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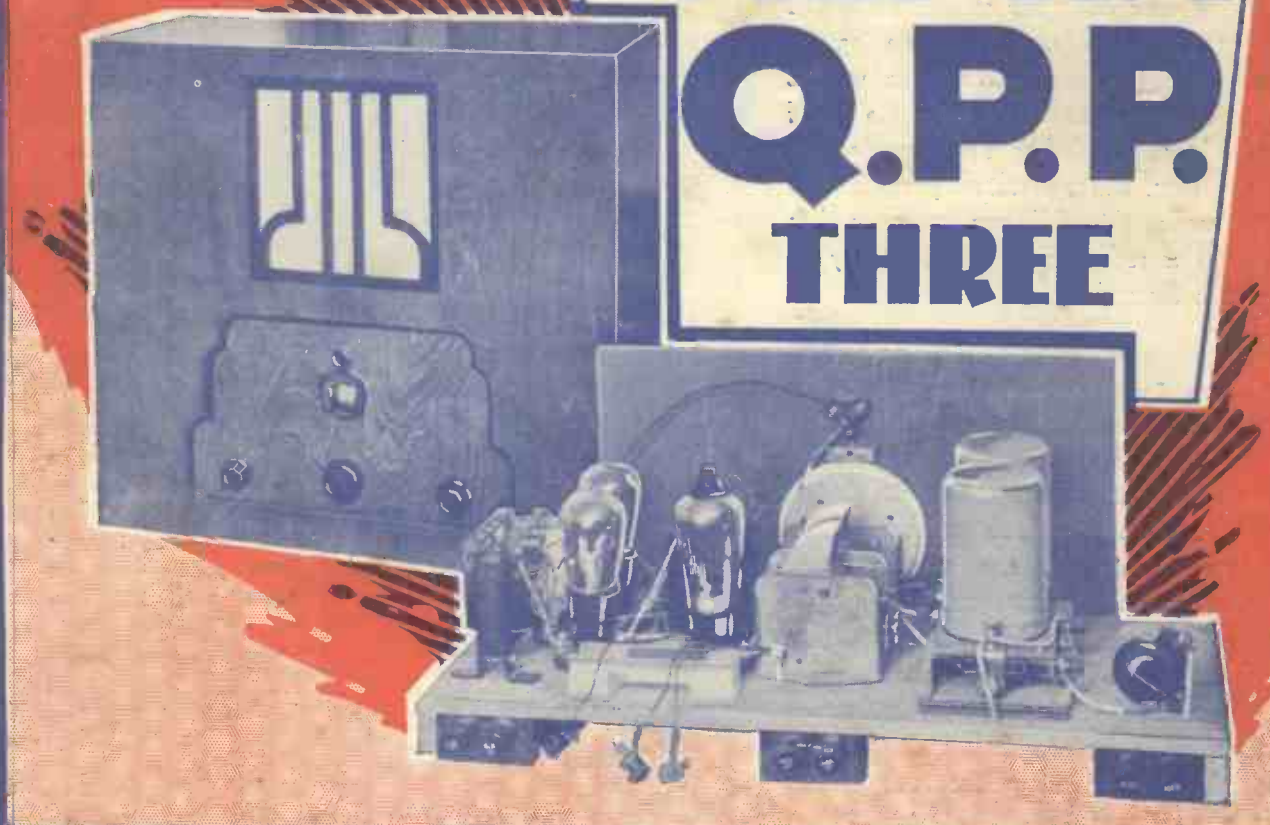
The ALPHA Q.P.P. THREE



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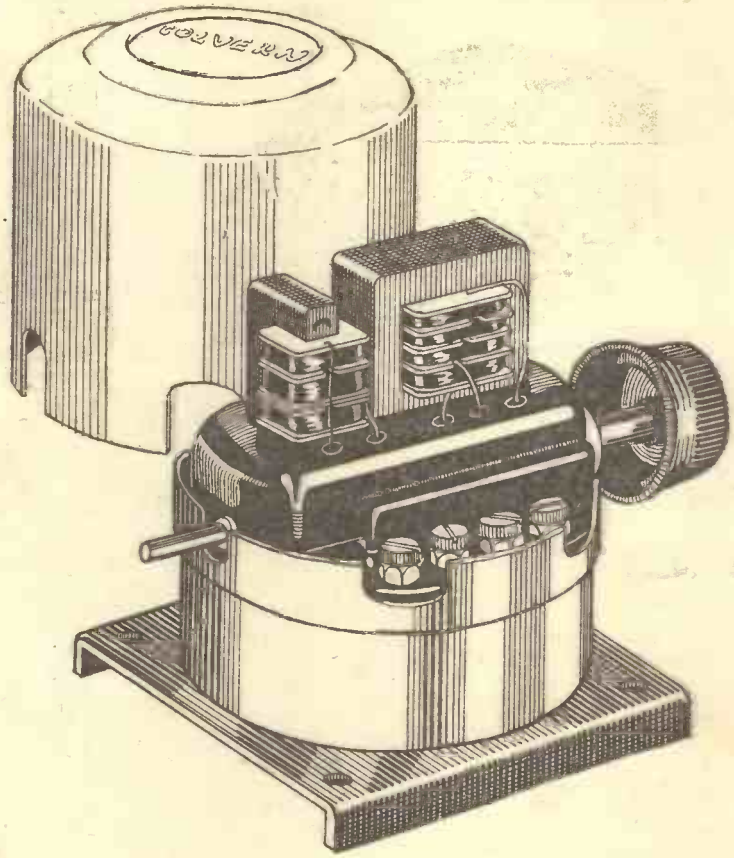

It has long been recognised that tuning coils of maximum efficiency are of paramount importance in the attainment of selectivity and sensitivity in a receiver. The design of tuning coils has made large strides in the past few years, but space considerations and the realisation of effective screening for band-pass filters and between the various stages of a receiver has involved the use of relatively small winding diameters for the coils. Thus, although actual progress has been made, this self-same progress has involved a reduction in the efficiency of the coils themselves.

Colvern Ferrocart coils have, however, changed all this at one fell swoop. These coils, though of considerably smaller dimensions than the relatively inefficient screened air-cored coils to which we have become accustomed, are actually more efficient than the unscreened Litz wound large diameter coils which have always been regarded as the last word in efficiency but which could never be put to practical use in a receiver, owing to their bulk and the impossibility of screening without very serious loss of efficiency.

The first types to be available are :—

TYPE F1—F2.

Input band-pass filter. Constant selectivity, ganging unaffected by variations in aerial reactance, symmetrical resonance curve.

TYPE F3.

Autotransformer intervalve coupling with reaction, ganging perfectly maintained on both wave ranges by transfer of tapping point in correct turns ratio, practically constant reaction.

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THIS ISSUE COMMENCES A NEW VOLUME!

ROUND *the* WORLD *of* WIRELESS

Publicity Broadcasts in U.S.A.

IF at any time you have heard broadcasts from America you must have picked up some transmission or other in which the goods of well-known concerns have been given a microphone "boost." From statistics recently published the largest amount paid by one manufacturer in 1932 for time on the air is 3,639,782 dollars. This sum represents the fee actually paid to the stations and does not include the salaries of artists taking part in the sponsored programmes, put out by the advertisers. Over the N.B.C. and C.B.S. networks one firm alone with a view to pushing the sales of a popular brand of cigarettes spent 1,851,000 dollars in the course of a few months. The salaries paid to artists specially engaged for these publicity entertainments is also worthy of consideration, some receiving as much as 7,500 dollars per week for their daily broadcast.

Radio Tessino

IT is hoped that the new Monte Ceneri high power transmitter, which is destined to give a service to the Italian speaking population of Switzerland, will be ready to work on April 1st. In the meantime programmes from its Lugano studio are being broadcast through Beromünster. The announcements are given out in the Italian language, the call being: Radio Svizzera Italiana (Radio Tessino).

The French Riviera Station

THE powerful broadcaster which the French Posts and Telegraphs propose to install at La Brague between Nice and Cannes on the French Riviera will be known as "Nice-Monaco-Corse," as its transmissions are also destined to Monte Carlo and to the Island of Corsica. In addition to studios at Nice, Cannes, Juan-les-Pins and Mentone, the station will also be connected to Paris in order to permit a relay of the *Ecöle Supèrieure* or of any others in the French State network.

Vatican-Castel Gandolfo Micro-wave Stations

DAILY broadcasts from the Papal See are being carried out simultaneously on 19.84 or 50.26 metres and on the 50 centimetre wavelength of the new Marconi transmitter. Transmissions on the micro-waves have proved remarkably successful, as the energy required is only 50 watts as against 10-12 kilowatts for the longer channels.

Radio to the Rescue

DURING the recent blizzard in Wales and consequent breakdown of overhead telephone cables, many districts were temporarily completely isolated from the rest of the country. Two-way wireless communication was rapidly established between Swansea and Fishguard, and in a similar manner with the help of the army authorities Tenby and Carmarthen were promptly reached by wireless.

Higher Aerials for Wychbold

THE 100 kilowatt transmitter which the B.B.C. is erecting at Wychbold, near Droitwich, will possess two giant aerial towers; they are to be 700ft. in height or only roughly 100ft. shorter than the masts used by Hillmorton (Rugby) for its long distance transmissions. Up to the present the highest masts built for the new B.B.C. National and Regional stations have not exceeded 500ft.

Drastic Wavelength Alterations

ALTHOUGH no decision can be taken before the meeting of the European Broadcasting Conference at Lucerne in June, it is already reported that some drastic alterations in wavelengths may be expected. According to a Swiss paper there is a likelihood that a long wave channel may be found for Beromünster and that Sottens may be displaced and moved higher up in the waveband. If such a step can be accomplished the 459 metre channel might be allotted to the new Tessin station. In the meantime listeners who twirl the dials after midnight may hear from time to time tests carried out by a number of European transmitters, as was the case before the last plan was brought into operation.

"Cut-Price" Components

A RATHER prevalent "penny-wise" procedure is that of buying components from the many cut-price wireless stores which have sprung up so rapidly during recent years. Obsolete components, like obsolete sets, can be particularly troublesome, unless the purchaser realizes that they are out of date and uses them accordingly. Definitely faulty parts can be even worse, and besides causing the constructor no end of difficulty, might be the means of ruining a set of perfectly good valves. It is better in every way to deal with a legitimate trader, and to pay the current list price; you then have the assurance that in the very event of a component being in the least defective, it will be replaced without demur. Remember that all manufacturers positively refuse to hold themselves responsible for any article bought for a penny under list price.

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

Women Again Leading !

ACCORDING to a recent report published by the American Radio Relay League, of the 232 licensed feminine amateur wireless experimenters, 190 dwell in the United States. The total number of amateur stations in the world has now exceeded the 50,000 mark.

A Gigantic S.B.

FOR the broadcast of Mr. Franklin Roosevelt's speech, on the occasion of his installation as President of the United States, all stations were linked up with Washington, eighty-seven being controlled by the National Broadcasting Company and eighty-eight in the Columbia System. In addition to relays carried out by the B.B.C. for the benefit of British listeners, the ceremony was also transmitted throughout Germany, Austria, Switzerland, and other European countries.

For Early-morning Listeners

THE *Poste Parisien* (Paris) is now on the air daily at 7.0 a.m. G.M.T. The broadcast opens with a fanfare of trumpets, a few pleasant greetings by the announcer, and is followed by a short recital of records. A programme consisting of a weather report, news bulletin, and hints to the housewife completes this early transmission.

Our Far-flung Line

FROM time to time we receive letters from readers in various parts of the Empire, showing that PRACTICAL WIRELESS reaches many odd corners of the world. The postcard reproduced on this page, which we have just received from a reader in Soviet Russia, indicates that our journal is active, even in that country.

Great Britain Still Forges Ahead

IN a recent statement made in Parliament, the Postmaster-General said that the number of listening licences issued during 1932 totalled approximately 5,263,000. During that year 2,825 convictions were obtained against persons using wireless receivers without permits, and the fines imposed amounted to £2,833. By the end of February, 1933, the number of licences increased to 5,425,700, showing 61,200 more registered listeners than in the previous month.

Canine S O S

THE Budapest studio broadcasts almost nightly, at the end of the news bulletin, a number of S O S messages in respect to stolen or lost dogs. This regular feature was instituted as a result of a test, and has proved so successful that by the help of these broadcasts 95 per cent. of the dogs are now returned to their owners.

Radio Wien

IN order to hurry forward the tests of the new high power Bisamberg transmitter with a view to a formal opening of the station in April, the first broadcasts will be carried out by means of the single aerial tower; the second or reflector mast will be built later.

Protecting the President

AS a sequel to the attempt on the life of President Roosevelt, the Columbia Broadcasting Company proposes to use a special bullet-proof shield which, equipped with microphones, can be erected whenever occasion arises for a presidential or other address on the occasion of open-air broadcasts. The steel shield is shoulder-high, thus completely protecting the speaker, can be quickly dismantled and re-erected, and will form part of the equipment of Mr. Roosevelt's private railway carriage when he travels through the States.

Census of German Wireless Receivers

ACCORDING to a recent report issued by the German Reichspost, following a general investigation in regard to the class of wireless receivers used by licence holders in that country, the census shows that only 7 per cent. of the listeners possess crystal sets. The figures also demonstrate the popularity of one- and three-valve receivers (74.8 per cent.), and the number of instruments using more than three valves reached 18.2 per cent. of the total. These statistics are based on replies received from 97 per cent. of Germany's listeners and, consequently, will prove very useful in planning out further improvements of the broadcasting system. It would be interesting to know what the position is in Great Britain, and to what extent the old crystal set is still used in these islands.

Suspension of Radio Television in U.S.A.

ACCORDING to a report from New York, television broadcasts have been generally suspended in the United States. Although experiments have been carried out privately for some time, the Columbia Broadcasting Company was the only concern which actually devoted a special short-wave transmitter (W2XAB) to daily television broadcasts over a period of eighteen months. The sound part of the programme was regularly transmitted by W2XE, Richmond Hill, New York, on 49.02 metres (6,120 kc/s), and vision through W2XAB on 2,800 kc/s. In view of this suspension, W2XE has now reverted to its former duties, namely, the relay of the WABC, New York, wireless entertainments, and is now well received in the British Isles from midnight onwards.

New Canadian State Owned Transmitters

THE Canadian Radio Broadcasting Commission has taken over from the Canadian National Railways, the latter's stations at Monckton, Ottawa, and Vancouver. They will be operated independently until arrangements have been made to include them in the existing network.

Country With Greatest Percentage of Listeners

DENMARK still holds the record for possessing the greatest percentage of registered listeners in respect to general population. Recent statistics show that there are fourteen licence-holders for every one hundred inhabitants, or an increase of one per cent. over the previous year.

INTERESTING and TOPICAL PARAGRAPHS

OUR FAR-FLUNG DISTRIBUTION

Here is further evidence of the world-wide popularity of "Practical Wireless," and incidentally a tribute to the remarkable organisation of Geo. Newnes, Ltd., who publish it.

SOLVE THIS!

PROBLEM No. 27

Brown's receiver consisted of S. G. Detector and Output stage, operated from a small mains unit giving H.T. and Grid Bias. The filaments were operated from a separate accumulator. Reading about Quiescent Push Pull he decided that it would be interesting to try out, and accordingly purchased another valve similar to that in the Output stage, together with the necessary input and output Q.P.P. transformers. The wiring was altered (correctly) to suit the new scheme, but when tried out the results were definitely bad. Distortion, poor volume, and instability were the result. The Grid Bias output terminals on the mains unit gave sufficient bias to enable the Q.P.P. scheme to be adopted, but for some reason or other it did not work. What do you think was the reason? Three books will be awarded for the first three correct solutions opened. Address your envelopes, marked Problem No. 27, to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and post to reach us not later than March, 27th, 1933.

SOLUTION TO PROBLEM No. 26

The amount of wire required for the larger size of frame should, of course, have been the same, and this would have resulted in a decrease in the number of turns. By winding on the same number of turns, therefore, Abrahams had a frame which was much too large.

The following readers received books in connection with Problem No. 25:—

H. T. Lunson, 65, Brockhurst Road, Gosport; W. Smith, 4, Detmold Road, Clapton, London, E.5; E. Williams, Gwenallt, North Road, Aberystwyth.

THE ABC OF SELECTIVITY

An Interesting Article on What It Is and How It Is Obtained.

By W. B. RICHARDSON

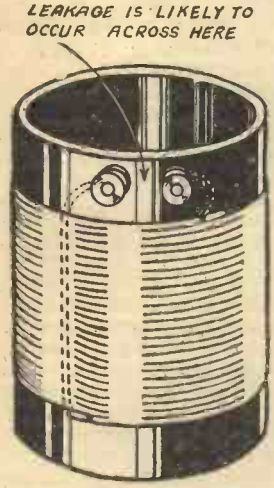

Fig. 2.—In designing efficient coils, terminals connecting the extreme ends of the windings should not be mounted close together.

THERE is no more vexing problem in modern radio than that of selectivity. That it arises from the increase in power and number of the broadcasting stations of the world is obvious, but how to tackle it is not always so clear. That a solution *can* be found is evidenced by the performance of carefully designed receivers such as the Fury Four, and also many of the more expensive commercial receivers. However, what the home constructor wants to know is the "how" and the "why."

Why is one circuit more selective than another? Why does H.F. amplification give more selectivity than L.F.? Why is one tuning arrangement better than another?—and so on. Such questions are always being asked, and it seems that all too often they are left unanswered, or else are answered in such a delightfully indefinite manner as to leave the inquirer with just as hazy a conception as before.

Perhaps it is this inquisitiveness in my own nature which leads me to expect it in others and to sympathize with the home constructor of an inquiring turn of mind. It seems to me that all too often he is put off with the kind of statement that such and such a new set is very selective because "it has two H.F. stages," or that twiddling this knob or that "increases the selectivity." But no suggestion is ever made as to *why* it does it.

This sort of thing is annoying, as it presupposes that the reader either knows all about the theory of the thing, or else that he is not interested. I grant that it is possible to overdo the explaining business, and that, for example, a long-winded dissertation on elementary principles is out of place in describing a receiver; but I should like to see occasionally a reason given when claims are made regarding the selectivity of some particular coil or receiver. How often, for instance, does one come across any explanation of why a band-pass coil gives a "square" peak? Very, very rarely indeed. No, we are just told that it does, and with that we have to be content.

Well, what I am going to attempt here is to answer some of the "hows" and "whys."

The Effect of Resistance

The selectivity, or if you prefer it, the sharpness of tuning of a receiving circuit, is dependent on the ratio of the resistance to the inductance. The reduction of resistance, therefore, is all important.

This resistance, which might be termed the "wasteful" resistance, is due to various losses which occur in the circuit. They may be classified as follows:—

(1) Conductor losses (copper losses, etc., in the wire itself).
(2) Dielectric losses.
(3) Losses in surrounding conductors.
(4) Losses at terminals or contacts.
(5) "Dead-end" losses.

Fig. 1 illustrates this point. Here is a group of resonance curves. They represent the signal strength obtained with various circuits over a band of frequencies. Curve (a) shows a very efficient circuit. It will be noticed that a large response (loud signals)

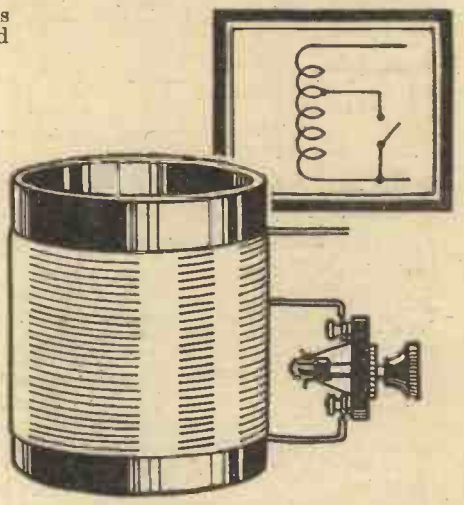

Fig. 3—Simple, but not the most efficient arrangement for a dual-wave coil

is obtained at what is called the *Resonant Frequency*, that is, the point at which the circuit is exactly in tune with the broadcasting station. This is shown by the height of the curve at the point *x* on the graph. On either side of the resonant frequency, however, there is a quick falling off in response. This means that another station of equal power broadcasting on a nearby frequency, say at *y*, would give in this case less than one-third of the response (compare height of curve at *y* with that at *x*. Again at *z*, still further from resonance, there is practically no response. Contrast this with curve (c), that of the most inefficient of the three circuits, and see how it differs. In this case the maximum response, even when the wanted station is dead on tune, is not as good as with the first circuit. The most important point, however, is the shape of the curve. Instead of being pointed it is comparatively flat. The result of this is that the broadcasting station at *y* would come through comparatively loudly, actually at about half of the strength of the wanted station. This you can see by comparing the height of the curve (c) at *x* with its height at *y*.

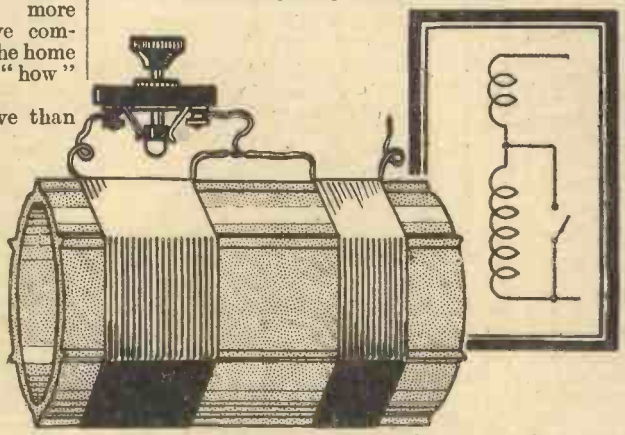

Fig. 4.—A better arrangement in which the two windings are separated.

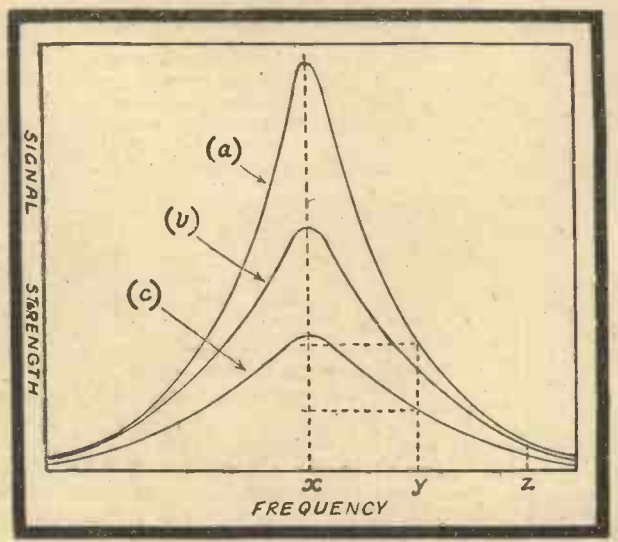

Fig. 1.—Group of resonance curves for circuits of varying efficiency.

How to Improve Selectivity in a Simple Circuit

Now suppose you have a set with a simple tuned circuit, such as is found in most sets of the "det. and 2 L.F." type. How can the resonance curve be made to approach that of (a)? Well, first of all there should be a good tuning coil. Screened coils are quite unnecessary with this type of circuit, as the screening is not necessary, and only introduces losses of

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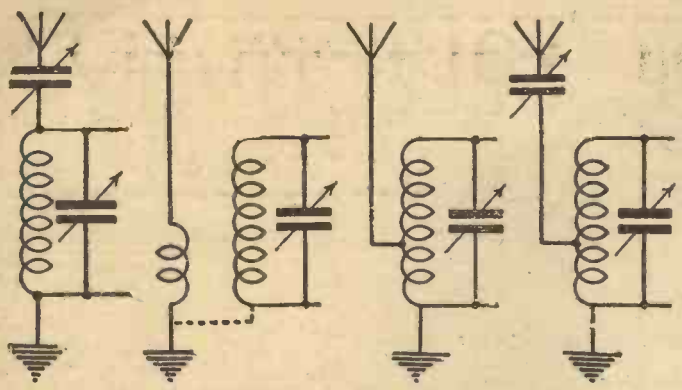

Fig. 5.—Various methods of obtaining selectivity in a single tuned circuit. They all suffer from certain drawbacks. (See text.)

(*Continued from page 5.*)

the third class previously mentioned, namely, losses in surrounding conductors, the screen or "can" being the surrounding conductor.

The former of the coil should not be too small (two to three inches is suitable), and the insulation between the turns should be of a high order. In this connection silk is better than cotton as a covering for the wire, and the windings should not be coated with shellac varnish or wax. A ribbed former is better than a plain one, as there is less risk with the ribbed type of leakage from one turn to another through the material of the former. Again, avoid bringing out the ends of the coil to terminals placed very close together, as in Fig. 2, as the full voltage across the coil will then be applied across the narrow strip of material between them, and unless the insulating properties of this is of the very highest order there will be leakage between the terminals. Even if the former is of the finest ebonite, it is better to have the terminals well spaced because of the possibility of surface leakage due to the accumulation of dust or moisture.

Attention to these points will all help to reduce losses (2), (3) and (4). We have yet to consider losses (1) and (5), namely, conductor losses and dead-end losses. Not much need be said regarding the former beyond reminding you to use wire of a reasonable thickness, by which I mean not thinner than about 28 gauge. On the other hand, no useful purpose is served by having it of a larger section than 22 gauge, as it only makes the coil bulky.

I will not over-stress the question of dead-end losses as the tapped tuning inductance is very rarely used nowadays, and it is only in this type that true dead-end losses occur. However, in dual-range coils where part of the windings are short circuited, as in Fig. 3, some slight loss of efficiency will occur on the medium waves if the shorted portion is not a separate winding some distance from the medium wave section. This is not, of course, a true dead-end loss as the turns are shorted, but may be looked upon more as losses in surrounding conductors. Fig. 4 will show what I mean by a separate winding.

Self Capacity

There is one point in connection with tuning coils which I have not mentioned. I refer to *self capacity*, that is the capacity between the turns of wire. This should be kept as low as possible by avoiding pile winding (winding one turn over the other to save space), and in the case of short-wave coils by spacing the turns. Wave-change switches associated with the coil should also have low self capacity, that is why only switches intended for use in H.F. circuits should be used, ordinary plugs and jacks and many types of mains switches being quite unsuitable.

The tuning condenser is another component in the tuned circuit which should be above reproach. Most modern types are very good and losses here are almost certain to be confined to the dielectric. For this reason the minimum solid dielectric is advisable, therefore an air dielectric instrument is preferable to one with bakelite between the vanes.

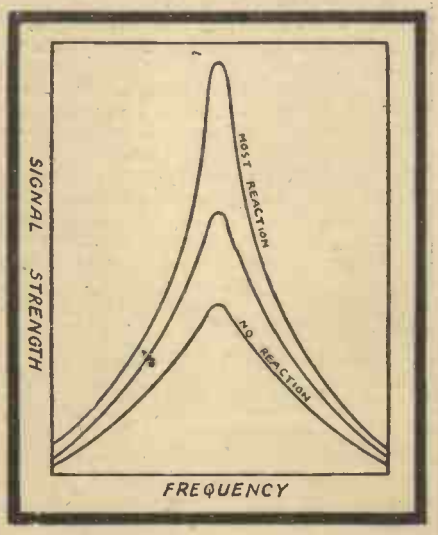

Fig. 6.—Graph showing how sensitivity and selectivity increase with the addition of reaction.

Selectivity and Signal Strength

A low-loss coil and condenser alone will not give sufficient selectivity for modern needs, so recourse has to be made to one or more of the dodges shown in Fig. 5. Unfortunately, all these arrangements cause some loss in signal strength for the gain in selectivity. Fitting a series aerial condenser, using a loose-coupled semi-aperiodic aerial coil, or tapping the aerial on to the coil near the earthed end, all have much the same effect in that sensitivity drops rapidly with the increase in selectivity. This means that where interference from the local station is very bad the series condenser has to be reduced to such a small figure or the tapping has to be taken to such a low point that sensitivity is sadly reduced, with the result that the wanted station then disappears with the unwanted one.

The Effects of Reaction

The fact is that the single tuned circuit has its limitations, therefore if the best is to be got out of it it should be carefully designed. There is, however, one easy means of overcoming the losses already mentioned, that is by using *Reaction*. The effect of reaction is virtually to negative the resistance of the circuit. "Well, then," you may ask, "why bother about having the circuit efficient if all the losses can be overcome by a twist of the reaction knob?" The answer is that the difference lies in the ease of operation. The inefficient circuit has to be made to work at the bayonet-point of reaction in order to maintain the maximum response, which response will drop to a low figure if the reaction is reduced slightly. The low-loss circuit, on the other hand, will give quite a good response even with minimum reaction.

That reaction is able to increase selectivity is shown by Fig. 6, which gives the different resonance curves obtained with varying degrees of reaction. If you study these curves carefully, you will see that an increase of reaction means a great increase in sensitivity at the resonant frequency, but only a very slight increase off-resonance. This means that if you had tuned in to a station and were experiencing interference from another station, on increasing reaction you would get a large increase in the strength of the wanted station, but only a small increase in that of the unwanted. It does not mean that interference from the unwanted station would disappear on bringing up the reaction as many people seem to expect. These argue that if there is no reduction in the strength of the unwanted station there cannot be an increase in selectivity. This is wrong. True selectivity is determined by the *ratio* of the two signal strengths. We must not forget that although the strength of the unwanted station is slightly greater when reaction is applied, yet the strength of the wanted station becomes *many times* greater than it was before.

Now suppose we reduce the strength of the wanted station by means of a variable condenser in series with the aerial or some similar device until it is back at its original level. What will happen to the unwanted signals? Well, naturally they will be reduced also. In fact they will either become very weak indeed or else disappear.

This clearly shows there is an increase in selectivity since whereas without reaction

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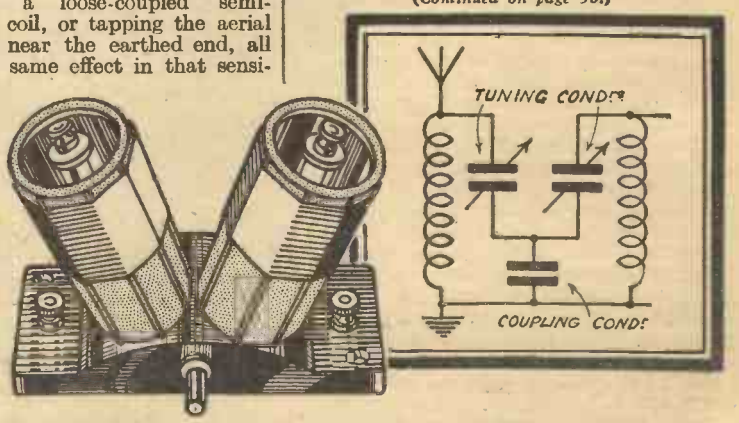


Fig. 7.—For selectivity two tuned circuits are better than one. The example here is of a typical band-pass filter.

MATCHING YOUR SPEAKER

An Article of Special Interest to the Amateur Experimenter

By S. J. GARRATT

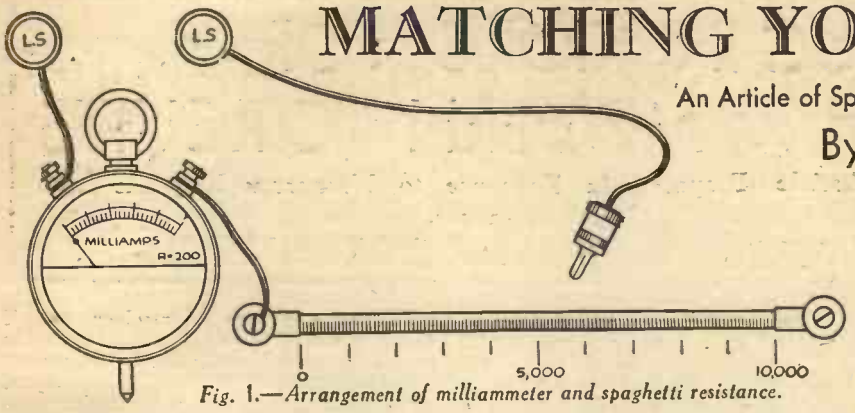


Fig. 1.—Arrangement of milliammeter and spaghetti resistance.

WIRELESS experimenters and constructors are frequently advised to see that their loud-speaker is matched to the output valve. Excellent advice as far as it goes, but not of much use to an amateur unless accompanied by instructions as to how the matching business is to be done; this article explains how to conduct a series of tests, and how to apply the results. PRACTICAL WIRELESS, of course, specializes in practical articles, but our present subject is an example of how practice and calculation help each other; practical experiments give the results, but simple calculation and a graph are required to apply them.

A Question of Wattage

First, let us clearly understand what results we want to obtain. We have a certain strength of current passing through the speaker and a certain voltage across its terminals. Now current multiplied by volts gives watts, and watts are a measurement of power, and we want to get as much power—or, in other words, as many watts—as possible into the speaker. Let us consider two extremes. If the speaker had a negligible resistance we should get a big current but no voltage across the terminals, therefore multiplying the current by the voltage the result is 0 watts. At the other extreme, if the resistance of the speaker was infinitely high, we should get a high voltage but no current, the watts, as before, would therefore be nil. But somewhere between a very low resistance and a very high one there is a value which will give maximum watts and we want to find that value; it will depend upon the characteristics of the output valve and is termed the optimum load for that valve.

Now to proceed with the testing. The only instruments required are a milliammeter and a spaghetti resistance of, say, 10,000 ohms. An ordinary small watch pattern meter reading to 30 milliamps or less will do fairly well for our present requirements, but a larger instrument with a more open scale would be better; it should be as low in resistance as conveniently possible because we shall ignore the resistance of the instrument in arriving at results. The resistance is usually marked somewhere on the instrument; it will probably be about 200 ohms, but it is advisable that it should not exceed this. The covering of the spaghetti should be stripped off very carefully and inside will be found a strip of insulating material closely wound round with very fine wire; great care should be taken not to break this wire.

Using the Milliammeter

Disconnect the speaker, and connect up the milliammeter and the bare spaghetti to the output terminals of the receiving set, as shown in Fig. 1. (See remarks at the end of this article if the set has choke or transformer output.) The resistance should be screwed down on to a flat piece of wood covered with white paper; mark out a scale on the paper, dividing up the length of the resistance into ten equal parts so that each division represents a resistance of 1,000 ohms. This gives us an inexpensive variable resistance. See that the high-tension and grid-bias batteries are adjusted at their usual tappings and then switch on the low-tension.

Now take the wander plug shown in Fig. 1, and press it on to the resistance at the first mark (nearest the meter terminal) which represents a resistance of 1,000 ohms, and make a note of the meter reading. Take similar readings at all the other markings on the resistance scale, and write them out as shown in the accompanying table. This will fill up the first two columns, and we now have to work out the figures for the third column from the other two.

The watts absorbed by the resistance equals resistance multiplied by the square of the current. We therefore multiply the current by itself, then multiply again by the resistance. For example, the first reading is 8, the square is 8 × 8, which equals 64; multiplying this by 1,000 ohms = 64,000, but this must be divided again by 1,000 to bring it to milliwatts (1,000 milliwatts equals 1 watt), so the answer is 64 milliwatts, which is put down in the third column. The second line will be $\frac{7^2 \times 2{,}000}{1{,}000} = \frac{49 \times 2{,}000}{1{,}000} = 98$ milliwatts, and so on for all the other readings. If you can use a slide rule you can read off all the answers direct, otherwise you must work them all out.

Plotting a Graph

The next step is to draw a graph representing milliwatts for any value of resistance; you will require some squared paper for this. Mark the milliwatts scale on the left and the resistance scale at the foot, as shown in Fig. 2. Using the figures of the table (yours will, of course, be a different set of figures) run your pencil up the vertical line representing a resistance of 1,000 ohms, and when you reach a point level with 64 milliamps make a firm dot. Do the same for all the other values shown in the table (ignoring column 2) then draw a free hand curve to pass evenly among the dots. Almost certainly, you will find that you will not be able to draw a smooth curve to touch all the dots, but there will be a certain amount of unavoidable error in your readings, and a smooth curve will give the approximate mean of all your results. If the dots are too scattered, repeat the series of tests, and if the curve does not have a definite downward trend at the maximum resistance, use a higher value of spaghetti.

You will find, if you made your tests very carefully, that you will get a curve something like Fig. 2 in shape, though the actual figures will be different. The highest point on this curve represents the highest, or optimum output of the valve under the conditions of the test. In Fig. 2 the optimum is at about 7,000 ohms, and this should be the impedance (impedance is the resistance plus the inductance) of the speaker in such a case.

You may ask how to find the impedance of the speaker. Well, there is no need to find it. You now know the optimum load for the valve, and on referring to your table you will find that at this load (*i.e.*, resistance, column 1) the current is, say, 4.5 milliamps. So connect up the milliammeter in series with the speaker while it is working, and if the meter reads in this case 4.5 milliamps the speaker is right. Of

(*Continued on page 30.*)

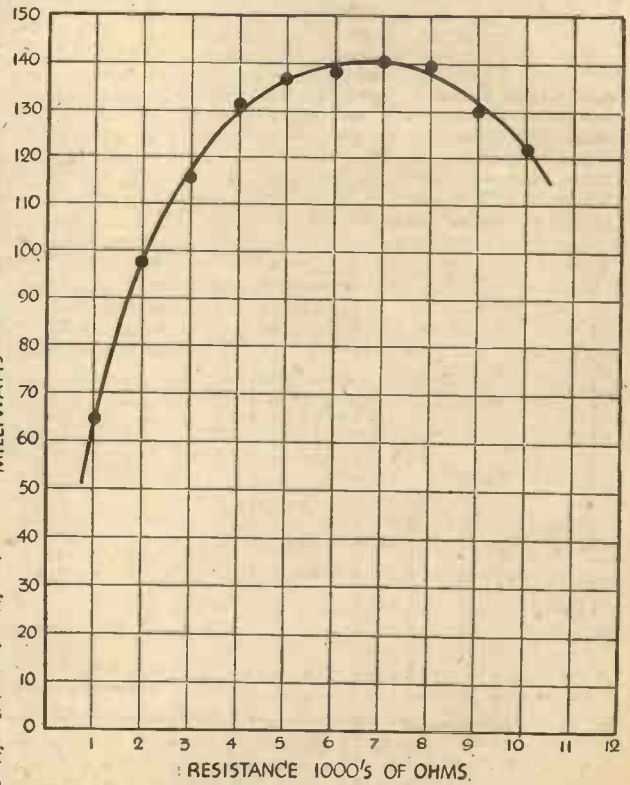
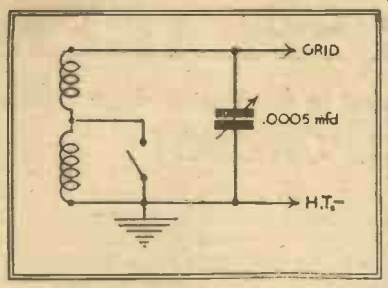


Fig. 2.—Plotting the graph.



PLUG-IN COILS FOR MODERN CIRCUITS

An Article Prepared in Response to Numerous Requests from Readers.

By FRANK PRESTON, F.R.A.

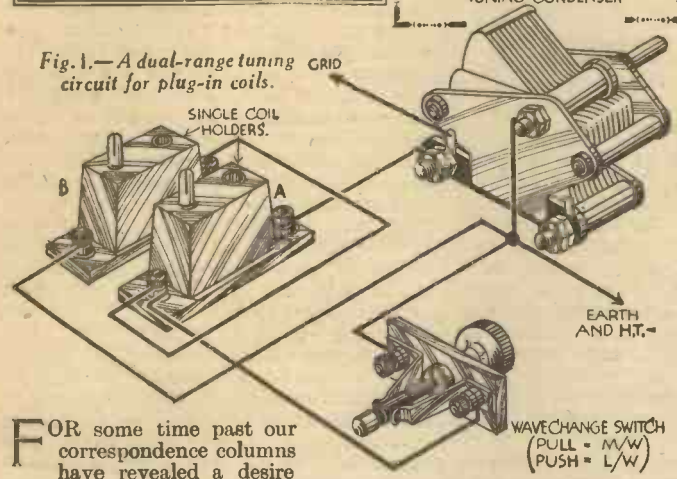


Fig. 1.—A dual-range tuning circuit for plug-in coils.

FOR some time past our correspondence columns have revealed a desire on the part of numerous readers to make use of plug-in coils which happen to be on hand. Whilst I would not advise anyone to buy a new set of coils of this type, I do not hesitate to say that, for a simple set, plug-in coils can be quite as efficient and satisfactory as their more modern dual-range counterparts, if they are properly employed. I would go further by expressing the opinion that the older types of coil are often *more* efficient than many of the cheaper tuning units now on the market, and that if their limitations are realized they can be built into distinctly modern circuits of the less pretentious patterns, with every success.

Dual-Range Tuning

Probably the principal reason why honeycomb and basket coils fell into disfavour was that they had to be changed every time a different wavelength range was to be covered, but as nearly all broadcasting is now confined to two wavelength bands there is absolutely no reason why two coils should not be wired in series to cover the long waves, and a switch arranged to short-circuit one of them when medium-wave reception is required, thus entirely overcoming the old bogey of coil-changing. This is, of course, precisely the same principle as is used for nearly all dual-range tuners at present in use.

To make use of this scheme you will need two single baseboard mounting coil-holders and a push-pull wave-change switch, the connections being as shown in Fig. 1. Notice especially that the holders are "cross-connected," so that the turns of both coils go in the same relative direction. If adjacent terminals were joined together the two coils would act in opposition, and the wavelength covered by both coils together would be something less than that of the larger one used by itself. Also notice that the moving vanes of the variable condenser are connected to earth; if the condenser connections were reversed, trouble due to hand-capacity effects would most probably be experienced. The arrangement can be used for tuning either the aerial or grid circuit of any type of receiver, and if coil A is a size 50 and B, size 150, tuning ranges of approximately 300 to 600 metres and 1,000 to 2,000 metres will be covered by using a good .0005 mfd. tuning condenser. Other ranges can be covered by using alternative coil sizes, and under different circumstances it will be necessary to use a 25 or 35 coil for the medium waveband. By "different circumstances" I refer principally to the length of the aerial in use and the minimum wavelength required. For example, if the aerial were particularly long a 35 coil would cover the same range as a 50 coil used with a short aerial. On the other hand, when reception of such stations as Fécamp, London National, or Newcastle was desired, a 25 or 35 coil would be necessary.

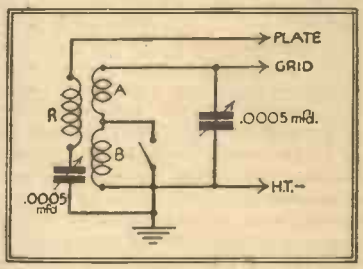
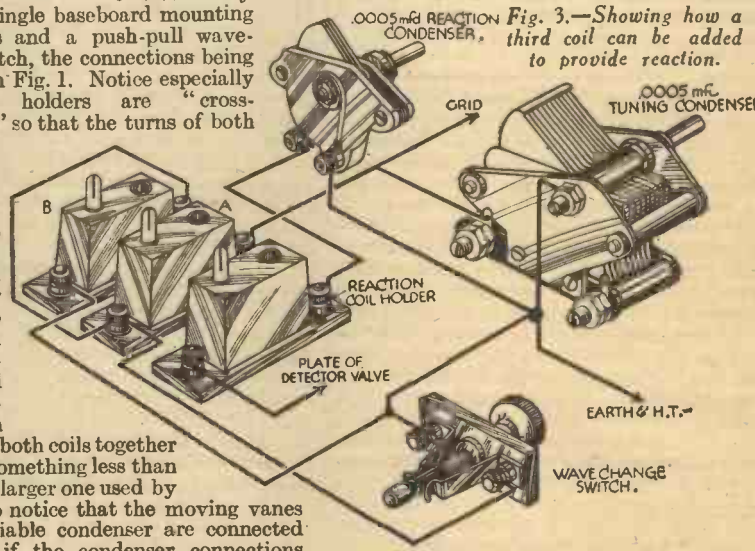


Fig. 3.—Showing how a third coil can be added to provide reaction.



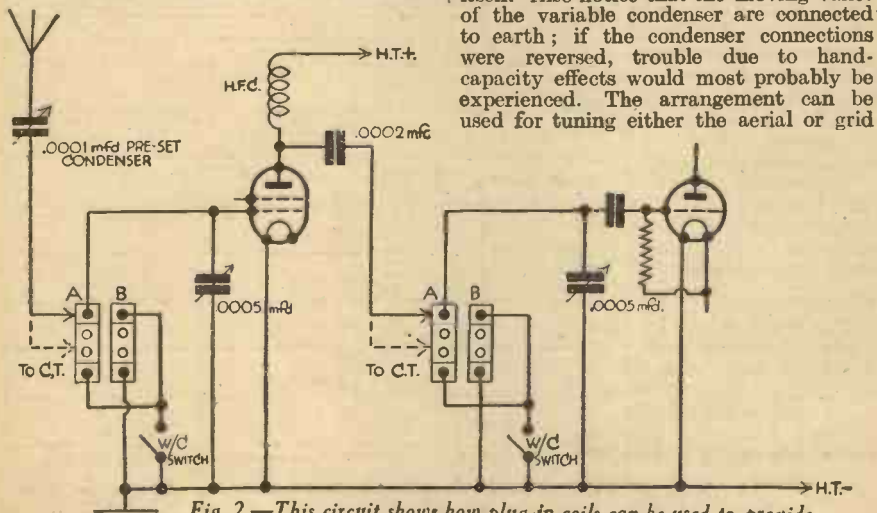
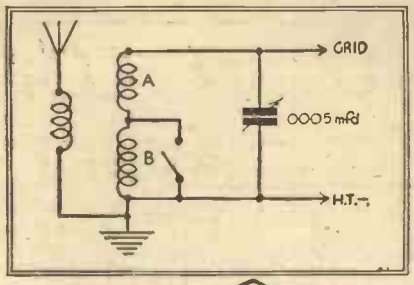


Fig. 2.—This circuit shows how plug-in coils can be used to provide two dual-range tuners, one of which is connected in the aerial, and the other in the tuned-grid circuit of an S.G. receiver.

When the coils are used for aerial tuning a .0001 mfd. pre-set condenser must be inserted in series with the lead-in or else selectivity will be very poor and the wavelength range will seriously be restricted. In Fig. 2 a skeleton circuit diagram is given, showing how two dual-range tuners of the type illustrated in Fig. 1 can successfully be employed in the aerial and tuned-grid circuits of a typical screened-grid receiver. It will be seen that the connections are very straightforward and easy

to follow. When centre-tapped coils are available, additional selectivity can be obtained by transferring one connection from the "grid" end of the tuner to the centre tapping of the medium-wave coil, and this modification is shown on the diagram by two broken lines. Generally speaking, long-wave selectivity will be sufficiently good when using the connections shown, but here again still greater selectivity can be obtained where necessary by taking the aerial and anode leads to the centre-tap terminals of the long-wave coils (B). Provided that both pairs of coils had identical characteristics, a two-gang tuning condenser could be employed, but as in practice the coils will rarely be sufficiently well matched, even if they are of the same make and type, it is always advisable to tune each circuit by a separate condenser.

In a receiver having a circuit similar to that of Fig. 2, there will be a good deal of feed-back between the two tuners unless certain precautions are taken. It would obviously be best to erect an aluminium screen between them, but in addition to this the two sets of coils should be mounted with their axes at right-angles to each other to avoid respective interaction. Very often the screen can be dispensed with if this is done and if the tuners are fairly well spaced.



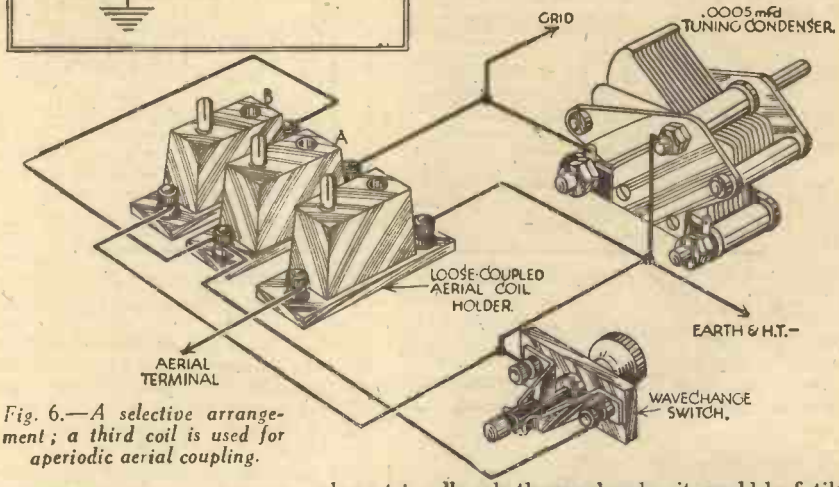


Fig. 6.—A selective arrangement; a third coil is used for aperiodic aerial coupling.

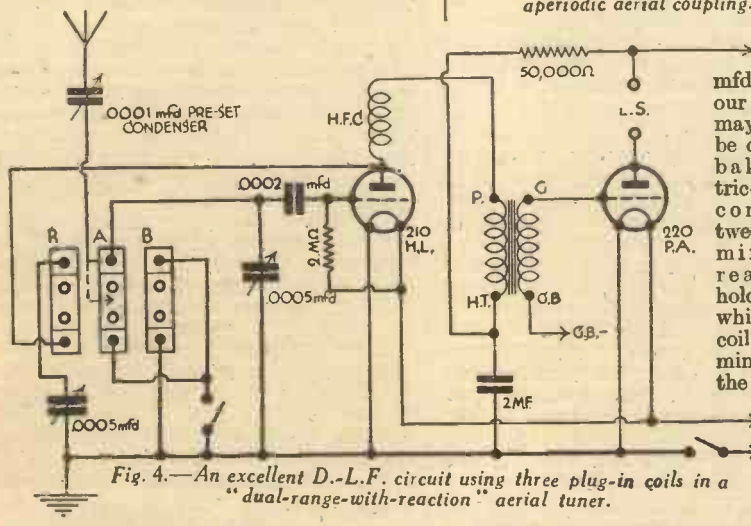


Fig. 4.—An excellent D.-L.F. circuit using three plug-in coils in a "dual-range-with-reaction" aerial tuner.

Reaction

We have not yet considered the question of applying reaction to our tuner, so let us see what can be done in this respect. We could, of course, use a three-coil holder and "swinging-coil" reaction, but this is certainly not advised, since the moving-coil introduces many variable factors due to unwanted coupling with other components. Besides, it is generally far more difficult to obtain a smooth control by this method than by the use of Reinartz or capacity reaction. In consequence, it will be better if we concentrate our attention on the latter system. The reaction coil will be mounted in a separate holder placed next to that taking the medium-wave coil, in the position shown in Fig. 3—all three coil-holders are so placed that the coils, when inserted, will just touch each other. A reaction condenser of about .0005 mfd. is best for our purpose, and may conveniently be of the cheaper bakelite dielectric-type. It is connected between one terminal of the reaction coil-holder and earth, whilst the other coil-holder terminal is joined to the plate terminal of the detector valve. The reaction condenser is thus at earth potential, and therefore its operation will not introduce the difficulty associated with hand-capacity. Connections to the reaction coil must be right way round, for otherwise signal strength will be reduced, instead of being increased, as the reaction condenser setting is advanced; the connections shown in Fig. 3 must therefore be duplicated exactly.

The size of the reaction coil will obviously be of importance, since it must so be chosen that it will function equally well on both wavebands—it would be futile to use a dual-range tuner if the reaction coil had to be changed for different wavelengths, and it would introduce undesirable complications if an attempt were made to switch over from one coil to another. As a matter of fact I always find that a 75 coil gives practically uniform degree of reaction over both ranges, once the H.T. voltage has been adjusted to a nicety, but if any difficulty is experienced a few different sizes should be tried.

A Good Two-valve Circuit

A good circuit for a two-valve D.-L.F. circuit using three plug-in coils as a dual-range tuner with reaction is given in Fig. 4, and I can strongly recommend this from a long and successful experience with it. The two-valver represented is as good as any similar type of set which can be made at the present time. It has a distinctly long range combined with a degree of selectivity ample for most requirements. Values of the principal components as

(Continued on page 10.)

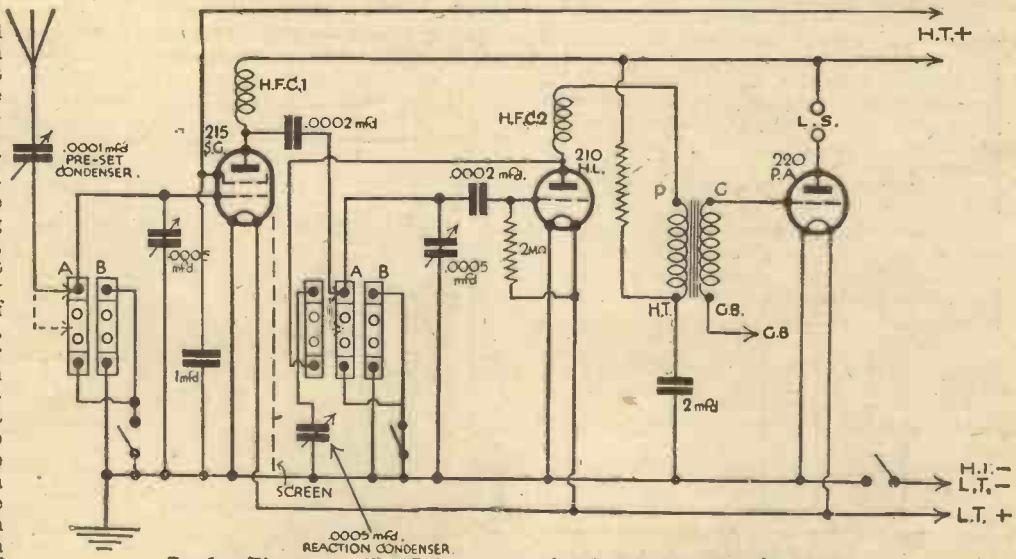


Fig. 5.—The circuit of an S.G. receiver of modern design using plug-in coils.

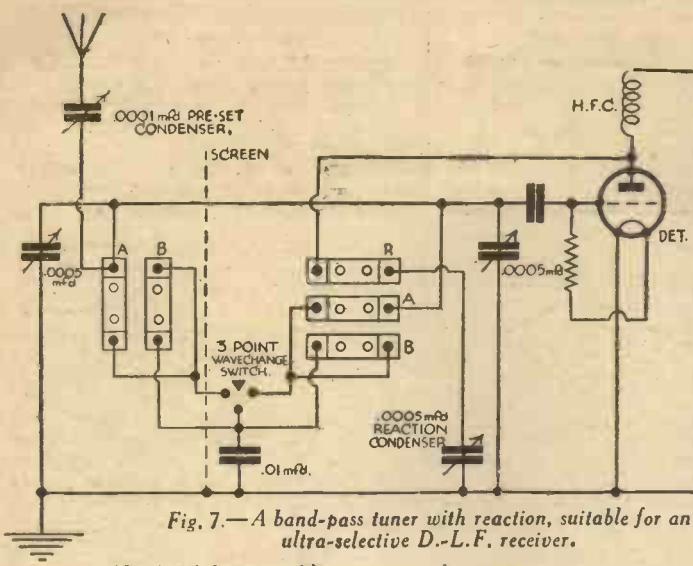


Fig. 7.—A band-pass tuner with reaction, suitable for an ultra-selective D.-L.F. receiver.

(*Continued from page 9.*)

well as the most suitable types of valves are indicated, so I do not think you should have much difficulty in building the receiver.

A Three-valve S.G. Circuit

If you want a rather bigger set with a greater margin of power and easily capable of bringing in as many as thirty or more stations at full loud-speaker strength the circuit of Fig. 5 will appeal to you. This represents a three-valve S.G. receiver of perfectly modern design and using plug-in coils throughout. The aerial circuit is tuned by a pair of coils connected as shown in Fig. 1, whilst the tuned grid circuit employs the coil arrangement depicted in Fig. 3. Reaction is applied to the latter circuit, but in this case a .0003 mfd. condenser is specified for reaction control, the lower capacity being quite sufficient to produce oscillation over the entire tuning range, due to the fact that the tuning circuit is not now "damped" by the aerial. As in the two-valve circuit previously mentioned, the detector valve is decoupled by means of a 50,000 ohm fixed resistance and 2 mfd. condenser, and consequently the form of L.F. instability commonly known as motor-boating is entirely obviated. In building this set a little more care will be necessary to ensure that there shall be no high frequency instability. The tuning circuits must therefore be separated by a vertical aluminium screen and the two sets of coils should for preference be mounted at right-angles to each other. Metallised valves should be used in the S.G. and detector stages and the choke marked H.F.C.1 must be of a high inductance type designed for use in S.G. circuits. The second choke (H.F.C.2) can be of any good pattern, but should for preference differ from H.F.C.1; if both chokes were alike there would be a danger of uncontrollable oscillation setting in at certain wavelengths.

Increasing Selectivity

Although the two circuits dealt with are thoroughly good and reliable they cannot be considered as being ultra-selective. Do not misunderstand me—they are quite as selective as the average present-day receiver, but could not be expected to separate, say, London Regional and Mühlacker at a distance of less than twenty miles of Brookmans Park. To attain a sufficiently high degree of selectivity for that purpose it is essential to use either a loose-coupled aerial coil or a band-pass filter. Both of these arrangements can be provided quite easily with plug-in coils if a little extra complication is not objected to. Fig. 6 shows how a loose-coupled aerial coil can be used in conjunction with the dual-range tuner of Fig. 1. The additional coil might conveniently be a size 25 or so for medium-wave reception, but the optimum size must be found by trial, since it will vary considerably with the type of aerial in use and the degree of selectivity required. It is sometimes possible to find a particular coil with which the set's sensitivity is just as good as with the less selective arrangement, but in general a little loss in volume must be expected when selectivity is increased. The larger the aerial coil employed the greater will be the sensitivity and the smaller the degree of selectivity, whilst the reverse is also true.

Unless there is a good margin of volume it will be necessary to use a larger aerial coil for long-wave reception or otherwise to revert to the original arrangement. Of course two coils could be wired in series and one of them short-circuited by means of a switch just the same as with the tuning coils, but this method would introduce too much complication to make it generally acceptable.

Band-Pass with Plug-in Coils

The arrangement of Fig. 6 is only suitable for the aerial circuit of an S.G. receiver, because it could not conveniently be modified for use with reaction. When reaction is to be applied to the aerial, as in a Det.-L.F. set, the only really efficient way to obtain ultra-selectivity is by the use of a band-pass tuner. The connections for a band-pass circuit with reaction are shown in Fig. 7. It will be seen that five coils are used in all, two of them forming the dual-range circuit of Fig. 1 and the other three making the arrangement of Fig. 3. The two circuits are tuned by separate condensers, but a single three-point wave-change switch acts on both. Coupling between the two circuits is on the "capacity" system, a .01 mfd. non-inductive condenser being used for coupling purposes. It is essential that a screen should be placed between the two tuned circuits and it is also advisable to place the two sets of coils with their axes at right angles, as shown in Fig. 7.

A USE FOR OLD RECORDS

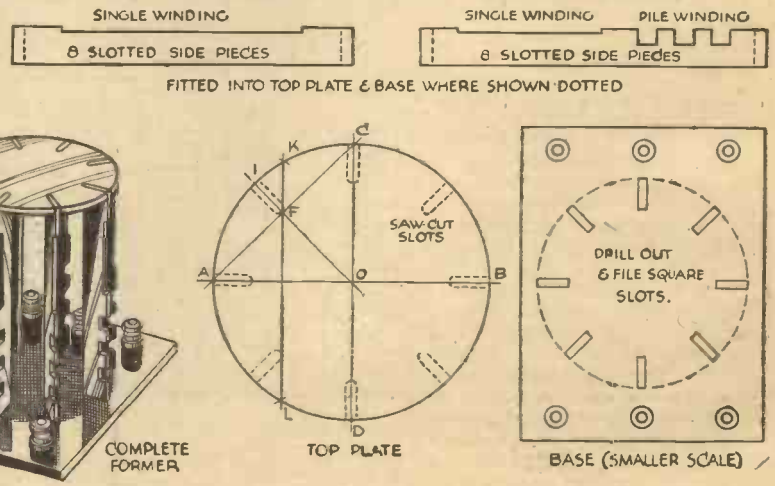
FOR all uses, where insulation is required—as in panels for fitting in mahogany or other radio cabinets—the construction of formers for coils—aerial windings—chokes—condensers of various types—and multifarious other uses, this apparently useless material which possesses insulative qualities of the highest order combined with a hard surface should prove a boon to constructors. In working thin plates, place them between thin ply boards.

If made hot, it bends well, and may be worked round an iron "core," which should also be made hot—but not a *burning* heat, as this would damage the composition. It will easily mould into casings or sheathes for various components, the seams or joins being closed with a *hot* knife-shaped blade of metal, or a *thick spirit-shellac* mixed with vegetable black to match the record.

The accompanying illustrations show a readily made former with octagonal base and top plates.

First of all describe the circumference of desired diameter of former, and draw line through centre A to B. Set compasses to points A and O, place leg in point A and mark off point K and L. Draw Line K L, and mark line C D through O, parallel to K L. Draw line from point A to point C, and from point O draw line through F to I. The dotted lines at the 8 points of octagonal plate, Fig. 2, indicate the slots for side pieces. As a wiring guide, 3 times the diameter A to B plus once I to F gives the measure of the circumference.

—J. A. C. PETTITT (Leigh-on-Sea).

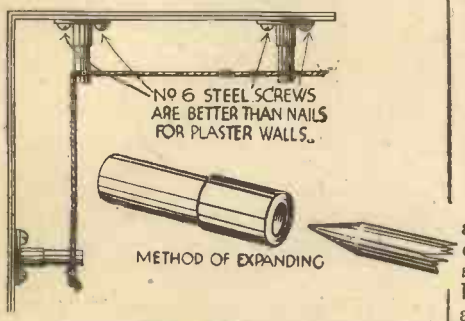


THE HALF-GUINEA PAGE

Radio Wrinkles FROM READERS

Novel Indoor Aerial Insulators

THE accompanying sketch shows a neat and cheap method of making indoor aerial insulators. It consists of small curtain rod brackets and pieces of lead-in tube fitted to the ferrule made to take the

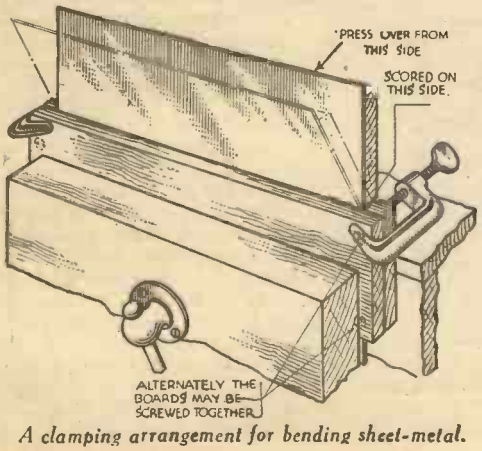


Method of making indoor aerial insulators

curtain rod. If the ebonite tube is too large it can be held in the steam from a kettle until soft, then pushed in and dipped in cold water to set it. Should the tube be small, this is just as easily overcome. Unscrew the ferrule from the back plate and place it over the tube.—L. A. VINTON (Hackney).

Working Sheet Metal

MANY amateurs hesitate to build their own chassis owing to the difficulty in bending the metal. Here is a method by which an almost professional result may be obtained by simple means. Secure three boards, the length of the metal to be bent—1in. flooring board will do—and plane one edge of two of the boards true. Very lightly score the metal where it is desired to bend, and clamp between two of the boards, as shown, in the sketch, with the scored side of the metal away from you. Place the third board as shown and press over until the metal is bent at the desired angle. If the corner is not as sharp as you may wish, gently hammer the top board adjacent the



A clamping arrangement for bending sheet-metal.

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.

angle. This method may be employed for cutting sheet metal. Score deeply on both sides and clamp between the boards as before, and bend the metal backwards and forwards by pressing on the board until the metal is severed. The edges may afterwards be trimmed up by means of a file. Flanges for securing the sides of a chassis may be bent by inserting the metal in a saw cut in a piece of hard wood held in a vice and the metal manipulated as before.—E. A. DINMORE (Forest Gate, E.7).

Making Pliers Self-opening

BY fitting a spring between the handles of a pair of pliers, as shown in the accompanying sketch, they can be made

Fitting pliers with a spring for self-opening.

self-opening. The ends of the spring should be slightly softened so that they can be coiled round the pliers in the manner shown.—H. J. NICHOLSON (Liverpool).

An Inexpensive Baseboard Potentiometer

A VERY efficient yet cheap potentiometer or variable resistance may be made of the following materials, which in most cases can be obtained from the "junk box":—

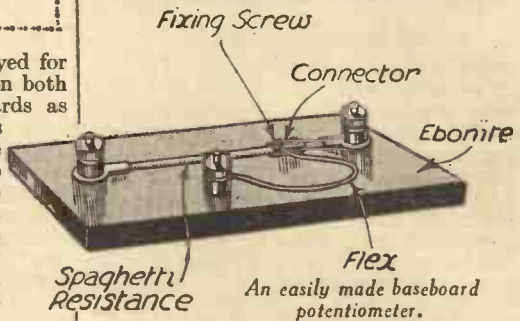
1 Spaghetti Resistance (of any desired value).

1 strip of ebonite of any thickness, about 1in. wide, and 1in. longer than the Spaghetti.

3 small terminals.

1 wire connector, and a length of flex, about the same length as the resistance.

Remove the connecting tab from one end of the spaghetti resistance, and then slide off the sleeving, exposing the resistance wire, which is wound round a stringy material. Slip the brass connector over the resistance, and refix the connecting tab. Next drill a small hole suitable for mounting one of the small terminals at a distance of about ½in. from the one end of the ebonite, and drill a small hole of the same size at a distance equal to the length of the resistance away from this hole, near the other end. Then mount the resistance on the terminals which are screwed to the ebonite as shown in sketch, and mount the remaining terminal near the centre of the ebonite strip, but not allowing it to catch the resistance. This last terminal may be connected to the connector with the flex, and this completes the potentiometer. This gadget may be mounted on the baseboard of the set, and will prove invaluable for biasing, or voltage dropping in an "All mains set." This idea may also be used to save the cost of buying another resistance, which you may need, though you have a resistance of greater value.—A. J. PERRY (Wellington).



An easily made baseboard potentiometer.

Auto-transformer Switch

WHEN a transformer is parallel fed, different step-up ratios may be obtained by altering the connections. By means of the arrangement shown in the illustration, it is possible to quickly and simply change the ratio when desired. When the switch is over to the right, the ratio is 1-1 which, when local or powerful stations are being received, prevents overloading, and gives improved quality. For weak signals the switch is put over to the left, resulting in a step up ratio more than the normal stated ratio, *i.e.*, 4-1 in the case of a 3-1 transformer. Thus greater amplification is obtained.—R. G. MITCHELL (Edinburgh).

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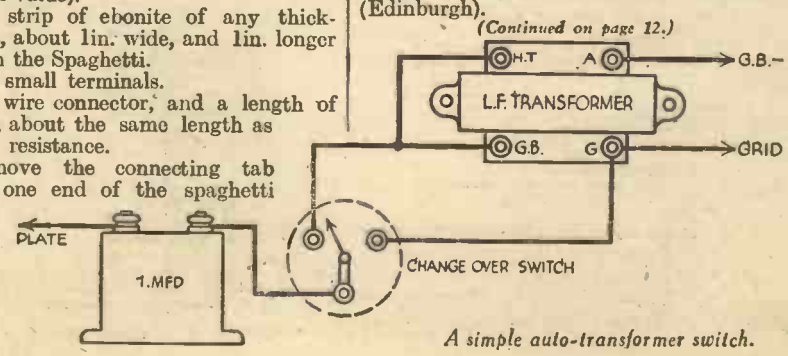
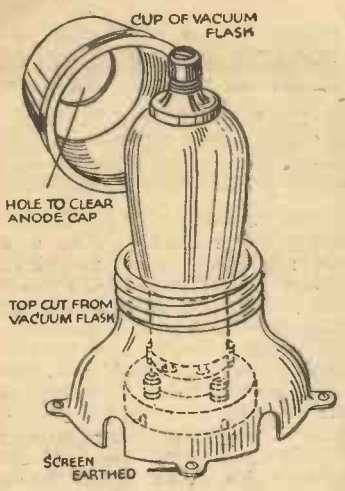


A simple auto-transformer switch.



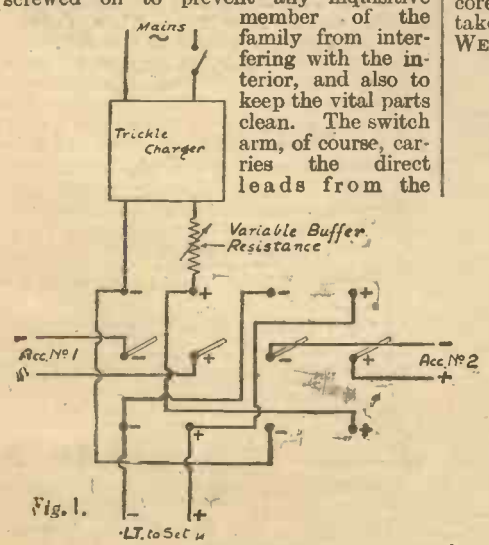
A novel screening device.

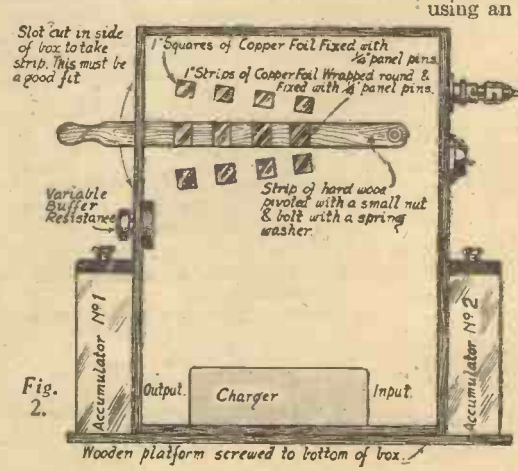
An Improvised Screening Device

AN efficient screen for valves or any small component can be made from a disused Thermos flask, as shown in the accompanying sketch. Remove the top part of the flask and turn up the bottom edge to form lugs for fixing to the base-board. Cut out the slots for the connecting wires, and if the screen is to be used for a screen-grid valve, cut a hole in the top of the cap as well. The bottom part of the screen can be fitted over the valve-holder and the cup screwed on after the valve is inserted.—W. E. HASKELL (Newport).

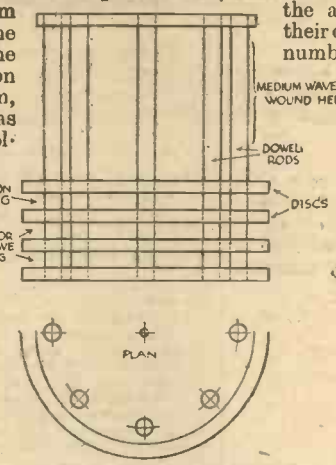
A Handy Battery-charging Switch

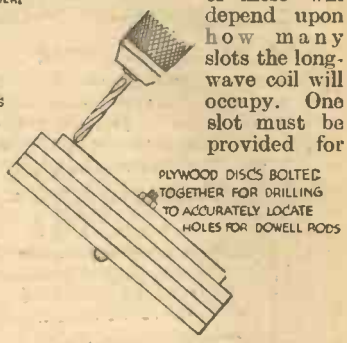
THE battery-charging arrangement shown in the sketches has been in use for over eighteen months, and has proved satisfactory in every respect. It is very cheap to make up, and providing a little care is used in making the slot for the switch arm there is nothing to give any trouble. In the event of the accumulator running down whilst the owner of the set is absent, any member of the family can move the switch arm to the opposite position and do so without any risk. In my case the box is mounted on the wall of an outhouse and is kept away from the wall by half-inch battens. The lid of the box is used as a cover and is screwed on to prevent any inquisitive member of the family from interfering with the interior, and also to keep the vital parts clean. The switch arm, of course, carries the direct leads from the accumulators, and they are held down by small staples, leaving the switch arm as near to the pivoted end as possible to prevent them from being broken by the movement of the switch. The wiring on the pictorial diagram, Fig. 2, is omitted, as this can be easily followed on the circuit diagram, Fig. 1. All contacts made with the copper foil are, of course, soldered. The platform on the bottom of the box should be fixed securely, as this has to carry the weight of the two accumulators.—G. W. READ (Bow).





Circuit diagram and general arrangement of a handy battery charging switch.





Making coil-formers with plywood.

Mounting a Volume Control

WHEN potentiometers are used as volume controls across the transformer secondaries, they are in some cases used with a semi-permanent adjustment, especially when tuned to the local station. To those readers who have sets with easy access to the interior, the following method of mounting the component will be found quite satisfactory, and will mean the saving in many cases of long lengths of wire which would normally go to the panel. Two small strips of stout brass are the only requirements, and these should be cut to the desired lengths and bent to shape, according to the transformer in use—a hole being drilled in the end of each. The potentiometer can then be mounted above the transformer as shown in the accompanying sketch. If the core is joined to earth, care should be taken to prevent a short-circuit.—H. WEARING (Devonport).

Mounting a potentiometer on a transformer.

Novel Coil-formers

HERE is a novel way of making low-loss coil-formers, which will appeal to the amateurs who enjoy constructing their own apparatus. First the required number of discs are cut from three-plywood; the total number of these will depend upon how many slots the long-wave coil will occupy. One slot must be provided for the reaction coil. All the necessary data can be obtained for this by consulting PRACTICAL WIRELESS Data Sheet No. 2. Upon one of the discs a circle is scribed and divided into eight equal parts, as in the lower sketch in Fig. 1. All the discs are now clamped together as shown in Fig. 2 and drilled right through with a 3/16in. drill at each of the eight points, to take a like number of 3/16in. dowel rods. Before removing the clamping bolt, mark all the discs so that all the holes can be brought into line when assembling. The whole when put together will appear as in Fig. 1.—A. S. RICHARDS (Bargoed).

Eliminating Hum

HUM from mains sets may be due to a number of causes, and it is often difficult to effect a complete cure. The trouble, however, can sometimes be minimised by using a potentiometer having an adjustable tap instead of a fixed tap in the heater circuits. If a centre-tapped transformer is used the potentiometer is connected in the circuit by taking the wire from the centre tap to the sliding contact of the potentiometer. The ends of the potentiometer are joined one to each side of the heater transformer. A total resistance of about 90 is usual.

Reducing Mains Hum

BY the way, 50 cycle mains hum can generally be reduced fairly considerably by inserting a fixed condenser somewhere in the loud-speaker circuit. When using an output transformer the condenser can be connected between one secondary terminal and the loud-speaker; a capacity of .5 mfd. or so will generally prove just about right. If the speaker is fed through a choke-capacity filter it is only necessary to reduce the capacity of the filter condenser to a value similar to that referred to above. The idea in both instances is to provide a comparatively difficult path to the very low frequencies without restricting the passage of any others. This can be done quite easily by the methods suggested, and if care is taken in choosing the optimum condenser capacity, the quality of reproduction will scarcely suffer at all.

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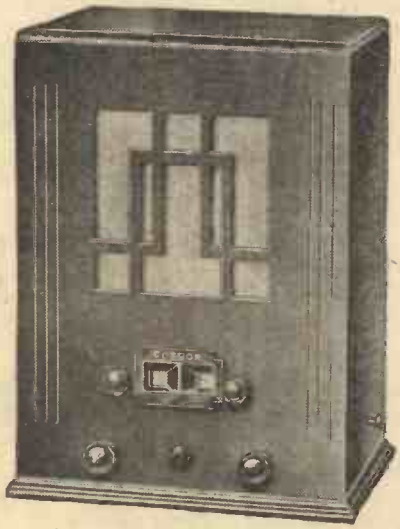
COSSOR MELODY MAKER KITS

Cossor Melody Maker ALL-ELECTRIC Model 337

with self-contained Loud Speaker

Complete Kit of Parts for building Cossor All-Electric Melody Maker Receiver Model 337 as illustrated above includes Cossor M.V.S.G. Variable-Mu Metallised Screened Grid, Cossor 41 M.H. Metallised Detector, Cossor 41 M.P. Output and Cossor 442 B.U. Rectifier Valves; Individually Shielded Coils; All-metal Chassis; Cossor Mains Transformer and all components for home assembly. Handsomely finished cabinet (18½ in. by 17½ in. by 10¾ in.); Balanced Armature Loud-Speaker. Provision is made for fitting Gramophone Pick-up Plug and Jack. For A.C. Mains only, 200-250 or 100-125 volts (adjustable), 40-100 cycles. PRICE **£8.10.0**

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



Cossor Melody Maker BATTERY Model 335

with self-contained Loud Speaker

Complete Kit of Parts for building the Cossor Melody Maker Receiver Model 335, as illustrated above including Cossor 220 V.S.G. Variable-Mu Metallised Screened Grid, Cossor 210 H.L. Metallised Detector and Cossor 220 P. Output Valves; Individually-Shielded Coils, Cossor L.F. Transformer; all-metal panel and base and all the components, bolts, nuts and screws necessary for the rapid assembly of the Receiver; handsomely finished Cabinet, 18½ in. by 13½ in. by 10¾ in., and 10-in. Balanced-Armature Loud Speaker. Provision is made for fitting gramophone pick-up socket and plug if required. PRICE **£6.17.6**

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Please send me, free of charge, full particulars of

Cossor Melody Maker BATTERY Models
Cossor Melody Maker ALL-ELECTRIC Model
Cossor ALL-ELECTRIC Receiver Model 533A
Strike out whichever not required

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COSSOR Radio de Luxe

Cossor ALL-ELECTRIC Receiver Model 533A

5 valves including Rectifier)

Complete Receiver as illustrated, with 5 Cossor A.C. Mains Valves, viz.: Two Cossor M.V.S.G. (Metallised Variable-Mu Screened Grid), Cossor 41 M.H. Metallised Detector, Cossor 41 M.X.P. (Super-power Output) and Cossor 442 B.U. (Rectifier). Completely shielded coils, triple-gang condenser givin one-knob tuning. Illuminated dial, calibrated in wavelengths. Graded volume control and alternative tone selector. Mains-energised Moving Coil Loud-Speaker, gramophone pick-up plug and jack, magnificent cabinet with conveniently-placed controls. Wavelength range 200-580 and 1,000-2,100 metres. For A.C. Mains only 200-250 or 100-125 volts (adjustable), 40-100 cycles. PRICE **£13.15.0**

Hire Purchase Terms: 27/6 deposit and 11 monthly payments of 25/-.

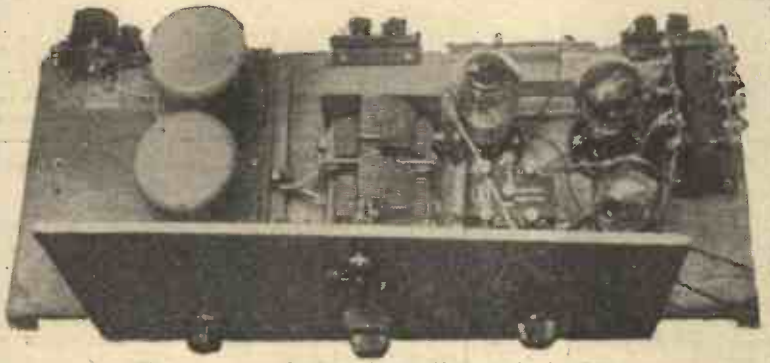
♡ 2586

THE ALPHA Q.P.-P. THREE

A simple-to-construct, highly-efficient three-valve Receiver employing a Screened-Grid Detector and two Pentode valves

Designed by T. D. BAKER

THE receiver described in this article is a splendid self-contained, battery-operated receiver which will give a really high standard performance. The circuit diagram shows that the aerial tuning arrangement is designed to provide the necessary degree of high selectivity which must be employed in order to ensure that there shall be no difficulty in separating stations working on adjacent wavelengths. This is carried out by means of band-pass tuning, and the coils used are a little different from those normally employed. Instead of a two-band tuner, the usual wavelengths have been divided up into three bands, the first covering a range of from 150 metres to 230 metres, the second covering the range from 200 to 500 metres, and the third tuning to the long-wave stations working on wavelengths from 1,000 metres to 2,000 metres. A small adjustable series aerial condenser is fitted to the rear of the baseboard, and this enables the set to be adjusted to the particular aerial with which it is employed. The remainder of the circuit is quite orthodox, the special input and output quiescent push-pull transformers being provided with the necessary tone-control and safety resistances. The detector-valve is of the normal H.F. screen-grid type, and this provides a high degree of amplification and selectivity in this stage, and ensures that the two output pentodes will be fully loaded so as to enable the moving-coil loud-speaker fitted in the upper part of the cabinet to give of its best. The photograph of the rear of the receiver will show that a shelf is provided for the accommodation of the H.T. and L.T. batteries. The grid-bias battery is held in a clip at the rear of the lower baseboard. Provision for gramophone reproduction is made by the usual pick-up terminals connected between the grid circuit of the detector and earth.



The above-board view of the Alpha Q.P.-P. Three.

For Wiring Diagram, see page 18.

For List of Components, see page 16.

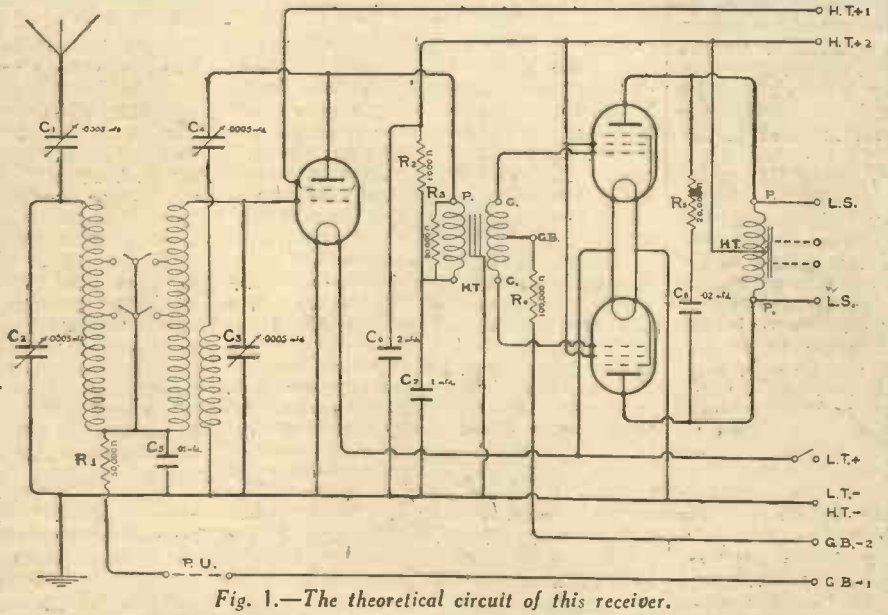


Fig. 1.—The theoretical circuit of this receiver.

Construction

Remove the baseboard from the cabinet and mark out the positions for the Clix valve-holders, as shown on page 18. Whilst cutting work is in progress, mark out and drill the panel from the details given in Fig. 3. The actual fitting of the various parts may now be commenced, and it is preferable to first of all fix the parts on the underside of the baseboard, as shown in Fig. 2. Attach the terminal blocks in the required positions, after fitting the terminals to them.

The neat panel lay-out of the finished receiver.

Turn over the baseboard and mount the remaining components, taking their position from Fig. 4. Notice particularly the actual way round for the two transformers, so as not to be met with difficulty when wiring is commenced. It should also be pointed out that care should be taken in handling the variable condenser, so as not to damage or bend any of the vanes. Mount the reaction condenser on the panel, and fit the escutcheon window. The on-off switch is easily fitted above this window, and the panel may then be attached to the baseboard by means of appropriate wood-screws. The dial should be just clear of the back of the window, and if there is any bad alignment here, such as the dial touching the window, or being too far to the back, the panel should be removed and the variable condenser fitted in a more suitable position. The small hole through which projects the control rod of the tuning-coils should be just large enough to prevent rubbing.

Wiring

The wiring may now be carried out, using for the purpose the coil Glazite. One or two parts of the circuit may be a little awkward to get at, but in general this part of the construction will be found quite straightforward. Note how the switch is joined to a soldering tag (or by means of a loop) under the holding-down screw of one of the feet of the variable condenser assembly. This prevents a long lead being run round to the terminal on the opposite end of the condenser. The 100,000 ohms resistor is attached to the GB terminal of the input transformer by means of a short length of Glazite, and the flexible grid-bias lead is attached to its opposite end. The thick Glazite wire keeps it in position. The remaining resistors are also held in position by means of the connecting wires, no special holders being provided for them. It will be noticed in Fig. 2 that the pick-up terminals are short-circuited with a small piece of wire. This procedure is necessary only

LIST OF COMPONENTS FOR THE "ALPHA" Q.P.-P. THREE

1 2-gang .005 mfd. Variable Condenser with escutcheon. (Polar).
2 .0003 mfd. Precision Condensers. Lissen.
1 .01 mfd. Fixed Condenser. (T.C.C. Type S.)
1 1 mfd. Condenser. (T.C.C. Type 50.)
1. 2 mfd Condenser. (T.C.C. Type 50.)
1. .02 mfd. Condenser. (T.C.C. Type M.)
1 1,000 ohms 1 watt resistance. (Erie.)
1 2,000 ohms 1 watt resistance. (Erie.)
1 8,000 ohms 1 watt resistance. (Erie.)
1 50,000 ohms 1 watt resistance. (Erie.)
1 100,000 ohms 1 watt resistance. (Erie.)
1 Q.P.P. Transformer. (R.I.)
1 Q.P.P. Output choke. (R.I.)
2 5-pin valve holders. (Clix.)
1 4-pin valve holder. (Clix.)
1 Coil Unit. (Hambling.)
1 On-off Switch. (Busco.)
6. Terminals, marked E, A, L.S., L.S. Pick-up, Pick-up. (Belling Lee.)
6 Wander Plugs, marked G.B.+, G.B.1., G.B.2, H.T., H.T.+1, H.T+2. (Clix.)
1 7-way Battery Cord. (Bulgin.)
2 L.T. Spade Terminals. (Clix.)
1 Grid Bias Clip. (Bulgin.)
2 Coils Glazite.
2 Valves Pen 220A. (Mazda.)
1 Valve 215 S.G. (Mazda.)
1 P.M. Moving Coil Speaker.
1 Alpha Cabinet. (Hambling.)
1 Panel 14in. × 8in. (Becol.)
1 Plywood Baseboard 19in. × 7in.
1 120 volt H.T. Battery. (Lissen.)
1 16 volt G.B. Battery. (Lissen.)
1 L.T. 2 volt Accumulator. (Lissen.)
1 Q.P.P. Moving Coil Speaker. (Ormond No. R/494 C.T.)

The finished Alpha Q.P.-P. Three.

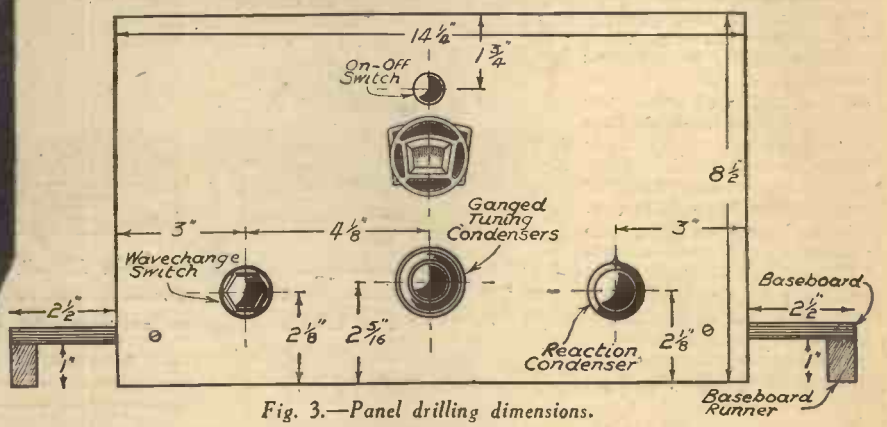


Fig. 3.—Panel drilling dimensions.

when the receiver is used for radio reception, and a convenient switch could, of course, be mounted on the motor-board of the gramophone portion of the equipment. There are no other points which require attention, and the receiver may be completed by reference to Fig. 4 and the photographs of the receiver which are included in this article.

Operating Notes

The screen-grid valve is inserted in the socket nearest the variable condenser, and the flexible lead, which is joined to the A terminal on the input transformer, should be attached to the cap of the valve. A point which should be mentioned here is that this lead should never be disconnected whilst the H.T. plugs are in their sockets. The reason is this. H.T. negative is joined to earth, and the primary winding of the transformer is joined to the other side of the H.T. battery. Therefore, if this lead is allowed to drop on to the variable condenser, or the metallized coating of the valve (if such a valve is used), the high-tension battery is short-circuited, with, of course, disastrous results. Therefore, use a soldering ring on this lead, and you will remember, when going to remove it, first of all to take out the H.T. plugs. The two pentode valves are inserted in the remaining holders, and they may, of course, be used indiscriminately in any holder. A 16 volt grid bias battery must be inserted in the clip, and the three plugs inserted in the appropriate sockets. G.B.+ is inserted in the end socket marked with a plus sign; G.B. P.U. is inserted in the 3-volt tapping, whilst G.B.— is inserted in the opposite end socket on the battery. The position of the socket marked P.U. should be varied to see if, with your particular valve, there is any better position for it. The H.T.1 plug should be inserted in the high-tension battery at some point between 60 volts and 80 volts. The best position will be found by experiment. The best voltage will be that which gives smoothest reaction control, and this will no doubt be nearer to 60 than 80 volts. The battery, as already mentioned, should be stood on the upper shelf, together with the L.T. accumulator. If now the set is switched on, it will be found that maximum signal strength will be obtained when the series aerial condenser is turned with the vanes "all in." This should be adjusted to give the best compromise between selectivity and signal strength, and when tuning to a station, the small knob which is concentric with the main tuning knob should also be adjusted to give the accurate tuning spot. The selectivity will be found ample for normal requirements, and it may be augmented, where required, by suitable adjustment of the reaction condenser.

(Continued on page 18.)

Points About Selectivity

USUALLY, if a set is made too selective, tuning will be more difficult. It is not an easy matter to obtain a good tone when tuning is of the knife-edge variety. If a station can be received anywhere within three degrees on the dial, the correct point at which it is properly tuned in can easily be found.

By increasing the potential of the detector valve selectivity is automatically increased. In circuits employing magnetic reaction the use of a larger capacity condenser across the primary of the first transformer will increase sensitivity, and, to a certain extent, selectivity as well. Many tuning units work in a very unselective condition. When they do, connect a small capacity in series with the aerial and the aerial terminal of the unit. If your earth lead is long your set may tune broadly. Here, again, sharper working can be obtained by connecting a variable condenser in series—this time with the earth.

Long aerials tune broadly and it is a good plan to limit the length to about 70 feet, including the down lead. A set may be unselective through being earthed to a water main to which other sets, generally tuned to a local station, are earthed. If possible, use an independent earth.

A Fuse Hint

IN sets where a flashlamp bulb is fitted to act as a fuse, constructors are often puzzled by the bulb glowing at the moment of switching on, and sometimes fusing. It may be thought that a fault exists, but this may not be the case.

If a set contains various fixed condensers of fairly large capacity, these take a relatively heavy current when switching on, and it may therefore be necessary to use a fuse bulb of larger capacity. If the valves take a total filament current of .5 ampere, which is usual for a three-valve set, a bulb that will blow .4 ampere will afford protection and leave a sufficient factor of safety.

Top- and Sub-Baseboard Wiring Diagram of the Alpha Q.P.-P. Three

(Continued from page 16.)

OPERATING INSTRUCTIONS OF THE ALPHA Q.P.-P. THREE WILL BE GIVEN NEXT WEEK!

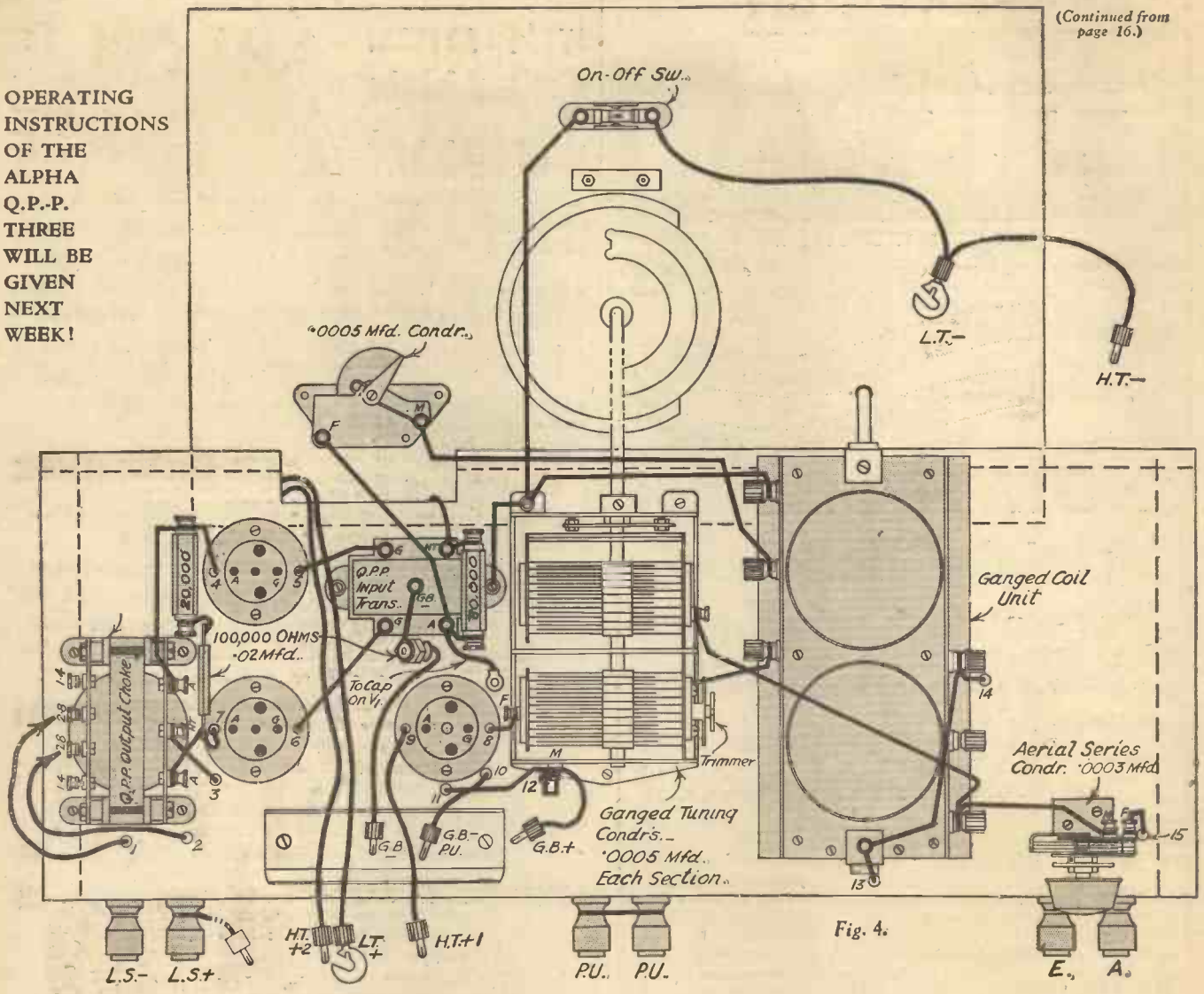


Fig. 4.

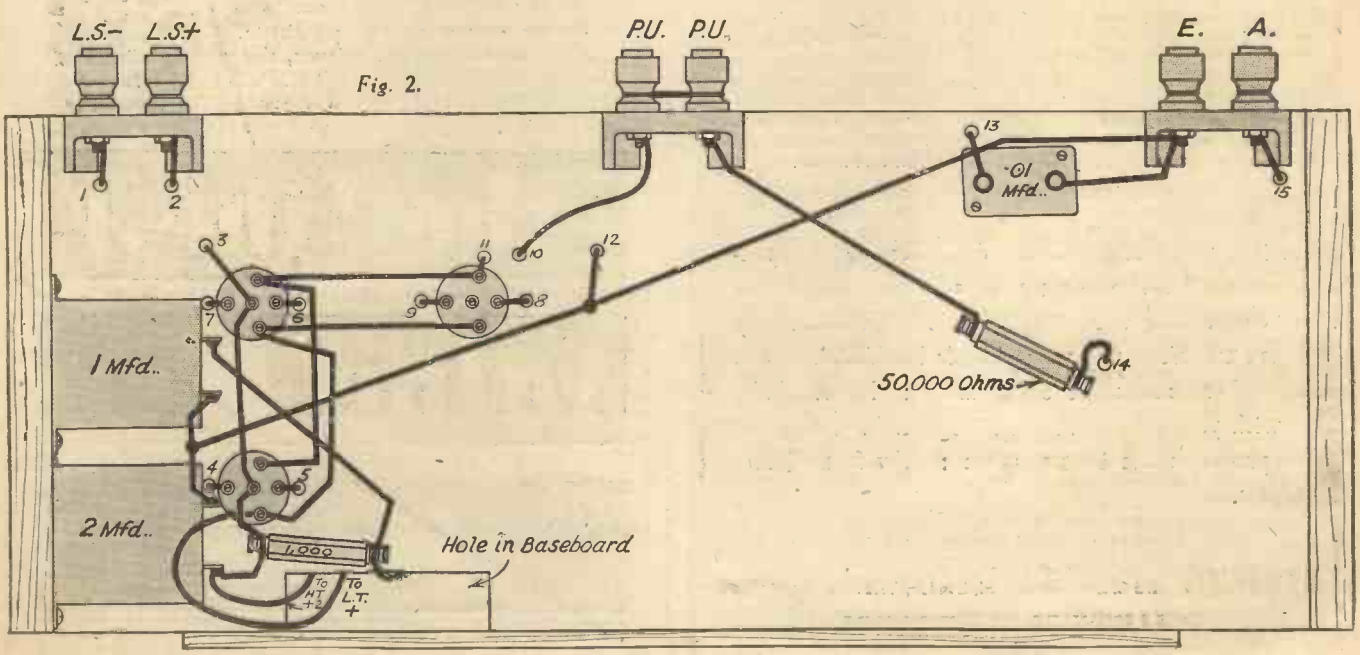


Fig. 2.

TELE-TALKIE TOPICS

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

THE unmistakable interest which is now being manifest in television and all its allied problems (letters from readers form one definite criterion in this matter) prompted me to suggest to the Editor of PRACTICAL WIRELESS that it would be advisable to furnish readers with items of topical and technial interest in the subject. His ready acquiescence finds material realisation in this new feature called Tele-Talkie Topics. Through the medium of these columns I hope to give readers details which will enable them to keep abreast with the times as far as television is concerned and in addition, where such a course is possible, I shall be pleased to make use of the space available to settle any reader's problems in this most fascinating science.

A Tele-Talkie Cine Transmitter

The Fernseh A.G. recently built and delivered to the Reichsrundfunk Gesellschaft is a new tele-talkie cine transmitter capable of giving twenty-five pictures per second. The film is horizontally scanned with ninety lines and the resultant image has a ratio of 4 horizontal to 3 vertical. This transmitter, shown in Fig. 1, has been fitted up in the Haus des Rundfuncks Masurenallee and, as its name implies, is intended for the transmission of sound films. The television signal is made to modulate the powerful ultra short-wave transmitter (7-metre wavelength) of the Central State Post Office. The aerial and wireless transmitter is accommodated on the Witzleben wireless tower, being connected with the television transmitter in the Wireless House by a cable 750 yards long.

The tele-cine transmitter is a most ingenious piece of apparatus, and consists of a cinema projector together with a disc analysing device complete with a single photo-electric cell built into it. In addition, there is a device for the production of the synchronising frequencies specially required by cathode ray tube apparatus together with a first stage amplifier, power amplifier and a mains drive for feeding the last named, and these are seen in the illustration.

The power amplifier has two separate outputs, one being intended for the modulation of the wireless transmitter and the second for driving a control or pilot receiver. The cinema projector and picture analysing device form a completely enclosed unit situated next to the photo-electric cell housing. The scanning disc as well as the driving motor is completely enclosed in a dust proof casing and mounted on a strong pedestal.

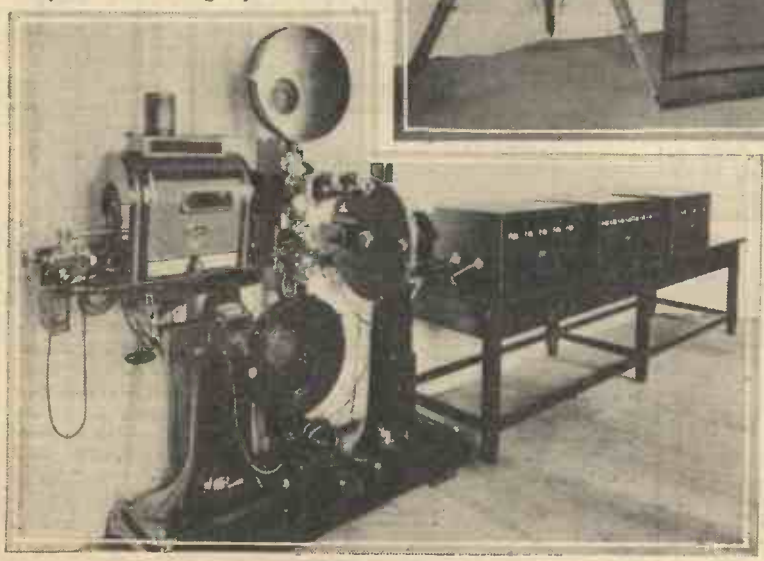


Fig. 1.—This new tele-cine transmitter consists of a cinema projector together with disc analysing device and photo-electric cell built with it.

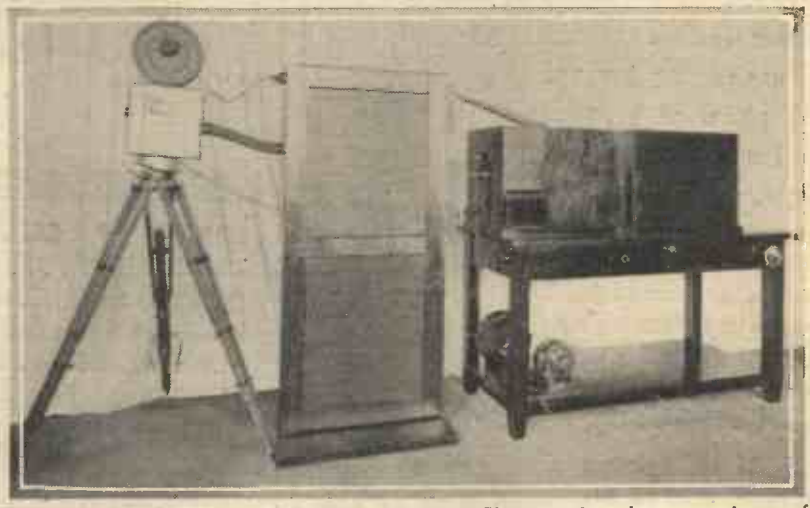


Fig. 2.—Showing the relative simplicity of the new film apparatus developed for television transmissions.

Daylight or Floodlight Television by Films

Another most important piece of apparatus which is clearly to be of far-reaching importance in the future has been developed by the same firm. This is a television inter-film transmitter and is illustrated in Figs. 2 and 3. It permits television transmission to be made of any event which may be filmed at all within the very short period of from 10 to 20 seconds, the number of pictures per second being 25. In operation a film is first taken of the actual event to be transmitted, and immediately following the filming of the subject the film is rapidly developed and fixed. The negative so obtained passes to the next section of the apparatus which is a special and extremely simple cinema transmitter, specially built for the purpose.

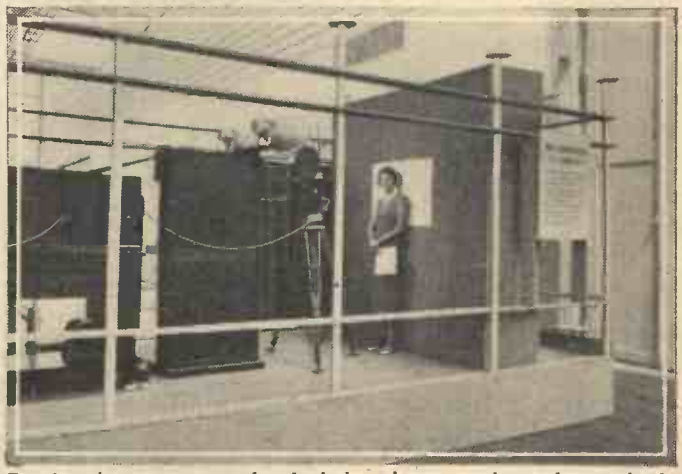
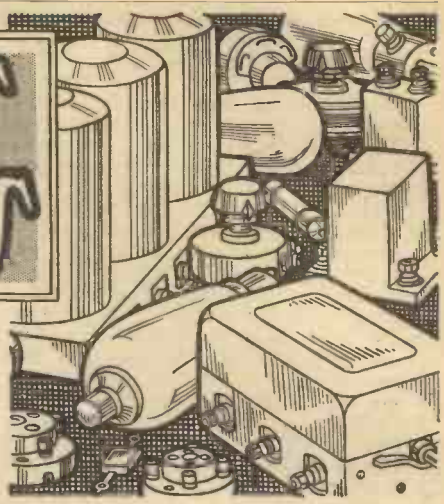


Fig. 3.—A transmission of a daylight television taking place with the new inter-film transmitter.

Between the taking of the film and the appearance of the image in the television receiver there is a lapse of time of about 15 seconds. It will be obvious, therefore, that this apparatus can be made adaptable for the televising of events at choice even with a very high number of scanning lines. The small delay of 10 to 15 seconds can be ignored in many cases and does not in any way give rise to difficulties as far as the delay of the sound which has to be transmitted with the television image. With this particular apparatus either scenes by daylight or those lit by artificial lamps can be transmitted, and the transmission will depend solely on the sensitiveness of the films used and the quality of the photographing optical system.

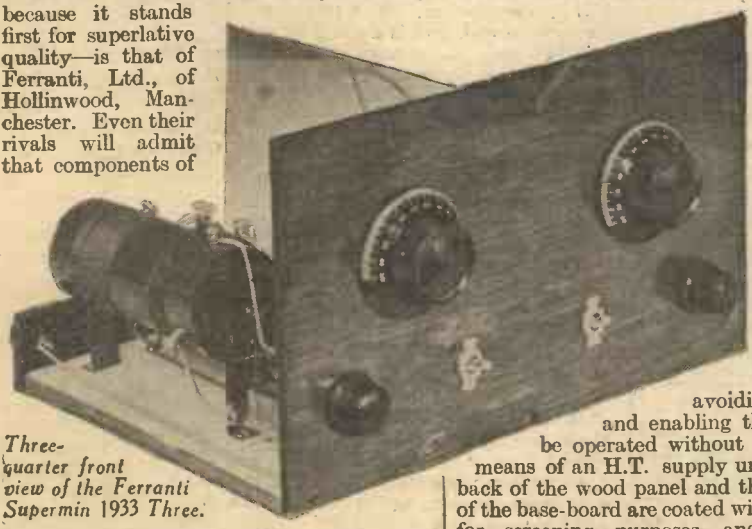
REVIEWS of LATEST KITS



THE FERRANTI SUPERMIN 1933 THREE

By F. J. CAMM

IN all industries there are certain firms whose ideals are not alone the acquisition of large profits, but the establishment of a reputation for quality which imparts a hall-mark or *cachet* to goods bearing their name. A name revered in the electrical industry since 1882, and since the earliest days of radio telegraphy and telephony because of quality, and whose name sets a standard not easily emulated because it stands first for superlative quality—is that of Ferranti, Ltd., of Hollinwood, Manchester. Even their rivals will admit that components of



Three-quarter front view of the Ferranti Supermin 1933 Three.

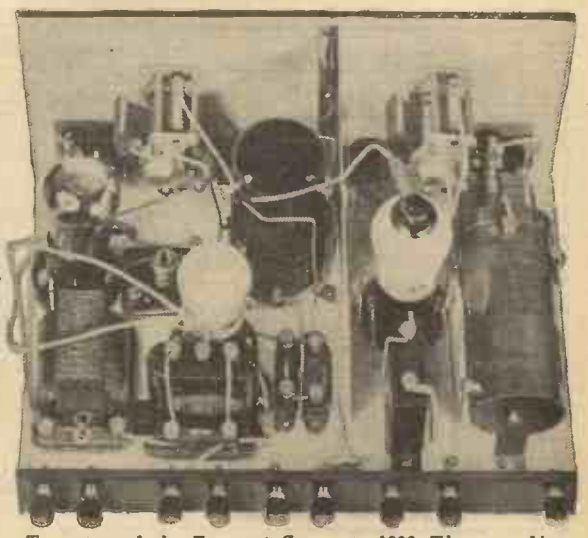
Ferranti manufacture are of impeccable quality, original design, and really superb workmanship. They set standards by which others may be judged. Everyone knows the name; and therefore when they entered the kit market with their "Supermin" Three it was a natural corollary that it would be good. Only recently have I been able to test one, and in according praise to a worthy article, I would firstly draw attention to the circuit itself. An examination of this discloses that it is of the screen-grid three type, making use of special Ferranti coils, tuned anode connection forming the coupling between the screen-grid valve and the detector. Risk of overloading the high-frequency valve is eliminated by the use of an aerial series volume control condenser. The detector valve is transformer-coupled by means of the Ferranti A.F.10 transformer to an output power valve, and the anode feed system is used for decoupling. This effectively prevents back coupling and interaction between the stages, thus avoiding distortion and enabling the receiver to be operated without alteration by means of an H.T. supply unit. Both the back of the wood panel and the upper side of the base-board are coated with aluminium for screening purposes, and this metal coating is imparted by a special Ferranti process, and is thoroughly effective.

Separate tuning controls are used so as to ensure selectivity. The "Supermin" may be erected in eight simple operations within a couple of hours, the valves used in my set being a Cossor 220S.G., the Cossor 210H.L., and the Cossor 215P. The aerial series volume control is, of course, judiciously used to cut down the signal strength where necessary.

If the station heard is too loud the volume control condenser which is located at the bottom left hand corner of the panel should be set back in an anti-clockwise direction until the station is heard at the desired strength. This control has a marked effect on the selectivity of the set, and where interference is experienced it may, in many cases, be entirely removed by rotating the volume control in an anti-clockwise direction, at the same time increasing the signal strength by rotating the reaction control clockwise to the required amount. The running costs of the "Supermin" are quite low, for with a 40 ampere hour accumulator fully charged the set should operate for seventy-five hours before the accumulator will need re-charging. In one evening I logged twenty-three stations on the medium wave, and six stations on the long wave, all of the programmes received being of a strength and quality to provide entertainment value. Only here and there (such, for example, as with Mühlacker) was interference experienced, and even then by use of the volume control it was reduced to tolerable minimum.

I have no adverse comments to make on this receiver, every part of which bears the impress of high-class workmanship. It is cheap and good; you can roam over the Continent with it (at least over the ether Continent), and it is delightfully simple to operate, the reproduction of excellent quality.

The Supermin 1933 Three readily lends itself to fitting into any of the ready-made cabinets now sold by most wireless dealers. I find that it fits quite well into a Clarion self-contained cabinet, which has a loose inside frame to accommodate the loud-speaker and all of the batteries. Although the Cossor 215P valve is recommended, the Cossor 220P will give even greater volume and even better reproduction, although, of course, it will consume more H.T. current and require an increased amount of grid bias.



Top view of the Ferranti Supermin 1933 Three. Note the special coils and the compact lay-out.

SPECIFICATION AND BRIEF DETAILS

Kit:
The Ferranti Supermin 1933 Three.

Makers:
Ferranti, Ltd., Hollinwood, Lancs.

Price:
£4-12-6 (excluding H.T., L.T., G.B. batteries, cabinet and valves).

Circuit:
Screened Grid, Detector and Power.

Stations Received:
Medium waves: 23 stations; long waves: 6 stations (all at loud-speaker strength).

Quality: **Excellent.**

Selectivity: **Good.**

INTRODUCING—

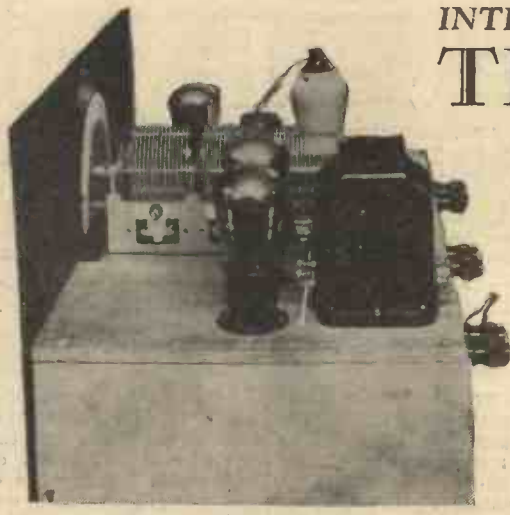
THE FER

Q.P.-P.

THE

SUPERHET WITHOUT SUPE

By the "Practical Wi

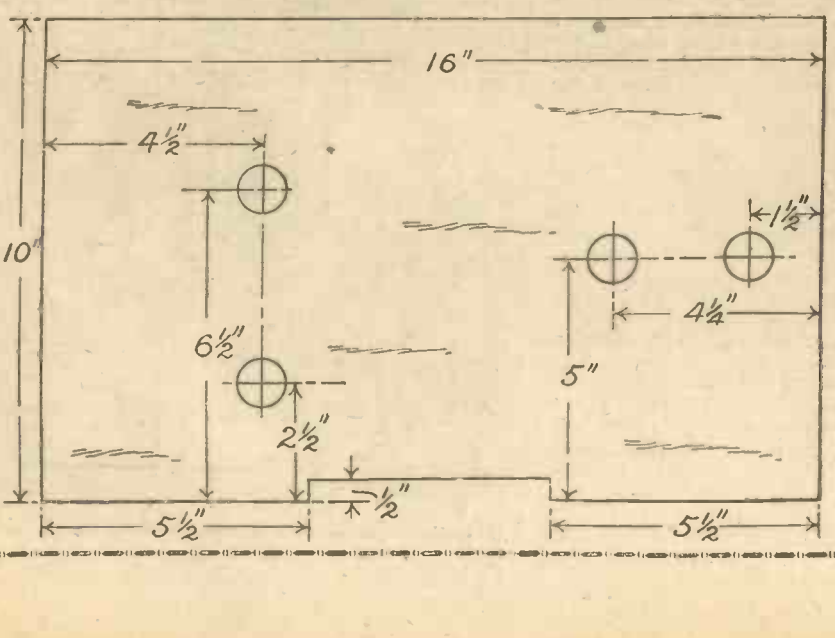


Side view of the new receiver.

AS was announced last week, the receiver bearing this name has been designed round the two most popular and up-to-date methods of employing tuning circuits and low-frequency output circuits. In other words, Ferrocart coils are employed for the tuning circuits, whilst valves working on the quiescent push-pull principle are employed to feed the loud-speaker. For the benefit of those who may be new readers, or who have not read the previous announcements, it would perhaps be as well to briefly point out what Ferrocart coils are. As has been stated in many articles in these pages, the tuning circuit is a most vital affair. The high-frequency resistance has to be kept low; the self-capacity has to be kept low; all-round efficiency has to be kept high; and many other factors have to be correctly dealt with. Selectivity is, of course, the principal consideration in these days of high-power stations working on the minimum separation. Where it is necessary to employ more than one coil in a receiver (and this must be done to provide selectivity, as then there is more than one tuned circuit which assists in the separation of closely-situated stations) the over-all size of the coil must be kept small in order to prevent the baseboard assuming dimensions which would prevent the installation of the receiver in the ordinary living room. As soon as the dimensions of the coil are reduced, down goes the efficiency factor, and so the coil designers have tried again and again to bring about some sort of compromise, but, until the arrival of Ferrocart, without success. The new coils owe their design to the fact that an iron core in a coil of wire increases the value of the inductance, but for high-frequency circuits, the losses introduced by the core offset the gain so obtained. The Ferrocart coil, however, employs the iron in the form of a finely divided dust held in suspension in a material which is easily worked. The finished coil is shown in the "close-up" on this page, from which it will be seen that the finished tuning coil bears a striking resemblance to an ordinary L.F. transformer. The larger coil is the medium-wave coil, and is wound on a core built up of "I" and "E" stampings of the new material, and the long-wave coil (on the right of the medium-wave coil) is built up on "L" stampings. The actual windings are of Litz wire, and thus the H.F. resistance is low, whilst the inductance is high.

Rear view of the new "Practical Wireless" receiver, employing Ferrocart coils.

The two coils are mounted at right-angles to each other on the substantial bakelite base, inside which the necessary switching is incorporated. This is much more complex than that adopted for the ordinary types of coil, and as will be seen from the theoretical circuit of this receiver, there are several changes carried out in the coil, in the process of switching from normal to long waves. The actual containing case for the coils is no smaller than those adopted for the normal coil, except that the over-all height has been reduced somewhat. Eight terminals are provided on the base of each coil, but in this particular receiver, they are not all employed. The design of the coil is such that the remaining parts of the receiver must also be carefully chosen, and in particular the three-gang condenser is essentially critical.



The Circuit

As will be seen from the circuit diagram, the

The complete set of Fe

Close-up of one of t

LIST OF COMPO

THE FERROCART Q.P.-P.

1 Set Ferrocart Coils. Colvern.
Three-Gang Condenser Assembly. Brit. Radiophone.
1 5-Pin Valveholder. Clix.
3 4-Pin Valveholders. Clix.
2 L.M.S. screened H.F. Chokes. Graham Farish.
1 Q.P.-P. Input Transformer, Type D.P. 36. Varley.
1 Q.P.-P. Transchoke, Type D.P.38. Varley.
1 .0002 fixed condenser, Type 670. Dubilier.
1 .1 mfd. fixed condenser, Type B.B. Dubilier.
1 .001 mfd. fixed condenser, Type 670. Dubilier.
1 2 mfd. fixed conde... Dubilier.
1 20,000 ohms resistan... Graham Farish.
1 50,000 ohms resistan... Graham Farish.
1 5,000 ohms resistance Graham Farish.
1 10,000 ohm Potentiome... Luxus. Preh.
1 One Megohm Grid Lea... Farish.
1 .0003 Reaction Conden...
1 On-Off Switch, Type S.
3 Terminal Mounts. Belli...
6 Terminals, Aerial, Ear...

RROCART HI-MAG REE

SELECTIVITY RHET EXPENSE

reless" Technical Staff

rrocart coils.

e Ferrocart coils.

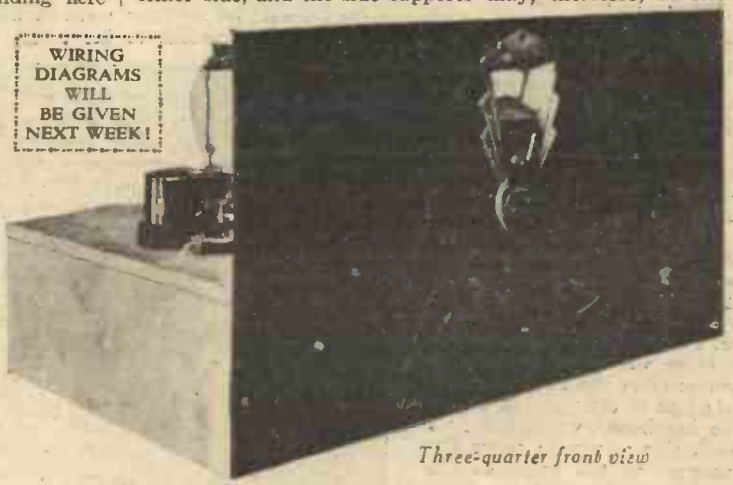
A further view of this new receiver.

input arrangement consists of a more-or-less normal band-pass filter, with the third coil acting as the detector grid coil. Reaction is employed in a normal manner in this coil, and the same winding here serves for both wave-bands. The H.F. valve is of the variable-mu type, this being chosen to assist in the removal of a high-powered station working within a few miles of the receiver. The detector valve is a normal valve working with a rather lower value of grid-leak than is usually employed in a battery receiver. The output valves are arranged to work with an increased grid bias voltage, and with the use of an input transformer and output transchoke of the quiescent push-pull type, the anode current is kept at a minimum, whilst the undistorted output is somewhat higher than would be obtained with one valve alone. In view of the expense of the remaining part of the circuit it was thought undesirable to include pentode valves in this stage, although if expense does not matter, there is no objection to employing two valves of the pentode type in these two sockets. A three-gang condenser is employed for tuning purposes, and this requires a little care in trimming, a point about which more will be said later on.

The Constructional Work

The layout of the receiver is on somewhat unorthodox lines, and therefore the method of construction should be rigidly adhered to. First of all the baseboard must be drilled to accommodate the special Clix valve-holders. The positions of these are shown on the baseboard diagram below. Before the coils can be attached, they must each be reversed on the base. This must be carefully done to avoid damage, or wrong connections. First of all withdraw the switch rod. Next remove the can of the coil at one end of the base and unscrew the two holding-down bolts. Turn the coil base round one-half of a revolution—that is, so that the numbers are reversed. Screw the coil down and replace the cover. Carry out this process with each coil, so that the terminal numbered 1 will be nearest the ganged condenser when the coil unit is mounted underneath the baseboard. Next position the coils, ganged condenser, and output choke. Screw these in place, but remember most particularly, *do not remove the covers of the coils.* You will, no doubt, have examined the coils before affixing them, and the reason for the above admonition will have been apparent to you. The formers of the coils are extremely delicate, and any mishandling will undoubtedly result in damage. The baseboard will now stand upon either side, and the side supports may, therefore, be left

WIRING DIAGRAMS WILL BE GIVEN NEXT WEEK!



Three-quarter front view

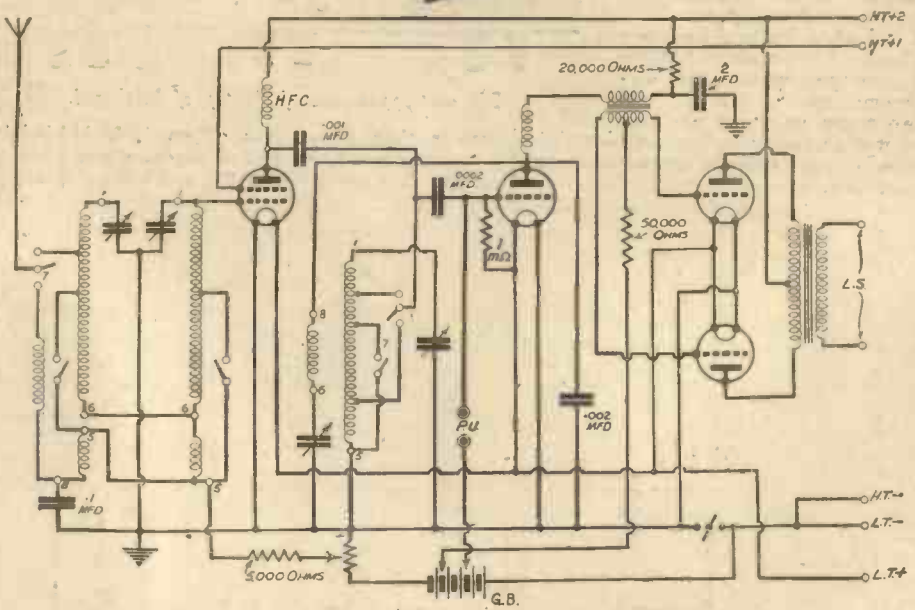


Fig. 1.—Circuit diagram of the Ferrocart Q.P.-P. Hi-Mag Three. Baseboard layout is opposite.

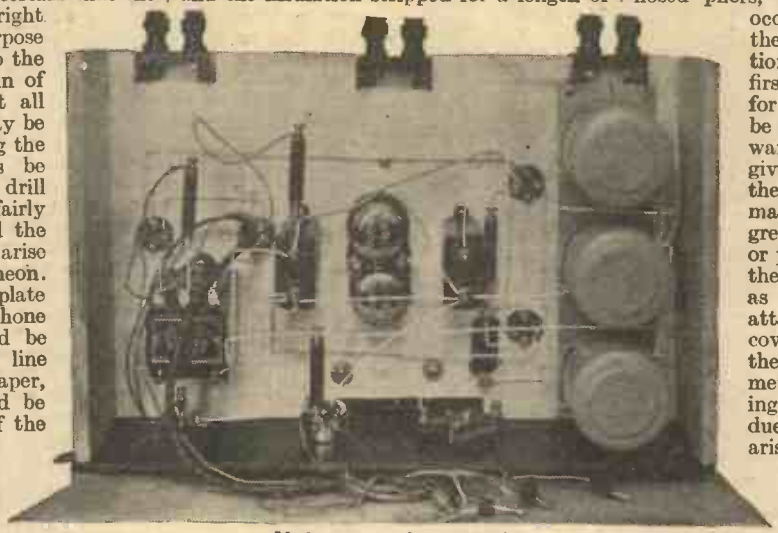
ONENTS.

HI-MAG. THREE.

Type B.B. (Ohmite). (Ohmite). (Ohmite). er, Type B. t. Graham er. Lissen. 85. Bulgin. g Lee. h. Pick-up,

L.S.—, and L.S.+. (Type H). Belling Lee.
3 Wander Plugs (G.B.+, G.B.1, G.B.2). Clix.
1 5-Way Battery Cord (H.T.1, H.T.2, H.T.—, L.T.—, and L.T.+). Belling Lee.
2 Coils "Quickwyre." Bulgin.
1 220 V.S.G. Valve } Cossor.
1 210 H.F. " }
2 220 P.A. "
1 Plywood Baseboard 12in. by 9in.
1 New Hertford Cabinet. Smiths.
1 120-volt H.T. Battery. Lissen.
1 15-volt G.B. Battery. Lissen.
1 2-volt L.8. Accumulator. Lissen.
1 R. and A. "Challenger" Speaker.

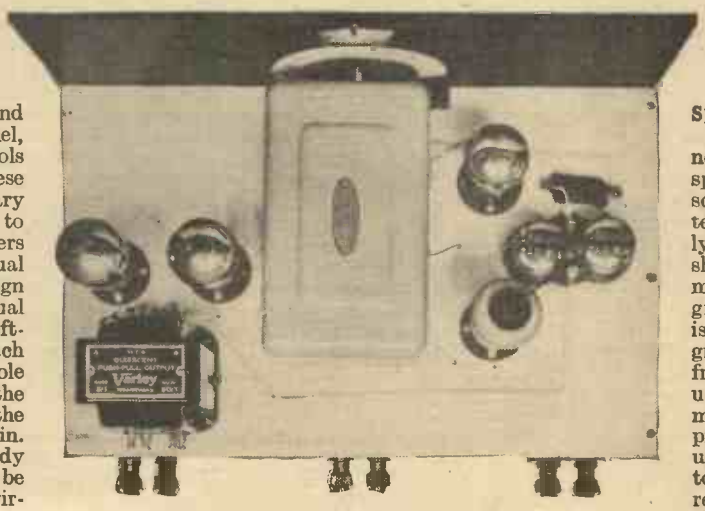
until the last, so that wiring is facilitated. Next screw down the valve-holders, and the other baseboard mounted components, making quite certain that the valveholders are put on the right way round. For this purpose pay particular attention to the direction of the anode pin of each valve. In order that all the constructional work may be finished before undertaking the wiring, it would perhaps be as well at this point to drill the panel. This is a fairly simple piece of work, and the only difficulty is likely to arise over the hole for the escutcheon. There is a drilling template supplied with the Radiophone condenser, and this should be cut so that the centre line comes to one edge of the paper, and the centre line should be marked down the back of the panel. Lay the template over this line, so that it coincides at both top and bottom. The edge of the baseboard comes 3⅞in. from the lower edge of the panel, provided the baseboard is ⅜in. thick. If any deviation is made in this respect it will have to be allowed for when marking out the hole for the escutcheon. The line upon which the remaining panel controls are positioned is 2in. from the bottom edge of the panel, and the two outside controls are situated 2¼in. from the right and left-hand edges of the panel, whilst the two remaining controls are situated 3¼in. from these towards the centre. The necessary holes for attaching the panel to the baseboard and the side runners may be drilled to suit individual ideas, but in the original design two holes were drilled at equal distances from the right and left-hand edges of the panel to attach to the baseboard, whilst one hole at each side serves to screw the lower part of the panel to the runners. These latter are 3½in. deep and 10in. long. As already mentioned, they should not be fixed into position until the wiring is completed, as there are one or two wires going to the coils which will be rather difficult to place into position if the runners are attached at this juncture.



Under view of baseboard.

Wiring

The wiring is carried out with the usual Glazite, the required lengths being cut off and the insulation stripped for a length of five-eighths of an inch at the end for the formation of a loop. This is a point which should be carefully watched when making the connections to the coils. If a space greater than five-eighths of an inch is bared, there will be a risk of the bare wire coming into contact with the coil screens, and this will result in a short-circuit. The loop for attachment to the terminals should be formed with a pair of round-nosed pliers, and made so that it fully occupies the bared portion of the wire. The actual connections to the coils should be made first, removing the covering cans for the purpose. It will not be out of place to repeat the warning which has already been given regarding the handling of these coils. Therefore, when making the connections, take great care that the screwdriver or pliers do not slip and damage the coils. Furthermore, as soon as all the leads have been attached to a coil, replace the cover, and remove the cover of the next coil, and so on. This method of carrying out the wiring will prevent disappointment due to damage which might arise through carelessness. It will be noticed that in the case of two of the coils more than two wires are taken to one terminal. This may, of course, be avoided by baring one of the wires and soldering the remaining leads to the bared portion, but this is a matter which must be left to the constructor. Notice that the Ohmite resistances are not fixed into any form of holder, but are simply held in situ by the stiff wire used for wiring-up.



The neat appearance of the top of baseboard.

Speaker Connections

In the photographs no connections are made to the loud-speaker terminals, and this is left so that the appropriate pair of terminals may be used. Similarly, the connections for the pick-up should be made according to the method which is to be adopted for gramophone reproduction. That is to say, if a self-contained radio-gramophone is employed, the lead from the detector grid to the pick-up terminal may be wired in permanently, whilst the remaining pick-up terminal should be taken up to the motor-board and joined to one side of the pick-up. The remaining lead from the pick-up should then be taken to one side of an ordinary on-off switch, which is joined on its other side to earth via a grid bias battery. Further notes and operating details, will be given next week.

THE LATEST DEVELOPMENT IN L.F. AMPLIFICATION.

WE HERE draw the reader's attention to the latest development in L.F. amplification, explaining the advantages of "Class B" working, and give advance details of the new types of valve which has been developed for the purpose. After the calm comes the storm, and fast in the wake of Q.P.-P. comes "Class B." Storm is not a far-fetched metaphor to describe "Class B" amplification, because it bids fair to take its place in upwards of seventy-five per cent. of the battery sets now in general use, and further, this ultra-economical "Class B" twin-valve speaks with a voice suggestive of thunder.

Q.P.-P. may have filled a certain need, or perhaps gap would be a better word, but it has certain disadvantages in its generally accepted form. Firstly, Q.P.-P. calls for two pentodes costing 35s.; secondly, with all but the larger pentodes, a high ratio output transformer is required; with low resistance speech coils the ratio is so high that it becomes impracticable, with the result that a makeshift ratio is used. Thirdly, the correct matching of anode currents in a pair of Q.P.-P. valves is a simple matter to the fortunate owner of a *suitable* milliammeter, but there are thousands of constructors not so equipped.

The New Valve

The "Class B" valve which we have received is the Cossor 240B*, which is the result of many months of extensive and continuous research, aimed to place in the hands of the battery user a make capable of giving all-mains volume for a few milliamps. So successful have the designers been that the valve, with suitable values, will give double the volume obtainable from the average mains set for a total anode current no greater than that taken by a small standard power valve.

Additional advantages of "Class B" include: simple speaker matching, low initial expenditure and upkeep costs, with volume far greater than that required for normal purposes, with irreproachable quality and simplicity.

Following the usual custom of PRACTICAL WIRELESS to be first with all important information, we shall very shortly publish an exclusive article, placing before our readers for the first time complete theoretical and practical details of this revolutionary valve.

* To be released shortly.

The BEGINNER'S SUPPLEMENT

Conducted by F.J. CAMM

Coil

THIS term is applied in a general sense to any length of wire wound round and round. In fact, it is capable of a very wide interpretation, and is not by any means confined to wireless. Almost any piece of electrical apparatus has some form of "windings" or "coils" of wire through which the current passes. Usually these coils are of copper wire with some form of covering such as rubber, cotton, or silk. Good examples are to be found in the field and armature coils of the dynamo and electric starter on a motor car, or the motor of an electric fan, or vacuum cleaner. Coils much finer wire of many thousands of turns are used in medical coils; the "coil" of the motor coil ignition system, magnetos, etc.

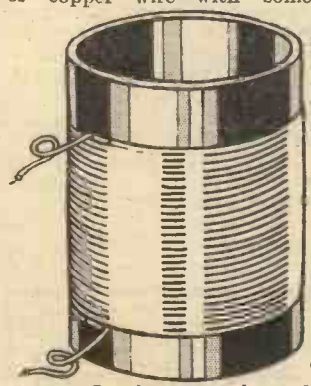


Fig. 1.—Simple tuning coil wound on an ebonite tube.

In radio the term is most often used to mean "tuning coils." Of course, other components embody coils as part of their construction, but they are not usually spoken of as such apart from the component itself. For instance, transformers contain *primary* and *secondary* coils, loud-speakers have *moving-coils*, so also have many measuring instruments such as milliammeters, voltmeters, etc.

Tuning coils form a necessary part of every wireless receiver. There must be at least one tuning coil in a set (although there are sometimes more), and it is connected directly, or indirectly, to your aerial. Wireless waves striking the aerial cause an electric current to flow through the coil. It is the fluctuations in this current which control the sounds emitted by your loud-speaker.

Fig. 2.—A typical plug-in coil.

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

The coil has to be "in tune" with the incoming waves, otherwise no current will be generated. To ensure this it has to have the right number of turns of wire—a few turns to receive short-waves, and a large number of turns for long-waves. Coils are usually wound with sufficient turns to receive the shortest waves required, and then, instead of adding more turns to get longer waves, a *tuning condenser* is joined to the coil. By rotating the knob of the condenser the coil can be made to tune to a range of different wavelengths. Any stations broadcasting on wavelengths within that range will then be heard as soon as the condenser adjustment is in the right position. The capacity of the condenser is unfortunately limited, so in order to extend the range still further, two and sometimes three, coils are wound on one tube. Each winding in turn may be connected to the condenser by using a switch.

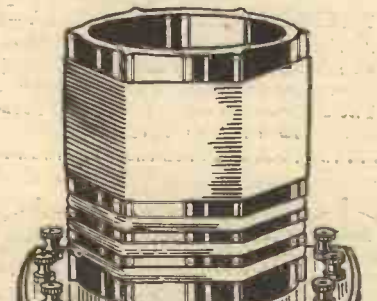


Fig. 3.—A commercial dual-range coil.

A few examples from the countless varieties of coils in existence are illustrated on this page. Fig. 1 shows one of the simplest coils possible. It is wound with cotton covered wire on a cardboard, or ebonite tube. Fig. 2 is a "plug-in" coil with the wire wound in lattice fashion. Fig. 3 is a typical dual-range coil. Fig. 4 is a similar, but more compact coil with a metal cover or shield. This last is the most modern type, and is used where compactness is desirable.

Coil Former

The support on which the wire of a tuning coil is wound. It may consist simply of a cylindrical cardboard, or ebonite tube, as in Fig. 1, or it may have "ribs" as in Fig. 3, which keep the wire from touching the rest of the tube. This latter pattern is usually more efficient as it tends to reduce any possible leakage of current from one turn of wire to the next should the insulating properties of the tube not be very good, or should the wire become damp. It also reduces what is known as the "self-capacity" of the coil. Low self-capacity is a very desirable feature in a coil. Self-capacity is at a minimum where there is the least possible solid matter near the turns of wire, so you can see that by supporting the wire well away from the body of the tube or former, the self-capacity is reduced. (See also, "*Self-Capacity*"). The coil former need not necessarily remain always in position. Some coils are wound so as to be self-supporting, and when the winding is completed the former is removed. One method greatly used by amateurs some years ago consisted of driving an odd number of nails into the circumference of a disc of wood. The nails were usually in two rows radiating from the disc like the spokes of a wheel. The wire was wound in lattice fashion in and out between the spokes. When complete it was soaked in wax, drained, and the "spokes" pulled out. It could then be slipped off of the

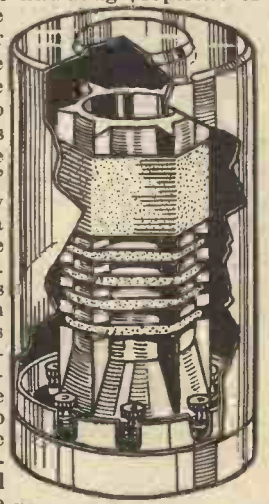


Fig. 4.—A screened coil with cover cut away to show coil.

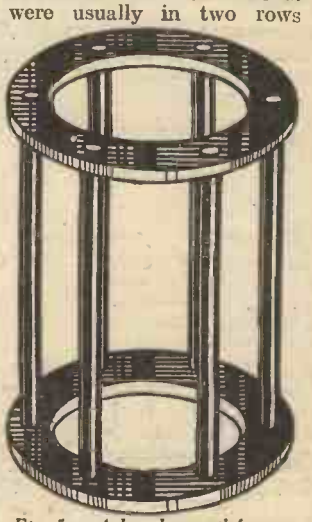


Fig. 5.—A low-loss coil former.

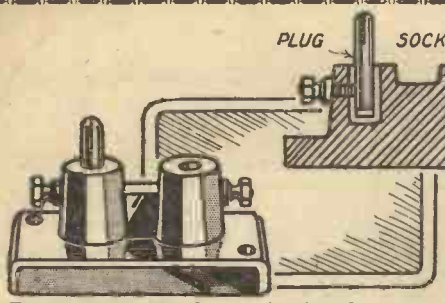


Fig. 6.—A coil holder for baseboard mounting also sectional drawing of the holder.

wooden disc and was ready for use. The honeycomb arrangement of the wire together with the wax prevented it from collapsing or unravelling. One of the most efficient types of coil former is that shown in Fig. 5. It is used for ultra short-wave coils, and is wound with bare copper wire. It is usually made of ebonite.

Coil Holder

A device for supporting plug-in coils. There are several types, the most common being baseboard mounting holders, as in Fig. 6. These consist of a small bakelite stand with a plug and socket to receive the coil and two terminals for making the necessary connections. Other types of coil holder are made to take two or three coils and allow of movement of the coils in relation to one another. A typical example is shown in Fig. 7. These holders are not often used nowadays as the plug-in type of coil has been largely displaced by the types shown in Figs. 3 and 4. Where plug-in coils are still used they are usually mounted on the baseboard in the type of holders shown in Fig. 6, and any variation in the coupling between them is arranged by means of variable condensers, and not by moving the coils nearer to, or farther from, one another.

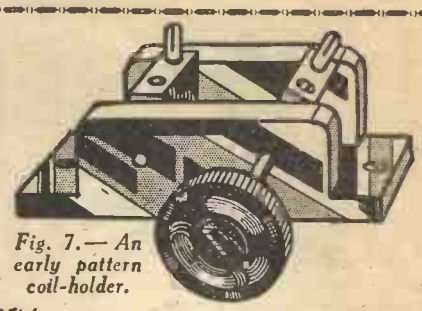


Fig. 7.— An early pattern coil-holder.

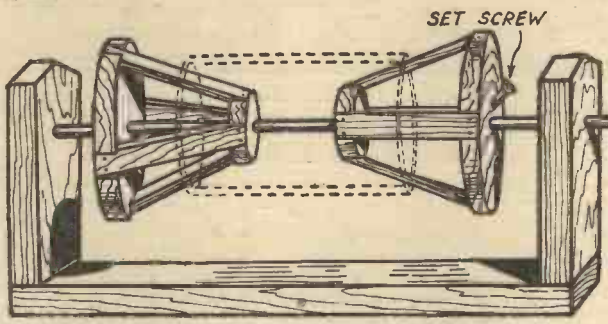
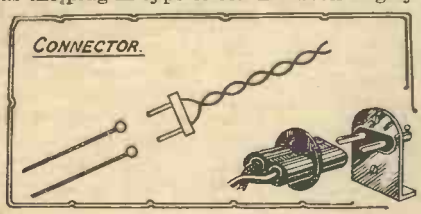


Fig. 8.—An easily-made coil winder. Dotted line shows position of coil former when being wound.

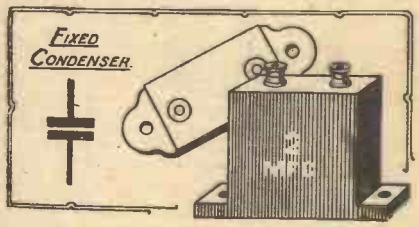
Coil Winder

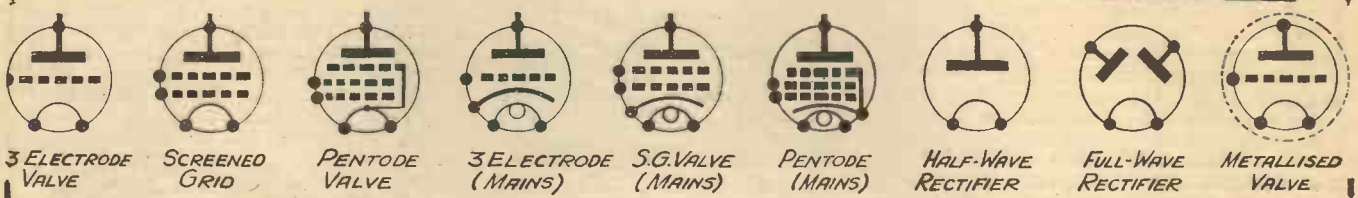
A machine for winding the wire on the former when making tuning coils. Manufactured coils are often wound on very elaborate automatic machines, but the home constructor, when he undertakes the making of his own coils, usually winds them by hand. This is quite simple, and if only an occasional coil is needed is quite satisfactory. If, however, a large number are likely to be wanted it pays in the long run to buy a simple coil-winding machine, or else to rig one up from odds and ends. The one shown in Fig. 9 is, as you will see, very simple to make. The object of the tapered wooden chucks is to accommodate any size of former. They slide along the spindle, but can be secured in any position by means of set screws. Ordinary wood screws with the points filed off will do. They should be screwed into the wooden discs forming the end of the chucks at an angle so as to pass through and drive into the spindle. To wind a coil the chucks should be placed one in each end of the coil former which should then be placed in position between the two uprights of the machine. Then thread the steel spindle through the whole lot and tighten up the set screws. The wire is fed to the revolving former by hand.

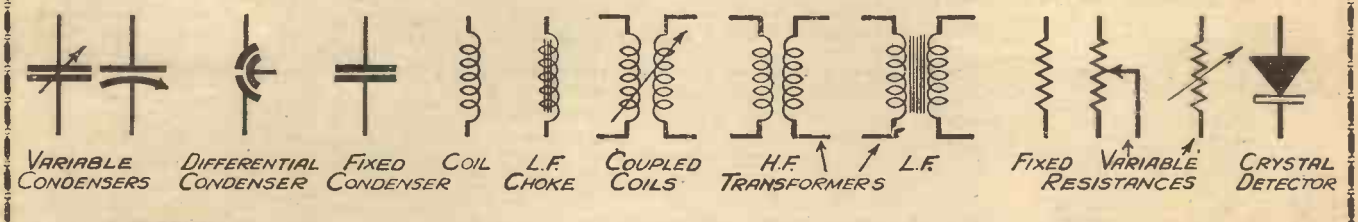


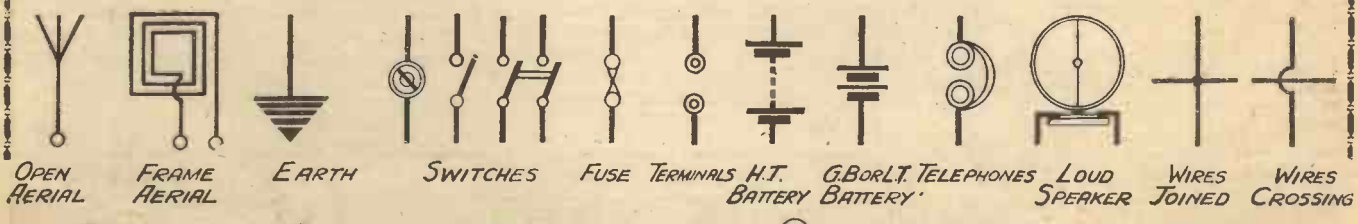
THE SHORTHAND OF WIRELESS.—4

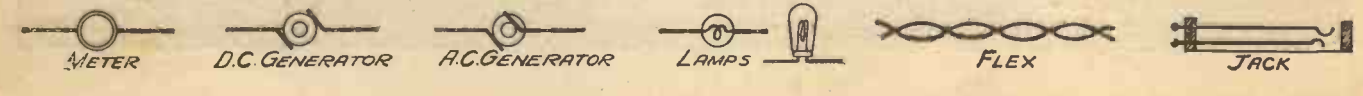
At the special request of many beginners, we reproduce below a complete series of theoretical signs used in wireless circuits. The diagrams to the left and right show two actual interpretations.











PETO-SCOTT RADIO BY MAIL

SNIP FOR "PRACTICAL WIRELESS" READERS

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1	DUBILIER 2 mfd. fixed condenser, type BB		3 6
1	GRAHAM FARISH 20,000 ohm resistance (Ohmite)		1 6
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1	PREH 10,000 ohm. Potentiometer Type B. Luxus		4 6
1	GRAHAM FARISH One Megohm Grid Leak		1 6
1	LISSEN .0003 mfd. Reaction Condenser		2 6
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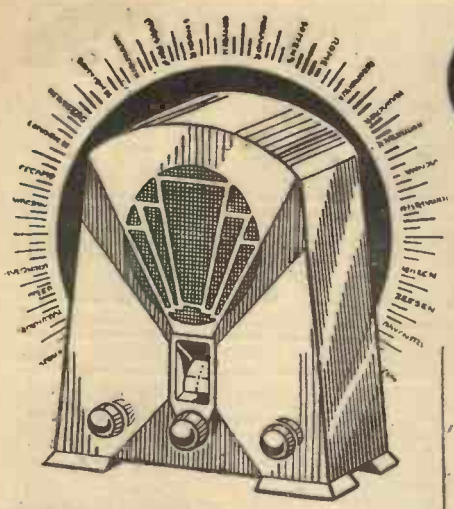


Our Views on Receivers

McMICHAEL DUPLEX MAINS FOUR (Transportable)

THE name of McMichael has been known in connection with wireless since before the days of broadcasting, and their new products year by year have invariably proved excellent examples of skill in workmanship and maintain the highest standards of performance. The Duplex Mains Four (Transportable) model illustrated on this page is no exception. Externally, it is most prepossessing, the chassis being housed in a figured walnut cabinet with an operating panel of polished grained ebonite suitably engraved. The control knobs are of polished ebonite, while a dustproof glass covered Duplex scale facilitates station logging. A pilot light shows whether the set is "alive" and a ball bearing turntable enables the whole set to be rotated and point in the direction of the station it is desired to receive.

The McMichael Duplex Mains Four (Transportable).

Circuit Details.

So much for external qualities and before giving details of performance attention will be turned to the circuit used in this set. It is a four-valve receiver using indirectly-heated A.C. mains valves. A dual range frame aerial (which incidentally has provision made for connection to an external aerial and earth system) tuned by a .0005 mfd. condenser is coupled to a MS4B metallized screened grid valve *via* a .01 mfd. condenser. The volume control is effected by adjusting the bias to the grid of this valve from a 2,000 ohm potentiometer, a grid leak of 0.5 megohm resistance being included in the circuit together with proper decoupling. In the anode circuit of this valve there is a dual range coil functioning as a tuned anode circuit (gang tuned with the aerial circuit) with the usual grid leak and condenser coupling to a second high-frequency valve, an AC-HL metallized. A high-frequency choke in the anode circuit of this second valve serves to checkmate the high-frequency currents and the reaction control—a .0001 mfd. differential condenser—is included here, the feed-back taking place by means of a reaction coil coupled to the tuned anode coil of the first valve. This second high-frequency valve is coupled to the detector valve, an AC-HL metallized, by the conventional resistance capacity method, the detector valve functioning in the normal leaky grid fashion.

Provision is made here for a pick-up jack. In the anode circuit of the detector valve we have a second high-frequency choke by-passed at each end with two condensers of different capacity, namely, .001 mfd. and .0003 mfd, the first named being connected at the anode end of the choke and the second at the H.T. end. In the output stage there is a pentode valve, AC-Pen, this being coupled to the preceding detector stage by a transfeeda unit (resistance capacity fed transformer method). The signals are fed by a transformer to a moving-coil loud-speaker (provision being made for the use of an external speaker when such a course is desired) whose energized field acts as the smoothing choke in the main H.T. feed. Dry metal rectifiers connected up as voltage doublers supply the main H.T. current and throughout the circuit it is noticed that adequate decoupling provision is made and this very effectively removes the slightest trace of L.F. instability. In a compact transportable mains set of this character this feature is essential if consistently good performance is to be maintained.

Controls.

The complete metal chassis accommodating all the set's components is a remarkably fine piece of workmanship, being neat and compact but with each part readily accessible on those remote occasions when servicing becomes necessary. Very complete and explicit instructions are furnished for installation and operation, and in addition there is a service manual available at no charge for those who should desire same, this latter giving full details for testing and servicing when such is necessary. Having seen that the valves are firmly in their sockets by removing the back, the mains plug is simply inserted in place and the set switched on *via* the combined switch and volume control, the reaction control being left at minimum. Both the pilot light and Duplex scale light up and after a wait of approximately twenty seconds the set is ready for use.

The normal working position of the volume control is with the index pointer opposite the letter "L" in the word "volume" but in places remote from broadcasting stations greater range is obtained by turning the control round to maximum. On the left-hand side of the control panel is a lever marked "range" and when moved up and down the wavelength pointer is correspondingly moved up and down so that it can sweep over the medium or long-wave markings on the scale. In use the pointer is set to the actual wavelength of the station desired and within reasonable distance of that station it will be heard, the final and critical tuning being obtained by the trimming device, that is the right-hand lever marked "adjust."

The reaction control on the left of the control panel intensifies the reception in the usual manner and causes the set to oscillate, a necessary feature when searching for distant transmissions. The selectivity of the instrument, while already remarkably high, may be further increased by reducing the volume on the right-hand control and turning the reaction control in a clockwise direction when it will be observed that the tuning becomes sharper on the knurled control.

Performance

Using the frame aerial alone it was possible to tune in at full loud-speaker strength over thirty stations with ease. This number was doubled when a small external picture rail aerial and good earth was added.

Background noises, often very troublesome in a set of this nature, were absent, while the quality of reproduction from the moving-coil loud-speaker was markedly natural. Speech was crisp and clear without any slurring of sibilants, while musical selections and songs came through in a manner which was a delight to listen to. The price of the set is 21 guineas, complete, this being for either 100-115 or 200-250 volt models.

TEMPORARY EXPEDIENTS

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc.

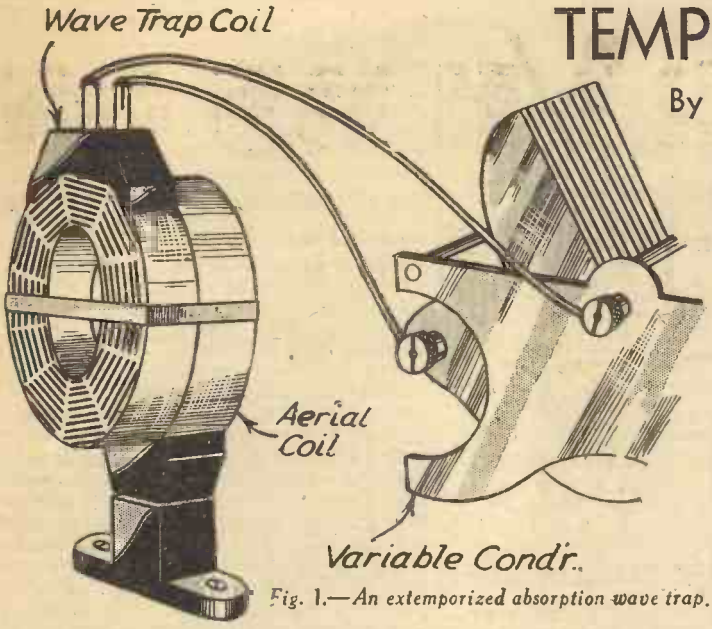


Fig. 1.—An extemporized absorption wave trap.

THE sage who declared that you cannot make a silk purse out of a sow's ear never spoke a truer word, and the adage applies with its full force to radio. Good reception and consistent results cannot be obtained without good design and good components. In an emergency, however, passable results are obtainable by the use of temporary expedients and there are hundreds of little wrinkles whereby substitutes may be made to serve a turn. Many of these have been published in PRACTICAL WIRELESS from time to time, and here is another selection which readers should bear in mind for necessitous occasions.

Everyone knows the vexation which is caused when a major component such as a condenser or a transformer breaks down—usually just when a most interesting or important transmission is about to commence. The knowledgeable constructor, however, frequently can provide a jury rig which will tide matters over until a new part can be obtained.

Transformer to R.C.

For example, suppose the primary winding of your low frequency transformer burns out suddenly. You can speedily convert the stage for resistance capacity coupling in this way. Disconnect the burnt out primary winding and in its place fit a spaghetti or metallised resistance, then connect a small fixed condenser between the anode of the detector valve and the grid terminal of the transformer secondary, leaving the secondary winding with its normal connections to serve in place of the more conventional grid leak. Fig. 3 shows exactly how this is done.

The value of the anode resistance should be from twice to five times the impedance of the detector valve, but for temporary use the actual value is not critical and even an old grid leak will do at a pinch. The same remarks apply to the value of the coupling condenser for any capacity between .005 mfd. and .05 mfd. will serve. It is true that in all probability the detector valve is not a true R.C. valve, that is, one of the fairly high impedance, high amplification factor type, so that for this reason and also because of the loss of the transformer step up the overall magnification of the stage, and therefore the volume of the sound, will suffer, but your set will have been saved from temporary dumbness.

If it is the secondary winding of the transformer which has broken down it is not so simple to apply a temporary remedy. Of course a hasty resistance capacity coupling can be hooked up if you happen to have a resistance, condenser and grid leak of approximately correct values to hand. Failing this, it is useful to remember that any old transformer, however ancient, can be made to serve, and will give quite reasonable quality, too, by adopting the well-known parallel feed system. It means, of course, a resistance of about 50,000 ohms and a condenser having a capacity of 1 mfd. or thereabouts, but values departing greatly from these figures will give results of a sort.

Another method of using a transformer with a broken secondary winding is to convert to choke capacity coupling. To do this leave the primary winding connected to act as a low frequency choke, disconnect the faulty secondary, connect a small condenser from the detector anode to the grid of the next valve and a grid leak from the grid to G.B.—. This arrangement is indicated in Fig. 2.

A broken down resistance in a complete R.C.C. unit can be repaired by connecting a spaghetti resistance of suitable value between the anode and H.T.+ terminals of the unit. It is not a bad plan to keep on hand a small assortment of spaghetti, grid leaks and fixed condensers for emergency use, and remember that instead of a fixed resistance a potentiometer or volume control can always be used at a pinch, and there is no reason why a variable condenser should not be requisitioned as a coupling condenser if no fixed capacity unit is available.

Another Vulnerable Point

Another rather vulnerable point in radio sets is the high frequency choke so often included in the detector anode circuit to sidetrack the high-frequency currents to the reaction circuit. Should this break down it is useful to know that the average long-wave tuning coil can be used as a temporary substitute. A plug-in coil of size No. 200 or thereabouts will probably be quite satisfactory. It should be borne in mind, however, that coils of this type have a fairly large magnetic field and may cause a considerable amount of magnetic coupling, often sufficient to produce a condition of instability. It may be necessary, therefore, to move the coil about until a position is found where no harmful effects are noticed. Alternatively, the coil can be screened, and for this purpose any tin box such as those used for packing cocoa or other products can be used. Even a wrapping of "silver" paper can be used for a temporary screen. Many modern low-frequency transformers of good quality have a primary winding of sufficient inductance to render the use of a high-frequency choke, if not quite unnecessary, at least unessential in an emergency, so if your H.F. choke does go down, try shorting it out by connecting a wire across its terminals.

Temporary Measures for Mains Sets

It is not wise to play too many tricks with an all-mains set, but there are some directions in which temporary expedients may be used. For example, if the rectifier valve should fail, some sort of results can be obtained by using in its place any four-volt valve of fairly large emission which is handy. There have been many recorded cases of old "bright emitter" general purpose valves spending their last days as "temporary" rectifiers, while four-volt output valves will also serve. Of course under this treatment the life of the valve will not be very long, and it is not likely to be of much use for its legitimate purpose afterwards, but there are occasions when it may be considered worth while to take these somewhat heroic measures.

If the filament winding of your power transformer breaks down, it is as well to know that indirectly-heated valves can be operated quite satisfactorily from a four-volt accumulator. Of course the consumption is high—that is one ampere per valve—but if you are a car-owner your car battery will stand the strain quite well. Do not forget, however, that if you adopt this

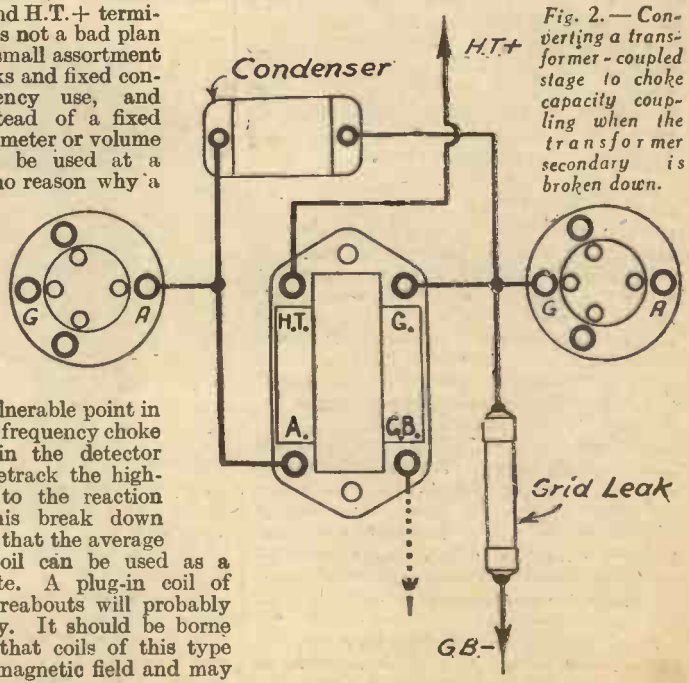


Fig. 2.—Converting a transformer-coupled stage to choke capacity coupling when the transformer secondary is broken down.

expedient it will be necessary to connect the centre point of the battery; that is to say, the two-volt tapping of the battery, to the cathode wire of your set—*i.e.* to the point usually connected to the centre tap of the filament winding. This is necessary to complete the anode circuit of the output valve, should this be of the directly-heated type.

While on the subject of filament transformers, it sometimes happens that the centre tap is not at the true electrical centre, with the result that bad hum is experienced. The usual cure is to disconnect the lead from the centre tap and join it to the slider of a potentiometer connected across the filament winding. Quite a low value of resistance, say 100 ohms, is suitable, but if no potentiometer is available a satisfactory "hum dinger," as it is sometimes called, can be improvised from two old filament resistances connected in series across the filament winding and with their point of junction joined to the set's cathode wire.

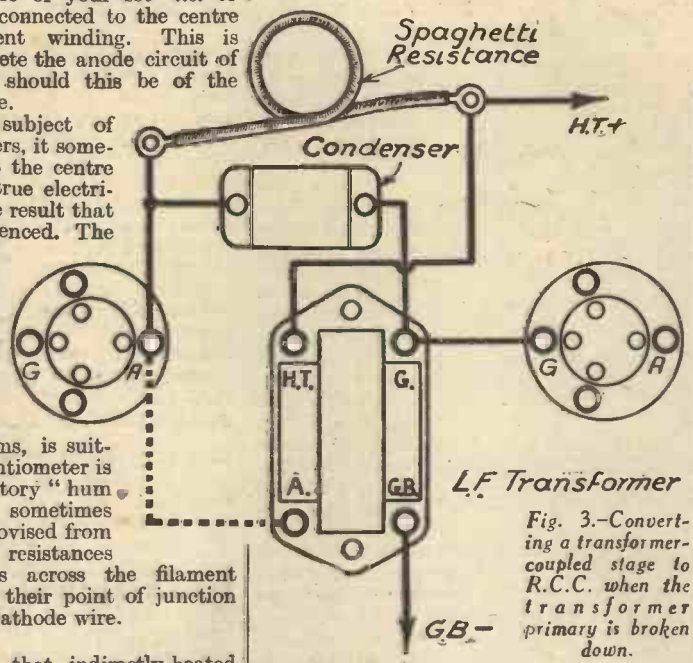


Fig. 3.—Converting a transformer-coupled stage to R.C.C. when the transformer primary is broken down.

Variable Mu's

It is not often that indirectly-heated mains valves fail, but if you are using a variable mu valve and it does happen to go on strike, you can often replace it temporarily with an ordinary screened-grid valve. It will be necessary, of course, to cut out the variable biasing resistance, and you will not be able to obtain the volume-control effect which you enjoyed with the variable mu.

It is not generally realized that it is not essential for the biasing resistance of variable mu valves to be incorporated in the set itself. As the resistance is in the cathode lead and not in the grid circuit, it may be removed quite a considerable distance from the set without harmful results. Fitted at the end of a pair of flexible wires, which can be taken to any part of the room, distant volume control may be arranged. It is very convenient to be able to control the volume on occasions from your chair instead of having to tinker with the set.

Most listeners to-day are installing modern and highly-selective sets, and it is rather old-fashioned to talk about wave-traps. It may happen, however, that you are troubled with a little interference which you cannot cut out with your existing tuning, especially if your set is of the detector and L.F. type. An "absorption" wave-trap is easily rigged up at short notice. Should your set have plug-in coils, look out a coil of approximately the same size as your aerial coil and place it as close to the aerial coil as you can, keeping it in close coupling with a couple of elastic bands. From the ends of this coil run wires to a variable condenser of .0005 mfd. capacity. This can be accommodated anywhere. Now tune in with the aerial tuner to the interfering station, and then adjust the condenser of the wave-trap until the interference disappears, after which you can proceed to tune in the wanted station. Note that the wave-trap is not electrically connected to the receiver circuit in any way—it is just a tuned circuit closely coupled to the aerial coil as shown roughly in Fig. 1, and its function is to absorb any signal of the wavelength to which it is tuned.

ABC OF SELECTIVITY

Continued from page 6.

the desired station is of a certain strength, but accompanied by interference, yet with reaction it is still the same strength, but without interference. Of course, some method of reducing the input is necessary in order to achieve this result.

A Useful Expedient

The method just described of reducing the input from the aerial and compensating for the resultant loss of signal strength by increasing the reaction is quite commonly used, and is a very useful way of reducing interference from other stations.

Band-pass Filters

As I have already said, the single tuned circuit has its limitations, and if it is found that such a circuit when efficiently designed and used with a judicious amount of reaction is still inadequate then the only thing to do is to use more than one tuned circuit. Perhaps the simplest arrangement is the addition of another tuned circuit before the detector. The two circuits are loosely coupled, the degree of coupling determining the shape of the resultant response curve. The advantage of this scheme is that it gives increased selectivity without a very great loss in signal strength. Such an arrangement is shown in Fig. 7, which is an illustration of one of the popular *Band-Pass Filters*. Here the coupling, which is partly capacitative, and partly inductive, is of such a value as to give a flat topped response curve.

THE ATLAS Q.P.-P. MAINS UNIT MODEL "Q.P.24"

The Mains Unit illustrated below has been developed by Messrs. H. Clarke & Co. (M/C), Ltd., especially for use with receivers employing the Quiescent Push-Pull principle. There are four tappings, one negative and three positive. Tapping 1 gives 60/80 volts for Detector or H.F. valves; Tapping 2 gives 130/140 volts and enables accurate adjustment of Pentode valves to be made. The third tapping is 150 volts fixed. The average output is 150 volts at 12m/A which enables it to operate satisfactorily on multi-valve sets employing this particular type of output stage. The price is £3 12s. 6d.

The new Atlas Q.P.-P. Mains Unit.

MATCHING YOUR SPEAKER

Continued from page 7.

VALVE 215P.

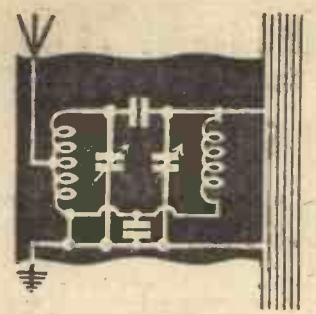
Anode Volts = 100. Grid Bias—1.6.

Resistance Ohms	Current Milliamps	Valve Output Milliwatts
1,000	8.0	64
2,000	7.0	98
3,000	6.2	115
4,000	5.8	134
5,000	5.2	136
6,000	4.8	138
7,000	4.5	141
8,000	4.2	140
9,000	3.8	130
10,000	3.5	123

course, the figure 4.5 will probably be different in your case and is only given here as an illustration.

Variable Ratio Transformers

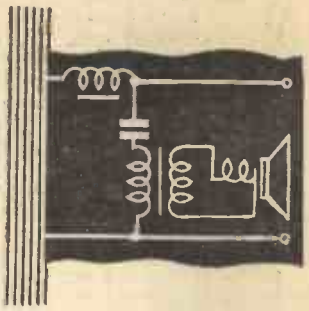
If the current is appreciably more or less you will probably obtain better results with a different speaker or by using a step-down transformer. If your speaker has a variable ratio transformer it will only be necessary to find the terminal that gives a milliamp reading in the anode circuit equal to or the nearest below the figure required. It will not do to reduce the anode current by altering the grid bias or by putting a resistance in series with the speaker, but you can put two speakers in series when you may get greater volume with less anode current.



RADIO RAMBLINGS

By JACE

Jottings from my Notebook



Broadcast Music

I SEE it has been suggested by a well-known musical composer that special music will have to be written for broadcasting purposes. His theory is that under present conditions it is quite impossible for either transmitter or receiver to do justice to the range of frequencies encompassed by existing musical scores. Of course, there is much truth in this, especially since the frequency separation of the main European transmitters is only 9 kilocycles. (This makes it impossible to take full use of musical frequencies exceeding 4½ kilocycles for any other than "local" reception.) Nevertheless, I think that we shall find it a more acceptable problem to devise means of allowing a wider station separation rather than to narrow down our harmonic range.

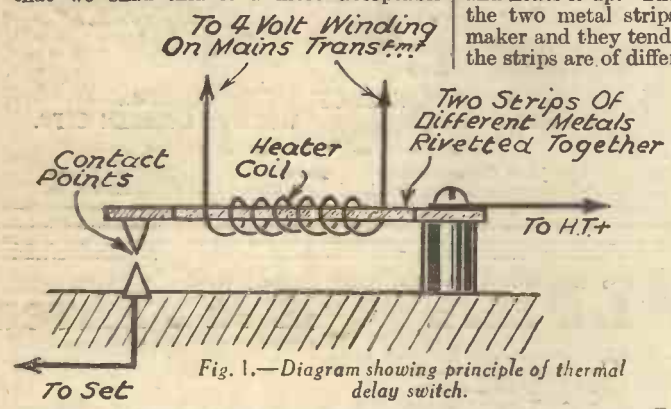


Fig. 1.—Diagram showing principle of thermal delay switch.

Selectivity or Quality?

HISTORY repeats itself in wireless matters just as with everything else, and the old controversy as to whether or not broadcast sets should be designed for purely local reception or whether they should be capable of receiving over long distances has cropped up again. On the one hand it is said that the foreign programmes are scarcely ever used for real entertainment purposes, whilst on the other we have the folk who swear they scarcely ever listen to the home stations. My personal opinion is that all better-class receivers should be designed to bring in a number of foreigners—with the proviso that they should give really good quality from the British stations. You might argue that the two conditions cannot be fulfilled in any one instrument, because a selective set, which is necessary for distant reception, cannot possibly give perfect quality. But why not make the set so that the degree of selectivity can be varied as easily as can the volume?

Thermal Delay Switch

THIS reminds me of another scheme for preventing the application of excessive H.T. voltages to the receiver components, and which is employed principally with more powerful sets and amplifiers taking a very high anode voltage. I refer to the use of what is commonly known as a thermal delay switch; the principle of this is that the H.T. supply circuit is automatically broken until the valve cathodes attain a normal working temperature. The switch consists essentially of the parts shown in the sketch of Fig. 1; two contact points are connected respectively to the H.T. positive lead from the rectifier smoothing system and to the H.T. circuits of the set; the two ends of the coil are connected to the 4-volt heater terminals of the mains transformer. When the mains supply is switched off the H.T. contacts are open, but after switching on, current flows through the coil and heats it up. The heat is transferred to the two metal strips forming the contact maker and they tend to expand. But since the strips are of different kinds of metal the expansion is uneven and, being riveted together, they bend and so close the H.T. contacts. The switch is generally designed so that the coil heats up sufficiently to close the contacts in the same space of time as the valve cathodes take to reach the correct working temperature.

The Super-Regenerative Receiver

THE super-regenerative receiver looks like returning to popularity for long distance short-wave reception. This type of set was popular with amateurs about 1923, but its principal disadvantage was that reception was always accompanied by a high-pitched whistle or hiss. On the shorter waves, however, this form of interference is much less pronounced and can, in fact, be almost completely eliminated. The idea of the circuit is that the detector valve is more or less continually maintained in a state of oscillation. But to prevent the carrier wave being heard as a whistle the oscillations are "quenched" at supersonic frequency, or in other words, some 20,000 times a second. As a result, although the detector is oscillating the usual heterodyne note is not heard. Sometimes a single valve is made to perform the combined function of oscillating detector and quenching valve.

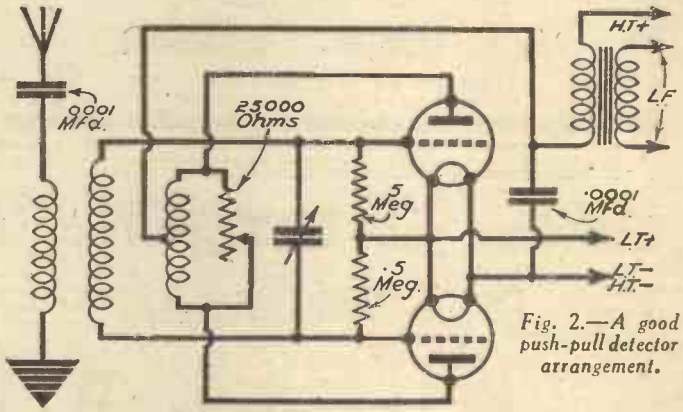


Fig. 2.—A good push-pull detector arrangement.

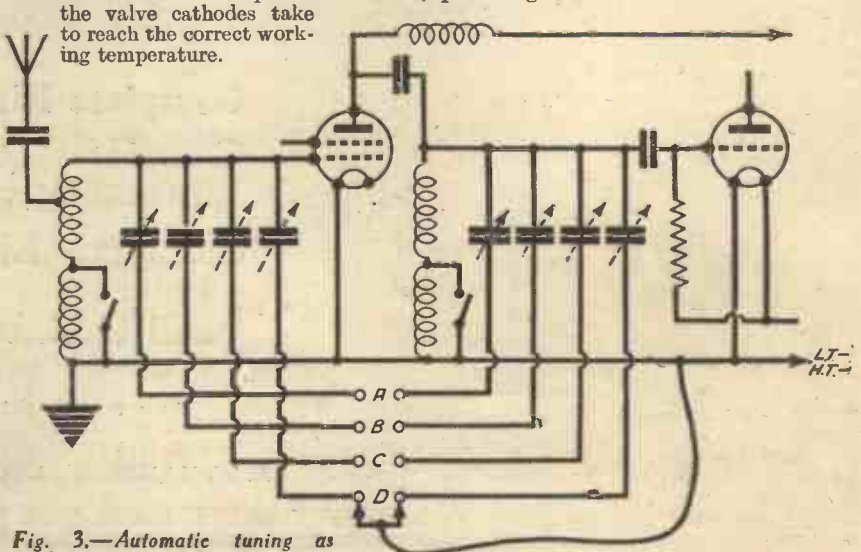


Fig. 3.—Automatic tuning as applied to a screened-grid receiver. Details concerning this arrangement were given in last week's Radio Ramblings.

The Only Way

WHILE things remain as they are, we listeners will have to fight our own battles. If we know the cause of the interference, we must approach the owner of the apparatus concerned and reason with him to apply a cure. Should he refuse it is not a bad idea to invite him round to hear the disturbance he is causing, but beyond that we can do nothing. At least, we can do nothing to cure the existing interference, but we might minimize future trouble by insisting that any electrical device we might buy, such as a vacuum-cleaner, hair-drier, etc., shall be effectively silenced. By so doing we shall strike at the root of the trouble and possibly, in time, make the manufacturers realize that we will not buy any apparatus which is a potential source of interference with our musical entertainment.

Ask the Post Office

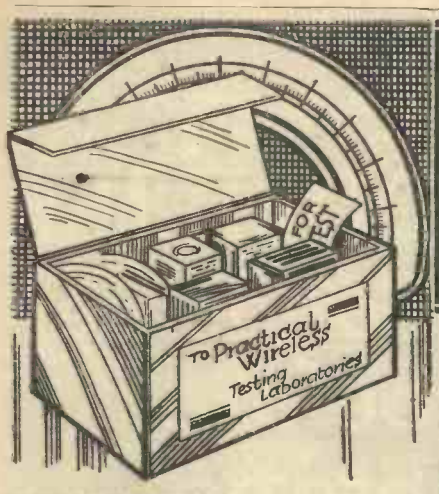
ANYONE suffering from electrical interference of which the source is unknown would be well advised to call in the assistance of the Post Office, by making application either at the local branch or by writing to The Secretary, General Post Office, London, E.C.1. The P.O. engineers have already done some excellent work in this direction, and are apparently only too pleased to do more. No charge is made, unless some silencing device, generally only a combination of fixed condensers, is necessary to effect a cure, and in that case the owner of the apparatus is called upon to carry the bare cost of the components. This is, in effect, a reply to numerous querists who have recently written to our Advice Bureau, and it might be helpful to many who have not yet written. It must be borne in mind that no person or firm is compelled to silence any apparatus, so it is useless to adopt a "high-handed" attitude; a little gentle persuasion will prove far more effective in the long run.

A Station Log-Dial

I HAVE previously suggested in these notes that some kind of calibrated tuning-dial would be very much appreciated by the amateur constructor. In view of this, I am very pleased to note the introduction of a new drum dial of excellent design. The drum is some 3ins. wide, and has the ordinary 0-180 degree scale running round its middle. In addition to the usual window, however, there are two others, one on each side of that through which the scale divisions can be seen. The plain white, matt-finished, celluloid drum is visible behind the side windows, and it can easily be marked with a pencil to show the names of stations corresponding with various scale readings; medium-wave stations can be marked in one window and long-wave ones in the other. Unlike most station-calibrated dials it is adaptable to any wavelength changes, since the pencil marks can easily be erased with an india-rubber.

Reception Conditions

SINCE I last referred in these notes to the reception of American medium-wave stations, there has been a most decided tendency for conditions to become worse. Whereas towards the end of last year, and especially just after Christmas, I found no difficulty in bringing in at least four "Yanks" at good strength on any evening with my "Selectone," I now have some difficulty in receiving even an odd one until well into the "wee small hours."



Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

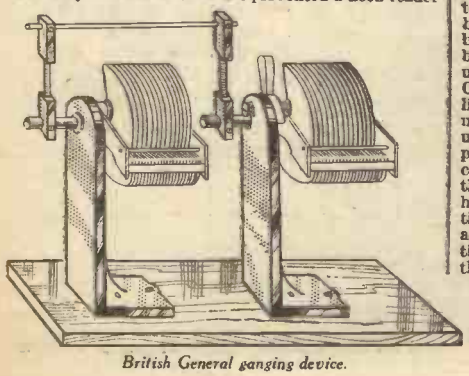
LISSEN UNSHIELDED COIL

A NEW coil has now been produced by Messrs. Lissen, Ltd., and is illustrated below. This is of the Dual Broadcast Band type, tuning from 190 to 560 metres on the one band, and 800 to 2,100 on the other. It will be noticed first of all that the minimum wavelength has been reduced so as to enable the now popular Fécamp station to be well received. With many of the older coils, of course, the minimum wavelength was about 220 metres, and this prevented the correct tuning of this station. The appearance of the coil is very neat, being finished in mottled bakelite and provided at the top with a small knob. This is the adjusting screw of a small pre-set condenser, and with this at its maximum setting the minimum wavelength is raised a few metres. The inductances of the coil for both bands are 0.18 mhy. for the medium, and 2.3 mhy. for the long, and these inductances are guaranteed to within 10 per cent (plus or minus). The disposition of the terminals on the base of the coil will enable it to be mounted direct on to the Lissen Triple switch, and in this condition it forms a most easily-mounted, and highly efficient component. The use of this type of coil, is, of course, owing to the fact that it is not screened, restricted to one or two simpler types of receiver, but as the cost has been reduced to the low figure of 5s. 6d., it is rendered admirably suited for the listener who wishes to make up a simple, cheap, yet at the same time, efficient little receiver for general all-round purposes. It may thoroughly be recommended.

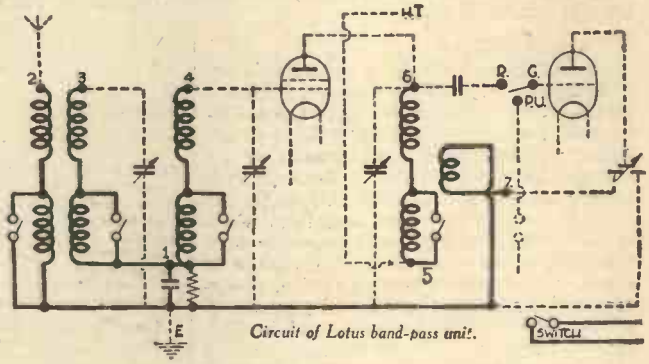
New Lissen unshielded coil.

BRITISH GENERAL GANGING DEVICE

MANY keen experimenters often find a necessity for using a ganged condenser, when such condenser is not readily handy. The cost of purchasing such a condenser is one of the principal drawbacks, and many a time has no doubt prevented a keen reader from trying out some little idea where such a condenser was a necessity. In addition to those readers just mentioned, there are no doubt many who possess two separate condensers, and who wish to make up a set employing a ganged condenser, but who do not feel disposed to scrap the two existing condensers and buy a ganged unit. The little device shown below has been produced especially for the benefit of this class of listener, and it is a most efficient device. As can be seen, two brackets are supplied, into which ordinary condensers may be mounted by means of the normal one-hole fixing screw. To the spindle of each is screwed one of the special bars which are, in turn, locked together by means of the rod. A small device (seen on the rear condenser) enables trimming to be carried out where necessary. This is an extremely useful accessory and can be recommended. The price is 2s. 6d.



British General ganging device.



Circuit of Lotus band-pass unit.

HOWE BOX BAFFLE

THE principle of filling the corners of a cabinet with non-resonant material for the avoidance of resonance has already been mentioned in these columns, and the Howe Box Baffle was referred to. This is the patented device which is used by the B.B.C., and it is claimed that all resonance is removed and that the reproduction from a moving-coil speaker fitted in such a cabinet gives the very best reproduction. Readers who are interested in this device should write to the manufacturers, Messrs. F. McNeill and Co., Ltd., 52, Russell Square, W.C.1, for a copy of the booklet issued by them describing the invention, and showing the various types of cabinet manufactured and incorporating the device. Where a good cabinet is already being used we understand a special simple box baffle may be purchased for insertion in the existing cabinet. In the smallest size, 15in. by 15in. by 10in, made of thick plywood and complete with the absorbent material, the price is 30s. In polished oak, walnut or mahogany, the price is 37s. 6d.

LOTUS BAND-PASS UNIT

WE have already mentioned that the Lotus Company were producing a new type of triple band-pass unit, and the unit is now ready for the market. Slight improvements have been made in the experimental model which was submitted to us originally, and the unit is shown in its completed form in the lower right-hand corner of this page. The unit is one of the neatest and most comprehensive we have yet had the pleasure of examining. As can be seen, the base is very deep, and is made up of stout aluminium, with a substantial front plate bolted into position. The whole assembly is, therefore, extremely rigid. As was mentioned in the previous report, the assembly consists not only of the three band-pass and secondary coils, but also the band-pass coupling units and an on/off switch. On the complete unit a bakelized card is attached to the under-side of the base, and upon this is printed the complete contents and wiring. A copy of this is reproduced at the top of this page. The heavy lines denote the portions of the circuits which are included in the Unit, and the broken lines show the wires and components which are required to be added to complete the receiver. As can be seen from this diagram, there is very little left. In the event of the small coupling condenser not being required, or some different value being wanted, terminal 1 is joined to the earth terminal. The total inductance of the combined coils as used for long waves is 2,160 microhenries, and the medium-wave inductance is 155 microhenries. The inductance of the three coils in respect to each other is guaranteed accurate to within 1 per cent., whilst the tuning range is 200 to 550, and 900 to 2,000 metres. A very important feature of this Unit is the provision of a Radio-Gram. switch, so that the control knob which projects from the front serves as a wave-change switch, on/off switch, and Radio-Gram. switch, and this greatly reduces the number of controls which are normally required on the panel. The on/off switch is of the Q.M.B. type rated at 5 amps. The Unit is sold complete with art metal escutcheon engraved off-short--gram-long. The price has now been fixed at 27s. 6d.

The Lotus band-pass unit.

LISSEN I.F. BAND-PASS TRANSFORMERS

WE have received from Messrs. Lissen samples of their new Band-pass Intermediate Transformers for use in superheterodyne receivers. These are, in appearance, very similar to the standard Lissen screened coil, and to ensure accuracy the necessary padding condenser is included in each coil, is adjusted by the makers at the works, and is then sealed. The most interesting feature of these coils is their size, for they are by far the smallest we have yet seen of this type. The transformer is tuned to 126 kc., and it is claimed that a stage gain of the order of 100 can be obtained with an appropriate valve. No trimming is required, and these coils would appear to meet a great demand. We shall have more to say about these in a later issue.

(*Continued on page 39.*)

Simple Home-Made Tuning Coils

An Explanation of the Principles Governing the Design of Efficient Tuning Coils, with Constructional Data to enable readers to make up various types of Tuning Inductance.

By W. J. DELANEY

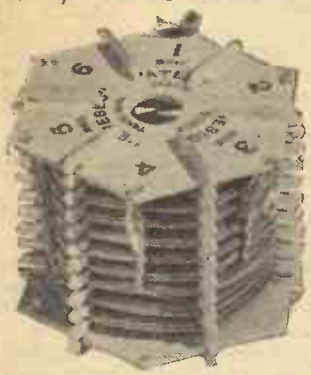


Fig. 1.—Three simple broadcast coils, made up according to the details in this article.

THERE is a certain fascination in making up your own wireless parts, and probably one of the simplest parts of the normal receiver which can be made by the average listener is the tuning coil. Fixed condensers, low-frequency chokes, high-frequency chokes, and one or two other parts of a receiver certainly may be made at home, but these are now obtainable so cheaply from the manufacturer and are so standardised, that there is not much fun in making these. The tuning coil, however, comes into a different category. It is true that there are many different makes of tuning coil on the market, and that these are certainly not expensive. It is also true that the different types of coil which are manufactured should enable everyone to choose a coil to suit a particular need. The coil is so simple to make, however, that many listeners prefer to carry out this part of the construction of a receiver—not on the grounds of saving expense, but purely out of interest in the art of radio. This article is, therefore, not written to tell you how to save money, but how to make up different types of coil for experimental use, and it should be borne in mind that the commercial coil, made by a reputable manufacturer, will be of a higher degree of efficiency (although more expensive), and will be most certainly standardised, so that where a second coil is required to match one already in use, it may safely be taken that a second coil of the same make as the first will be identical in all respects. However, the following notes will no doubt prove of interest to many readers.

What Governs the Efficiency

A tuning coil, as every reader now knows, consists of a coil of wire, either wound on a former of some type, or self-supporting. The electrical features possessed by the coil include high-frequency resistance; self-capacity; inductance. The H.F. resistance is determined by the thickness of the wire; the self-capacity is governed by the spacing of the adjacent turns; and the inductance is governed by the number of turns (principally). In addition to these features, there is what is known as "dielectric losses." This means that the high-frequency currents are able to leak away through the material from which the coil former is made, and obviously these losses must be kept at a minimum. A reduction in the high-frequency resistance may be obtained by using very thick wire. This leads to a rather clumsy coil, and when a coil is large, the surrounding electrical field is also large (I am speaking, of course, of the plain solenoid, or cylindrical coil). The H.F. resistance may be lowered by using stranded wire, but this is expensive, and owing to the size of the electrical field, leakage losses occur, and there is also the risk of stray couplings with other components in the receiver. The spacing of the turns will reduce the self-capacity, but here again the size of the coil will be increased, with the same troubles as previously mentioned. Dielectric losses may be reduced (or even completely eliminated) by making the coil self supporting.

Is It Necessary?

From the foregoing remarks it will be obvious that the design of a *highly efficient* coil is no simple matter, and the question therefore arises, "Is all this necessary?" For the average home-receiver, where it is not desired to get 100 per cent. efficiency from one or perhaps two valves, it is certainly not. For an experimental receiver, built with the idea of achieving results from a one-valve set which are comparable with a five-valver, by all means study the points above set out—but remember, if the coil is to be 100 per cent. efficient, every other part of the receiver must also be of the same order, or you will be wasting the efforts spent on the coil construction.

Easily Made Coils

The use of an ebonite former upon which to wind a tuning coil will enable dielectric losses to be reduced to a very low order. The type of ebonite former having a series of ribs along the surface will enable the coil to be practically air-spaced and will increase the efficiency. The difficulty arises, however, in the homes of many readers, of making the necessary slots to accommodate a pile winding, or of even making the anchoring holes or securing holes for terminals. Where this is the case, or for those readers who are desirous of making up a series of coils for experimental purposes, with the advantage of stripping down one coil and building

(*Continued on page 36.*)

SIMPLE HOME-MADE TUNING COILS

(*Continued from page 35.*)

Fig. 2.—A simple wave trap.

another of a different type, the coil former illustrated in this article will be found extremely useful. This is the article known as a "Ewebec" former, and, as can be seen, it consists of two hexagonaldiscs of bakelised material, with six strips of similar material having one edge smooth and being cut on the opposite edge into a number of slots—very similar to the ordinary comb. The two discs are provided with slots, and slots in the strips enable the whole assembly to be put together to form an air-spaced, six-sided coil former, having either smooth sides, or sides divided into a number of sections. The six points on the hexagonal ends are provided with holes, against which is printed a number, and terminals may be inserted into these holes for connections to the ends of a coil winding, or to tapping points. The photographs show six different types of coil built up on these formers, and the following data will enable readers to make up some of these coils, and variations may, of course, be carried out to suit any particular ideas or requirements. These coil formers are very cheap.

Simple Coils

The simplest coil is shown in the centre of the group in Fig. 1, and this consists of a solenoid, or single-layer coil, having a total of fifty turns of No. 24 D.C.C., which just fills the straight side of the former. The H.F. resistance of a coil of this description would be roughly 5 ohms, and the inductance approximately 150 microhenries. This will tune, with a .0005 mfd. condenser in parallel, to just about 500 metres. Obviously, such a type of coil would not be of very much use on the average valve receiver owing to lack of selectivity, but it is a suitable illustration of how the coil is made up. A coil suitable for covering both the normal and the long-wave bands, and which is efficient enough to be included in a modern receiver, is shown on the right, in Fig. 3. This is a dual-range coil wound with 28 gauge double-silk-covered wire. Six terminals are fitted into the top of the coil, and two or more small feet, *constructed from aluminium or brass*, should be attached to the lower end to enable the coil to be

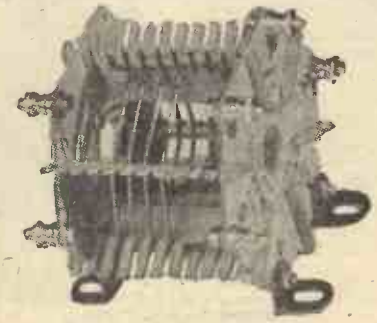


Fig. 4.—A short-wave coil.

mounted in the receiver. It should be particularly noted that iron brackets must not be used for this purpose. The beginning of the wire is attached to terminal No. 1, and fourteen turns are wound into the first slot, after which the wire passes into the second slot, in which a further fourteen turns are wound. The wire then passes into the third slot, in which a further fourteen turns are wound, and the wire is then taken up to terminal No. 2, a space of about half an inch scraped clear of the silk covering and the bare wire attached to that terminal. The wire is then taken back to slot No. 4, into which ten further turns are wound. The wire is then carried up to terminal No. 3 and a connection made as for No. 2, after which the wire is led back into slot No. 4, into which four more turns are wound. The wire is then taken up to terminal No. 4, connection made, and the wire led down to the third slot from the opposite end. Into this, and the remaining two slots at the lower end, fifty-five turns are wound (in each slot),

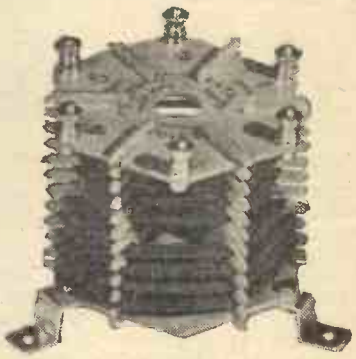


Fig. 3.—A dual-range coil.

and the end of the wire taken up to terminal No. 5. A length of wire is then cut off and joined to this terminal and taken down to the fourth slot from the lower end, into which thirty-five turns are wound. The end of this small winding is joined to the remaining terminal, No. 6. All the turns are, of course, wound in exactly the same direction. The connections for this coil are 5 and 6 to earth, 1 to the tuning condenser, and 6 to the reaction condenser. An on-off switch is joined between terminals 4 and 5, whilst the aerial is fed through a small pre-set condenser (.0003 mfds.) to either terminal 2 or 3, according to the degree of selectivity required.

Short-Wave Coils

This type of former is ideal for the construction of short-wave coils, a specimen of which is shown on the left in Fig. 4. For this particular coil three turns of No. 28 D.S.C. wire are wound in the first slot, the commencement being joined to terminal 1 and the finish to terminal 2. Two slots away, the grid coil is commenced, and this consists of 18 gauge enamelled wire, wound one turn per slot, for five slots. The commencement of this winding is joined to terminal 5 and the end to terminal 6. Into the next, and final slot, is wound five turns of the 28 gauge D.S.C. wire, joined to terminals 3 and 4. This latter winding is for reaction purposes, whilst the first fine wire winding is used as an aperiodic aerial coil. The remaining coil in Fig. 2 is a simple type of wave-trap for use on the 200 to 500 metre wave-band, and a series aerial condenser is mounted upon one end, by using two of the holes as fixing holes. The spacing will be found just right for this purpose.

SHORT WAVE SECTION

NOISE SUPPRESSION ON THE SHORT WAVES.

By TOGNI.

ONE of the most prevalent faults in home-constructed short-wave receivers is all too often noisy reception. Until this is cured it is useless to consider the addition of any further amplification, as it must be quite obvious that, however great the extra magnification may be, the actual ratio of signal to noise remains the same; were it not for this fact, setting aside questions of stability, there is really no reason why L.F. stages should not be added *ad infinitum* until the required amplification be obtained. Many listeners must have noticed that reception of short-wave stations is often much better on their own modest set than when received as a relay, the reason being that the B.B.C. is compelled to amplify to an inordinate extent to ensure a successful re-broadcast. It must be pointed out, of course, that the accompanying noise in this case is almost entirely external, and quite outside human control. Atmospheric disturbances are rarely severe enough on the high frequencies to seriously mar reception on the small set of comparatively low amplification. In this article, however, we are more concerned with preventable noise which actually originates inside the receiver itself.

No apology is made for the oft reiterated advice concerning the importance of good sound connections, and the avoidance of anything with a tendency to wobble. Soldered joints are naturally the best, but if there is any doubt about skill in this connection, a well-screwed-down connection will be infinitely better. A soldered joint may pass muster for mechanical strength, but it is not nearly so uncommon as one would imagine to find that from an electrical point of view it leaves much to be desired; the average amateur often makes a semi-conducting join consisting more of flux than anything else, In short, if you really *can* solder, do so, but if in any doubt, leave it alone.

Look to Your Components

Having disposed of the wiring part of the receiver, we turn now to the components. From a noise point of view the *bête noire* of short-wave sets is the tuning condenser. Economy in this connection should not be attempted; a few extra shillings spent on this vital component is a very sound investment. A large number of condensers on the market rely for the connection from the moving-vanes on a rubbing contact. This is a highly unsatisfactory arrangement, and usually a prolific source of noise. The only reliable method of connection is by means of a "pig-tail," a small piece of springy metal akin to a hair-spring, one end attached to the central spindle and the other to the terminal shaft. This, in effect, shorts the doubtful rubbing contact. Although the reaction condenser is not so prone to develop noise, it is wise to use a pigtail connection also. In both cases it is essential to see that the moving-vanes are properly aligned, as any shorting between fixed and moving plates will result in terrible cracklings, and in the case of the reaction condenser a damaged H.T. battery or worse. In this last connection it is always wise to insert a fixed condenser of comparatively large capacity in series with the reaction condenser; this forms a very effectual guard against shorting the H.T., whilst in no way impairing the working of reaction. Yet another source of trouble with variable condensers is the tendency to collect particles of dust between the vanes; if the latter are at all closely spaced a leakage path is easily formed, giving rise to fryings and cracklings every time any adjustment is made. The remedy, of course, is obvious.

Faulty Resistances

With regard to other components, the only ones likely to give much trouble are variable resistances, particularly the potentiometer commonly used in connection with the detector valve for improving reaction control. It often happens that the resistance wire possesses actual inductance of an order comparable with that of the tuning coil, especially if one is working below 20 metres. Consequently, if we are in the habit of giving the finishing touch to reaction by adjustment of this, loud crackling is the result, because of partial absorption of the H.F. oscillations by the entirely unintentional tuned circuit. The writer has often experienced this trouble using potentiometers of good make, which are quite above reproach and absolutely noiseless on the broadcast band. Fortunately, it is an easy matter to cure this fault by connecting a fixed condenser of not less than .0002 mfd. across from the slider to earth. Whilst on the subject of absorption noises, it is well to remark that practically any coil or length of wire near the set which is likely to move in any way is liable to cause crackling. In windy weather persistent crackling may often be traced to the intermittent earthing of outside guy-wires, more particularly if, as often happens, the natural wavelength of the wire (or harmonic thereof) happen to fall within the tuning range of the set. A cure may generally be effected by breaking up the guy-wire into odd lengths with insulators, thus removing the natural period of the wire from the danger zone.

Apart from the above likely sources of noise in short-wave sets, it must not be forgotten that any common faults which develop in ordinary broadcast sets are just as liable to happen on the higher frequencies. Nowadays it is rare to hear of a transformer breakdown, but the possibility must not be overlooked when searching for those elusive frying noises. In nearly every case of transformer failure it is the primary winding which is to blame. A continuity test is not always conclusive, and the best test is by replacement. Such elementary precautions as the cleaning of plug contacts must also not be overlooked. In all cases of doubtful contact, plugs, whether of the old-fashioned split-pin variety or the modern "banana" type, should be opened with a penknife.

Exterior Noises

A large amount of noise originates outside the set, and little can be done in this connection. In passing, it should be noted that the removal of the aerial wire will definitely establish whether the noise is external or not; a cessation or reduction thereof with the aerial disconnected conclusively proves that the set is not to blame. Trams, of course, are responsible for a lot of trouble, as are all electrical appliances which cause sparking to any degree. A diplomatic approach to the people concerned will often result in their endeavours to find a palliative for the nuisance. It is surprising how effective a few large fixed condensers can be when employed usefully. Noise emanating from brush sparking on electric motors can often be entirely stopped by fixing a condenser across. Motor vehicles are also troublesome by reason of their ignition; it is seldom, however, that the noise from this source is annoying unless the set is used under 20 metres. It is amusing to note that one car of very well-known make, and widely used commercially, can be identified by the abominable crackling it causes on or about 10 metres. As this latter is a frequency allotted to amateur transmitters, their exasperation may be well imagined, especially those who are unfortunate enough to live on a main road.

AN ALL-TEST METER

THE handy instrument shown in the accompanying illustration can be made for a few shillings. The components required are as follows:—

A volt-amp. meter; 10,000 ohm resistance; a valve holder (chassis type); a 3 v. dry cell; 8 sockets (3 black, 5 red); 4 plugs (2 black, 2 red); and 18in. red and black flex. First of all construct a box about 6in. by 5in. by 1in. deep, with a lid if desired, and obtain a piece of 3-ply or ebonite to fit as a panel. Cut a large hole in the panel into which the meter should fit flush with the face of the panel. Make this a fairly tight fit, so as to avoid the meter dropping out. Next drill a hole for the valve holder and eight ¼in. holes for the sockets.

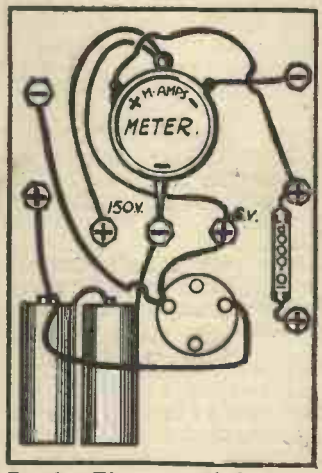


Fig. 1.—The wiring of the complete test-meter.

Now fix all components and sockets in place and wire up as shown in Fig. 1. Fix a red and black plug to each end of the flex, or if preferred a pair of testing prods should be fixed at one end. Now for its uses: To test valve filaments, plug the valve into the holder and if needle

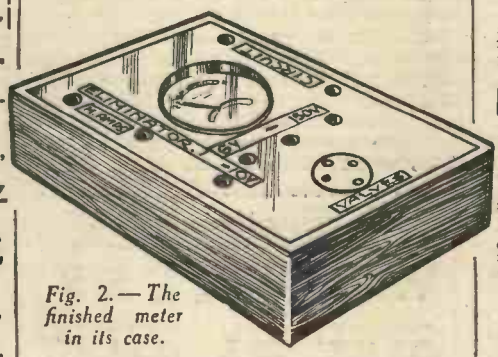


Fig. 2.—The finished meter in its case.

deflects the valve is O.K. To test continuity of coils, chokes, transformers, etc., plug into circuit plugs and the other end on to the ends of the winding under test. A needle deflection again indicates that the winding is O.K. Now to test batteries, use the sockets marked 6 v. or 150 v. But for H.T. eliminators I have included a 10,000 ohm resistance for this purpose, and the milliamp. scale should be taken here so that 1 milliamp.=10 volts. A truer reading would be obtained by using the same plugs for H.T. batteries instead of the 150 v. socket.—J. WILLIAMS (Abertridwr).

(*Continued from page 34.*)

SILTIT

MANY readers already have purchased a good metal earthing tube, and have buried this in an appropriate position. We have previously pointed out the need of a moist earth for good results, and various types of chemical earthing devices have also been reviewed. With all of those so far examined, the chemical was enclosed in a metal container, to which the earth lead had to be attached. The Birka Laboratories, of Birkenhead, have now produced an earthing device which is intended for use with an existing earth tube which is already efficient in an electrical manner. This earthing material is enclosed in a cardboard carton, and appears to consist of the normal hygroscopic material to which has been added a substantial quality of metallic dust. The carton contains, of course, very much more chemical than the other devices. To use it, we recommend you to remove the earth rod, and dig out a fair quantity of the earth into which the rod is to be driven. When the required hole has been dug, the earth which has been removed should be spread out as evenly and thinly as possible, and then the contents of the carton sprinkled over the earth. When all has been emptied, the earth and Siltit are mixed together, and the hole filled in with the mixture. The result is, of course, that the earth contains a large quantity of metal in powder form, together with a well-distributed quantity of the chemical. When the earth rod is then driven into this mixture, the result is a really high-class earth, having a very low-resistance, and remaining quite moist over a very long period. The price is only 1s. 6d.

FERRANTI MAINS UNITS

WE understand that following certain new production arrangements the prices of the well-known Ferranti A.C. Mains Power Units are being reduced in price, as follows:—

	£ s. d.
Type E.1 Mains Unit .. .. Price	10 0 0
„ E.2 „ „ .. .. „	3 17 6
„ E.3 „ „ .. .. „	4 7 6
„ E.4 „ „ .. .. „	7 10 0

The latest details of these units, together with details of trickle chargers, etc., are included in the new list published by Messrs. Ferranti. Those readers who are interested should write to Messrs. Ferranti, Hollinwood, Lancs., for a copy of list No. Wb523. There is no charge.

BLUE SPOT LOUD-SPEAKERS

THE British Blue Spot Company inform us that their loud-speakers are being re-designed and reduced in price. The Type 99 P.M., recently reported upon in these pages, will, in future, be fitted with a de-luxe transformer, a moisture-proof cone, and, in common with all Blue Spot Speakers, will have plugs and sockets provided with the transformers in place of the usual soldering tags. This will prove of great value to the listener. Models of this re-designed speaker will be ready by the beginning of April.

LISSEN PT. 2A VALVE

THE Lissen laboratories have now produced a new pentode, designed to give a very large output from a moderate grid input voltage. It is of the 2-volt, .2 amp. type, with a slope of 2.5 mA/V. The maximum power output is rated at 1,100 milliwatts, and is designed for 150 volts H.T. The optimum load impedance is 8,500 ohms. For Quiescent Push-pull two of these pentodes may be used and biased down to provide about 2 mA. per valve. The normal Push-pull arrangements should be used.

THE "WESTECTOR"

FOUR types of the new high frequency metal rectifiers are now available, and the type numbers and prices are as follows:—W.4, W6, Half-wave. Retail list price 7s. 6d. WM.24, WM.26, Full-wave centre tap. Retail list price 10s. Further particulars of these "Westectors," and the circuits suggested for use with them, are given in an instruction sheet, I.P.11.W, which can be obtained from The Westinghouse Brake and Saxby Signal Co. Ltd., 82, York Road, King's Cross, London, N.1.

RADIO CLUBS AND SOCIETIES

(*Continued from page 42.*)

BATTERSEA AND DISTRICT RADIO SOCIETY

On Tuesday, 28th February, the Battersea and District Radio Society greatly enjoyed a lecture by Mr. Parr on the manufacture of valves. The lecturer carefully explained, with the aid of a well-chosen set of lantern slides, each process from the beginning until the valves had been tested and passed out to the public. At the conclusion a large number of questions were asked and ably answered by the lecturer.—S. F. Harris (G5SH), Hon. Sec., 93, Salcott Road, Battersea, S.W.11.

SMETHWICK WIRELESS SOCIETY

At a recent meeting of this society, Mr. G. Parr gave an interesting lecture on "The Output Stage of a Wireless Receiver." He discussed the differences between triodes and pentodes and referred to 2nd and 3rd harmonic distortion. Push-pull (including Q.P.P.) and Class B amplification were explained in full. Finally the lecturer summed up his discourse by giving a table wherein the peak acceptances of the grid, the power outputs and the optimum loads of triodes and pentodes were compared in straight output, in paralleled output and in push-pull.—Hon. Sec., Mr. E. Fisher, M.A., 33, Freeth Street, Oldbury, Nr. Birmingham.

Practical Letters from Readers.

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

A Boon to the Beginner

SIR,—I have just received my presentation volume in good condition, and am greatly pleased with it. I should like to express my extreme satisfaction, for it has surpassed my greatest expectations. I have found PRACTICAL WIRELESS invaluable to me as I am only a raw amateur, but since taking your paper I have learned a great deal about wireless. Although my set is an old-fashioned one, I especially appreciate your articles on selectivity with plug-in coils, but as I shortly intend to build a modern set, the whole of the paper is greatly appreciated. I look forward every Wednesday, which to me means some more highly interesting and valuable reading matter. Here is one suggestion.

Could you not add some small cartoon or joke in a corner each week so as to give us a laugh? Thanking you for your speedy despatch of my volume.—B. T. H. DALE (Charing, Kent).

[*We have some excellent cartoons in hand which will be published shortly.*—ED.]

Carry On the Good Work

SIR,—Please accept my thanks for the cover for Data Sheets; this is really excellent and is as pleasing a possession as was the Encyclopædia. Carry on the good work! PRACTICAL WIRELESS is a boon to all amateurs.—F. G. CHRISTALL (Coulsdon).

Full of Sound Information

SIR,—Allow me to express my thanks and entire satisfaction for a volume so comprehensive and full of sound information that I would have thought it impossible to present on such generous terms.

Also my best wishes for the success of PRACTICAL WIRELESS, which fills a long felt want.—HUGH V. DAVIES (Liverpool).

"Handiest Book in My Collection"

SIR,—I would like to express my appreciation of your wonderful weekly. I have taken wireless weekly papers for a number of years, but give me PRACTICAL WIRELESS every time. Having shown this to several of my wireless friends, it is now enough to say they have placed orders with their newsagents for a copy every week. I need not add that I have already got your Encyclopædia, which is the handiest book I have in my collection.

Wishing your paper the success it deserves.—S. ROBSON (Felling-on-Tyne).

"A Splendid Book"

SIR,—Allow me, as a regular reader of PRACTICAL WIRELESS, to thank you for your "Wireless Constructor's Encyclopædia," which I received under your gift scheme. I am delighted to possess such a splendid book, which contains such valuable information for anyone interested in wireless. A more concise and useful collection of radio information will be hard to find, being so well illustrated, and the circuit diagrams are a good addition to the book. I have taken PRACTICAL WIRELESS since its first number, and I sincerely hope that your journal will continue to supply the long felt want to those interested in wireless. Again thanking you, and wishing PRACTICAL WIRELESS the success it so richly deserves.—JOHN ALFRED WHITLEY (Lytham).

CUT THIS OUT EACH WEEK

DO YOU KNOW?

—THAT in a receiver employing two H.F. stages, both a pre-detector as well as a post-detector volume control should be incorporated.

—THAT a Pick-up must not be left connected to the grid of a detector valve when using the receiver for radio—in view of the biasing of the grid.

—THAT the choice of the wrong value of the coupling condenser in an R.C.C. stage will affect the response curve by cutting off top notes.

—THAT a variable series aerial condenser used as a volume control should be provided with a short-circuiting switch in the minimum position.

—THAT dial illuminating lamps may be operated from the normal heater windings of mains operated receivers.

—THAT the metal braiding surrounding shielded wires must be connected to earth to be effective as a screen.

—THAT for the above-mentioned reason, all metal screens should be joined to earth.

—THAT a vertical wire running to one of the upper windows of the house may prove more effective than an indoor aerial.

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 and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11. Southampton Street, Strand, W.C.2.*

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

A South African Reader's Appreciation.

SIR,—You will no doubt be surprised to receive a letter from a schoolboy reader in South Africa. I have been getting PRACTICAL WIRELESS since the first number. Although I have not got a set of my own yet, I hope to have one later on. I did not understand much about wireless till I read the Beginners' Supplement, and now I am able to follow circuits and articles quite well. I will certainly take great care of your Data Sheets till I need them one day! It is a great pity that overseas readers have not been given time to send in their forms for the Wireless Constructors' Encyclopædia, or the special binder for the Data Sheets. Will we be able to obtain one of these binders without sending in the Reservation Form, if so, let us know. Please give us more sets like the Midget Two, as these types of sets are of more interest to the beginner than sets like the Argus Three. Thanking you for your very fine paper, that caters so well for the beginner and the advanced wireless fan. Wishing it every success.—C. THORNLEY (Bloemfontein, S. Africa).

From An Outpost of Empire

SIR,—As a "Radio Teacher" and Lecturer at various Boys' and Men's Clubs, also Scout Halls of Western Australia, I extend to you and your staff my heartiest congratulations on the two new publications, namely, "Newnes' Complete Wireless" and PRACTICAL WIRELESS. They are just the very thing that we have been wanting so that we could instruct young and old alike, along the simple and easy road to a better understanding of Radio. I do not hesitate to state that I have noticed a greater display of interest on all subjects since using your two excellent magazines. I intend using them throughout my classes, and have asked all my pupils to subscribe to them. Whilst on the subject, I wish also to congratulate you for being the first to publish the useful and up-to-date Data Sheets.

I trust that you will maintain the standard of your publications in the future as you have to date.—C. S. SOUTHCOTT (West Subraco, Western Australia).

Metal Chassis Construction

SIR,—Please accept my thanks for PRACTICAL WIRELESS; it lives up to its name and contains much instructive and useful information in an "easy to take" form. No complaints, and as for suggestions, I would like to see published articles on "Meters (including A.C. and frequency), their construction and how they operate," and "How to make a metal chassis." Best wishes for future success.—S. H. GREGORY (Birmingham).

[*An article on Making a Metal Chassis appeared in* PRACTICAL WIRELESS, *dated October 22nd,* 1932.—ED.]

PRACTICAL LETTERS

(Continued from page 40.)

A Plea for Quality

SIR,—Ignoring the "practical" contents of PRACTICAL WIRELESS (which is its chief attraction) you, in common with others, proclaim (modestly, I admit) the wonderful "reaching" and "volume" capabilities of your circuits. We hear nothing about a set, the prominent feature of which is "*quality*" of reproduction.

Without casting any reflections, I will suggest that any old S.G.3. circuit will produce a crop of stations satisfying to most people. Whether a super-circuit adds another half-dozen or so stations to the crop doesn't make a deal of difference, actually. I say "actually," because when we have a crowd of friends around we naturally feel proud to pull in plenty of stations and "show 'em" what we can do. We never "listen" to a third of the stations we can obtain, and when the home circle, as it were, is gathered around, "quality" is what, in our hearts, we need. To be as unbiased (?) as possible, I will say that the quality of my set is such that speech can be heard clearly in any part of the house and every note of music is clear and faithful to the instrument producing it. I do not proclaim my reproduction to be perfect, but I will most definitely state that few super-sets can touch it for clarity. You will note I make no mention of "tone," as this is an elusive and individual affair. The more far "reaching" a set is the more it has to be "compensated," "balanced," "tone controlled," etc., etc. Certain natural (if I may use the word) quality in the super-super-sets is lost and has to be restored, and, to condense my argument, I will merely mention the words "selectivity," "side-bands." To further omit details, I suggest the older S.G.3, with flat tuning (as far as circumstances permit), and limited range, gives purer quality than the super "put and take" circuits. It is said that one watt output is necessary for perfect reproduction and that it is the despair of designers to be able to produce a battery set capable of delivering this output. All I can say is that a pleasant Sunday evening by the fireside with one watt blaring out for hours is not my idea of "quality." Instead of the customary headlines, why not "the star set of the year. Quality the like of which you've never heard before"?

Believe me, it would be phenomenally popular.—H. S. BASSETT (Llansamlet).

WIRELESS TERMS TRAVESTIED—2

Gramophone Pick-up

RADIO CLUBS & SOCIETIES

SLADE RADIO

A lecture was given by Mr. E. F. Handley to the members of the above society at a recent meeting. After referring to modern receivers and volume control he went on to describe overloading and also correct working of rectifiers. The formula for grid to anode gain was given and mutual conductance described, this being followed by the formula for H.F. stage gain and characteristics of variable mu valves. Diode rectifiers came next and a circuit of a 3-stage H.F. amplifier and diode described. Control of sensitivity was referred to, after which full details were given of the double diode triodes and it was shown how these function and also how they can be controlled. Automatic volume control, new variable mu valves and resistance coupled push-pull were all dealt with during the evening. The lecture proved exceptionally interesting and was enjoyed by all those present. Details of the society, which still has room for anyone interested, may be obtained from the hon. sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

THE CROYDON RADIO SOCIETY

Mr. E. G. Power, of a well-known wireless firm, lectured upon and demonstrated one of the latest types of mains-driven superheterodyne receivers at a recent meeting at "The Horse and Groom," Cherry Orchard Road, E. Croydon. A lantern slide of millivolts per metre of wanted signals against voltage amplification of the unwanted, enabled the lecturer to explain the problems involved in foreign station reception. For instance at a certain place, London Regional gave 300 m.v. per metre, and Stuttgart 3 m.v. per metre, so Mr. Power made it clear why, to receive Stuttgart, the British station must be received at a thousandth of its original value, or a tenth of that of the German. A unique feature of this set was its automatic volume control, which could deal with a 20 : 1 fade. Its theory was discussed, it being shown how a greater signal caused more bias to be applied to the H.F. valves with consequent cut down of gain. Mr. Power mentioned that he had designed the set to give 1 watt output for full room strength, the signal input being .01 m.v. per metre. As regards its response, it cut off at 5,000 cycles, which he considered was correct for avoiding heterodyne whistles and sideband "splash." Finally members explored Europe with the set, noting how easy it was to operate with its automatic volume control. Hon. Sec., E. L. Cumbers, 14, Campden Road, South Croydon.

THE CATFORD AND DISTRICT RADIO AND TELEVISION SOCIETY

Members of this society listened with great interest to a lecture on "Valve Characteristics" given by Mr. Deal at a meeting held on March 2nd. The speaker dealt with this subject very lucidly and explained many points which have always puzzled the novice. Valve Curves, Optimum Load, and measuring undistorted output were all thoroughly dealt with. The Chairman, Dr. Bannounah, opened the discussion that followed, and members were soon busy telling Mr. Deal all their valve troubles, all of whom received a ready answer. In conclusion the speaker forecast some very radical changes in valve design in the coming year. A hearty vote of thanks was accorded to Mr. Deal and all present agreed that it had been a very enjoyable and instructive evening.

Full particulars can be had from the hon. secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23.

CLACTON AND DISTRICT RADIO CLUB

The inaugural meeting of the Clacton and District Radio Club was held at Dixon's Café, Station Road, Clacton-on-Sea, on Thursday, March 2nd. Mr. J. A. Dixon presided, and the club was formed on the proposition of Mr. Frank Baynton, seconded by Mr. Arthur Byrnes. The officers were elected as follows : Chairman, Mr. A. J. Dixon ; vice-chairman, Mr. Lewis ; hon. secretary, Mr. Loader ; hon. treasurer, Mr. Woods ; committee, the above four officials and in addition, Messrs. D. Heightman, A. Brynes, and H. Greenfield. Mr. F. L. Stollery, district representative of the R.S.G.B. (Radio Society of Great Britain) was also present and promised the club his support.

The club has been formed to encourage interest in radio in Clacton and District, and the activities of the club will be many and varied. The programme will be designed to interest everybody, however small their knowledge of the science of radio. Meetings will be held each Monday at 8.0 p.m. at Dixon's Café, Station Road. Further particulars may be obtained from the hon. secretary, Mr. Rodney Loader, 49, Southcliff Park, Clacton-on-Sea.

The annual subscription to the club will be 5s. and 2s. 6d. for members under seventeen years.

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.

METAL RECTIFIER

"I am building the A.C. 'Fury Four,' and have come across a point which I have not yet seen in print, but which is one which I think ought to be raised. The mains unit employs a metal rectifier, and obviously, when the mains voltage is switched on the rectifier will at once deliver its full voltage. However, the valves in the set are indirectly heated, and, consequently, will not need full voltage on the anode. This must, in my mind, result in a heavy strain on the fixed condensers. Could not some device be fitted to prevent this sudden surge with its consequent danger of breakdown?"—(P. R. V., Bournemouth.)

The risk you refer to is, of course, present in every type of mains receiver, and the choice of condensers has been made with the surge values in mind. However, if you are anxious to instal a safety device, the thermal delay switch will meet your requirements. This should be wired in the H.T. negative lead, and the supply to it taken from the heater winding terminals. The switch is obtainable from several advertisers in this paper, and as you probably know, it works on the principle that the circuit is not completed until the element in it has attained a certain temperature. This is arranged so that it takes practically as long as the normal indirectly heated filament takes to gain normal emission temperature.

SUPERHET. AND OUTSIDE AERIAL

"I have an American superheterodyne receiver employing six valves, and where I live it does not give too good results. I am anxious to know whether I can use it with an outdoor aerial, as I have heard it said that this type of receiver will not work on this type of aerial. Will any alteration be necessary to the set?"—(R. S., Gt. Yarmouth.)

Some types of superhet. receiver employ a circuit which necessitates the use of a centre-tapped frame aerial. If your receiver is of this type, then we would not advise you to attempt to use it with an outside aerial. Without knowing, therefore, what type of circuit is employed, we regret that we cannot be of any assistance to you in this connection.

CRACKLING NOISES

"I had a small two-valve set, operating from the mains by an eliminator. One afternoon it started crackling. I put this down to atmospherics at the time, but when it continued and sometimes eliminated the programme altogether, I thought something was wrong. Thinking it might have been the eliminator, I connected up batteries in its place, but the same result. I went over all connections, but all were in order. Having previously decided to make it into a three-valve set, I did so, but the crackling was there as bad as ever. Would this be the Washford transmitting station? I shall be grateful if you can conquer this trouble."—(A. H. N., Taunton).

There are many points in your receiver which could give rise to the trouble, but we do not think you can blame the nearby transmitter. First of all, disconnect both your aerial and earth. If the crackling ceases upon doing this, then the noises are being received on your aerial, and there is nothing wrong with your set. If however, the noises persist when no aerial and earth is attached, the crackling is caused by a faulty component, and you should examine all resistances, and the transformer primary winding. Naturally, the simplest way of finding the culprit is to substitute the components one by one, but if you can obtain a good meter, this will enable you to test the various parts of the circuit for partial disconnection, high resistance, leaks, etc. Test the transformer primary first. After that has been passed O.K., look to the resistances, and we think you will not be long in finding the faulty component.

RAIN AND NOISE

"Whilst it was pouring with rain the other day I noticed a most peculiar noise in my set. There was a sort of loud plop, plop, plop at almost regular intervals, and I did not take a great deal of notice of it until it stopped. Just after this I noticed that it had stopped raining. I only noticed the matter as a slight peculiarity, and would have forgotten all about it, except that last night, when it started raining again, on came the plopping. I watched carefully, and just after the rain stopped, so did the noise. What do you think this can be?"—(R. S., Hornsey.)

We should imagine that you have fitted, outside the house, an aerial-earth switch. The rain running down the lead-in wire is dripping across the contacts of this, and owing to the conducting properties of water, the contacts are temporarily short-circuited with each large drop of rain-water, and this gives the plop you can hear. You should be able to verify this when next it rains, and if this is found to be the cause, the switch should obviously be covered, or some device attached to the wire above the switch to prevent the rain water running across the contacts of the switch. A good scheme is to pierce a hole in a tin lid and thread this on the wire just above the switch. The rain will accumulate in this and then run over the edge, clear of the switch. This arrangement will also not prevent the switch being operated, as would be the case with a box or other device enclosing the switch.

DATA SHEET No. 27

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

CONVERSION TABLE

English Measures to Metric System.

	Multiply by
Ins. to centimetres	2.54
Feet to metres	0.3048
Yards to metres	0.9144
Sq. ins. to sq. centimetres	6.45
Sq. yards to sq. metres	0.836
Cub. in. to cub. centimetres	16.39
Cub. ft. to cub. metres	0.028
Grains to grammes	0.065
Ounces to grammes	28.35
Lbs. to grammes	453.6
Tons to kilogrammes	0.1016
Fl. oz. to cub. cm.	28.4
Pints to litres	0.568
Cub. ft. to litres	28.3

SOLDERED CONNECTIONS

"I notice that you do not include any soldered joints in the sets which you describe in your interesting book, and I am anxious to know whether there is now no necessity to make this method of connection. Not so long ago it was thought very inefficient to run wires to a terminal and not make a soldered joint, and I should therefore be glad to know why you do not adopt this scheme."—(T. R., Watford.)

There is no necessity to solder a joint, although, without doubt, a soldered joint is the most secure. The majority of parts now made for wireless receivers are fitted with terminals, and if the wire is clean, and the terminal contacts are clean, and the wire is clamped tightly under the terminal a sound electrical joint is the result. No oxidation will take place owing to the exclusion of air at the point of contact. There is no need to use a soldered joint with the terminal arrangement, but where no terminals are provided, a soldered joint must be made, and you will note that there are still one or two component parts used in our receivers which call for this method of connection.

THREE-BAND COIL

"I wish to make up a coil for myself to cover the long, medium, and short waves. I have worked out the required number of turns on the particular size of former I wish to employ, and the only point I am in doubt about is the method of arranging these coils. I could build it up on the lines of the normal dual range coil, with appropriate short-circuiting switches. Do you recommend this arrangement? The alternative which I have thought of is to include the normal and long wave sections on the one former, and to place the short-wave winding on a separate former arranged at right-angles to the remaining coil. This would necessitate a separate switch. I should be glad to have your remarks upon the above suggestions, and which you think is most desirable."—(J. B., Pinner.)

The inclusion of three separate coils on one former as at first outlined by you would probably lead to losses owing to the presence of the earthed medium and long wave coils when using the short-wave coils. We assume, of course, that you are simply going to short-circuit the unused winding. Therefore, the better arrangement is to fix the normal broadcast coils on one former, with the short-wave coil at right-angles, and, if possible, at some distance from the remaining coils. You do not mention what type of tuning you propose to adopt, but we would inform you that the normal .0005 mfd. condenser used for broadcast purposes would be very unsuitable for the short-wave work. The most efficient arrangement is, of course, to use separate receivers for the two purposes, or where this is not suitable for some reason or other, build up a separate detector circuit.

HOME-MADE COIL

"I am going to build a simple tuning coil, but I am not sure as to the gauge of wire to employ. I have read that the wire should be thick to reduce the resistance, but I do not want a clumsy coil. The set is not for foreigners, but I want to get the loudest possible results on the local station. What shall I use? The circuit is a simple detector, followed by a L.F. stage."—(N. H., Hatfield.)

As you are employing a detector valve there will be a certain amount of damping due to the grid leak. Furthermore, you are situated very close to Brookmans Park, and, therefore, practically anything will do for tuning purposes. However, to ensure the very utmost we would suggest a 4in. diameter paxolin tube, upon which is wound 60 turns of 22 D.C.C. wire. This should be tapped at the 10th turn from one end, and at the 10th, 20th, and 30th turns from the opposite end. This latter end should be joined to earth and the moving vanes of the tuning condenser, whilst the opposite end of the coil should be joined to the fixed vanes of the tuning condenser. The aerial should be joined to the 10th, 20th, or 30th turn from the earth end—according to the particular result which works best with your aerial, whilst the grid condenser should be tapped on to the 10th turn from the other end of the coil. This will give you the best on the local, with the advantage of probably being selective enough (with signal strength of a sufficiently high order) to enable you also to receive the Northern Regional station in your district. Naturally, the spread will prevent your hearing the Midland without interference, but the two London stations should be easily separated.

FREE ADVICE BUREAU COUPON

This coupon is available until April 1st, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS 25/3/33.

CATALOGUES RECEIVED

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IGRANIC COMPONENTS

IN an attractive booklet issued by Igranic Electric Co., Ltd., a full range of their well known components is listed. Amongst the various items shown are plug-in short wave coils, H.F. chokes, fixed and variable condensers, slow motion dials, L.F. transformers, mains transformers, potentiometers and a series of push-pull and other switches. For radiogram work there is also the "Igranovox" pick-up and a response corrector, which is designed to afford the requisite compensation for the deficiencies of the record at the lower frequencies. Constructors who look for high-class workmanship in their components would do well to obtain a copy of this booklet. The address is 149, Queen Victoria Street, London, E.C.

HOWE BOX BAFFLE

IT has long been recognised that one of the chief causes of unbalanced quality of reproduction is resonance in speaker cabinets, and the Howe Box Baffle affords a scientific solution of the problem. Briefly, the Howe Box Baffle consists of an inverted cone, shaped like a short, wide, exponental horn, comprising a special type of sound absorbing material known as Slagbestos made from silicate of cotton. The baffle, which can be fitted in any box cabinet and is suitable for all moving coil and cone loudspeakers, can be supplied either in kit form, for the home constructor, or assembled and ready for immediate use. In a booklet we have received from the sole licencees, F. McNeill and Coy., Ltd., 52, Russell Square, London, W.C.1, particulars and prices are given of assembled units, and also various types of cabinets complete with baffles.

THE MILNES H.T. SUPPLY UNIT

IN a new booklet we have just received from The Milnes Radio Company, full particulars are given of this unit which consists of indestructible nickel iron cells which are kept automatically fed from the L.T. accumulator, when the set is not being used, and is always ready to supply a steady H.T. current when required. The only attention required is to top up the cells with distilled water about twice a year, and an occasional refill of electrolyte about once in every two or three years. There is no possibility of sulphation, and the cells may be overcharged or discharged without damage to the unit. Readers interested in trouble free H.T. should make a point of getting a copy of this booklet, together with the technical data sheet, which will be sent post free on request. The address is Cottingley Bridge, Bingley, Yorks.

Replies to Broadcast Queries.

BRS 1038 (Herne Bay): VQ7LO, Nairobi (Kenya Colony) on 49.5 m. HAMPER (Bradford): Hilversum. TRIPLE THREE (Wednesbury): These amateur experimental stations were probably working on 40 m. band, but in view of proximity of G6PC, you could hear signals on higher wavelength; G6PC, C. D. Price, "Ardath," Park Lane, Wednesbury (Staffs); G2AK, D. H. Young, Jr., 52, Maidstone Road, Handsworth, Birmingham. Regret, cannot trace G6UI(?); G2NB, advise you to write to Radio Society of Great Britain, 53, Victoria St., S.W.1. For list of Amateur transmitters see the Radio Amateur Call Book Magazine, obtainable from F. T. Carter, Flat A, Gleneagle Mansions, Streatham, London. NEWCOMER (Radstock): (1) cannot say, but apparently more than the limit stated; (2) Yes, W3XL relaying Boundbrook (N.J.) on 46.69 m.; (3) DJH, Zeesen (25.25 m.); (4) G6CW, J. J. Curnow, "Tregenna," Garrard Rd., Banstead, Surrey; If G5LX, P. H. Dutton, 8, Somersby Grove, Skegness, Lincolnshire; If G5YB, R. C. Ashton, 41, Sithney St., St. Budeaux, Plymouth, Devonshire; If G5UL, J. W. Coveney, 16, Rochester Gardens, Ilford, Essex; all on the 40 metre Amateur Band, i.e., about 41 metres odd; you would do well to write to Radio Society of Great Britain, 53, Victoria St., S.W.1, for wavelengths. A. J. (Glasgow): Willie Lewis's Band from the Penguin Club. GO GETTER (Kensington): YVIBC, Caracas (Ven) on 49.1 m. CANNY (Aberdeen): Cannot understand your wavelength as the programme would tally with that of Athlone. PUZZLED (Bratton): Breslau; German election results; Hitler demonstrations. LUMMY (Gosport): (1) W8XK, Saxonburg (25.27 m.) relays KDKA programme; (2) PA0IM, M. B. Gorter, 30 Pieter de Hoogh Straat, Amsterdam Z, Holland; PA0MC, H. V. Swanenburg, 52B Groote Visscheriz Straat, Rotterdam; for English call signs write to Radio Society of Great Britain, 53, Victoria St., S.W.1. IBERICA (Wimbledon): (1) Moscow Popoff (RW50) on 25.16 m.; probably *Radio Bulletin*; slow dictation for reception by Clubs, etc.; (2) Belgian Amateur experimental probably ON4WM (*Waterloo Maroc*) Antwerp; (3) W2XE, Richmond Hill (N.Y.) relays WABC (Columbia Broadcasting System) on 49.02 m.; (4) W8XAL, Cincinnati (Ohio) on 49.5 m.; (5) Taschkent working with Moscow; (6) Must be EAQ, Madrid according to call, *Radio Ibero-Americana*.

DATA SHEET No. 4—Correction.

In the PRACTICAL WIRELESS Data Sheet No. 4, as well as on Page 535 of PRACTICAL WIRELESS dated 3rd December, 1932, a table of Stalloy Core Proportions was given. Owing to errors in the information supplied to us by manufacturers, one or two slips occurred in some of the dimensions. The table has therefore been corrected, and is given here in its corrected form. This table is printed in the same size as that on the Data Sheet referred to, and it should, therefore, be cut out and pasted over the Data Sheet in order to prevent any mistakes arising.

CORE PROPORTIONS

Size of Stalloy Stampings.	Dimensions (ins.) A	B	C	D	Number of Stampings.	Watts (approx.)	Turns per volt.
5	3 1/8	5/8	3/4	1 1/2	6 doz.	25	15
4	3 9/16	15/16	7/8	2 5/16	6 doz.	50	8
4A	3 9/16	15/16	7/8	2 5/16	6 doz.	50	8
30	3 9/16	15/16	7/8	1 1/8	6 doz.	40	8
30A	3 9/16	15/16	7/8	1 1/8	6 doz.	40	8
28	5	1.22	1.765	3	6 doz.	100	6
29	6 3/4	2	1 3/8	4 1/2	6 doz.	250	4

ADVERTISEMENT INDEX

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Presented with PRACTICAL WIRELESS, dated March 25th, 1933.

"PRACTICAL WIRELESS" DATA SHEET No. 14

LOUD SPEAKERS

Loud speakers are divided into two classes: Moving-iron and Moving-coil. But no matter what type of loud speaker is employed it is essential that it should match the valve if the maximum undistorted power output is required. With normal three-electrode valves, the loud-speaker load, or as it is more correctly called, the "optimum valve load," should be roughly twice the normal impedance of the valve. A moving-coil loud speaker (and some types of electrostatic loud speaker) remains constant in impedance throughout the normal frequency range, but moving-iron speakers vary in impedance with the frequency. It is, therefore, usual to take the impedance of this type of speaker at 256 cycles. To enable the matching to be carried out it is necessary to use a transformer, and the ratio of this may be obtained from the adjoined formula. Where two or more valves are connected *in parallel* in the output stage, the load is proportionately less. For instance, two valves in parallel would require a load half that of either valve used separately. Where two valves are connected *in push-pull* in the output stage, the load required is just double that of either valve.

$$\text{Transformer Ratio} = \sqrt{\frac{\text{Optimum Valve Load}}{\text{Loud Speaker Impedance.}}}$$

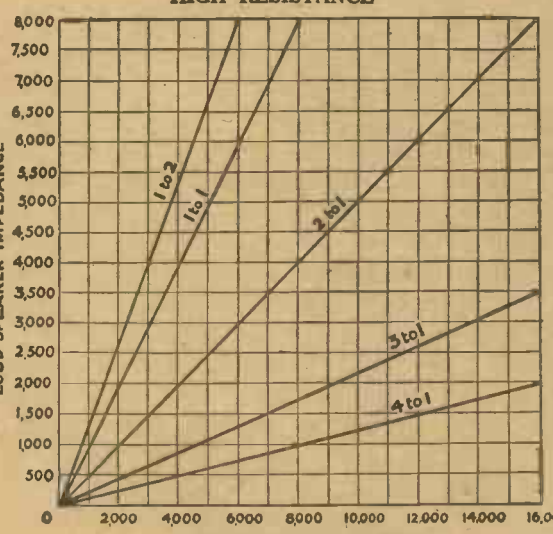
MOVING-IRON LOUD SPEAKERS.

Moving-iron loud speakers may consist of a simple reed movement, a balanced armature, or an inductor-dynamic arrangement. The former is the simplest, but owing to its inertia fails to deal with the lower frequencies in the musical range. The balanced armature possesses slightly more freedom and, therefore, gives better response at the lower frequencies, whilst the inductor-dynamic is especially designed to respond well down in the musical scale. It is not, however, very good at the higher musical frequencies. Owing to the fact that the impedance of moving-iron loud speakers varies with the frequency, it is inadvisable to employ this type of speaker with a pentode valve. Great care should be taken with these speakers to see that the reed does not get bent out of alignment, and the cone washer employed for attaching the diaphragm should be kept well tightened. The material of which the diaphragm is made will affect the response, and, generally speaking, this should be of thin material with felt rings between the cone washers and the diaphragm at both back and front.

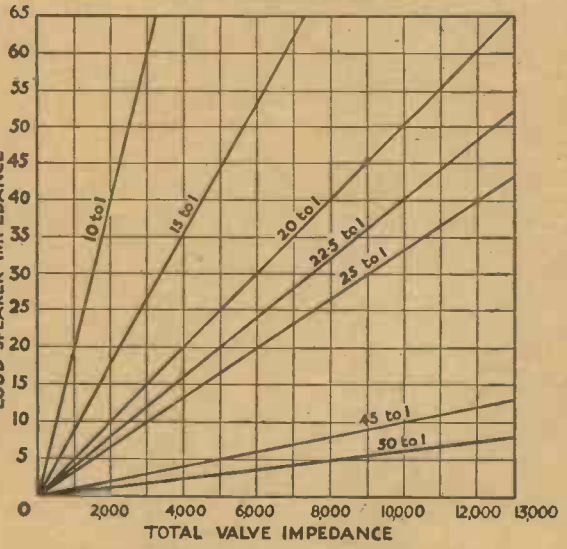
DIAPHRAGMS.

With all types of loud speaker, the material from which the diaphragm is made will affect its response. The effects are especially noticeable with the moving-coil type of loud speaker. A very good all-round material is No. 2 sheet Bristol Board. This should be formed into a cone with right-angled sides, and the edge turned back at an angle for a distance of not more than a quarter of an inch. This turned-back edge should be cemented to *thin* leather, and this should not be stretched when attaching it to the clamping ring or other device to which it may require to be affixed. The speech coil should be of the minimum weight, and it should, therefore be wound on a very thin paper cylinder, and doped with collodion. A very good material to use for this purpose is Durofix. The resistance of the speech coil should be from 5 to 50 ohms, and the matching carried out by means of a transformer as pointed out in the first section above. The angle of the cone will affect its response, and for general results in the home, a right-angled cone will be found best. It should not be made less than a right-angle owing to the risk of focussing. Generally speaking, a light, thin diaphragm will give brilliancy, whilst a heavy dead material will result in a deep tone.

HIGH RESISTANCE



LOW RESISTANCE

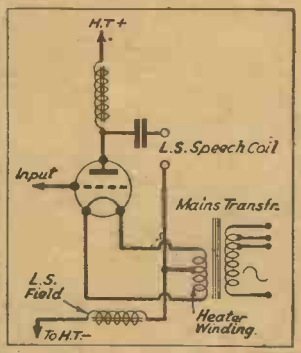


MOVING-COIL LOUD SPEAKERS

Moving-coil loud speakers are divided into two classes, those having a permanent magnet and those possessing an energised field. In the former the magnet may take on any shape, but it requires no method of energising, and owing to modern methods of manufacture it is sufficiently permanent in its magnetism to outlast the design of the speaker. The other type has a large winding round the pole-piece, and this requires the application of a direct current in order to produce the magnetic field. The required voltage may vary from 10 volts in some designs to 200 volts in others. The type of speaker which requires a high voltage usually has a field winding with a resistance of from 2,000 ohms to 10,000 ohms, and, therefore, in the lower values it may be employed as a smoothing choke in a mains eliminator. For this purpose the eliminator should be designed to give an output of 350 volts at 100 mA or so, and the drop through the field will give a dissipation of from 3 to 10 watts, according to the resistance of the field. The voltage drop will permit of the full 200 or 250 volts being applied to the receiver. Care must be taken in handling this type of speaker so as not to introduce hum by induction, and with all types of moving-coil speaker the diaphragm should be handled carefully so as not to upset the centralising device.

BAFFLES.

Practically all types of loud speaker necessitate a baffle, which prevents the sound waves from one side from passing round to the other side and so neutralising the effect of very low notes. The baffle should be as thick as conveniently possible—not less than three-eighths of an inch. The hole in it should be of the same size as the mouth of the diaphragm—not smaller. The speaker should be securely fixed to the baffle to prevent rattle, and it is also a good plan to glue large odd-shaped pieces of wood to the inside of the baffle at various positions to break up unwanted resonances. In cases where the baffle is built in the form of a cabinet, resonance may be removed by packing the corners with non-resonant material such as wool, kapok, etc. The size of the baffle will govern the reproduction of the bass notes, and the following details will assist in the choice of the correct size for particular individual requirements. For the reproduction of a 200-cycle note, the baffle should be 18 inches wide. For 100 cycles, 2 ft. 9 ins.; for 60 cycles 4 ft. 6 ins., and for 30 cycles at least 9 ft. must be provided. Where undue emphasis is given to the bass notes, a reduction in strength may be obtained by removing the loud speaker to a distance of about one inch behind the baffle. In other words, a slight air space between the front of the diaphragm and the rear surface of the baffle will assist in reducing the low note response.



TRANSFORMER RATIOS AND FIELD BIASING.

The two graphs above have been designed on the assumption that the optimum load required for the valve is double the A.C. impedance of the valve. As pointed out above, however, this does not hold good for Pentodes, Valves in Parallel and Valves in Push-Pull. To ascertain the ratio of transformer, find the point of intersection of the lines, corresponding to the valve resistance and speaker impedance. The nearest line running from the lower left-hand corner will then give the transformer ratio required. Where the field of the speaker is of the energised type having a D.C. resistance of 2,000 to 5,000 ohms, it may be employed for biasing the output valve. The illustration on the left shows the method of connection. The total anode current of the output valve passes through the field, and therefore the bias obtained may be worked out by multiplying the resistance of the field (in ohms) by the anode current (expressed as a decimal fraction of an amp.). If this results in an excessive voltage, a reduction may be obtained by joining a high-resistance potentiometer (of the order of 50,000 ohms) across the field, and connecting the arm, as well as one end, to H.T.—as shown on the right. The slider should be adjusted until the anode current, as shown by a milliammeter, is of the correct value. The manufacturer's instructions should, of course, be carried out in all cases.