly would not recommend you to try and repair a valve at home. Apart from the fact that a very high degree of vacuum is required, the sealing-off of the valve after evacuation is a difficult proposition, and you would have a very inefficient piece of apparatus after the job had been completed.

FREE ADVICE BUREAU COUPON

This coupon is available until July 29th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 22/7/33.

REVIEWED BY AJAX

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

GRAHAM FARISH COMPONENTS

THE new Graham Farish catalogue, which is printed in either English, French, German or Spanish, will be welcomed by readers at home and overseas. Amongst the components listed are the Filt Percolative Earth, Lit-Los Condenser, Ohmite Resistances, Fixed Condensers, and a new twin-screen H.F. choke. Particulars are also given of a new precision volume control which has an element of fine nickel-chrome wire embedded in bakelite. The action is through a slipper-plate, giving a smooth, positive contact. A copy of either of these catalogues can be obtained from Graham Farish, Ltd., Masons Hill, Bromley, Kent.

UTILITY PRODUCTS

A USEFUL range of "Utility" steel ganged condensers is shown in an attractive catalogue issued by Wilkins and Wright, Ltd. The chassis is built of heavy gauge steel, and the spindles run in ball bearings of ample size which ensure smooth action. All ganged condensers are matched to less than one-half per cent. For superhet sets a model is supplied which incorporates a specially-designed section for tuning the oscillator circuit. These condensers are obtainable in the two, three or four-gang type. Other high-class components shown in the list include a new straight-line dial, anti-capacity switches, drum dials, and the "Utility" Micro-Dial with a ratio of 100 to 1. This dial, with its fine vernier adjustment and smooth action is specially suitable for short-wave tuning.

MULTITONE CLASS B CONVERTER

HOW to get all mains volume from a battery set without extra battery consumption is explained in a folder just to hand, which gives full particulars of the Multitone Class "B" Converter. This instrument, with which any Class "B" valve can be used, is simply plugged into the output valve-holder of a set, giving greater volume without added battery consumption. There are no terminals or switches. The converter, which is housed in a neat cabinet, is priced at 37s. 6d. without valve. A copy of the folder can be obtained from Multitone Electric Co., Ltd., 93-98, White Lion Street, London, N.1.

EELEX SHORT-WAVE CONVERTER

READERS interested in short-wave reception will find plenty of useful information on the subject in a new Short Wave Booklet we have just received from J. J. Eastick & Sons, 118, Bunhill Row, London, E.C.1. Details are given of the Eelex Short Wave Converter, an efficient unit working on the super-het principle, and priced at 52s. 6d., less valves. Full particulars are also given of the Eelex Modulated Oscillator. A list of short-wave stations and times of transmissions is also included in the booklet, a copy of which can be obtained from the address given above.

Replies to Broadcast Queries

VEAL (Putney): The latest published list gave the address of G2DL as Romford (Essex); possibly the address of the experimenter has since been changed. J. W. D. (Nottingham): This was a simultaneous broadcast by GSC Daventry (Empire) on 31.297 m. (9,585 kc/s). HOT BEARING (Acton): Radio Luxembourg (1191.5 m.). SPRINGBOK (Weston-super-Mare): G2LI, H. C. Wilkinson, 14, Kingswood Avenue, Queen's Pk., Kilburn, N.W.6; G2QZ, J. R. Miller, 11, Forty Avenue, Wembley (Mdx.); G2UV, W. E. F. Gorsham, 31, Rugby Avenue, Wembley (Mdx.); G2XO, A. Turner, 13, Elgin Avenue, London, W.9; G5GY, T. B. Gregory, 60, Lea Road, Wallasey (Cheshire); G6QB, L. H. Thomas, "Conway," 66, Ingram Road, Thornton-Heath (Surrey); ON4KR, S. Vanderstichele, College St. Joseph, Mouscron (Belgium). Cannot trace in latest published lists, G2SR, G2SQ, G5AY; write R.S.G.B., 53, Victoria Street, London, S.W.1. NICHOLLS (Whitley Bay): English talks from Moscow are broadcast on Monday, Wednesday, Friday and Sunday between 8.0 and 9.0 p.m. and are best heard through the short-wave transmitter on 50 m. S.B. on 1,304 m. Between 7.0 and 8.0 p.m. similar talks may be tuned in on 1,000 m. and 1,481 m., also occasionally from Leningrad on 857 m. The time of the next broadcast is usually given out at the end of the transmission. MONTAGUE (Bury, St. Edmunds): Identification can only be made if full call letters are given. Cannot trace 5.0W in lists. G2OZ, J. W. Norton, "Daleside," Lincombe Drive, Torquay (Devon): G2XX, F. Wilson, Risca Road, Newport (Mon.). J. W. D. (Nottingham): Cannot trace G5YP; write to R.S.G.B., 53, Victoria Street, London, S.W.1; (2) The broadcast was from WBZA, Boston (Mass.) and heard through WIXAZ, Springfield (31.35 m.). In the U.S.A. Z is pronounced Zee, hence you mistaking it for letter B. G6QR, A. Shearer, "Orrell," Bootle, Liverpool; G5GY, T. B. Gregory, 60, Lea Road, Wallasey, Cheshire. YUGO (Wirral): G6UH, H. E. Smith, "Arawa," Granville Road, Limpsfield, (Surrey); W2MG, Willet Hamilton, 1044, Woodycrest A., New York City, U.S.A. 5 METRE (Bradford): G5RX, S. Newell, 9, Moor View, Rakehead, Stacksteads, Bacup (Lancs.); G6AZ, F. B. English, 42, Brownberrie Ave., Horsforth, Leeds (Yorks); CT1AA, Abilio Nunes dos Santos, Avenida Antonio Augusto d'Aguiar 144, Lisbon, Portugal; G6RL, R. F. Loomes, 14, Nursery Close, Wickham Rd., Shirley, Croydon (Surrey); G6SR, S. W. Rowden, "Rosebank," Pilrig St., Edinburgh, Scotland; G5XT, F. Robinson, 4, Cranford Gardens, Acklam, Middlesbrough (Yorks); G2OC, L. R. Seal, 98, Wollaton Rd., Beeston, Nottingham; regret, cannot trace G5MM, G6MR, G6IF, and G2GB; advise you to write to R.S.G.B. SUPERHET (North Wales): Sverdlovsk (U.S.S.R.) on 1,860 m., testing with other Russian stations (Samara, etc.). PIP (Sussex): Probably IAF, Fiumincino (at the mouth of the Tiber) on 10.06 m., working with IAG, Golfo Aranci (Sardinia) (9.8 m.). A. S. P. (Stockton): G2HS, J. G. Maitland Edwards, 127, Ashley Gardens, Westminster, S.W.1. VICRIS (Southport): G2QI, D. Briggs, 24, Gaer Park Crescent, Newport, Monmouthshire; G6JQ and G5CO, regret, cannot trace; advise you to write to R.S.G.B.

IMPRESSIONS ON THE WAX

(Continued from page 607)

personality is presented by a real comedienne, aided by a rattling good tune, and —a considerable amount of spice! It is by no means offensive: it is just one of the best songs of its kind ever done.

Then Anona Winn. This wireless favourite is a very clever artist indeed—her versatility is remarkable. She has a splendid voice and brilliant powers of mimicry. You get both on *Columbia DB*1138—*All Over Italy* and *Our Little Baby Boy*. The imitation of the two American Aunts in the second is a gem.

Lastly, Billy Caryll and Hilda Munday are at it again on *Broadcast* 3311. They indulge in some *Home Chat*, hurling verbal venom at each other without stopping to breathe. Very amusing—to the eavesdropper!

ADVERTISEMENT INDEX

£500 CASH AWARDS FOR READERS OF "PRACTICAL WIRELESS"

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AI	985900	AK	212540	AM	629638	AN	40004	AO	884692	AO	164992	AP	701238
AI	832814	AK	527790	AM	887499	AN	496128	AO	501326	AO	790318	AP	882662
AI	627422	AK	91264	AM	28119	AN	771802	AO	43826	AO	232528	AP	521348
AI	71536	AL	695614	AM	973416	AN	171526	AO	055291	AO	488533	AP	219524
AI	546587	AL	76182	AM	544983	AN	471401	AO	639748	AO	058973	AP	278091
AJ	242480	AL	521776	AM	408273	AN	061532	AO	387425	AO	946302	AP	330082
AJ	199568	AL	432947	AM	604199	AN	341381	AO	003942	AP	49981	AP	546678
AJ	838946	AL	758258	AM	063888	AN	821876	AO	417731	AP	655092	AQ	394111
AJ	672156	AL	269524	AM	752104	AN	500423	AO	79201	AP	128602	AQ	215602
AJ	547722	AL	924012	AN	923458	AN	588615	AO	847198	AP	943840	AQ	436184
AJ	286088	AL	145081	AN	160994	AN	93327	AO	183003	AP	415388	AQ	587889
AK	423715	AL	357250	AN	742839	AN	238762	AO	280616	AP	928616	AQ	792457

☛ **This offer applies to licences which are actually in force on Saturday, July 22, 1933.**

Before the awards are paid, claimants will be asked to undertake a simple publicity service in distributing leaflets to encourage the sale of licences amongst those who at present do not fulfil their obligations by taking out a Post Office Wireless Licence before receiving broadcast programmes. Claims cannot be considered in connection with any Licence the date of issue of which is after July 20, 1933.

AWARDS MUST BE CLAIMED BY JULY 28, 1933

If the number of your wireless licence appears above you only have to forward the licence for official verification by registered post, and state the name and address of the Newsagent who supplies you with your weekly copy of "Practical Wireless." Address your application to Wireless Dept. (73), 8-11, Southampton Street, Strand, W.C.2.

Claims received later than Friday, July 28, 1933, will be disqualified.

All licences will be returned by registered post.

For Complete List of Licence Numbers See

TIT-BITS

ON SALE EVERY SATURDAY

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Clearly written and fully illustrated.

This series covers a wide field and will prove of the greatest value to everyone interested in models and how to make them; woodwork and other crafts.

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An up-to-date handbook dealing with every type of accumulator, methods of charging them at home, care and maintenance, also explains how to erect a charging station.

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