THE BEST POSSIBLE CRYSTAL RECEPTION

A VERY FINE FOUR-VALVER

Amateur Wireless
And Electrics

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PRINCIPAL CONTENTS

WELL ILLUSTRATED

Registered at G.P.O. as a Newspaper.

Full constructional details of this fine four-valve set are given in this issue.

Amateur Wireless and Electrics

The Leading Radio Weekly for the Constructor, Listener and Experimenter

Edited by BERNARD E. JONES

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Chief Contents

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THE BEST POSSIBLE CRYSTAL RECEPTION

AND HOW TO OBTAIN IT

THERE has been so much written about crystal receivers that it might well be thought that the subject is exhausted. And yet, either because so much has been written or because the writers have attempted to introduce novelty into the receivers described, much of the subject matter has been somewhat contradictory.

It is fairly generally known that an efficient aerial and earth system and a sensitive crystal are of the utmost importance when maximum signal strength is desired, and the writer proposes to confine his remarks to the tuner portion of the receiver.

Tuner Requirements

The tuner should possess high inductance, low self-capacity, low losses and a minimum resistance.

Attempts to reduce capacity often result in an increase in the resistance. By reducing the capacity it has been necessary to increase the size of the coil to obtain the necessary inductance, and this has increased the resistance. In other cases the coil has not been of such a design which gives maximum inductance per length of wire.

There is a rule for obtaining high inductance which says that the diameter of a solenoid coil should be two and a half times the length. If the coil is wound with thick wire, air-spaced, this often necessitates a very large diameter, which introduces other disadvantages. This has resulted in coils being wound with a length much greater than the diameter, with a consequent reduction in the inductance for a given length of wire.

It is possible that the importance of avoiding self-capacity has been over-estimated, especially between adjacent turns. Reducing this, already small, capacity necessitates air-spaced turns and a larger coil, and the writer has obtained his best results with solenoid coils, of a suitable length and diameter, in which the only spacing was that provided by the covering on the wire.

When considering the design of the tuner, it is advisable to concentrate on reception of the local station only. Distant reception with a crystal receiver is rare, and by attempting to make it possible it is necessary to increase the tuning range of the coil, with a possible loss of efficiency.

Tuning Systems

If it were possible to build a coil of exactly the right size for a given wavelength, tuning would be unnecessary. This is, however, very difficult, and it is usual to resort to tuning by means of (*a*) a variable condenser, (*b*) tappings, (*c*) variometer, or (*d*) damping ("spade" tuning). The first, by introducing capacity, reduces the inductance; *b* introduces the risk of dead-end and other losses; *c* increases the resistance through using a greater length of wire than is necessary for the required inductance; *d* introduces damping. But whichever method is used, the losses can be minimised by making the coil as nearly as possible the correct size, so that very little tuning is necessary.

Coil Sizes

If condenser tuning is employed, the coil must be slightly smaller than necessary and must be tuned up to the desired wavelength. A really good-quality low-loss condenser with a low minimum capacity should be used, and as such is fairly expensive it is not used extensively by the crystal experimenter. The possession of such a condenser does, however, extend the scope of the experiments by making possible series tuning, when a larger coil can be used. If this is tried, do not make

(*Concluded at foot of next page*)

HOW VALVE FILAMENTS ARE MADE

THE filaments of all bright-emitter and the majority of dull-emitter valves are made of tungsten. Behind this simple statement lies what may be regarded as almost an impossible achievement, and is certainly the romance of the electric lamp and the thermionic valve. It is very difficult to realise that the filaments of the valves which we use are at one stage of manufacture a very fine powder.

The Raw Material

Tungsten in its crude state is found as an ore in Australia and other parts of the British Empire, and also to a lesser extent in Cornwall in association with tin. On entering the factory, the ore is first ground up into powder, and then washed in acid for purification purposes; this process also changes the calcium tungstate which is contained in the ore into tungstic oxide. This oxide is now treated with ammonia, and the result is a solution of ammonium tungstate. The mixture is now treated with hydrochloric acid, and a yellow powder is precipitated, which is tungstic oxide. The powder is dried out by warming in shallow pans.

Mineral to Metal

Next comes the first great change, that is, the alteration from the mineral form to metal. The yellow powder is put into a silica tube through which hydrogen is passed and the tube is heated by a gas furnace. The result of this treatment is that the oxide is reduced to a fine grey powder, which we know as tungsten. The next two stages perform the most wonderful operation of making the powder into solid form. The powder is closely packed into a small steel box, the top part of which is separate from the body; the whole is then set up in a hydraulic press and a pressure of about twenty tons per square inch is applied, and the powder is pressed into the form of a rod about the size of a small lead pencil. The next stage is to weld all the minute particles of tungsten together. This is done by passing an electric current through the rod in a chamber of hydrogen.

The rod is next subjected to a treatment known as "swaging," that is to say, it is heated up in a furnace and during the heat treatment is continuously hammered by a set of circular hammers. As a result of this process the rod is lengthened into a very thick wire and is very much more malleable. The swaging process enables the wire to be drawn as is explained below.

How the Wire is Drawn

The next stage is the wire drawing. This is carried out in easy stages. The number of stages of drawing depends on the final diameter that the wire is required to be. It should, of course, be realised that at each stage of drawing the wire becomes longer. At the final stage it is wound on small metal bobbins. One of the problems of wire drawing is that when the wire is ready for insertion in the die of the next stage it is, of course, larger than the die hole; this difficulty is overcome by dipping the end of the wire into boiling sodium nitrate. The effect of this is to eat away the wire to a sharp point at the end, and it can thus be readily started in the die.

Measurement

The wire is measured at the end of each stage of drawing in order to see that the die is drawing to the correct size, because the dies wear out with use. In the larger sizes the wire may be measured by means of an ordinary micrometer, but the smaller sizes such as in the case of the wire used in the DE3-type valve, which consumes only .06 ampere, this is not possible, as the diameter of the wire is only .015 millimetres! The method of determining the diameter of the wire is as follows: A length of 200 millimetres is accurately measured and cut off, and is weighed on a very accurate torsion balance. By calculation the corresponding diameter for a given weight can be found. A. H. H.

A COMMON FAULT

A FREQUENT cause of leakage in wireless receivers is due to placing the terminals too near the panel edge so that they touch the cabinet sides.

The amateur may see that his terminals do not touch the cabinet, and think there is no danger, but dust accumulates more quickly just under the edges of the panel than anywhere else, and this results in a leakage from the terminals to the wood.

The terminals should be placed at least half an inch from the edge of the panel; the security from leakage well repays any small additional cost in ebonite. E. B.

"THE BEST POSSIBLE CRYSTAL RECEPTION"

(*continued from preceding page*)

the mistake of using a very large coil and small condenser setting, otherwise signal strength will be reduced.

With a tapped coil, the number of turns should be in excess of what is required and a few tappings taken at the earth end, making a tapping for every turn and shorting those not in circuit. Extremely fine tuning can be obtained by combining variometer or spade tuning, described below. Such a tuner can be very efficient.

The variometer is a firm favourite and is cheap and simple to construct. The writer has obtained excellent results by making one coil as nearly as possible the exact size, tuning it with another coil of only four or five turns mounted at one end.

Spade Tuning

Spade tuning can be very efficient if only slight damping is introduced. In this case the coil is made slightly larger than necessary and damped down.

In view of the storm of criticism which he might arouse, the writer would not presume to say that any of the four methods is better than the others. He has obtained excellent results with all four, and it is impossible, simply by the aural test, to say which is the best. Nevertheless, the writer thinks that the variometer method has more in its favour than the others.

Comparisons

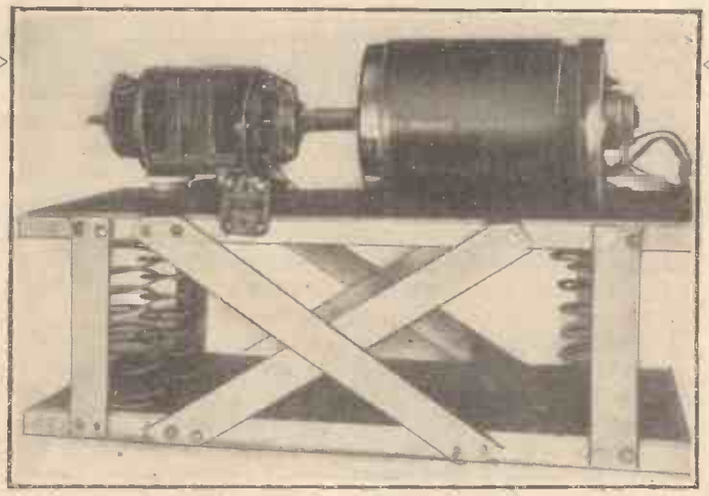
The condenser method necessitates the use of a good—and consequently fairly expensive—condenser. The tapped coil necessitates a number of soldered joints, which some amateurs find difficult, and introduces the risk of dead-end losses and other slight losses if studs and a switch arm are used. (Although not so neat, spring-clip connectors are preferable.) The damping-plate method is a little difficult to apply if a large solenoid coil is used, but if too much damping is avoided it can be very efficient. The variometer method is very easy constructionally and need not introduce serious losses provided the main coil is slightly smaller than is required, and the small coil is used to add the necessary inductance to bring the whole up to the desired wavelength.

The writer does not propose to give any constructional details of the coils he has been using, his intention being to give information which will assist the crystal user in his experiments. If, however, the hints contained in this article are kept in mind, the reader should be able to construct tuners which will give him excellent signal strength. At nine miles from 2 L O the writer is able to obtain such good signals that when they are put on a large Amplion they can be heard comfortably at the other side of a good-sized room.

R. H. B.

GENERATOR VIBRATION

Practical Hints for the Amateur Transmitter on the Elimination of Generator Noises



Photograph showing Generator Mounted on Anti-vibration Base.

ONE of the chief troubles of amateur transmitters who use high-speed D.C. generators is the elimination of the noises which are produced by the machines. These may be divided into three classes. The first of these is caused by the commutator ripple, and this may be easily overcome by the use of a 1- or 2-microfarad condenser placed across the H.T. terminals.

The second noise is that caused by the high speed at which the machine is running. This can be overcome by making a double box of 3-ply wood after the manner shown in Fig. 1. The air chamber between the two boxes should be about

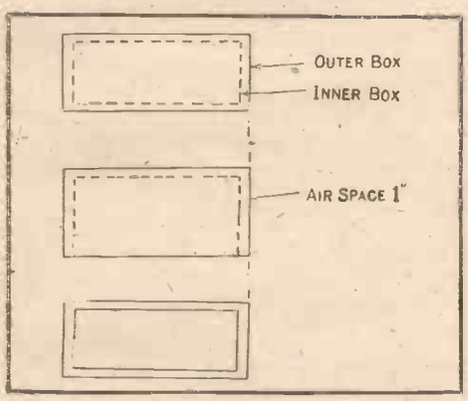


Fig. 1.—Construction of Sound-proof Box.

1 in. thick. If the machine is very noisy the disturbance may even penetrate the two boxes and may be overcome by lining the inner walls of the boxes with felt.

Mechanical Vibration

In the writer's experience, however, the most troublesome disturbance to eliminate is that caused by the vibration of the machine itself. This vibration is, in most cases, transmitted to the baseboard and to neighbouring objects. After several trials the following apparatus was found completely to eliminate all the vibration from a 10-watt machine giving 2,000 volts and running at a speed of 3,000 revolutions per minute.

The general idea of the gear may be gathered from Fig. 2 and the photographs. It will be seen that two baseboards are used, and the size of these will depend on the machine being used. The top board carries the motor and generator, and this is supported by four strong upholsterer's springs; the length of the springs when not in a state of compression should be about 8 in., and the greatest diameter should be about 5 in. These springs will take up the same frequency of vibration as that of the machine and prevent the vibrations from being transmitted to the lower baseboard.

Preventing Side Play

Now comes the important point—in order to take up the side play of the machine four rubber strips must be fixed to each side of the baseboard as shown in Fig. 2 and the photographs. The rubber should be about ¼ in. thick and 1½ in. wide. Two strips should be fixed on each side in the same direction as the springs, and two on each side should be crossed. As far as the writer knows this method of elminating vibration on high-speed machines is new to amateur transmitters and will prove very useful in stopping this very annoying trouble.

A. H.

Another Photograph of Generator Mounting.

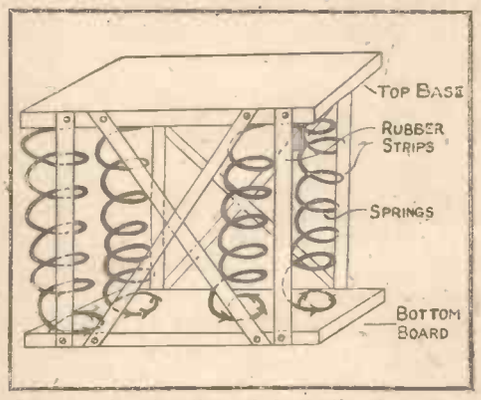


Fig. 2.—Construction of Anti-vibration Base.

AUSTRIAN COPYRIGHT FEES

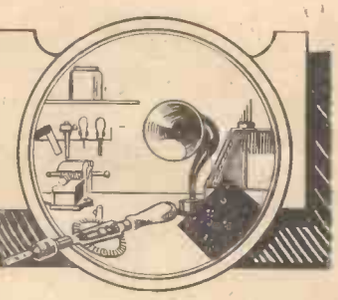
THE Vienna authorities have now concluded an arrangement with authors and music publishers in respect to the payment of fees on works broadcast through the Vienna and Graz stations. A contract has been made by which the Ravag stations will be entitled to broadcast any or all of Verdi's operas against the payment of a yearly sum amounting to roughly £100; the fee for broadcasting Puccini operas is fixed at £15 per performance.

As regards fees payable on dramatic or musical works relayed from a local theatre, it has been decided that the one payment made by the company responsible for the stage performance will also cover broadcasting fees. At the same time, as it is considered that the authors should receive some compensation for the increased audience on these occasions, a voluntary contribution may be made by the broadcasting authorities, and on this basis arrangements have been effected for the relay of entertainments from both the municipal and grand opera houses.

J. G. A.

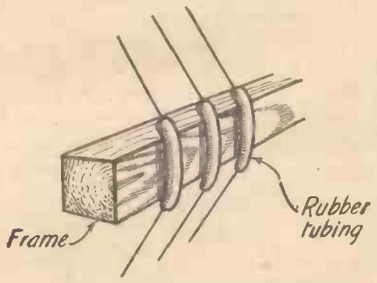
The Empresa Venezuelana Radiotelefonica Company of Venezuela has installed a one-kilowatt broadcasting station at Caracas. The call-sign is AYRE, and transmissions are made daily on 375 metres.

PRACTICAL ODDS AND ENDS



Insulation for Frame Aerials

GREAT care must always be taken when constructing a frame aerial to keep the various turns of the frame thoroughly insulated one from another. This



Insulation for Frame Aerials.

point, indeed, must be watched even more closely than when winding tuning coils, for although the frame is but a large coil, it is also the collector of energy. Even the slightest leak will have a serious effect on signal strength.

There is no need, however, to wind the aerial with heavily insulated wire, as short lengths of chemical rubber tubing slipped over the wire at the points where it is supported by the frame provide sufficient insulation. G.

Obtaining Louder Signals

CONSIDERABLY louder and purer signals, free from metallic resonance, may be obtained by the following simple device.

Cut a ring of fairly thin cardboard to fit the phone and place it in position on top of the diaphragm. A piece of uncrumpled tissue paper cut to the size of

Diaphragm Adjusting Device.

the diaphragm is placed on top of the cardboard ring and the phone cap screwed up tightly. Various thicknesses of cardboard for the ring may be experimented with in order to find that most suitable. The difference between the outside and inside diameters of the ring should be only about ¼ in. F. W. K.

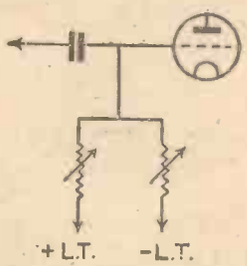
Accumulator Leakage

AFTER an accumulator has started to leak and has been patched in several places with pieces of celluloid, the amateur often decides that the only way to end the trouble is to buy a new accumulator.

This is an unnecessary course to adopt, for a little glass wool can be most effectively used in preventing such trouble. The leaky accumulator should be packed with glass wool, which will soak up the acid, so converting the cell into one of the "dry" type with no electrolyte to leak. B. A.

Grid Bias

A SIMPLE method of regulating the bias applied to the grid of a valve is shown in the diagram. The great advantage of the arrangement is that no expensive potentiometer is necessary, two grid



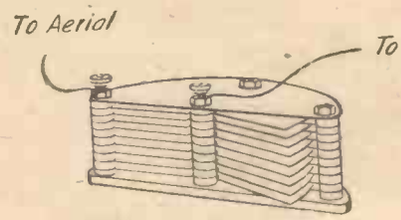
Simple Grid-biasing Device.

leaks in parallel being used to control the applied voltage. The leaks are connected together at one end and the joint is connected to the grid of the valve. The free ends are then connected, one to the positive and the other to the negative end of the L.T. accumulator. By increasing the resistance of either leak a corresponding bias is placed on the grid of the valve. H.

Series Aerial Condenser

WHEN receiving on the short waves it is generally found advisable to place a small fixed condenser in series with the aerial lead. A condenser having a value of about .0003 microfarad is suitable, and when connected between the lead-in and the aerial terminal of the receiver tuning and reaction control are generally greatly improved.

The condenser must be a good one if the best results are to be obtained, and one having an air dielectric is preferable, at least for receiving purposes. An excellent air-dialectric condenser suitable for inclusion in the aerial lead can be made quite easily from a few fixed and moving vanes of a discarded variable condenser. The vanes should be mounted on a small strip of ebonite and separated by spacing washers in the usual manner. Four short lengths of screwed brass rod should be fitted to the ebonite strip for the purpose of supporting the condenser. Connections

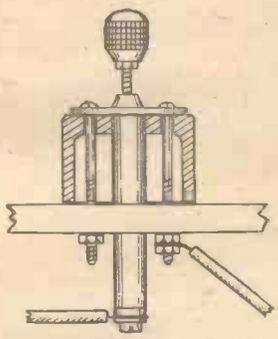


Series Aerial Condenser.

should be taken in the usual way from the fixed vanes to the aerial and from the "moving" vanes (now fixed firmly in position) to the set. With standard plates and spacing washers about six fixed and five moving vanes will be necessary. K.

A Mounting Tip

THE sketch shows a simple method of "packing" a variable resistance of the carbon-pellet and spring-plunger type in order to prevent the lower or inner end from fouling other components or leads or to permit the instrument being mounted on a panel attached to a very shallow cabinet. The packing-piece consists of the lower portion of a small wooden pill-box, the base of which is bored centrally to pass



Method of Mounting Rheostat.

the body of the resistance, and also drilled to take two extra long bolts. The receiver panel is similarly drilled, so that when the pill-box is inverted and passed over the resistance it acts as a washer or spacing sleeve. The idea should be clearly understood from the sketch, where the pill-box is shown in section. J. R.

HOW TO MEASURE SIGNAL STRENGTH

A Simple Means of Determining Strength of Reception

SIMPLE measurement of signal strength is most fascinating, as it enables the amateur to visualise the efficiency of his apparatus or the success of any particular circuit he may be testing. The method of measurement which is described below is almost instantaneous, and eliminates practically anything in the way of "work" other than the moving of a slider or the rotation of a knob.

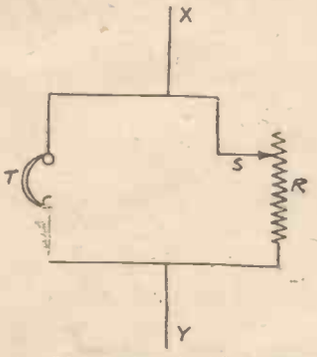


Fig. 1.—Phone Circuit with Resistance.

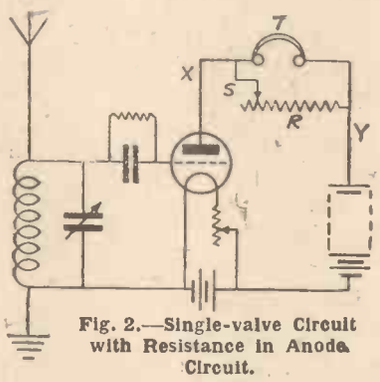


Fig. 2.—Single-valve Circuit with Resistance in Anode Circuit.

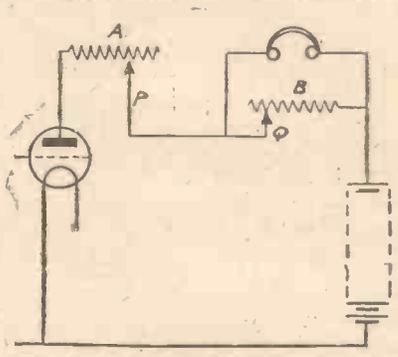


Fig. 4.—Circuit with Two Resistances.

The Principle of Measurement

To take absolute measurement of signal strength would necessitate hours of work and the use of hundreds of pounds' worth of expensive apparatus, and, moreover, would call for a very detailed technical knowledge. Where one wishes merely to compare the efficiency of receivers one does not need to know absolute values. All that is really required is a method of comparison.

If we listen with a pair of ordinary phones to, perhaps, a distant station, and if we connect a fairly high variable resistance such as a potentiometer across the telephones in the all-in position, we notice a slight diminution of signal strength. As we gradually rotate the slider of the potentiometer so that less and less resistance is connected across the telephones, the signals will become weaker and weaker, until they are finally inaudible. This is shown diagrammatically in Fig. 1, in which T is the telephones, R the variable resistance, and S the slider. If we assume that a current is flowing between the points X and Y, we see that it takes a divided path, part flowing through the telephones and part through the resistance S R. Now we know that in the case of a direct current it will divide itself in simple inverse proportion to the resistance. In other words, the higher the resistance, the more current will flow through the telephones and the louder the signal. Conversely, the lower the resistance the more current will flow through S R, therefore diminishing the current through the telephones and weakening the signals. By decreasing the resistance between S and R sufficiently, the current flowing through the telephones will become so small that it will fail to move the diaphragms and we shall hear nothing of the signals. Hence we find an easy way of comparing signal strength. Thus the louder the signal the less resistance we have to connect across the telephones in order to render them inoperative. Conversely, the weaker the signal the more resistance is required.

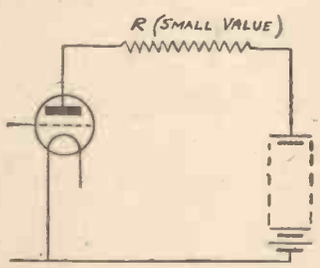


Fig. 3.—Anode Circuit with Resistance.

It would appear, then, that all we have to do is simply to employ a large variable resistance with the slider working against a scale calibrated, if desired, in any arbitrary manner. If we simply use one resistance as shown in Fig. 1 we shall not get accurate results. This can easily be seen by referring to Fig. 2. Here the telephones with the shunted variable resistance are shown in the anode circuit of a single-valve receiver. When receiving a very loud signal, in order to "fade it out"

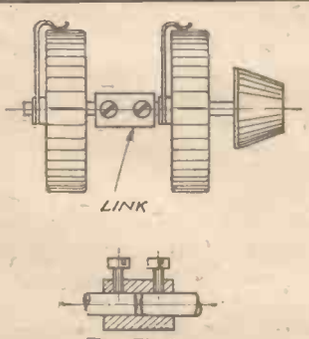


Fig. 5

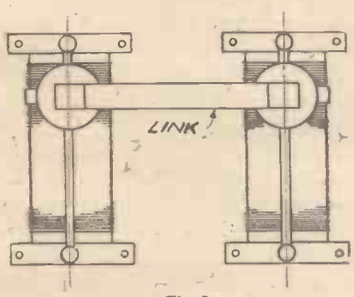


Fig. 6

Figs. 5 and 6.—Methods of Coupling Pairs of Resistances.

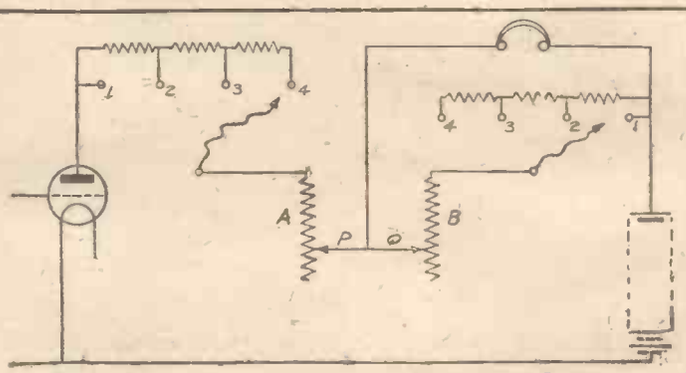


Fig. 7.—Connections for Audibility Meter.

the amount of resistance in shunt with the telephones will be very small. Electrically, the anode circuit of the valve in Fig. 2 is as shown in Fig. 3. Here we find the anode connected directly to the high-tension battery through a resistance which is very small compared with the internal resistance of the valve.

Now it is well known that the output of a valve, or the amplification, is dependent upon the load resistance; that is, the resistance or the total impedance in the anode circuit. Hence, if we simply use the single resistance we are altering the conditions under which the valve is functioning, and, consequently, we are varying its total amplification. This source of error can easily be eliminated by the simple expedient of using two identical variable resistances connected as shown in Fig. 4. The two identical variable resistances A and B are arranged so that the two sliders P and Q are linked together. Thus it will be seen that as the sliders move from left to right the amount of resistance B, which decreases, is exactly equal to the amount of resistance A, which increases. Thus it will be seen that the total resistance between P and Q remains approximately constant.

The actual value of the two resistances which would be required depends very largely upon the signal strength, and the resistances of the telephones. If the measurement is made on the output of a powerful amplifier from which very loud signals are being obtained, the variable resistance need only be of small value. If, however, the signals are very weak, or the measurement is being carried out on a single-valve receiver, the small signal voltage obtained will necessitate the use of a somewhat higher resistance. Accordingly, in order to provide for all eventualities, it is preferable to use two variable resistances, such as 300-ohm potentiometers, and connect in series with each a tapped variable resistance, the units being equal to the resistance of each potentiometer.

As the two variable resistances have to be moved together it is necessary to devise some form of link. If the shaft of the rotary type is sufficiently long to enable a sleeve containing two set-screws to be attached, the rotary resistance will be found more compact and convenient. The slider type must be mounted as shown by Figs. 5 and 6.

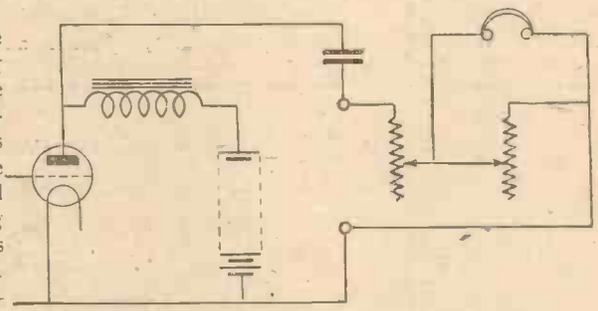


Fig. 8.—Another Scheme of Connections for the Audibility Meter.

As previously mentioned, the variable resistance alone will be of too low resistance when used with very weak signals, and accordingly it is necessary to include an additional resistance in series with each. This is preferably composed of a number of bobbins of resistance wire, each having a resistance equivalent to that of the variable resistance. If the variable resistance is 300 ohms, the bobbins can be wound with 10 yd. of No. 40 Eureka wire.

The Meter in Use

The strength measurer, or "audibility meter," as it has been termed, is provided with a scale, preferably marked into units of resistance. For example, if the resistance of the potentiometer which is being used as the variable resistance is 300 ohms, it is convenient to divide the scale into ten equal parts, each representing, of course, 30 ohms. This may then be further subdivided. The audibility meter may be connected simply as shown in Fig. 7, or it may be connected as shown in Fig. 8 through a choke and condenser. The latter method is perhaps preferable. The choke should be an iron-cored inductance of fairly high value, such as the secondary winding of an old spark coil or an intervalve transformer primary.

In comparing the relative strengths of two or more signals, the resistance across the telephones is placed in the maximum position and the sliders moved until the signal becomes just inaudible, the position of the pointer being noted. The same process is carried out with another signal, and the signal strength may then be taken as being inversely proportional to the shunt resistance as read by the pointer; that is, the smaller the resistance across the telephones the more powerful is the signal.

PAUL D. TYERS.

A children's concert in Glasgow City Hall, arranged by the Radio Circle in aid of the funds to provide wireless sets in hospitals, will take place on June 5. It has been postponed from the original date of May 29.

THE EFFECT OF SUN-SPOTS

IT has been suggested that DX reception is adversely affected by the presence of sun-spots. This kind of solar activity is normally accompanied by intense electrical disturbances in the earth's atmospere, which may, in turn, affect the condition of the Heaviside layer and thus interfere with the normal propagation of short-wave energy.

In 1924 sun-spots were few and far between, and the conditions for long-distance working, particularly in the case of amateur short-wave transmission, were admittedly very favourable. The same applies to Transatlantic broadcast reception. The present year commences a cycle of increasing sun-spots, and if the above theory is well-founded the best conditions for DX working will not again occur for another ten years, when the sun's periodical activity once more sinks to a minimum.

M. A. L.

HIGH- AND LOW-FREQUENCY RESISTANCE

IT is well known that the resistance of a conductor is greater to an alternating than to a steady current. At very high frequencies, where the so-called skin effect becomes pronounced, the H.F. resistance may be many times the ordinary value. For example, the resistance of No. 10 S.W.G. copper wire to currents of the order used in broadcasting (approximately 1,000,000 per second) is twelve times its normal value to direct current.

The difference between the two resistances becomes less pronounced as the diameter of the wire is decreased until, at a certain gauge, the skin conductivity finally reaches the same value as the internal conductivity. For instance, the H.F. resistance of No. 36 S.W.G. copper wire is the same to A.C. currents of a frequency of one million per second as it is to the steady current taken from a battery. In all cases the H.F. resistance of a coil of wire is greater than the H.F. resistance of a straight piece of wire of the same gauge.

M. A. L.

On Your Wavelength!

Echo

I NOTICED recently that the experiments on which the B.B.C. engineers have been occupied for some considerable time were beginning to bear fruit. In the past several public trials had been given of methods of producing an echo such as is obtained when a transmission is relayed from a large hall. Many people are averse to the introduction of this reverberation. They quite correctly state that it spoils the purity of the music, but it should be borne in mind that previous to the introduction of the draped studio this pure form of "listening," whether on wireless or direct to the ear, was seldom encountered. When one listens as part of an audience to a musical concert the echo is ever present, though the ear, being less sensitive than the microphone, does not reproduce the echo to such a pronounced extent.

One then is led to the conviction that to the majority of listeners the absence of this echo makes wireless broadcasts somewhat of a novelty and that "purity," the retention of which is advocated, raises a feeling of unreality in the mind of the ordinary listener. This can be judged by the popularity of those transmissions which come from a room whose acoustic properties include a pronounced echo.

Artificial Production

It is obviously out of the question to fashion every studio in such large dimensions that this echo will be naturally present. The next step was to produce this mechanically. To this end a room devoid of drapings was set aside, and various loud-speakers were tried and the reproduction from these was picked up by a microphone and superimposed on the original broadcast. This trial appeared to be adequate, but in practice it would seem to have failed, judging by what I heard.

Then came some weeks of silence from the "echo" experts until one day during a visit I spotted a cupboard being filled with amplifiers; to this miniature "power house" was connected a very novel form of loud-speaker. The volume of reproduction by this instrument could be amplified up to the volume of the original performance or, alternatively, far beyond that point. By control, the exact balance of "echo" can be superimposed by means of a second microphone on to any transmission from any studio at Savoy Hill. This "echo set" was brought into use recently and the pleasing effect was very noticeable. Solo instruments sounded as they do when rehearsing in an empty hall, but when the combination finished together there appeared to be somewhat of a "blare."

The important result of this innovation is that the expense of constructing large studios will be obviated. It should be borne in mind that the room and set are experimental, but in course of time each studio will have its parallel "echo." This thought will be a comfort to the artiste, though the "dead" effect of performing in a confined space will still, of necessity, be present.

A Good Idea

I see that the B.B.C. is to broadcast early next month the ceremony at the opening of a new extension to one of the London tube railways. The broadcast will include as far as possible some of the characteristic noises. This should be distinctly interesting, and I hope that nothing will prevent it from being done. Personally I always like these "noise" items whether the sounds are familiar or not. Few people know how difficult it is to broadcast certain sounds, for, wonderful though it is, there are many that the microphone is quite unable to deal with. One sound that defeats it is that made by the firing of a pistol or a gun, in fact it is at its worst when it is called upon to tackle any sound of a sharp and violent nature. When plays are put on in the broadcasting studio a great deal of experimental work has often to be done beforehand in order to make the "noises off" sound at all realistic. In the broadcasting of ordinary speech there is one sound that is quite difficult to reproduce perfectly—the sibilant "s" sound. The ordinary land telephone deals rather imperfectly with this, but the appliances used in broadcasting can be adjusted so as to bring the "s" sound out well, or even to over-emphasise it. At the present time, as you may have noticed, 2LO is overdoing his s's a little. There was an occasion during a "rag" programme in the early days of broadcasting when somebody unbeknown to a speaker wangled things in such a way that his sentences sounded rather like the splutterings of a soda-water siphon.

More and More

As I predicted, the absence of newspapers during the strike produced quite a boom in the sale of wireless sets and added hundreds of recruits to the ranks of wireless folk. Of one thing I am quite certain, and that is that those who installed receiving sets for the purpose of picking up the news bulletins will have discovered by this time what a splendid thing wireless is, and will be asking themselves how they ever managed to exist without it for so long. The great wireless brotherhood in this country now numbers more than two millions, which means that on any given night from five to ten million people in Great Britain alone listen to the broadcast programmes. I believe that if it were generally realised how cheaply a crystal set can be constructed the number of listeners would be more than double what it is at the present time. It is quite possible to make a set that works excellently at a total cost, exclusive of telephones, of about a shilling. And very decent headphones can be bought at prices as low as five shillings a pair. Thus for six shillings you can obtain a complete outfit which will give quite good results at places up to thirty miles of London or fifty of Daventry; in fact, with such equipment I can receive London, thirty miles away, or Daventry, forty-five miles, on an indoor aerial at quite respectable strength. And once you have installed a crystal set you have practically no further outlay, since the cost of upkeep is negligible. The only thing that remains is the cost of the licence, which may be regarded as the cheapest entertainment ticket in existence.

Cranks and Pranks

I have never been able to understand how it is that one's set sometimes goes wrong when it is not in use. Let me give you an instance of what I mean. On Monday night my set was working perfectly until I switched off at close-down time. On Tuesday not a sound came through when I switched on, though the set had not been touched in the meantime. Investigation disclosed a broken soldered joint in the plate circuit of one valve. What I want to know is how the set managed to do business as usual the previous evening if the defect was then in existence, or, alternatively, how the break could have occurred whilst the set was out of use and nobody so much as laid a finger upon it. Doubtless you have come across similar instances. Sometimes, of course, the breakdown occurs at the instant of switching on. This may happen when a condenser "goes" or when the windings of a transformer are burnt out by the sudden rush of current. In such cases there is a loud and ominous sound as you flick over the switch. In the instance that I have described nothing of the sort took place, and the whole business is very puzzling.

A Question Answered

I have referred more than once to the necessity for using a high-resistance voltmeter for measuring the E.M.F. of the high-tension battery. In this connection I have been asked several times what the resistance of the voltmeter should be and

On Your Wavelength! (continued)

how the intending purchaser can make sure that it is of suitable pattern. Speaking generally, the resistance should be such that the instrument at its maximum reading will not pass more than 25 milliamperes, and it is better if the load does not exceed 10 milliamperes. This means that the resistance of the instrument should not be less than 40 ohms per volt, and it is preferable to have a resistance of 100 ohms or more per volt.

The simplest way of discovering whether the resistance of a voltmeter is high enough is to get the vendor to place a milliammeter in series with it when taking a reading from a high-tension battery. If the milliammeter shows 25 milliamps. or less, then the instrument is suitable for the purpose for which it is intended. Twenty-five milliamperes is, of course, much too heavy a steady load for a high-tension battery composed of small cells, but since the moving-coil voltmeter should be "dead beat," a reading can be taken in less than a second so that no harm will be done to the battery.

Whether you want the instrument for testing your accumulator or for testing the high-tension battery, avoid the cheap moving-iron voltmeter, which is seldom anything like accurate when purchased and whose readings are apt to be "all over the place" after a varying period of use. I have one of these things at the present time which I bought four or five years ago. It then gave reasonably accurate readings, but after a short time it became utterly unreliable for any kind of work, and it now shows 2½ volts when applied to the terminals of a fully charged 6-volt accumulator!

Accumulator Waste

I had taken my accumulator round for a refil the other day and I stopped to chat for a short time with the man in charge of the station. "It is simply wicked," he remarked, "to see the way in which some people treat their accumulators. Just come and look at some of these." He took me into the charging-room, where a large number of batteries were under treatment. The first one that he showed me was badly sulphated, though he told me that it was hardly three months old. There were many others in much the same condition, and not a few showed plates that were more or less buckled, large deposits of sediment and badly corroded terminals. He assured me that quite 50 per cent. of the accumulators brought in were run right down, the terminal voltage being often 1 volt or less per cell.

The reason for this is to be found, I rather fancy, in the widespread use of the dull-emitter valve by people who began with bright-emitters. If you work valves requiring from 2.5 to 3 volts from a 6-volt battery you can keep the set working for days after the accumulator requires a fresh charge by turning the knobs of the rheostats farther and farther towards the "full on" position. There is no more foolish policy than this, for if an accumulator is run down below 1.8 volts a cell, its plates at once begin to suffer damage owing to the violent action of the electrolyte upon them. Even if you do not possess a voltmeter, the very fact that the rheostats require adjustment is a sure sign that the battery ought to go to the charging station, for as soon as the voltage begins to fall the plates are unfairly attacked. Terminals can always be kept in good condition if a little vaseline is applied to them from time to time. The buckling of plates and the formation of sediment is nearly always due to discharging at too high a rate. In the first three months of its life an accumulator should never have a load greater than one-twentieth of its actual capacity, though after this the load may be doubled without doing harm. Above all things, if you value your accumulator and want good service from it, never allow it to stand in a run-down condition, but take it as soon as possible to the charging station.

Correcting Noisy Transformers

Those amateurs who are for one reason or another unable to indulge in expensive and well-designed transformers are able to correct the resonance peak by applying a high resistance across the primary or secondary coil of the instrument. A few experiments will have to be performed in order to determine the correct value of resistance and which coil requires correcting, and a variable grid leak which is likely to be constant in working and is constantly variable should be used. It will generally be found that the secondary coil requires correction, and the leak should be applied when signals are being received, the knob being adjusted whilst signals are being received. If the experiment is carefully carried out and a grid leak having a value of 1 to 6 megohms is used, it will be found that there is a critical point at which best results are obtained, although it is possible that a slight sacrifice in signal strength is entailed. This loss will not be noticeable owing to the fact that the enhanced clarity makes easy reading possible.

Ultra Short Waves

There is still a mad plunge downwards on the part of the amateur in an effort to get on to the extra short wavelengths. Many of those engaged on the Transatlantic tests of the past winter are now working regularly on 20 metres, whilst other optimists are fitting themselves out for 5 and 10 metres. It will only be a matter of a year or two years before these ultra-short waves have been thoroughly explored.

In America serious consideration is being given to the use of wavelengths of 100 to 300 metres for broadcasting purposes, and I suppose that we shall in due course follow the lead—providing that none of the commercial people get there first. It is interesting to note that the various Government departments are engaged at the present moment in investigating the possibilities of the very short waves of 10 metres and lower, but what progress has been made is not yet known.

A Baby Transmitter

I have just received details of a tiny transmitting set with which wonderful results have been obtained. This is an American production, which weighs only 4 lb. and measures over all 12 in. by 7 in. by 7 in. The valve used is the American equivalent of our .06 type, the filament being heated by dry cells. The plate voltage is supplied by a standard 90-volt high-tension battery. With this equipment successful working has been accomplished at ranges up to a thousand miles with an input of only a fraction of a watt. One of the outstanding feats was that performed in September of last year when with only .4 watt readable signals were transmitted from Madison, Wisconsin, to New York City, a distance of 800 miles. With the addition of a second valve of the same kind to act as modulator, telephony has been carried out over quite big distances, the input in this case being between 2 and 3 watts. When it is remembered that an ordinary pocket flashlamp consumes usually rather more than 1 watt the wonder of these long-range transmissions at tiny power is realised.

New Designs

I believe that in the near future we shall see placed upon the market a great many types of sets of the non-radiating kind. I have been experimenting with a number of circuits recently and have found that there are several ways of producing a sensitive and selective receiver which cannot cause one's aerial to radiate in whatever way one operates the tuning controls. The great secret is to use a high-frequency stage before the detector and to couple these two valves so loosely that there can be no feed-back effect between them. The plate circuit of the high-frequency valve should be aperiodic, whilst reaction is best applied to the grid circuit of the detector. This means that you can make the detector valve oscillate, and can thus employ the easiest of all methods of searching—finding the silent point between squeals—without the possibility of your being able to cause any interference with your nearest neighbour. Receiving sets built on these lines are largely used in America, and will soon be popular in this country. THERMION.

KNOW YOUR VALVES!

The test panel described in this article will be found extremely useful to determinate the characteristics of your valves and thus ensure real efficiency.

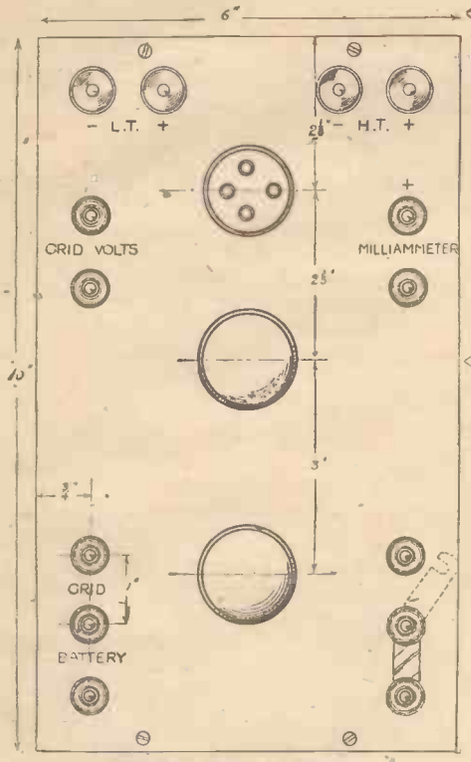


Fig. 2.—Front of Panel.

ONLY an intelligent appreciation of the purpose for which any valve was designed will enable its user to obtain the maximum efficiency from it, either as regards signal intensity or fidelity in the reproduction of music and speech from the receiver.

Much valuable information may be had from an examination of the characteristic curve of a valve and, in fact, the suitability of that valve to any particular position or working condition in the receiver can be accurately gauged.

To many valve users the preparation of a curve would seem to be a matter only for the expert with laboratory instruments at his disposal. Such, however, is not the case, and below is given a description of an extremely useful addition to the experimenter's work bench which will amply repay the short time expended on its construction.

A glance at Fig. 1 will show that a characteristic curve is simply a representation, in graph form, of the relationship between the grid potential of a valve and the current flowing in its anode circuit for different values of applied plate voltage. The vertical line is divided to show the plate current in milliamperes, and the horizontal line indicates the grid potential in volts.

It will be seen that in the preparation of similar curves to this there will be required some means whereby grid and plate voltages, and also plate current, may be measured. In addition, it will be necessary to provide for convenient adjustment of the grid potential within certain voltage limits. Figs. 2, 3 and 4 show how this may be simply arranged. An ebonite panel, upon which are mounted a filament resistance, a valve holder, a potentiometer and terminals is required.

For the measurement of grid, plate and filament voltages a good voltmeter, preferably with a large open scale, is used. It is essential that this should be of high resistance, otherwise the voltage drop across its windings will completely upset the readings.

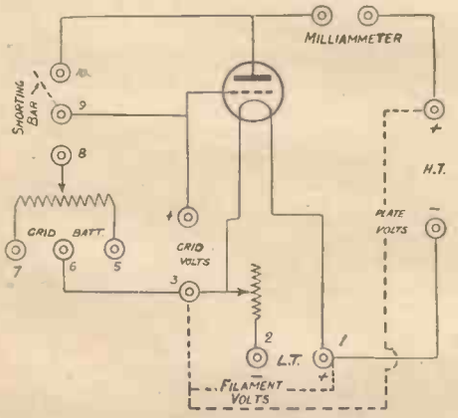


Fig. 4.—Diagram of Connections.

Constructional Details

The actual constructional details are easily understood from an examination of the front and back views of the panel, and when assembled the wiring should be carefully carried out in accordance with the circuit arrangement of Fig. 4. Two pieces of wood screwed on the under side of the ebonite will serve to support the panel.

When completed, H.T. and L.T. batteries may be connected to their respective terminals and a valve inserted in the holder. The H.T. should be given a commencing value of, say, 30 volts and the milliammeter connected in circuit. This may, with advantage, be of the type having several ranges, but, failing this, an ordinary 0-to-10 or 0-to-20 milliampere instrument will serve quite well. The grid battery, which may conveniently be about 12 volts on either side of the centre tap, depending on the constants of the valve on test, should be of large capacity.

To prepare a curve, a piece of squared paper, ruled similarly to Fig. 1, should be obtained, and with the batteries connected as shown, the filament resistance may be rotated until the voltmeter, placed first across terminals 1 and 3, shows a reading corresponding to the normal operating voltage of the valve filament. This may be ascertained from the maker's printed instructions. It is important that this value should remain constant throughout the testing, otherwise erroneous readings will result. Having adjusted the filament potential, the voltmeter is now placed across terminals 3 and 4. This will give the voltage of the grid in respect of the filament, and it will be noticed here that rotation of the potentiometer produces variations in both the grid voltage and the anode current. Further adjustments of the potentiometer towards its negative end will reduce this latter, until at one point the anode current is at zero. The negative potential of the grid has reached a value where the electron stream from the heated filament has been practically completely cut off, permitting no current to flow between filament and plate.

Assuming this to have occurred at a point representing, say, 6 volts negative

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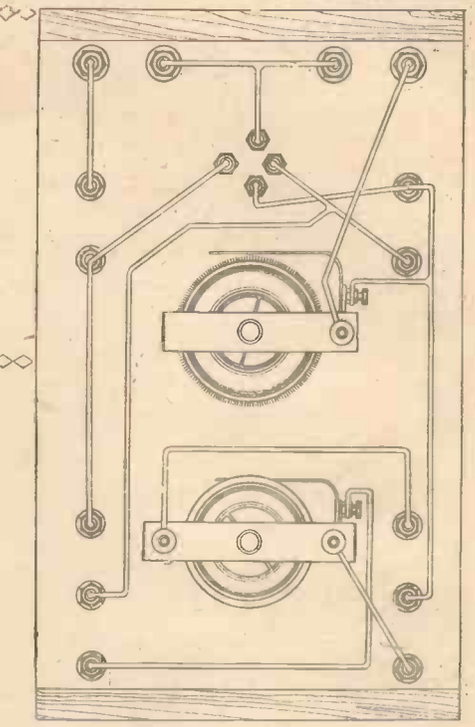


Fig. 3.—Connections on Back of Panel.

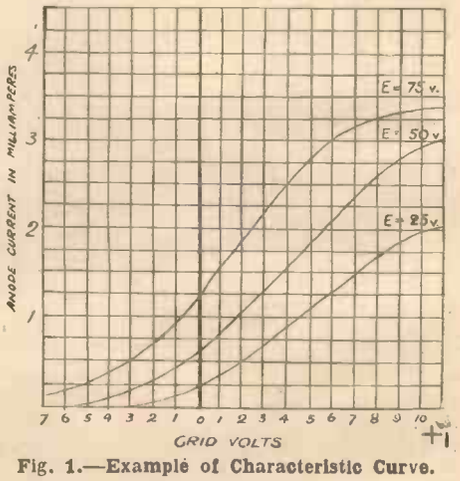


Fig. 1.—Example of Characteristic Curve.

INCREASING THE POWER OF THE SUPER-HET

An interesting circuit that will give you wonderful results

THE oscillator, or frequency-conversion circuit, of the super-heterodyne method of reception has been the subject of much experiment, especially during the last twelve months or so. There are several well-known methods: First, there is the separate oscillator for creating the necessary beat frequency; then there is the method of using the first rectifier as a combined oscillator as well, and thus economising in the total number of valves used by making one do the double duty of oscillator and detector.

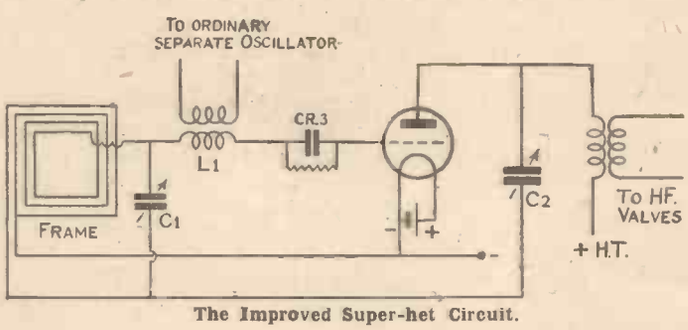
This method is again subdivided into various arrangements of the oscillator, known by such names as the second harmonic method, the tropadyne circuit, the Hartley oscillator, etc. etc.

My intention in this short article is to describe yet another method. I believe the circuit I am about to describe is quite new, but whether it is new or not, it gives wonderful results.

Compared with a standard super-heterodyne, using the second harmonic oscillator and three stages of intermediate frequency amplification, the new method gave an increase in signal strength of about seventy-five per cent., the same set being used in each case, and only the oscillator circuit being altered from the second-harmonic principle to the new method.

Briefly the idea is as follows: When either the separate oscillator system or the combined oscillator detector is used there is one disadvantage. In the first method, the detector is purely functioning as a detector and not as an amplifier also, and is therefore not in the most sensitive state for the reception of signals, and in the second method a similar state of affairs exists, only in this case the valve is oscillating violently, and is therefore not in its most sensitive state for correct rectification, although perhaps it is a little more sensitive than the former method.

My method overcomes this disadvantage by allowing the rectifier to work at its most sensitive point (as a detector-amplifier), that is, just before it is about to oscillate. In other words, the new method is to use the separate oscillator circuit and to introduce reaction into the first detector circuit and so bring it up to the point of oscillation, when it will be enormously sensitive to weak signals. The diagram shows the method of accomplishing this.



The Improved Super-het Circuit.

The frame aerial is tapped at one-quarter of its total number of turns; that is, if it is wound with twenty turns, a tapping at the fifth turn. (Twenty turns is only an example; most frames on the broadcast wavelengths have about twelve turns, so the tap would in that case be taken at the third tap.) This tapping, it will be seen, is taken to L.T. minus. The end farthest from the tapping goes to the oscillator pick-up coil L1; from there it goes through CR3 (grid condenser and leak) to grid of valve. (In the twenty-turn frame there would then be fifteen turns between the grid and filament.) The other end of the frame—that is, the remaining five turns from the tapping—goes through C2 to plate of valve. C2 should be about .00004 microfarad.

C1, it will be noted, is placed *right across* from one end of the frame to the other, *not* from grid to filament. C1 may be .00025 microfarad, and it will be found to give the rather astonishing tuning range between about 250-700 metres with one revolution of the dial. The separate oscillator may be any standard circuit; also the intermediate frequency stages and second rectifier are quite standard.

The method of tuning is quite simple, and is as follows: Set C2 at its minimum capacity, then proceed in the usual way that a super-het is tuned, using C1 and the oscillator condenser to tune in a station. When correctly tuned as loud as it is possible to get it, gradually turn C2 until the detector valve commences to oscillate; when this occurs reduce the capacity until it stops oscillating, then reduce it still further by a couple of degrees on the dial, and you need not touch C2 again, as the reaction will remain constant over the whole broadcast band. This is the great feature of the arrangement, as it still only leaves two controls as usual for tuning. You simply tune in the usual way now, only the signals will be enormously louder than before you moved C2. Anyone who tries this method will be very agreeably astonished at the difference in the results obtained with this method compared with the usual systems. 5 C G.

"KNOW YOUR VALVES". (*continued from preceding page*).

along the grid-volts line, the plate-current reading should be observed and marked by means of a dot on the squared paper. The potentiometer is now set to, say, 5 volts negative and the reading noted as before, the process being continued at intervals of 1 volt until additional increases in grid potential produce no further change in anode current. This is the maximum plate current that this type of valve can provide for these values of anode and filament voltage. A smooth line joining the points on the paper completes the curve, and additional readings can be taken for other H.T. values.

An examination of the curves thus produced will show that they consist chiefly of a straight line with curved extremities, and it will be evident that, to obtain proportionately equal changes in anode current for equal variations in grid potential, the valve must be operated along the straight portion of the slope. In other words, faithfully to reproduce impulses applied to the grid in an amplified form in the plate circuit, the H.T., L.T. and grid voltages must be arranged so that signal variations cannot take the working point off this straight portion.

This is essential when the valve is employed as an amplifier in the receiver, or distortion must result.

Measurement also of the filament emission of a valve may be made with the panel; in this case the wire shorting terminals 8 and 9 must be removed and replaced across 9 and 10, the required reading being obtained from the milliammeter as before. This is extremely useful in the testing of valves of the low-consumption type whose dull-emitting properties have been impaired, either by overheating the filament or by prolonged service in the receiver. A. S.

A competition of an original character recently took place in Paris under the title of "The Broadcasting Championship." The competitors were required to tune in a given number of foreign transmissions in the course of a period of five minutes, the prize being won by a Frenchman, who succeeded in hearing six foreign broadcasting stations, of which two were English.

"A.W." TESTS OF APPARATUS

Conducted in the "Amateur Wireless" Research and Test Department

Magnum Neutralising Condenser

A NEAT and effective neutralising condenser, designed for baseboard mounting, is manufactured by Burne-Jones and Co., Ltd., of Magnum House, 296, Borough High Street, London, S.E.1. The small variable capacity is obtained by two small circular brass discs, one of which is permanently fixed to the ebonite base of the component, while the other is attached to a screwed spindle, to the opposite end of which the operating knob is fixed. The spindle passes through a screwed spring collar, which grips the spindle tight enough to ensure that a good connection is made in all positions. A thin sheet of mica is placed over the fixed plate of the condenser, thus preventing the possibility of a short-circuit between the plate and grid of the valve. The actual condenser is enclosed in a dust-proof case and connections brought out to terminals mounted on the base.

Magnum Neutralising Condenser.

Polar Coil Units

WHERE quickly interchangeable coils are required having a high efficiency, small bulk and weight and possessing a micrometric control of the coupling between the coils, the Polar unit is ideal. The unit consists of two coils, aerial and reaction, mounted on a special carrier which has four pins arranged to plug into an ordinary valve holder. Both coils are completely interchangeable and possess the distinct advantage that either coil may be replaced without disturbing the setting of the other.

By turning the small knob, seen on the top of the unit, in one direction and then in the reverse, the coupling between the coils is increased or decreased as the case may be. Coils are available covering wavelengths between 235 and 4,720 metres, and all coils occupy the same space.

We have recently tested this unit in a portable set, for which purpose the unit is especially suitable. Results were very satisfactory and even exceeded those obtained by the use of standard plug-in coils. The micrometric adjustment gives a very smooth and accurate control of reaction.

Polar Coil Unit.

The Ferranti AF4

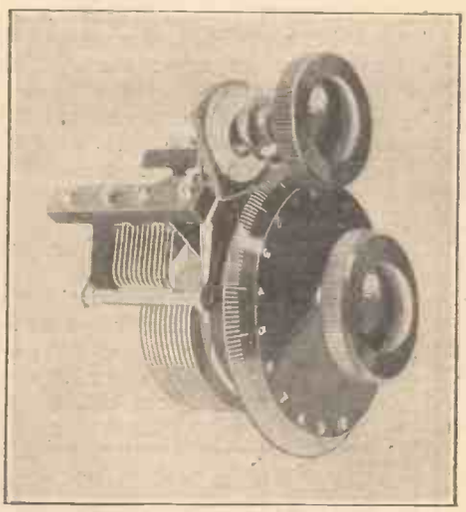
WE have just completed tests on the Ferranti type AF4 low-frequency transformer, manufactured by Ferranti, Ltd., of Hollinwood, Lancashire. This instrument has a voltage step-up ratio of 3½ to 1; its weight is 1 lb. 8 oz., and dimensions 2¼ in. by 3 in. by 3¼ in. It has been designed to meet the needs of those who require good results from an instrument sold at a popular price, and in this it entirely succeeds.

Ferranti AF4 Transformer.

The volume and purity of amplification obtained from these transformers when tested is comparable with well-known instruments at nearly double the price. The inductance of the primary winding is approximately 22 henries—a high value, giving good amplification on notes of low frequency. A small by-pass condenser is incorporated in the transformer to ensure that only the correct capacity is placed in shunt with the primary.

Cosmos Variable Condenser

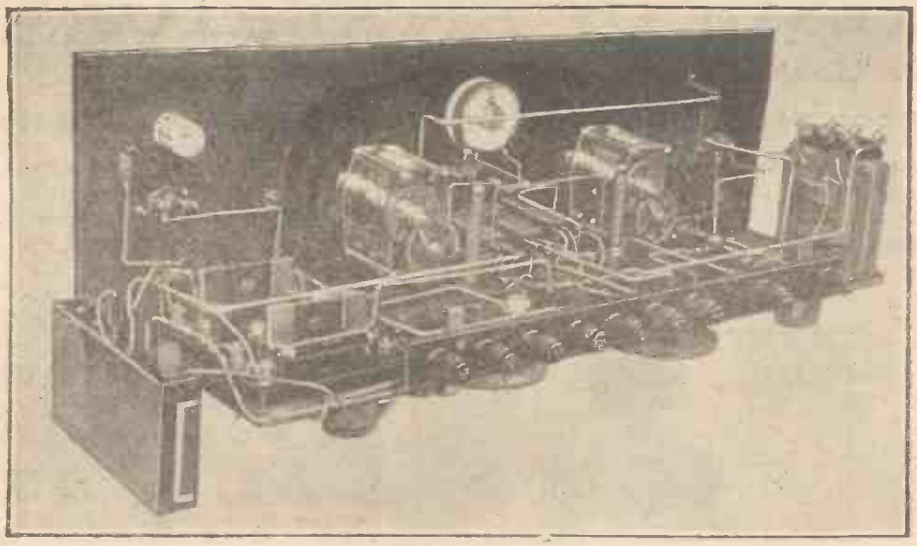
A VERY well-made variable condenser possessing some novel features is manufactured by Metropolitan-Vickers Electrical Co., Ltd., and may be obtained from Metro-Vick Supplies, Ltd., of Metro-Vick House, 145 to 147, Charing Cross Road, London, W.C.2. The Cosmos condenser, as it is called, has a slow-motion action accomplished by the use of a spring belt held in tension, which permits coarse tuning with the large knob and a 10-to-1 gearing ratio slow-motion with the smaller knob. If desired, the slow-motion control may be mounted at a considerable distance from the condenser, the extensible spring belt thus providing a remote control.



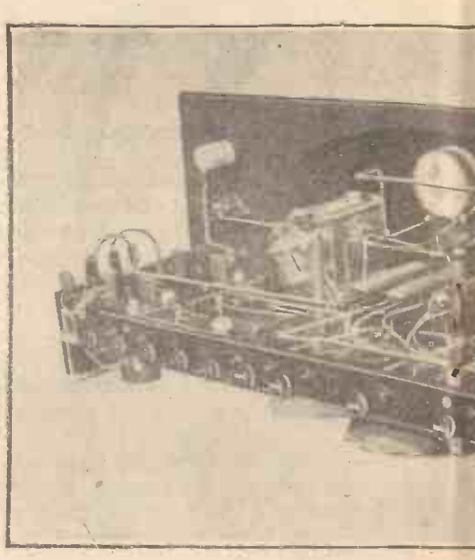
Cosmos Variable Condenser.

Cone bearings allow for adjustment, and a pigtail connection to the moving plates ensures quiet operation. The moving plates are connected to the metal frame and are shaped to give a square-law effect.

We can thoroughly recommend this instrument to our readers, as it possesses real low-loss properties, a rigid and lasting construction, is capable of a very fine adjustment of capacity and has a good appearance. The minimum capacity of the .0005-microfarad sample submitted was approximately .000015 microfarad.



Three-quarter View of Back of Panel.



Rear View showing Arra

A VERY FINE

SHORT WAVES OR LONG WAVES — *TWO VALVES VALV*

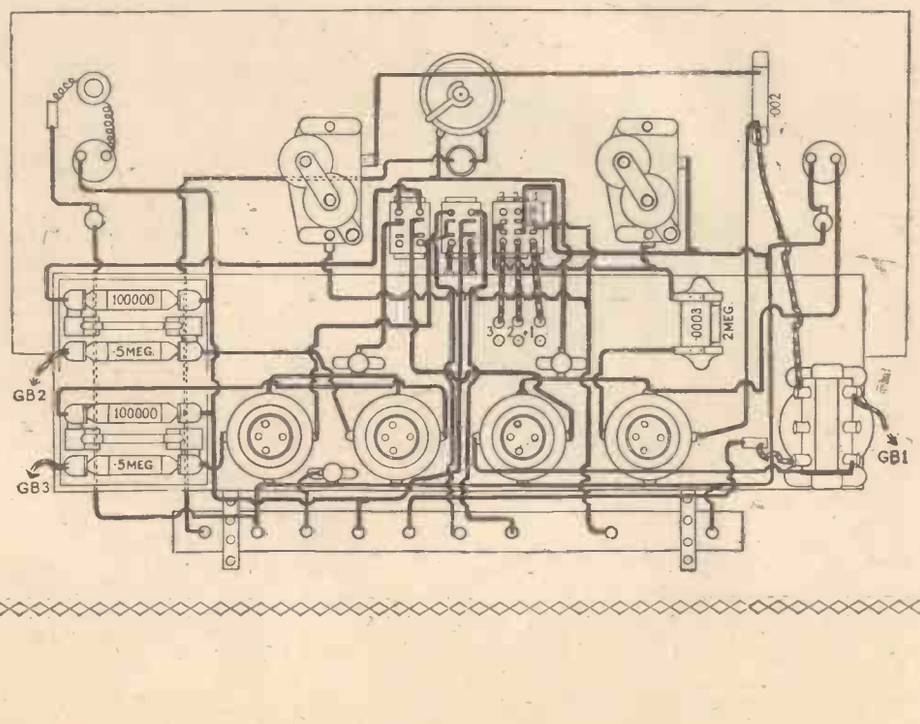
UNDOUBTEDLY there is a growing desire that receivers for the home shall be of pleasing appearance as well as efficient in operation. Exposed batteries and wires are completely out of favour. Here is a design for a really handsome set made for mounting in a small bureau. Not only is it luxurious in appearance, but care has been taken to select the best of components; nevertheless the total cost of the instrument is not excessive. Mounted in the bureau, the set takes the place of the usual pigeon holes. The batteries are very conveniently housed in one of the drawers beneath.

The Panel

The panel of the receiver is small and oval in shape. It is mounted on polished wood, the size of which and the shape is determined by the dimensions of the bureau or cabinet into which the set is to be installed. This makes a most pleasing arrangement, as the photograph and Fig. 1 show.

The set itself is arranged with three switches on the ebonite panel. These give at will short-wave B.B.C. stations or Daventry; two valves or four valves and switches the output either to the loud-speaker terminals at the rear of the set or to a telephone plug on the panel. There are also provided and mounted on the polished wood low-tension and high-tension voltmeters. The low-tension meter is arranged to take the reading at the filament legs of the first two valves so as to show exactly what pressure is being applied.

The valves are arranged in two pairs, the filament current of each pair being controlled by a fixed resistance. A master rheostat is in series with the connection from the negative pole of the accumulator. With this arrangement of voltmeter and resistances the voltage at the first two valves can be observed to rise and fall as the master rheostat is adjusted. Thus the filaments can have applied to them the exact voltage specified by the makers of



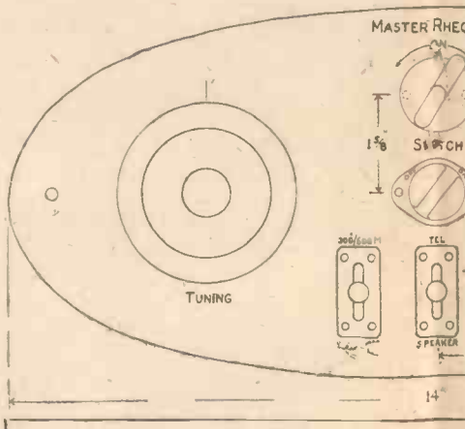
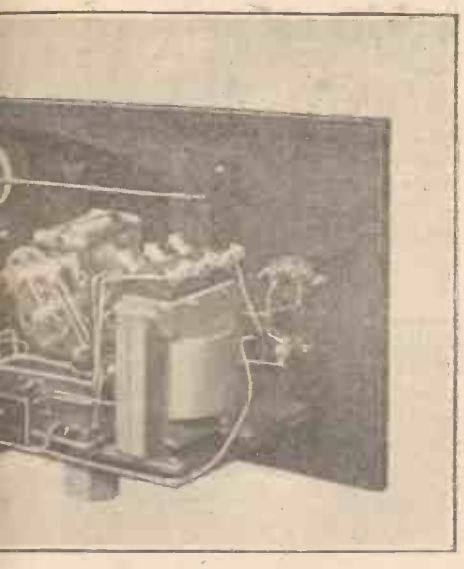
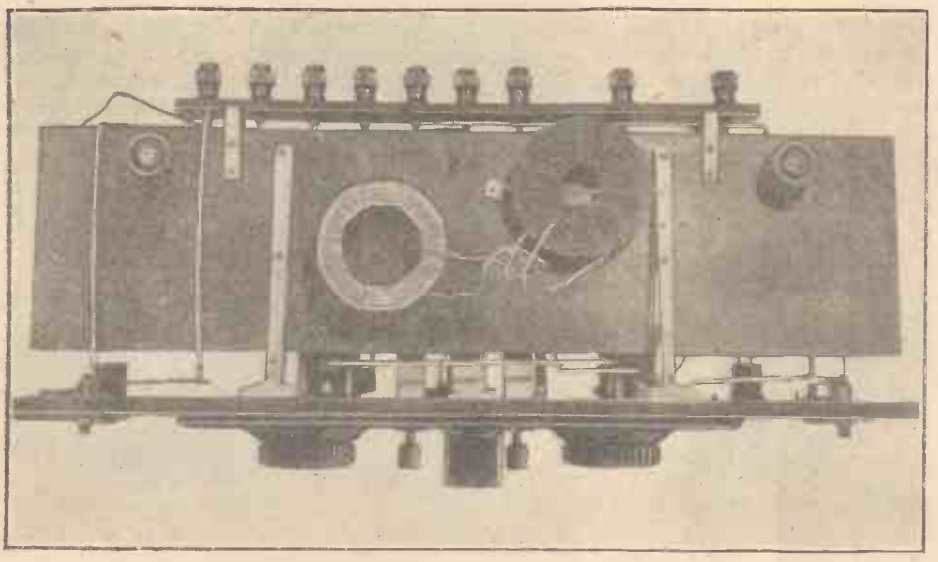


Fig. 4 (left).—Diagram showing Arran
Fig. 5 (above).—Dimension
Fig. 3 (right).—Complete Th



angement of Components.



Under-side View showing Tuning Coils.

FOUR-VALVER

S OR FOUR VES □ *PHONES OR LOUD-SPEAKER*

the valves. The voltmeter for the high-tension is arranged to give the reading of the pressure applied to the anodes of the amplifying valves.

The Circuit

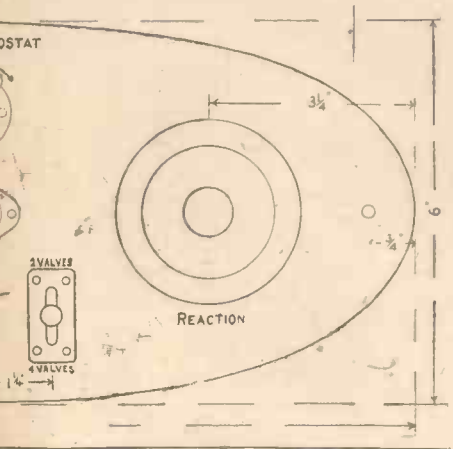
The circuit used in the set is that due to Reinartz, with one transformer-coupled and two resistance-coupled amplifying valves, making four valves in all. The resistance-coupled valves are so arranged that they can be switched in or out of circuit as required. When out of circuit the filament current of these two valves is cut off.

The basic theoretical circuit is shown in Fig. 2 as a two-valve arrangement, and in Fig. 3 is shown the complete theoretical diagram with the switching used; also indicated are the electrical values of the components.

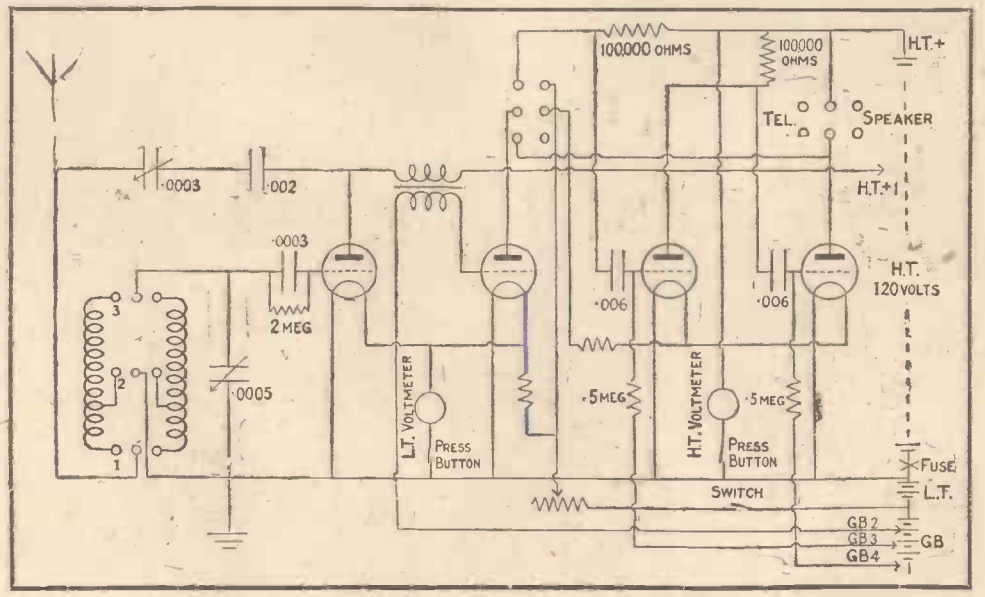
Tuning Coils

The complete lay-out behind the panel and on the baseboard is shown by Fig. 4. This gives the actual wiring connections in the positions they occupy. The tuning coils, it will be noticed, are mounted beneath the baseboard as indicated in the photograph. The practical wiring diagram just referred to shows the connections to one coil only; the connections to the other coil are omitted for the sake of preserving clearness. The points of connections are numbered to correspond with the numbering of the same connections on the developed theoretical diagram. These six connections to the two tuning coils are made with short lengths of rubber-covered flex. The coil for short-wave reception is basket-wound of 75 turns, tapped at the twenty-fourth turn from the inside. The Daventry coil is a Lissen 250 coil removed from its mount, the tap from the fiftieth turn being taken to the connection at earth potential.

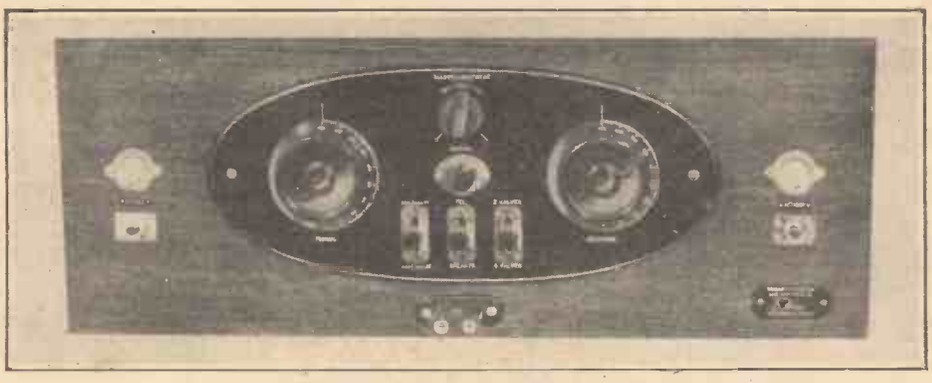
The transformer used is the new R.I. multi-ratio instrument. It is arranged so that the outside secondary is permanently connected to the grid terminal of the



gement of Components and Wiring.
ns and Layout of Panel.
eoretical Circuit Diagram.



second valve. The other connections to the transformer are by flex, so that they may be readily altered. One length of flex from the opposite end of the secondary coil passes along the back edge of the baseboard so as to cross to the grid bias battery.



Photograph of Wood and Ebonite Panels.

Anti-vibration valve holders are used, G.E.C. tuning condensers, and McMichael resistance-coupling units. The lever-type switches are of the anti-capacity type, two

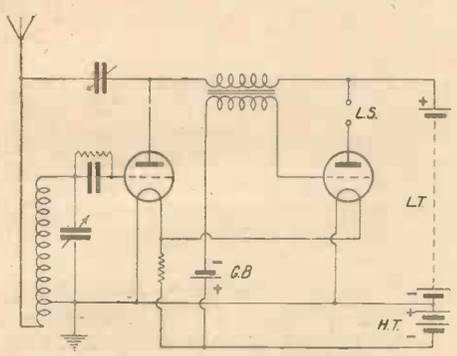


Fig. 2.—The Fundamental Circuit.

double-pole double-throw, and one three-pole double-throw, the last being for switching from one tuning coil to the other. The rheostat used has a master control, is an Igranic-Pacent, and as all the current to the valve passes this rheostat and it is liable to get heated slightly in consequence, the make was chosen as it has a porcelain body. The fixed resistances are those marketed by Burndept.

Terminals with engraved tops are used, and the terminal strip brackets, made from brass strip, are extended beyond the slat of ebonite so as to provide a means of holding into place the back of the bureau, which is usually made of thin 3-ply wood.

The Oval Panel

It may be helpful to mention that the panel (Fig. 5) was cut oval shape and its edges rounded off for a few shillings by a firm in the brass-finishing trade. This inexpensive little job is undoubtedly very largely responsible for the pleasing appearance of the set. Both the baseboard and the wooden front in which the voltmeters are mounted are made of ¾-in. American whitewood. The baseboard is just shellac varnished and the front stained and french polished.

Features of the Circuit

The Reinartz circuit is quite orthodox. The .002 fixed condenser, shown in series with the reaction condenser, may at first sight appear to be unusual. It is introduced so as to safeguard the high-tension battery. In the ordinary way the whole of the high-tension is across the reaction condenser, and should the vanes touch at any time a dead short circuit results. The fixed condenser prevents such a possibility and merely has the effect of slightly reducing the effective maximum capacity of the reaction condenser.

For most efficient operation the set requires 120 volts high-tension on the amplifying valves, and it is best to use high-tension batteries larger than the standard size. It is also advisable to employ four valves of similar current consumption, as otherwise the pressure on the valves is liable to fluctuate very considerably when switching from two to four valves. In any case, it will usually be found that the master rheostat requires adjusting when the two- or four-valve switch is used.

D. G. O. HISCOX.

Prominent artists coming to Scottish broadcasting stations are Miriam Licette,

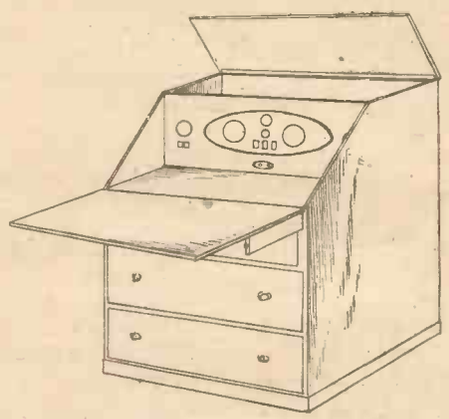


Fig. 1.—Receiver Mounted in Bureau

Leff Pouishnoff and Topliss Green. Some of the most famous military and other bands, which will be playing in Glasgow's public parks during the summer, are probably to be broadcast from the studio.

ROUMANIAN RADIO

AS is the case with other Balkan States the restrictions made by the Roumanian Government authorities have considerably hampered the progress of wireless telephony, but a few months ago certain modifications were made to the regulations controlling the reception of these transmissions. The Posts and Telegraphs Department have begun to realise the advantages of a broadcasting service, and a Wireless Telegraphy and Telephony Bill has been recently submitted to the Chamber of Deputies. In principle, the State will reserve to itself the sole monopoly for the entire kingdom, but will be willing to grant a concession to a limited company formed for the purpose of organising the programmes, the Government retaining interest in this concern to the extent of 60 per cent. of the shares. It is thought that such a licence may shortly be granted to a company backed by French interests.

For the present, receiving licences are obtainable, but many restrictions are imposed on the enthusiast, and all applications must be accompanied by a guarantee of good morality, signed by a responsible church dignitary. The issue of the licence is subject to the joint authority of the Posts and Telegraph, Civil and Military State Departments. Reception is now permissible throughout the country, and the prohibited zone of 20 miles within the frontiers has been abolished. All apparatus must be submitted to each of the authorities in turn, and is officially sealed. Receivers employing direct reaction on the aerial circuit may only be used in localities which do not possess more than ten licence-holders.

GRIDDA.

THE USE OF FIBRE

TO the constructor fibre is invaluable as an insulating substance, which can be bought in practically any form, and proves particularly serviceable where small work is being done and the material has to be easily cut and used in little pieces.

Although fibre has a natural dull polish, it is not generally known that a beautiful gloss can be put on it by polishing with fuller's-earth applied with a little lubricating oil.

Fibre has numerous advantages, and if it were as good an insulator as ebonite, there is little doubt that it would be very extensively used. It can be bought in almost any form, as rods, sheets or tubes, it is easily bent when it has for some time been immersed in hot water.

E. B.

EXPERIMENTING WITH TWO-GRID VALVES

The second and concluding article on the characteristics and uses of two-grid valves

ANOTHER circuit employing magnetic reaction is given by Fig. 7; its only disadvantage is that it requires an H.T. battery of about 20 volts. The plate being connected to 20 volts and the auxiliary grid to about 10 volts; all other values remain as before.

Regeneration may also be obtained by joining the two grids through a very low

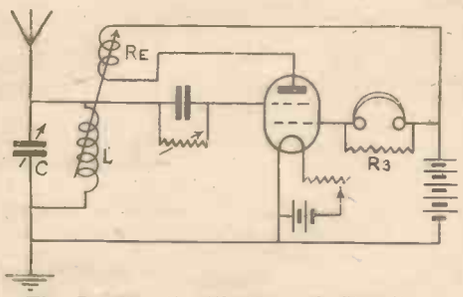


Fig. 7.—Circuit with Magnetic Reaction.

minimum condenser (.0002 microfarad) as shown in Fig. 8. Rather better control of electrostatical regeneration may be obtained by the use of a compensating condenser constructed on the principle shown

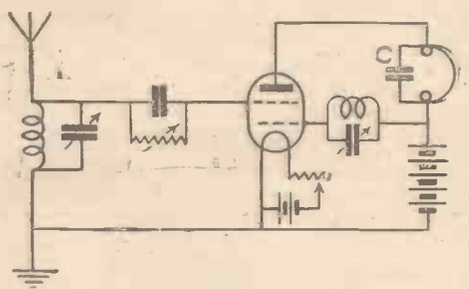


Fig. 10.—Another Useful Circuit.

in Fig. 9. The compensator may be made from an ordinary duplex condenser by cutting off a half of the fixed plates on one side and the other half on the other side, as in Fig. 9.

The duplex condenser should be so chosen that it should be possible to rotate the spindle through 180 degrees. This is necessary, as it is sometimes required to have the moving vanes partly in one set of fixed vanes without overlapping the other set. In the circuits Figs. 7 and 8 earthing should be tried on both positive and negative sides of the filament battery. Generally, best results are obtained when used as a detector by earthing the positive side, and when used as an amplifier by earthing the negative.

A circuit giving better results, but proportionately more difficult to handle, is given by Fig. 10. A stabilising resistance may also be included if the telephones are inserted in the extra grid circuit. The condenser C, shunted across the phones, should then have a fairly high capacity.

The amateur may have wondered why the stabilising resistance R3 may at times be omitted. It has been mentioned above that the second grid circuit possesses a negative-resistance effect. This means that if a suitable oscillatory circuit of inductance L (henries), capacity C (farads) and resistance R (ohms) be inserted in the

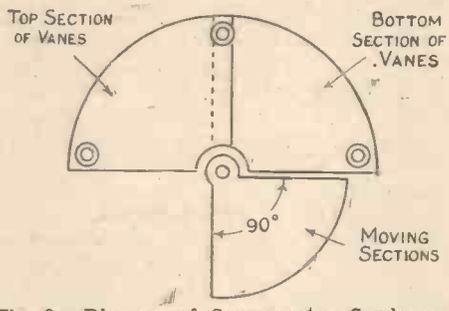


Fig. 9.—Diagram of Compensator Condenser.

extra grid circuit it will oscillate at a frequency given by the expression

$$f = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$

The object of the resistance R3 is to damp out these oscillations, also if R is too large no oscillations will be produced, and R3 may be omitted. In the present case the oscillatory circuit is formed by the telephones, and the extra grid circuit may thus oscillate at audio-frequency. Whether it will or not depends on the constants of the telephones and the anode, extra grid and filament potentials, all of which vary the amount of negative resistance.

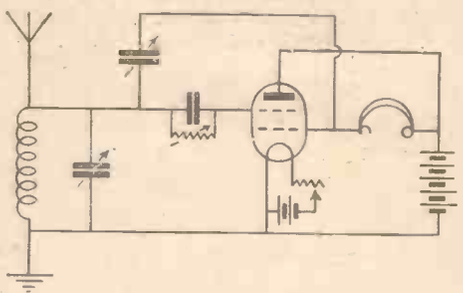


Fig. 8.—Circuit with Capacity Reaction.

On the whole the two-grid valve as a detector seems to be superior to an ordinary three-electrode valve with regeneration. It also works well as a H.F. amplifier, but is not specially good as a

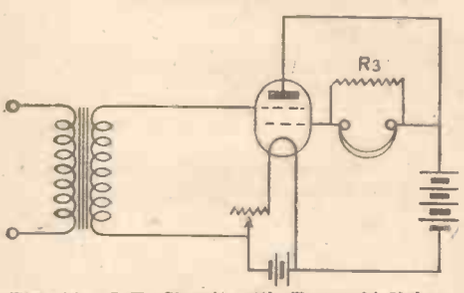


Fig. 11.—L.F. Circuit with Two-grid Valve.

note magnifier. Its advantage lies more in its great sensitiveness than in its power. Fig. 11 represents a circuit suitable for L.F. amplification.

The above notes may induce amateurs to experiment with these interesting valves.

C. H.

ECONOMY IN WORKING

WHEN it is a question of running three or more valves, there is no doubt that it pays well in the long run to install dull-emitter valves. The extra initial cost is soon outweighed by the saving in battery charging. The use of grid bias is another saving. With a four-valve set the steady load on the high-tension battery, without grid bias, may well be in the neighbourhood of 20 milliamps. By using grid cells this can be cut down to less than half and a corresponding saving effected in H.T. renewals.

Nothing shortens the life of a valve so much as overrunning it. Therefore use a light hand with the rheostat, and keep the filament current as low as possible consistent with good signal strength. Guard against "burning-out" by inserting a cheap flashlamp bulb in the H.T. leads. Should a wrong connection be made, the flashlamp will blow and save the life of the valve. With dull-emitter a high-resistance winding must be used instead of the flashlamp bulb, as in this case the bulb passes too much current to act as an effective safeguard.

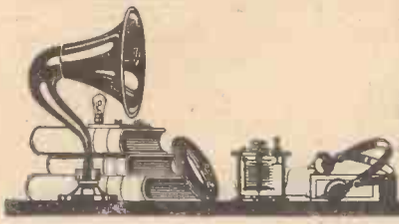
M. A.

UNDERGROUND AERIALS

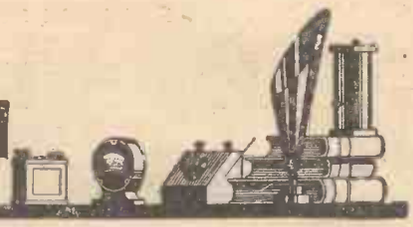
PROBABLY the finest method of eliminating static, which becomes more apparent during the summer months, is to use an underground aerial. Such an aerial should be at least 180 ft. in length.

It should be buried in a trench about 2 ft. deep and as long and straight as possible. If the aerial is going to be used for any considerable length of time a well-protected cable should be used to prevent damage by moisture. The free end should be well insulated and the lead-in taken in the usual way.

E. B.



OUR INFORMATION BUREAU



RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, layouts, diagrams, etc., on separate sheets containing your name and address. Always send stamped, addressed envelope and attach Coupon (p. 800).

Measuring Instruments

Q.—*I am interested in the description of an all-purpose measuring instrument which appeared in No. 200, and I would be much obliged if you could give me the name and address of the maker of the milliammeter used by the author of the article.—J. B. (Philadelphia).*

A.—The milliammeter used was supplied by F. C. Heayberd and Co., whose address is 8, Talbot Court, Eastcheap, E.C.3.—J. R.

Accumulator H.T. Battery

Q.—*I have constructed the accumulator high-tension battery as described in the issue of "A.W." for February 13 and I should be glad if you could tell me if it is advisable to seal down the cells when completed.—C. Gayton (Bristol).*

A.—There is no real necessity to seal down the cells, but this may be done provided an air vent is left to allow for escaping gases. This is of particular importance when the cells are on charge. As the mouth of the test tube is comparatively small the evaporation of the acid will not be anything considerable.—C. T.

Making Sulphur Panel

Q.—*As an experiment I have attempted to make a sulphur panel (flowers of sulphur), sulphur being also a good insulator. I experienced two difficulties, however, in the construction. When melted, the sulphur contained tiny black particles, giving a mottled effect when cold; all the utensils were clean. The panel also stuck fast to the wood mould and broke when an attempt was made to remove it.—F. Willers (Kingham).*

A.—Pure sulphur should be greenish yellow in appearance when cold, and it is therefore certain that the mottled appearance referred to was due to impurities either in the material or the utensils employed. The mould should be made of thin wood and must be broken away from the sulphur cast.—F. A.

Flash-lamp Batteries for G.B.

Q.—*Does a flash-lamp refill make a satisfactory grid-bias battery?—H. D. (Essex).*

A.—The cells contained in this type of battery are quite suitable, if that is what you mean by your query, but if best results are to be obtained it is undesirable to limit yourself to a fixed value of 4½ volts bias. A grid-bias battery should always be variable in steps of 1½ volts each, in order that the voltage can be adjusted to the most suitable value for the particular conditions of the circuit. The insulation may, however, be removed from the top of a flash-lamp battery, which can then be tapped at each individual cell.—B.

Long Aerials

Q.—*I have a one-valve reflex set and cannot make it oscillate on my present aerial, which is very long. With a short aerial it oscillates quite readily. Can I do anything to the long aerial in order to get the set to oscillate?—R. T. (Perth).*

A.—Your failure to make the set oscillate in the conditions mentioned is due principally to the large capacity of your present aerial. You can probably cure the trouble by connecting a small fixed condenser in series with the aerial lead to the set. This will, in effect, reduce the capacity of the aerial system. If at present you use the aerial-tuning condenser in parallel, the same result may be obtained by putting it in series, and omitting the fixed condenser. In either of these cases you may find it necessary to use a larger aerial coil. In any case the condenser settings for any particular station will be altered by the change.—R. W.

OUR WEEKLY NOTE

H.T. FROM THE MAINS

The chief trouble encountered when it is attempted to derive the H.T. current for a wireless receiver from the house mains lies in obtaining the requisite smoothness in the supply. The difficulty is the more acute when the supply is A.C. as the rectifying apparatus only changes a series of current impulses (each one of which is in the opposite direction to that preceding and succeeding it) into a series of impulses all in the same direction. At the same time, even a D.C. supply is far from steady owing to what is known as the commutator ripple.

One of the most effective methods of smoothing out the supply, and the one which is most frequently used, consists of a series of chokes inserted in both positive and negative leads to the receiver and condensers of large capacity connected across the leads before and after each pair of chokes. The values of these chokes and condensers will vary in individual cases as they depend upon the nature of the "ripple" to be smoothed, and there will be a best series of values in any particular case. It is a mistake to think that if the smoothing arrangements are not very effective the values are too small—they may just as frequently be too large.

A series of simple experiments with various sizes of chokes and condensers will soon enable the best values to be determined.

THE BUREAU.

Grid-bias Battery

Q.—*I have added a grid-biasing battery to the grid circuit of the L.F. valve of my three-valve receiver (high-frequency, detector and one low-frequency amplifier) and I find that it is possible to obtain much better reproduction of music and speech. I cannot see, though, how the battery can have any effect. As one side is connected (through the transformer) to the grid of the valve the circuit does not seem to be complete.—A. H. (E.C.4).*

A.—The grid circuit is, of course, completed through the valve itself, but the battery circuit itself is not complete. It is not necessary that it should be, for current does not usually flow from the battery. The function of the battery is not to supply current, but merely to raise the grid of the valve to a certain negative potential necessary for preventing the flow of grid current.—K.

Valve Fault.

Q.—*One of my valves has developed a very curious fault. When placed in the detector socket of my three-valve set (which consists of a detector valve followed by two L.F. stages) only one-half of the filament lights and that very brightly indeed. In either of the other sockets the filament will not light at all. No signals can now be received on the set. Can you tell me the cause of the trouble and the remedy?—R. E. W. (Blackburn).*

A.—What has obviously happened is that one end of the filament has broken away from its support and the centre of the filament is now touching, and making contact with, the grid. When the valve is placed in the detector socket the portion of the filament from the centre to the end which is still connected to its support is lit by current which flows through the aerial tuning coil. You can verify this by removing the aerial coil and noticing that the valve will not light. The valve is now of no further use unless you have it refilamented by one of the firms which specialise in valve repairs.—J. F. J.

Transformer and Chemical Rectifier

Q.—*It is intended to replace a vibrating reed rectifier which does not work satisfactorily with a chemical rectifier. It is also desired to utilise a step-down transformer in place of a lamp resistance, and particulars of the windings are requested.—K. B. (Stockton).*

A.—A 10 to 1 step-down static transformer has hitherto been employed, giving a voltage reduction of 240 to 24 volts on a 40-cycle circuit, with a secondary-carrying capacity of 3 amperes. To suit a chemical rectifier it is desirable to have a multiple, wound secondary, giving the option of 20 to 50 volts by 10 volt tappings, and if it is contemplated experimenting later on with a rectifier of the mercury-vapour type, the voltage range should be still further extended to about 70 volts. The dimensions of the Stalloy transformer core to be employed are as follows, the core being of the shell type, and the windings being distributed over the two long limbs; height 6 in., width 3½ in., length 1⅛ in., section of web 1 in. by 10 in., leaving a central winding space 4 in. long and 1½ in. deep. At a frequency of 40 cycles the turns-per-volt constant for a core having a sectional area of 1.375 sq. in. will be 7.25, and the requisite number of turns for either primary or secondary can now be determined by multiplying the desired voltage by this constant. The gauges of wire are proportioned on the basis of 1,500 amperes per square inch sectional area of copper or nearest gauge. If the maximum output required from the secondary is to be 70 volts 3 amperes, the rating of the transformer is therefore 210 watts, and the primary current is 210 watts ÷240 volts=0.9 ampere (approximately). As the efficiency of a well-designed transformer of this size will be well over 95 per cent., it is not worth while calculating the copper and iron losses. The winding specification as indicated from the above procedure will accordingly be as follows: Primary, 240 volts 40 cycles 0.9 ampere = 240×7.25 =1,740 turns of No. 22 S.W.G. d.c.c. copper, Secondary, 70 volts 3 amperes=70×7.25= 508 turns of No. 18 S.W.G. d.c.c. copper, with tappings for 20, 30, 40, 50 and 60 volts, at 155, 218, 310, 363 and 434 turns respectively. The present primary winding, it is understood, consists of 666 turns of No. 22. This number of turns is insufficient to give a reactance of 240 volts without working the iron to a very high flux density, and the result would be an extremely high magnetising or "no-load" current and a very low overall efficiency. It is strongly recommended to add to the present winding to bring the total figure up to 1,740. Both primary and secondary coils can be wound over one another on one limb without detriment, thus economising winding space.—A. H. A.

WHA — WIRELESS HAPPENINGS ABROAD

The Value of a News Vocabulary

HERE is an interesting suggestion from one of these queer intellectual corners of Europe well worth serious attention. In order to simplify the language difficulty in listening to foreign news from many different countries, it is suggested that an officially abbreviated vocabulary should be used at the chief transmitting stations in all countries; such vocabulary would contain only a standard minimum, as it were, of words and idiomatical expressions necessary in giving a general news bulletin, nothing more, and would therefore, it is argued, contain only a few hundred words, instead of the thousands of words contained in any dictionary of the language.

This standard minimum would therefore be comparatively easy for foreigners to master, and would make international news bulletins readily understood in all countries. Certainly an officially abbreviated radio news vocabulary in the different Continental languages seems a good idea. Some people, of course, are looking to Esperanto or some other auxiliary language being universally adopted; but in any case this would take a considerable time to come about, while this new suggestion of a sweeping simplification of present languages for international news bulletins might be put in practical working in a couple of weeks.

Broadcasting and Advertising

It gave my highly æsthetic temperament quite a grim shock when the advertisements were introduced at the French stations. It is economic but painful to hear the jazz band stop, and then the announcer, usually so polite, say: "Grenadin syrup is as good as zee English ginger beer. You will now hear a saxophone solo. If your boots get wet at the Faire de Paris, don't forget to drink Monsieur le Docteur Pom-Pom's hot rum," etc.

And another thing about this radio advertising, it is not always easy to tell whether it is a serious advertisement or some comedian cutting a sly remark. For example, the other afternoon the announcer at Radio-Paris said definitely that they were giving away valves free gratis and for nothing at one of the stalls at the Paris Exhibition, because owing to the rate of exchange they made more profit by giving them away than by selling them. Can that be so? Another time he said that one of the stalls was showing a valve made *without a plate*, that it was the "smallest valve in the world, and gave perfect reception."

Then there was another thing I tumbled on which sorely tested my bump of credulity. It was the general secretary of the French Radio Society, Monsieur Roussel, demonstrating how you can make, or at any rate how he made, a super-het receiver without valves by using two galena crystals and a bit of zincite.

Physical Jerks

Physical culture sounds curious on the wireless, nevertheless Colonel Bonvalot, the director at the Joinville gym., where a land-line has been run to the central station at Diderot, is very optimistic about it. It appears that everybody is now supposed to spring out of bed at eight o'clock in the morning, throw open the window, and then do physical jerks to the commands issuing from the loud-speaker: "Heads backward bend! Toes up! Eyes square! Steady! As you were!" and so on. "Huit heures, c'est bien tard, mon Colonel!" objected someone. But the Colonel explained that he had been unable to get the engineers at the transmitting station to start earlier. So I suppose they will have to alter the time of réveillé in the French Army.

Another energetic military radio Frenchman, General Ferrié, well known to T.S.F. devotees in Algiers, and who has lately been touring Africa as a whole, has been talking a lot about geographically measuring the world by wireless on the triangular system, which, it is said, will put all present geodetic methods on the scrap-heap. The exact difference in the longitude between Paris and Washington has already been demonstrated by wireless. The principle of the new method is simplicity itself, but I will not attempt to explain it here.

The Composers' Chance

I believe the B.B.C.'s coming competition for new composers has created much interest amongst foreigners who listen to Daventry. Here is what one German enthusiast said: "Ich möchte jetzt auf eine weitere Pflicht des Rundfunks zu sprechen kommen, und das ist die Förderung der jungen Komponistengeneration! Die meisten unter Ihnen wissen nicht, welchen Leidensweg der junge Komponist gehen muss, um aufgeführt und anerkannt zu werden. Wieviel Talente mögen nicht verkümmert sein, mögen nicht den Kampf vorzeitig resigniert aufgegeben haben, lediglich weil ihnen die Möglichkeiten fehlten, aufgeführt zu werden." It is this much desired "opportunity" for new genius to make itself heard that the B.B.C. is endeavouring to bring into being. Personally I think *all* competitors' work sent in ought to be played before the microphone and let the public judge by voting. It would be really interesting.

LYONS.

THIS YEAR'S EXHIBITION AT OLYMPIA

THE first exhibition fully representative of the British wireless industry will be held in the New Hall, Olympia, from Saturday, September 4, to Saturday, September 18. Organised by the National Association of Radio Manufacturers and Traders, on behalf of most of the British manufacturers, which eventually will be merged into one body, the exhibition will be on a much larger scale than those that have obtained in the past. The number of stands available for exhibitors amounts to about 250, and these will be distributed on the main floor and on the balcony. Arrangements have been made for a visit of the band of H.M. Air Force, and the active co-operation of the B.B.C. is assured.

As already stated, the exhibition will be wholly representative of the British radio industry, and stands will only be available for those whose exhibits are of British manufacture. By means of the exhibition visitors will be brought into close contact with home products. Every effort is being made to make the exhibition as attractive as possible, and to this end a decorative scheme—in blue and gold—is being carried out by Messrs. Waring and Gillow. At previous exhibitions loud-speaker demonstrations have been strictly prohibited, and this rule will again apply.

On the first day of the herring fishing season the Aberdeen station will renew its fishing news bulletin, which consists of a report from the various fishing centres of the day's catch, prices, areas in which the herrings were caught and details of weather conditions. The first bulletin will be issued this year on June 15, at 4 p.m.

AN experiment has been carried out over Paris to discover how messages from an aeroplane can be picked up by amateurs. A short talk was broadcast on 800 metres. Amateurs who were able to hear the speech from the aeroplane have been asked to communicate the result of their observations.

The Swedish Telegraph Board has concluded a contract with the Marconi's Wireless Telegraph Co., Ltd., regarding the delivery of transmission equipment for Sweden's first big broadcasting station.

A fifth of the farms in the United States are equipped with wireless, according to a recent survey. The farmers are paying great attention to weather and market reports.

A diver will descend from the parapet of the County Hall, Westminster, on June 21, and listeners will hear his experiences broadcast as he wanders about the bed of the Thames.

Leff Pouishnoff will be heard again from 2 L O on June 10.

An American broadcasting station at Denver, Col., asked its listeners to register for a course in the Italian language. No fewer than 15,000 listeners registered, and four editions of the special text-book had to be issued.

A special feature during the evening programme from 2 L O on June 10 will be the performance of old musical marches of the British Army.

Mr. Earle Cox (3 B D, Melbourne) conveyed a message by wireless to London which Mr. Bruce sent to Mr. Baldwin on the occasion of the opening of the Wireless Exhibition. The message was received by Mr. Swift (2 W Y), of Upper Tulse Hill.

London will transmit a studio version of Ethel M. Dell's "The Way of an Eagle" on June 16.

The transmitting station P C G G at the Hague is to be brought into operation again early this month. At times when Hilversum is not transmitting this station will broadcast on a wavelength of 1,150 metres. Attempts will also be made to reach the Dutch East Indies on a wavelength of 130 metres.

The Prince of Wales will be heard by listeners when he attends the dinner of the African Society on June 9. Earl Buxton will also speak, and his speech will be broadcast.

In a few months' time a new station will be opened at Langenberg, twelve miles from Cologne. It will be used in place of stations at Dortmund and Elberfeld, which served the Rhine and Ruhr districts hitherto, and will work with a power of 60 kilowatts.

By arrangement with Glasgow Corporation it has now been decided that certain selected band performances in the public parks will be broadcast through 5 S C. Concert party entertainments are also included in the scheme.

Farewell scenes at the departure of an emigrant ship from the Clyde are to be given from Glasgow on June 12. The transmission will continue while the ship (the Anchor liner *Transylvania*) is on her way down the river, and will probably give listeners an opportunity of hearing the commands from the bridge.

Lady Sleigh, wife of the Lord Provost of Edinburgh, has publicly expressed her gratitude to the staff of the B.B.C. station for all they have done in aid of many city charities.

There are now over 25,000 licensed wireless receivers in the Edinburgh district.

In a recent speech made at Berlin by the Commissioner for Broadcasting, it was stated that the Reichspost proposed to increase the power of the Königswusterhausen telephony transmitter to 100 kilowatts. Further plans include the early inauguration in the immediate neighbourhood of the capital of a short-wave transmitter (about 20 metres) to relay the Vox Haus concerts, and the erection of a 60-kilowatt station at Langenberg (Rhineland) to replace Elberfeld and Dortmund.

The Berne (Switzerland) station now opens its evening transmission with a peal of bells.

During the coming summer the Münster, Elberfeld and Dortmund broadcasting stations will relay (from various Rhineland towns) athletic displays, including the All-German Olympic Games, which are being held this year from July 4 to 11 at Cologne. Many of these broadcasts will be relayed to other German stations, including that of Königswusterhausen.

The Spanish Government proposes to adapt the high-power wireless station of Prado del Rey, in the vicinity of Madrid, to telephony for the purpose of broadcasting concerts, lectures and other entertainments. Tests will shortly be made on a wavelength in the neighbourhood of 3,800 metres.

The construction of the new 10-kilowatt Leipzig transmitter is nearing completion. Tests are being effected almost nightly on 452 metres and neighbouring wavelengths, and the station will come into regular operation towards the middle of this month.

Work on the new 6-kilowatt transmitter in course of erection at Frankfort-on-Main is now so far advanced that it is hoped to effect preliminary tests early this month. The aerial masts are approximately 935 ft. high, and will be painted red and white, bearing at their summit electric lights as a warning to passing aircraft. The new Frankfort-on-Main studio, one of the largest in Europe, is already in regular use.

According to Captain Eckersley, the B.B.C. is exploring the possibility of widening the field of reception in Scotland with a view to bringing in such areas as the Western Highlands.

Considerable interest has been aroused by the announcement that a Roman Catholic Father is shortly to give an address from the Glasgow studio. This will be the first occasion upon which such a broadcast has been given in Scotland.

Children will be pleased to learn that the B.B.C. contemplate a further visit to the Zoo on June 12, when they hope to broadcast the noises of the sea-lions during their feeding time between 6.15 and 7 p.m.

On the evening of June 9 the Glasgow station will broadcast the sounds accompanying the production of one of the important daily newspapers.

The output of companies manufacturing radio equipment in the United States is now valued at about 650,000,000 dollars a year, as compared with 2,000,000 dollars in 1920. The number of receiving sets is about 10,000,000.

A notable transmission which the B.B.C. hope to arrange will include the characteristic sounds at the opening of the extension of the City and South London Railway from Clapham Common to Morden, early in June.

Most of the regulations incorporated in the wireless receiving licence granted to listeners in the United Kingdom have been adopted by the authorities in the British West Indies. The cost of the listener's licence is 10s. per annum, and a tax of 5s. is also charged for a permit to import apparatus.

In accordances with requests received from distant listeners residing in the mountain and desert districts of California, K G O (Oakland, U.S.A.) on "signing off" at night, broadcasts the day of the week, date and time. It was found that this information was of considerable use to many listeners living in out-of-the-way districts.

NOTE.—*In the following list of transmissions these abbreviations are observed: con. for concert; lec. for lecture; orch. for orchestral concert; irr. for irregular; m. for metres; and sig. for signal.*

GREAT BRITAIN

The times given are according to British Summer Time.

London (2LO), 364 m. 1-2 p.m., con.; 3.15-4 p.m., transmission to schools; 3.30-5.45, con. (Sun.); 4.15 p.m., con.; 5.15-5.55, children; 6 p.m., dance music; 7-8 p.m., time sig., news, music, talk; 8-10 p.m., music; 9.0, news (Sun.); 9.30 p.m., time sig., news, talk; 10 p.m., special feature (Mon., Wed., Fri.). Dance music nightly (exc. Fri.) until midnight.

Aberdeen (2BD), 495 m. **Belfast** (2BE), 440 m. **Birmingham** (5IT), 479 m. **Bournemouth** (6BM), 386 m. **Cardiff** (5WA), 353 m. **Glasgow** (5SC), 422 m. **Manchester** (2ZY), 378 m. **Newcastle** (5NO), 404 m. Much the same as London times.

Bradford (2LS), 310 m. **Dundee** (2DE), 315 m. **Edinburgh** (2EH), 328 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 321.5 m. **Liverpool** (6LV), 331 m. **Nottingham** (5NG), 326 m. **Plymouth** (5PY), 338 m. **Sheffield** (6FL), 301 m. **Stoke-on-Trent** (6ST), 306 m. **Swansea** (5SX), 482 m. Daventry (25 kw.), high-power station, 1,600 m. Special weather report 10.30 a.m. and 10.25 p.m. (weekdays), 9.10 p.m. (Sun.); 11.0 a.m., light music (exc. Sat. and Sun.); relays 2LO from 4 p.m. onwards, own con. on Mon. Dance music daily (exc. Sun.) till midnight; on first Friday in each month until 2 a.m.

IRISH FREE STATE.

Dublin (2RN), 397 m. Daily, 7.30 p.m. Sundays, 8.30 p.m. until 10.30 p.m.

CONTINENT

The Times are according to the Continental system; for example, 16.30 *is* 4.30 *p.m., and* 08.00 *is* 8 *a.m. B.S.T.*

AUSTRIA.

Vienna (Radio Wien), 582.5 m. and 531 m. (temp.) (10 kw.). 11.00, con. (almost daily); 15.30, con.; 19.25, news, weather, time sig.; con., lec., news; 20.00, con.; 22.00, dance (Wed., Sat.).

Graz, 402 m. (1 kw.). Relay from Vienna. Also own con. (Tues., Wed., Fri.), 20.10.

BELGIUM.

Antwerp, 265 m. (100 w.). Relays Brussels.

Brussels, 486 m. (1½ kw.). 17.00, orch. (Tues., Thurs., Sat. only), news; 20.00, lec., con., news (opera, Mon. and Wed.).

CZECHO-SLOVAKIA.

Prague, 368 m. (5 kw.). Con., 20.00-23.00, daily. Also tests on 397.5 m.

Brunn (OKB), 521 m. (2.4 kw.). 10.00, con., news (Sun.); 19.00, lec., con. or dance (daily).

DENMARK.

Copenhagen (Radioraadet), 347.5 m. (2 kw.). Sundays: 15.30, lec.; 17.30, children; 20.00, play; 21.15, news, con.; 21.15, news, Esperanto (Mon.), silent night. Weekdays (Tues., Fri., Sat.); 20.00, lec., con., news, con.; 21.30, dance (Sat.).

Ryvang, 1,150 m. (1 kw.). Sundays: 09.30, sacred service.

Odense, 810 m. Relays Copenhagen.

Sorö,* 1,150 m. (1½ kw.). Relays Copenhagen.

FINLAND.

Helsingfors (Skyddskar), 504 m. (500 w.). Temporarily closed down.

Helsingfors, 440 m. Con., 18.00 (Tues., Thurs., Sat., Sun.).

***Tamafors**, 368 m.

***Jyvaskyla**, 561 m. (200 w.).

***Uleaborg**, 233 m. (200 w.).

* Relay Helsingfors.

GRAND DUCHY OF LUXEMBURG.

Radio Luxemburg (LOAA), 1,200 m. Con.: 14.00 (Sun.), 21.00 (Thurs.).

FRANCE.

Eiffel Tower, 2,650 m. (5 kw.). 06.40, weather (exc. Sun.); 07.15, 08.00, physical exercises; 11.00, markets (exc. Sun. and Mon.); 11.20, time sig., weather; 15.00, 16.45, Stock Ex. (exc. Sun. and Mon.); 18.00, talk, con., news; 19.00 and 23.10, weather; 21.00, con. (daily).

Radio-Paris (CFR), 1,750 m. (about 3 kw.). Sundays: 12.45, con., news; 16.30, Stock Ex., con.; 20.15, news, con. or dance. Weekdays: 10.40, news; 12.30, con., markets, weather, news; 16.30, markets, con.; 20.15, news, con. or dance.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 458 m. (800 w.). 07.15, 08.00, physical exercises; 14.00 or 15.00, studio con. or outside relay; 20.30, lec. (almost daily); 21.00, con. (daily).

Le Petit Parisien, 333 m. (temp.) (1 kw.). 21.15, con. (Tues., Thurs., Sat., Sun.).

Radio L.L. (Paris), 350 m. (250 w.). Con. (Mon., Wed., Thurs.), 20.30.

Radio-Toulouse, 430 m. (2 kw.). 12.30, con., time sig. (daily); 17.30, news (exc. Sun.); 20.45, con.; 21.25, dance (daily). Also operatic relays on 500 m., occasionally.

Radio-Lyon, 280 m. (2 kw.). 20.20, con. (daily). Temporarily closed.

Radio-Agen, 318 m. (250 w.). 12.40, weather, Stock Ex.; 20.00, weather, Stock Ex.; 20.30, con. (Tues., Fri.).

***Lyon-la-Doua**, 488 m. Own con., 20.00 (Mon., Wed., Sat.).

***Marseilles**, 351 m. (500 w.).

***Toulouse**, 280 m. (2 kw.).

***Bordeaux**, 411 m.

* Relays of PTT Paris.

Montpelier, 220 m. (1 kw.). Relays Radio Toulouse.

Angers (Radio Anjou), 300 m. (500 w.). Daily: 20.30, news, lec., con.

Bordeaux (Radio Sud-Ouest), 330 m. Con., 22.00 (Mon., Fri.).

Mont de Marsan, 390 m. (300 w.). Con. (weekdays only), 20.30.

GERMANY.

Berlin, on both 504 and 571.5 m. (4 kw.). 06.30, con. (Sun.); 09.00, sacred con. (Sun.); 11.00, con. and tests; 12.55, time sig., news, weather; 15.00, educ. hour (Sun.), markets, time sig.; 17.30, orch.; 20.30, con., weather, news, time sig., dance music until 24.00 (Sat., Sun., Thurs). Relayed on 1,300 m. by Königswusterhausen and Stettin (241 m.).

Königswusterhausen (LP), 1,300 m. (8 kw.), 11.30-12.50, relays Berlin (Sun.); 15.00, lec. (daily); 18.30, relay of Berlin (Vox Haus) con. (daily). 2,525 m. (5 kw.), Wolff's Buro Press Service: 06.45-20.10. 2,880 m., Telegraphen Union: 08.30-19.45, news. 4,000 m. (10 kw.), 07.00-21.00, news.

Breslau, 418 m. (4 kw.). 12.00, con. (daily), Divine service (Sun.); 12.55, time sig. (Sun.), weather, Stock Ex., news; 16.00, children (Sun.); 17.00, con.; 19.00, lec.; 20.30, con., weather, time sig., news, dance (relays Berlin). Relay: Gleiwitz, 251 m.

Frankfort-on-Main, 470 m. (1½ kw.). 08.00, sacred con. (Sun.); 11.55, time sig., news; 12.55, Nauen time sig.; 16.00, con. (Sun.); 16.30, con.; 18.00, markets, lec.; 20.00, lec., con., weather. Dance: relays Berlin. Relay: Cassel, 273.5 m.

Hamburg, 392 m. (4 kw.). Relayed by Bremen (279 m.), Hanover (294 m.), Kiel (233 m.) Sundays: 07.25, time sig., weather, news, lec.; 09.15, sacred con.; 13.15, con.; 18.00, con.; 19.15, sports, weather, con. or opera, dance. Weekdays: 05.45, time sig., weather; 07.00 and 07.30, news, weather; 12.55, Nauen time sig., news; 14.00, weather, con.; 16.15 and 18.00, con.; 19.00, lec.; 19.55, weather and con.; 22.00, dance (Sun., Thurs., Sat.).

Königsberg, 462 m. (1 kw.). 09.00, sacred con. (Sun.); 12.55, time sig., weather, news; 16.30, con.; 17.00, con. (Sun.); 19.30, lec.; 20.00, con. or opera, weather, news, dance (irr.).

Leipzig, 452 m. (700 w.). Relayed by Dresden (294 m.). 08.30, sacred con. (Sun.); 11.00, educ. hour (Sun.); 12.00, con. (daily); 12.55, Nauen time sig., news; 16.30, con., children (Wed.); 20.15, con. or opera, weather, news, cabaret or dance (not daily).

Munich, 487.5 m. (3 kw.). Relayed by Nuremberg (340 m.). 11.30, lec., con. (Sun.); 14.00, time sig., news, weather; 16.00, orch. (Sun.); 16.30, con. (weekdays); 18.30, con. (weekdays); 19.15, lec.; 19.30, con. (Sun.).

Munster, 412 m. (1 kw.). Relayed by Elberfeld (259 m.), Dortmund (283 m.). 11.45, radio talk, Divine service; 12.00, news (Sun.); 12.30, news (weekdays); 12.55, Nauen time sig.; 15.30, news, time sig.; 16.00, con.; 17.00, children (Sat.); 19.40, news, weather, time sig., lec., con.

Norddeich (KAV), 1,800 m. 24.00 and 04.00, weather and news.

Stuttgart, 447 m. (1½ kw.). 11.30, con. (Sun.); 16.30, con. (weekdays); 17.00, con. (Sun.); 18.30, time sig., news, lec., con. (daily); 21.15, time sig., late con. or cabaret.

HOLLAND.

Amsterdam (PCFF), 1,955 m. (1 kw.). Daily: 06.35-15.30 (exc. Mon. and Sat., when 12.30-13.30), news, Stock Ex.

Hilversum (HDO), 1,050 m. (2½ kw.). 09.00, sacred service (Sun.); 19.10, con.; 21.00, news, etc. Testing on 25 kw.

HUNGARY.

Buda-Pesth (Csepel), 560 m. (2 kw.). 09.00, news; 12.00 and 15.00, weather, news; 17.00, dance music; 20.00, con. or opera, dance.

Kosice, 2,020 m. (2½ kw.). 19.00, con.

ICELAND.

Reykjavik, 327 m. (700 w.). Tests: 22.30, 24.30.

ITALY.

Rome (IRO), 425 m. (3 kw.). 10.30, sacred con.; 13.15, official communique; 17.00, children; 17.30, relay of orch. from Hotel di Russia; 17.55, news, Stock Ex., jazz band; 20.30, news, weather, con.; 22.15, late news.

Milan, 320 m. (2 kw.). 20.00-01.00, con., jazz band.

JUGO-SLAVIA.

Belgrade (Rakovitza) (HFF), 1,650 m. (2 kw.). 17.00, news (daily), con. (Tues., Thurs., Sat.).

Agram (Zagreb), 350 m. (500 w.).

LETTLAND.

Riga, 488 m. (2 kw.). Con. daily, 21.00-22.00.

NORWAY.

Oslo, 382 m. (1.2 kw.). 11.00, Divine service (Sun.), Stock Ex. (weekdays); 13.15, markets; 19.15, news, time, lec., con.; 22.00, time, weather, news, dance relayed from Hotel Bristol, Oslo (not daily).

Bergen, 358 m. (1½ kw.). 19.30, news, con., etc.

POLAND.

Warsaw, 480 m. (6 kw.). Daily: con., 11.00-13.00; 15.00-23.00, daily.

RUSSIA.

Moscow (RDW), 1,450 m. (12 kw.). Weekdays: 12.30 and 17.53, news and con.; 23.00, chimes from Kremlin.

(Popoff Station), 1,010 m. (2 kw.). 10.00, 11.00, lec.; 13.00, 19.00, con. (Tues., Thurs., Fri.).

Radio Peredacha, 410 m. (6 kw.).

Trades Union Council Station, 450 m. (2 kw.). 18.00, con. (Mon., Wed.).

Leningrad, 940 m. (2 kw.). Weekdays: 16.00.

Nijni Novgorod, 1,400 m. (1.2 kw.). 21.30, con.

SPAIN.

Madrid (EAJ6), 392 m. (1½ kw.). Daily: con. (times vary daily). Closes at 24.00 on Sun., Wed., Sat.

Madrid (EAJ7), 373 m. (4½ kw.). 17.30-24.00, con. (almost daily).

(*Concluded in first column of next page*)

Leff Pouishnoff

NEXT WEEK AT 2LO

By "THE LISTENER"

Gordon Bryan

CONSIDERABLE variety is promised for next week if the actual programmes are broadcast and not altered at the last moment.

On Sunday afternoon the story of *Peer Gynt,* and which forms the basis of the popular suite by Grieg, will be relayed from the Manchester station. Part of the incidental music will be played. For 9.15 De Groot and the Piccadilly Orchestra is announced; a new tenor, Francis Russell, will also be heard.

Poetry forms a special item on Monday, when Miss Dorothy Pantling and Mr. L. de G. Sieveking will give readings from "The Lake Poets."

Mr. Eugene Goossens, just returned from America, makes a reappearance at 2LO on the same evening, conducting a symphony concert, which will include the unfamiliar "Overture to Anacreon," by Cherubini, not often heard nowadays, also Beethoven's 1st Symphony, also rarely heard, and the great B flat minor concerto of Tchaikowsky, in which the pianoforte solos will be played by Solomon, the famous pianist, who broadcasts from 2LO for the second time this year. At ten o'clock the last episode of the mystery serial *Wolf! Wolf!* will be S.B. to all stations.

Contrast marks the musical side of Tuesday's programme, for at eight o'clock a condensed version will be given of Andre Messager's opera *Monsieur Beaucaire.*

From musical comedy to grand opera is a wide step, and at ten o'clock Acts III and IV of *La Bohéme* will be relayed from Covent Garden, where Melba is making her farewell performance.

For Wednesday is announced a short programme of plantation songs. The speeches at the dinner of the African Society at the Savoy Hotel are to be broadcast this evening, the speakers including H.R.H. the Prince of Wales and the Rt. Hon. Earl of Buxton.

Military music forms the main part of Thursday's programme, when the band of H.M. Scots Guards will also take part, as well as the Wireless Military Band. British regimental marches will form the themes, and descriptive notes by Walter Wood will be given. The famous actress Eva Moore will be heard at 8.45, when a comedy, *The Woman in Chains,* written by her late husband, H. V. Esmond, will be given. Leff Pouishnoff, solo pianist, will give a short recital at ten o'clock.

A short variety programme is promised for Friday, the artistes including Messrs. Clark and Roberts, cross-talk comedians, Rex L'Estrange, colonial raconteur, and the Mayfair Four. The feature for 10 to 11 is a special programme devised by Mr. C. A. Lewis, entitled "Street Scenes in London Town."

"BROADCAST TELEPHONY" (*cont. from page* 794)

Madrid (EAJ4), 340 m. (3 kw.). 16.50, con.

Barcelona (EAJ1), 324 m. (3 kw.). 17.00-21.00, news, lec., con. (Sun.); 18.00-23.00 (daily).

Barcelona (Radio Catalana) (EAJ13), 462 m. (4½ kw.). 19.00-23.00, con., weather, news.

Bilbao (EAJ9), 415 m. (1 kw.). 19.00, news, weather, con. Close down 22.00.

Bilbao (Radio Vizcaya) (EAJ11), 418 m. (2 kw.). 22.00-24.00, con. (daily).

Cadiz (EAJ3), 357 m. (550 w.). 19.00-21.00, con., news. Tests daily (exc. Sun.), 24.00.

Cartagena (EAJ15), 335 m. 19.00-22.00, con. (daily).

Seville (EAJ5), 357 m. (1½ w.). 21.00, con., news, weather. Close down 23.00.

Seville (EAJ17), 300 m. 19.00-22.00, con. (daily).

San Sebastian (EAJ8), 343 m. (500 w.). 17.00-19.00, 21.00-23.00 (daily).

Salamanca (EAJ22), 405 m. (1 kw.). 17.00 and 21.00, con. (daily).

Saragossa, about 325 m. Testing.

SWEDEN.

Stockholm (SASA), 430 m. (1 kw.). 11.00, sacred service (Sun.); 12.30, weather; 14.00, con. (Sun.); 17.00, children (Sun.); 18.00, sacred service; 19.00, lec.; 21.15, news, con., weather. Dance (Wed., Sat.).

Relays.—Boden (SASE), 1,200 m.; Eskilstuna, 250 m.; Falun (SMZK), 370 m.; Gothenburg (SASB), 288 m.; Gefle, 325 m.; Helsingborg, 235 m.; Joenkoeping (SMZD), 265 m.; Kalmar, 253 m.; Karlsborg, 1,250 m.; Karl-Sundsvall (SASD), 545 m.; Trollhattan scrona (SMSM3), 196 m.; Kristinehamm (SMTY), 202 m.; Karlstadt (SMXC), 221 m.; Linkoeping, 467 m.; Malmo (SASC), 270 m.; Norrkoeping (SMVV), 260 m.; Orebro, 218 m.; Ostersund, 720 m.; Säffle (SMTS), 245 m.; (SMXQ), 322 m.; Umea, 215 m.; Varborg, 340 m.

TOURING EUROPE

THE fascinating experience of touring the European ether is within the reach of anybody possessing a fairly sensitive valve set. It is not necessary to have H.F. amplification or an ultra-powerful circuit, but the receiver must be well designed and capable of long-range reception.

The radio traveller is advised to make Brussels his starting point. SBR is a station which is easily picked up by a good single-valver anywhere in the south of England. The wavelength is round about 262 metres, which is just within the lower limit of most broadcast receivers. SBR is best heard in the evening, and is easily recognised by the crisp, cheery voice of the announcer with his farewell of "Bon soir, mesdames; bon soir, messieurs!"

Then tune up to 343 metres. This is the wavelength of the Spanish station of San Sebastian, which is well received in this country. The listener may be sure of some good music from EAJS.

Next take a trip to France. L'Ecole Supérieure may be heard most evenings of the week on 458 metres. Radio-Toulouse (430 metres), situated in the south of France, can also be received at very good strength in spite of its distance. The transmissions of Radio-Toulouse are very clear and his announcements easy to follow.

The best German stations are probably Berlin on 504 metres, Hamburg on 392 metres, Königsberg on 462 metres, Münster on 410 metres, and Stuttgart on 466 metres. These come in very well indeed, and the listener is often treated to some excellent music.

Zurich (515 metres) is the loudest Swiss station. This transmission is decidedly good and well worth picking up. He announces his identity quite clearly, and repeats the word "Zurich" several times in the course of the programme.

Lastly, for those who have sets which are capable of dealing with the higher wavelengths, we have our old favourite FL (Eiffel Tower) on 2,600 metres, Hilversum on 1,050 metres, Radio-Paris on 1,750 metres.

Everyone of the stations previously mentioned may, under favourable conditions, be received on a well-designed single-valve set provided a good aerial is used.

G. J. M.

The Hallé Orchestra has decided not to broadcast next winter. This decision has been taken as a result of the failure of negotiations between the orchestra, the British Broadcasting Co., and the Musicians' Union.

So much interest has been aroused locally in a "radio conducted tour of Ayrshire" from the Glasgow station (introducing songs, poems and incidents of the life of Burns) that the Glasgow Education Authority has had 1,500 descriptive pamphlets distributed amongst school children, for whom the programmes are regarded as having a real historical value.

SPECIAL NOTICE

The closing date of this competition which also appeared in this Journal on May 8th, has, owing to the recent strike been altered to June 19th, and Coupons from the earlier issue will also be accepted in connection with same, providing they reach us not later than June 19th, accompanied by P.O. covering the amount of entries submitted.

Wear the finest British Headphones and WIN

A SIX-VALVE DE LUXE RECEIVING SET or a Large Cash Prize

In order to introduce to the public their wonderful new wireless invention, the makers of H.M.H. HEADPHONES offer three valuable prizes, together with 25 sets of Headphones as consolation prizes, for the best solutions received of the cross-word puzzle given below.

Members of the Staff of the Company will not be allowed to compete.

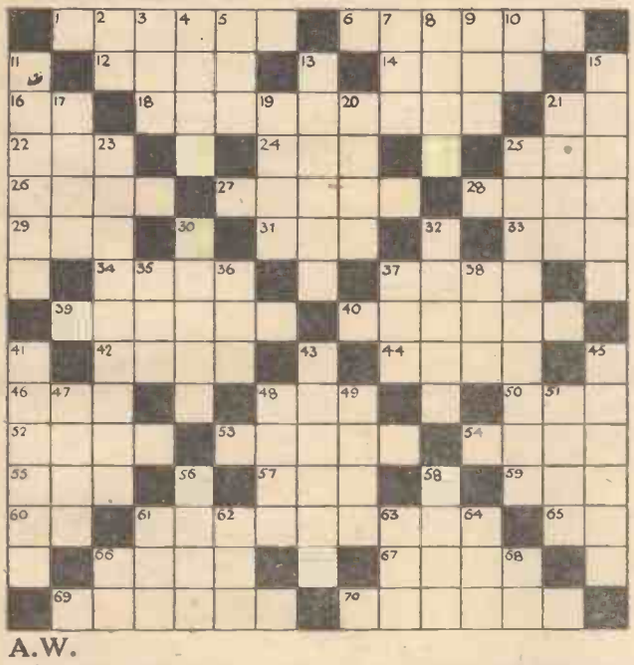
First Prize. A Six-Valve De-Luxe Receiving Set or £50 Cash
Second „ A Four-Valve „ „ „ £25 „
Third „ A Two-Valve „ „ „ £10 „

And 25 Consolation Prizes of a pair of H.M.H. Headphones.

This Competition is also appearing in two other leading Wireless Journals, and a sealed solution is in the keeping of the respective Editors.

YOU HAVE ONLY TO SOLVE THIS PUZZLE

CUT ALONG THIS LINE



A.W.

CLUES ACROSS

1. Pertaining to the lodestone.
6. Confine in a cage.
12. To draw asunder.
14. Where the sun rises.
16. Negative term.
18. One guilty of treason.
21. Denotes certain make of motor cycle.
22. To lower headlights.
24. A bay, or creek (Shetland).
25. Used for shooting arrows.
26. Furze, or Gorse shrubs.
27. Four-footed animals.
28. A lump or ridge on metal.
29. Established (abbrt.).
31. The beak of a bird.
33. A girl's name.
34. Is unwell.
37. Anything round.
39. A soft bog or marsh.
40. An allowance or pension.
42. Longing desire.
44. (Prefix) meaning against.
46. A priest (ancient)
48. A meadow.
50. Negative term.
52. Used for dressing wounds.
53. Conceals
54. Instigates.
55. Anger.
57. A girl's name.
59. Join together with a needle.
60. Church of England (abbrt.).
61. Offered as a gift.
65. Errors excepted (abbrt.).
66. Bottom of a ship.
67. Shortly.
69. A vessel for holding liquid.
70. Penetrates.

CLUES DOWN

2. Near.
3. Obtain.
4. An aromatic plant.
5. Period.
7. Born.
8. To throw or fling.
9. Beast of burden.
10. Great (abbrt.).
11. To supply with.
13. Hoarded.
15. To cover by wrapping.
17. Lubricates.
19. First "Russian Emperor."
20. Beer (reversed).
21. Kind of motor car.
23. Pertaining to a metal.
25. Houses.
30. Flow of blood to the face.
32. Gives notice of danger.
35. Memorandum of debt.
36. Sergeant, abbrt. (army).
37. Ladies' neckwear.
38. A large quantity.
41. A widow.
43. Supreme happiness.
45. To reply to.
47. Italian coins.
48. Sediment.
49. A boy's name.
51. A wavelike moulding.
56. To irritate.
58. Despatched.
61. Fondle.
62. Measure of cloth.
63. Make brown.
64. Female animal.
66. Knock out (abbrt.).
68. Near (abbrt.).

RULES OF ENTRY

1.—Prizes are awarded strictly for the skill shown in the solving of this puzzle.

2.—The first prize will be awarded to the competitor sending in the correct solution. Should more than one correct solution be received, prizes to the total value will be divided among the successful competitors.

3.—Every purchaser of a pair of our H.M.H. Headphones (direct from us) will be entitled to 3 free entries in this competition. All other entries must be accompanied by P.O. for 1/- made payable to H. Morser & Co. (Wireless), Ltd., and must be crossed " & Co."

4.—Solutions must reach H. Morser & Co. (Wireless), Ltd., 67/68, Hatton Garden, London, E.C.1, not later than JUNE 19th, 1926.

5.—Solution and names and addresses of prize winners will appear in AMATEUR WIRELESS, JULY 3rd, 1926.

6.—All prizes will be forwarded to successful competitors without delay.

7.—No correspondence can be entered into, and the decision of the Directors of H. Morser & Co. (Wireless), Ltd., must be accepted as final and binding.

To H. MORSER & Co. (Wireless) Ltd., 67/68 Hatton Garden, London, E.C.1

Dear Sirs,—I enclose P.O., value.....as Entrance Fee for the Enclosed Solutions.

NAME .....
(Please use Block Capitals, in ink.)

ADDRESS .....

.....

Low-frequency Transformers

SIR,—With reference to my letter under the above heading in No. 205, there is one point which perhaps should be further explained, namely, the nature of "r," which in the list of symbols was given as the D.C. resistance of the transformer primary.

Whilst this is approximately correct at frequencies up to about 100 cycles, above this the resistance concerned actually increases very rapidly, becoming at its maximum several hundred thousand ohms and being due apparently to the losses which occur in the iron circuit of the transformer. The resistance in question, therefore, must be taken as being in the nature of a high-frequency resistance, although not due in this case to the skin effect which is the main cause of the ordinary increase in resistance at high frequencies.—J. B. (Manchester).

Is There an All-purpose Receiver?

SIR,—May I, too, endorse the remarks of J. C. S. (Sheffield) and O. C. (Burton-on-Trent) in regard to the Reinartz receiver as the all-purpose receiver? I am at present using a Reinartz described in "A.W." and I am able to receive the new Rugby station and replies from U.S.A., and can hear every word comfortably. I have been able to listen to W G Y on 32.4 metres on a loud-speaker (this station now fades very badly. The 45-metre amateurs can nearly all be heard on the loud-speaker. As regards the broadcasting band, if there is a more efficient receiver in existence I would be glad to know which it is, for I have not come across one to beat the Reinartz.—G. R. (Trowbridge).

Declining Signal Strength

SIR,—After reading THERMION'S experience of distant stations getting weaker at this time of the year, I should like to tell you mine. I have a two-valve set and single-circuit tuner with plug-in coils, and I have found a great deal of fading recently. I had not been able to get Aberdeen at all for about two months until on a recent night when it came in at good phone strength, but faded very badly at times. Glasgow, Birmingham and Cardiff have gone down very much in strength this last month, and I have not been able to get any of the relays. I have not found any difference in the strength of the foreign stations. I am able to receive the Eiffel Tower, Radio Paris, Königswusterhausen, Geneva, Hilversum, Berlin, and Radio Toulouse. I am also able to receive all the air stations, several coastguard stations on 200 metres, and several amateur stations on the low wavelengths. I live about 25 miles from London on the north-east side, and my aerial is badly screened.—E. J. W. (Ware).

A movement is on foot to obtain the erection of a relay station in Freiburg and Karlsruhe in the Black Forest district of Germany.

The receiver used on the Horse Guards' Parade Ground for broadcasting the news bulletins during the strike (and illustrated in our cover photograph, No. 206) was a Liberty eight-valve super-heterodyne receiver, manufactured by the Radi-Arc Electrical Co., Ltd., of Bennett Street, Chiswick, W.4.

"Making a Garden Dinner-wagon" is the subject of a well-illustrated article appearing in the current issue of THE AMATEUR MECHANIC AND WORK (3d.), and will be acceptable to all those who prefer to take their meals in the open during the summer months. Other articles appearing in the same number are: "Overhauling the Mangle," "Imitating Woods in Distemper," "Building a Simple Garden Fence," "A Model Railway Station with Double-span Roof," "Small Scale Land Drainage Applied to Garden Plots, etc.," "A Convertible Wireless Three-valve Set," "The Scratch-tool and How to Use It," "Building a Bicycle Wheel," "The Reflecting Telescope and How to Use It," "Practical Photography Pars," "Repairing Leaky Radiators of Motor-cars."

CHIEF EVENTS OF THE WEEK

SUNDAY, JUNE 6

London	Shakespeare's Heroines.
Birmingham	Favourite Classics.
Bournemouth	Symphony Concert.
Manchester	The Story of *Peer Gynt*.
Newcastle	Orchestral and Vocal Concert.

MONDAY

London	Symphony Concert.
Aberdeen	Old Favourites in Music and Song.
Birmingham	Shakespearean Programme.
Bournemouth	An Hour on the Plantation.
Belfast	*The Last.*
Glasgow	Light Music.
Newcastle	Instrumental Concert.

TUESDAY

London	Plantation Choruses.
Aberdeen	Operatic Programme.
Birmingham	Orchestral and Instrumental Programme.
Bournemouth	Military Band Night.
Belfast	Musical Milestones.
Cardiff	Sea Serpents.
Glasgow	The Marsden Colliery Band.

WEDNESDAY

London	*Monsieur Beaucaire.*
Aberdeen	Julien Rosetti's Trio.
Dundee	The Band of the Royal Naval Volunteer Reserve.
Glasgow	The Production of a Daily Newspaper.
Leeds	Concert and Comic Opera.
Stoke	The Stoke-on-Trent City Orchestra.
Swansea	Sketches from Charles Dickens.

THURSDAY

London	British Regimental Marches.
Aberdeen	The Aberdeen Banjo, Mandoline and Guitar Orchestra.
Bournemouth	Irish Songs and Melodies.
Glasgow	Early Works of Great Composers.

FRIDAY

London	British Music Society Concert.
Belfast	Glimpses of Childhood.
Liverpool	The Station's Birthday.
Newcastle	Syncopated Music and Humour.

SATURDAY

London	Emilio Colombo's Orchestra.
Aberdeen	Scots Programme.
Birmingham	The City of Birmingham Police Band.
Cardiff	A Radio Carnival.
Glasgow	Scots Programme.
Newcastle	The Felling Colliery Prize Band.

ADVERTISEMENT INSTRUCTIONS for "Amateur Wireless" are accepted up to first post on Thursday morning for following week's issue, providing space is available.

PREPAID ADVERTISEMENTS.

Advertisements under this head are charged FOURPENCE PER WORD, minimum charge FOUR SHILLINGS.

DEPOSIT SYSTEM.

As the Publishers cannot accept responsibility for the bona fides of Advertisers in this publication they have introduced a system of deposit which it is recommended should be adopted by readers when dealing with persons with whom they are unacquainted. It is here explained.

Intending purchasers should forward to the Publishers the amount of the purchase money of the article advertised. This will be acknowledged to both the Depositor and the Vendor, whose names and addresses must necessarily be given. The Deposit is retained until advice is received of the completion of the purchase, or of the article having been returned to and accepted by the Vendor. In addition to the amount of the Deposit, a Fee of 6d. for sums of £1 and under, and 1s. for amounts in excess of £1, to cover postage, etc., must be remitted at the same time. In cases of persons not resident within the United Kingdom, double fees are charged.

The amount of the Deposit and Fee must be remitted by Postal Order or Registered Letter (Cheques cannot be accepted), addressed to

"AMATEUR WIRELESS,"
ADVERTISEMENT DEPARTMENT,
LA BELLE SAUVAGE, LONDON, E.C.4.

PATENTS.—Trade Marks. Advice Handbook free.—B. T. King, Regd. Patent Agent, 146a, Queen Victoria Street, London.

PATENTS and Trade Marks obtained.—H. T. P. Gee, Patent Agent, Member R.S.G.B., A.M.I.R.E., 51/52, Chancery Lane, London, W.C.2. Phone Holborn, 1525.

3/- does it!

The "Permatector" definitely provides trouble-free crystal detection. It has been built to fit instantly any model "Brownie Wireless" Receiver, and brackets, screws, and nuts are provided in each box to allow it to be fitted to any other crystal set in a very few minutes. The outer case is turned out of solid brass rod and heavily nickel-plated; the finished product being a handsome addition to any receiver. The "Permatector" is heavily nickelled and costs only 3/-. From dealers or direct.

Once and for ever

Pack up all your crystal troubles and forget them. Fit a Brownie Wireless "Permatector" to your set—the crystal detector that is always "ever set." After the initial outlay of 3/- you have no further expense or trouble. Simply make sure you have it adjusted to give the loudest signals (and loud they will be, too), and in months to come, no matter what rough handling the set may get, the adjustment will not have varied a fraction of an inch. It is extraordinarily stable, this Brownie "Permatector." The whole secret is in its unique spring construction and its two super-sensitive crystals. Each Brownie "Permatector" carries the Brownie Wireless Guarantee—"the guarantee that counts."

For trouble-free crystal reception use

THE "PERMATECTOR"

the always "ever-set" crystal detector.

Built by the makers of the famous "Brownie Wireless" Crystal Receiver.

THE BROWNIE WIRELESS CO. (of Great Britain), LTD.

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'Phone: Museum 3747.

Soldering simplified

The Fluxite Soldering Set will solve your soldering problems for ever. Everything from an aerial connection to a big multi-valve set may be soldered quickly and successfully with this simple soldering set.

The Fluxite Soldering Set is exceptionally suited for Wireless; it is simple and compact, and will last for ever. It contains a special "small-space" soldering iron with non-heating metal handle, a really efficient pocket blow-lamp, Fluxite, solder, and full instructions.

All Hardware and Ironmongery Stores sell the Fluxite Soldering Set, 7/6 complete. Fluxite can also be had in tins price 8d., 1/4 and 2/8.

FLUXITE LTD.
(Dep. 326),
Rotherhithe, S.E.16.

7/6 complete

FLUXITE

"...Yes, that's the best set I've made—*thanks to*

GLAZITE

BRITISH MADE REGD.

COLOURED CONNECTING WIRE"

Red, Yellow, Green, White, Blue & Black

10 ft. Coils 1/2 *Per Coil* 3/18 S.W.G.

2 ft. lengths *Per Packet 4 Assorted Colours* **1/-** 3/16 S.W.G.

Obtainable from all dealers

Write for descriptive leaflet to

The LONDON ELECTRIC WIRE CO. and SMITHS LTD.

(Makers of Electric Wire for over forty years)

Playhouse Yard, Golden Lane, London, E.C.1

This mark LEW *guarantees quality*

JUDD

ARE YOU A PATIENT MAN ?

£200

IF YOU ARE

"Let's see—five separate units give five capacities, taken singly. Then I can have the first two in series or parallel—total seven. Then the first three all in series or all in parallel—two more. The first and third and second and third in series, total 9. Ditto, in parallel, 11. First and second in series, and in parallel with the third—12 .... And the total number of different capacities with the five units is ———— ?" What is it?

If you get it right, you win £200!

Whatever your skill in counting capacities, however, the purchase of a Dubilicon will bring you one sure reward. The Dubilicon gives any capacity up to 0·011 mfd. simply by varying the connections of the eight unit capacities of which it is composed; so that by using the Dubilicon you will be able to select with unfailing certainty the best value of fixed capacity for any desired particular circuit.

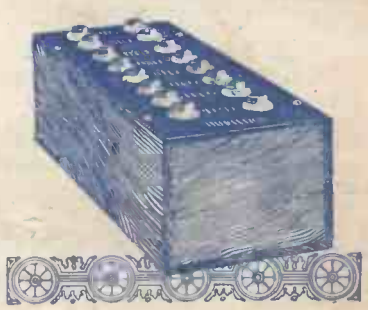
The Dubilicon is a multiple condenser containing eight separate units, the terminals of each unit being brought out to sockets on the lid. By using Clix plugs (made by Messrs. Autoveyors, Ltd., 84, Victoria Street, S.W.1) of which two are given with every Dubilicon, the units can be connected in a variety of series, parallel and combined series parallel arrangements giving a very large number of different capacities.

The uses and advantages of the Dubilicon, which we have summarised above, make it more than worth its low price of 30/-.

In addition, the purchase of a Dubilicon entitles you to enter for the £200 prize competition. All you have to do is to estimate the number of different capacities you can get by connecting up the first five units in various ways.

Ask your dealer about one to-day—and mind you enter for the £200 competition! He will tell you all about it!

The Dubilicon



REGISTERED DUBILIER TRADE MARK

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CONDENSER CO (1925) LTD

ADVERT. OF THE DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, N. ACTON, W.3. TELEPHONE: CHISWICK 2241-2-3.
E.P.S. 192

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INDEPENDENT CRYSTAL RECEPTION FOR INVALID

MAKING YOUR SET SELECTIVE

Amateur Wireless
And Electrics

Vol. VIII. No. 209 SATURDAY, JUNE 12, 1926 Price 3d

PRINCIPAL CONTENTS

WELL ILLUSTRATED

Registered at G.P.O. as a Newspaper.

Full constructional details of this useful two-valve set, which is complete with batteries and loud-speaker, are given in this issue.

Amateur Wireless and Electrics

The Leading Radio Weekly for the Constructor, Listener and Experimenter

Edited by BERNARD E. JONES

Technical Adviser: SYDNEY BRYDON, D.Sc., M.I.E.E.

Vol. III. No. 209 — JUNE 12, 1926

Chief Contents

"Amateur Wireless and Electrics." Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. Post free to any part of the world: 3 months, 4s. 6d.; 6 months, 8s. 9d.; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to the Proprietors, Cassell and Co., Ltd.

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

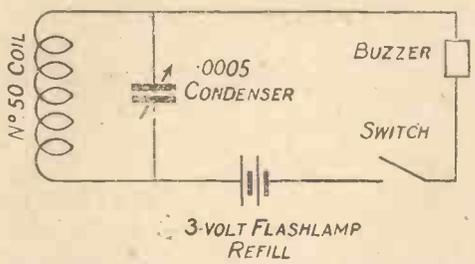
Contributions are always welcome, will be promptly considered, and if used will be paid for.

Queries should be addressed to the Editor, and the conditions printed at the head of "Our Information Bureau" should be closely observed.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

"HANDS" IN WIRELESS

IN the operation of a receiver one person may spend a long time in moving the dials of condensers or the coupling controls without being able to tune in any transmissions but those from near-by stations. And then another will take his place who seems to do just the same thing with the knobs, though he obtains very different results. It is all a question of hands, by which I mean the power to make tiny movements without any kind of jerking, combined with a kind of instinct for keeping all the tuned circuits of the receiver in resonance.



Circuit Diagram of Substitute for Wavemeter.

This last, keeping the tuning of all circuits together when searching is in progress, is one of the most difficult of the tasks that come the way of the man who undertakes searching with a multi-valver. Yet, if every circuit is not tuned to exactly the same wavelength when a step up or down the scale is made, very weak and distant signals will not be found. Again, should a man who has not the acquired delicacy of touch succeed rather by good luck than by good judgment in picking up the faint sounds of a distant station, it is as likely as not that in trying to strengthen the signal he will lose it altogether and not be able to receive it again.

The man with good "wireless" hands never annoys his neighbours by howling. Even if he is operating a rather unstable set he is able to detect the signs of approaching oscillation and to stop before the point is reached at which interference takes place.

The Requisite Touch

How can the beginner improve his controlling powers? Real delicacy of touch and the power to make minute adjustments are obtainable in many cases only by long practice, though some fortunate people are endowed by nature with these desirable attributes. But the beginner of to-day is very much more fortunately situated than the man who took up wireless two or three years ago, for the designers of components have now made it possible for even the most unpractised to make almost incredibly small variations in the tuning of circuits or in the couplings between coils. Geared condenser dials, with a reduction of fifty to one or more, are now available at very reasonable prices. Many patterns of these can be fitted to any existing variable condenser, and with their help the finest of tuning can be accomplished by anyone. Then there are geared coil holders which permit couplings to be adjusted to a nicety by anyone. Should you have difficulty in finding weak signals or in bringing them up to good strength when found, I would strongly advise you to try the geared condenser dial or the geared coil holder. You will be agreeably surprised to find how much they facilitate searching and how much easier they make it to avoid howling.

A Simple Expedient

Should you have difficulty in keeping the tuning of all your circuits the same when searching, the provision of a wavemeter will end your troubles. But wavemeters are rather expensive things and not every enthusiast can afford one, much as he would like to do so. A very simple substitute can be made by anyone at small cost. The components required are simply a high-note buzzer, a .0005-microfarad variable condenser, a No. 50 coil and a flashlamp refill. Some form of switch must also be provided for bringing the buzzer into action and cutting it out when not required.

Wire up your components as shown in

(*Concluded at foot of next page*)

THE EXPERIMENTER'S CABINET

The cabinet described in this article will be found of general utility by those who are constantly modifying their sets.

IT is characteristic of the wireless enthusiast that no sooner has he completed *the* set which is to fulfil all his ideals than he wants to make an addition to it or to try some different circuits. Usually he has a supply of components suitable for his experiments, but unfortunately neither his panel nor cabinet will stretch, and he often feels hampered through the disinclination to alter or scrap them.

The writer, experiencing the same difficulties, has built himself a cabinet capable of taking a panel much larger than any he has yet used, and by an arrangement of shelves and wooden panels he is able to make continual alterations and yet retain a neat and "finished" appearance.

A Novel Design

The cabinet is made with an open front and would take a panel measuring 24 in. by 14 in. The back is removable and the lid lifts. Runners are fitted in the sides of the cabinet 1 in. apart, and shelves slide in on these runners so that openings of any width can be obtained in the same manner as a bookcase with adjustable shelves can be arranged to take different sizes of books.

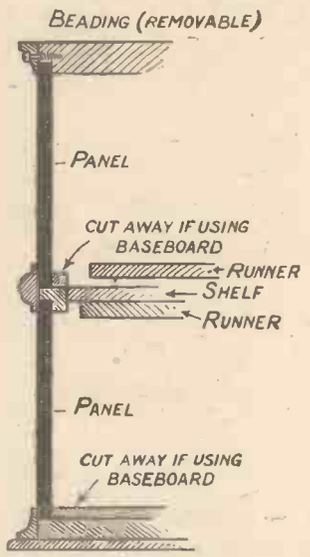
Wood moulding is used for the front framework of the cabinet, and moulding is also attached to the front edges of the shelves so as to form slots ¼ in. wide and about the same depth, as shown in the sketch of the front section of the cabinet.

With one shelf in the position shown in the sketch, panels 7 in. deep can be used one above the other. If panels of smaller width are used, two shelves are fitted and the space between filled with a strip of wood stained and polished to match the cabinet.

Panels shorter than the maximum length possible can be accommodated and the spaces filled with wooden panels, the general effect being very pleasing.

When fitting the panels in the cabinet, the lower ones should be fitted first and the shelves dropped into position so that the slot holds the top edge of the panel. By making the distance between the runners wider than is actually necessary the shelves can be tilted slightly to facilitate fitting the panels. The top beading is removable, so that it may be fitted after the top panels are in position.

As an example of the utility of such an arrangement, a description of the general appearance of the writer's cabinet may be of interest. His "household" receiver is built on a panel 15 in. by 7 in. This occupies the top half of the cabinet, leaving a space of 4½ in. on each side, into which wood panels are fitted. In the lower half two panels are generally used, both 6 in. wide by 7 in. deep, one being a wavetrap and the other a filter circuit and distributor. These two panels are placed at each end of the opening, the middle space being filled with a wooden panel 12 in. by 7 in., which for convenience is cut in two without spoiling the appearance.



Details of Experimenter's Cabinet.

If a stage of H.F. is required, the two wooden panels at the top are removed, the receiver moved along, and the H.F. panel fitted in the space on the aerial side of the main panel. Alternative or additional L.F. stages are accommodated in the lower section, or entirely different panels can be fitted for experimenting.

The cabinet is sufficiently deep to accommodate the batteries at the back of the lower section, so that the appearance is always tidy.

A cabinet constructed on these lines is particularly suitable for experimenters who wish to build their receiver on the unit system. It can, of course, be made without shelves to take a definite width of panel, but by making the opening long, panels can be inserted quickly and in any desired order, the remaining spaces being filled with wooden panels. Such a receiver always looks "complete," and the edges of the panels can be either cut square so as to fit closely together, or a very pleasing appearance can be obtained if the edges are bevelled.

R. H. B.

VLADIMIR POPOFF

THE new broadcasting station at Moscow has been christened Popoff, in honour of the well-known Russian physicist of that name. Professor Popoff is credited in some quarters with the invention of the elevated aerial for wireless transmission. There is no doubt, however, that the credit for this fundamental step in the evolution of wireless long-distance signalling rests with Senatore Marconi.

Vladimir Popoff certainly used an elevated wire, earthed at one end, as early as 1895—that is, a year before Marconi received his master patent for the transmitting aerial—but Popoff employed his aerial merely for the purpose of collecting and investigating the nature of atmospheric discharges, and not for receiving wireless signals. Marconi's stroke of genius consisted in using an elevated earthed wire at the transmitting station. This enabled him to increase the length of the radiated wave far beyond the dimensions attained by any of his predecessors, and thus to cover much greater distances in signalling with the type of receiving apparatus then available.

M. A. L.

"'HANDS' IN WIRELESS" (*continued from preceding page*)

the diagram. Place the device so that its coil is a yard or so away from your A.T.I. Now tune in the local station and switch on the buzzer. Turn the variable condenser of the improvised wavemeter until you find the point at which the sound of the buzzer is most loudly heard in the telephones. Loosen the coupling between the wavemeter coil and the A.T.I., either by moving the device away or by setting the two coils at an angle, until the note is only just comfortably heard when tuning is at its sharpest.

Searching Upwards

Make a note of the setting of the wavemeter of the condenser. To search upwards, increase the reading of the wavemeter condenser by one degree and retune your set until the buzzer is at its loudest. Proceeding in this way you can search right up to the top of the broadcast band, being sure that you are doing it thoroughly and that all your circuits are together. By reducing the reading of the wavemeter condenser one degree at a time from the setting required for the local station you can drop down to the bottom of the band. This simple device will enable you to cover all wavelengths between about 200 and 500 metres.

I. H. R.

MODERN METHODS IN PICTURE TELEGRAPHY

THE BELL SYSTEM

Fig. 2.—Photo-electric Cell Used in the Bell Picture-telegraphy System.

A SYSTEM of the telegraphic transmission of pictures which will play a prominent part in the future of this science is that worked out by four experts of the Bell Telephone Laboratories Inc., of New York, Messrs. H. E. Ives, J. W. Horton, R. D. Parker and A. B. Clark. The Bell Telephone Company owns a vast system of telephone lines in the United States, and although the method is one which can be applied admirably to wireless, it has been primarily designed for the purpose of providing a picture service for newspapers that would link up the big towns and cities of the United States.

Many of our readers will remember the system of Professor Korn which first made its appearance some twenty years ago. A large photographic transparency or celluloid film was mounted on a glass cylinder, and while it revolved a narrow pencil of light was passed through it, and after its passage through the film the light fell upon a selenium cell. The resistance of selenium changes with any change in the intensity of light falling upon it, and thus as light and dark parts of the photograph intercepted the pencil of light, the illumination of the cell correspondingly changed, and an electric current passing through the cell and thence into the telephone lines connecting the apparatus with the distant receiver was continuously varied in amplitude.

An epoch-making advance has been made through the advent of the photo-electric cell. Selenium, despite its sensitiveness to light, does not respond to changes in light intensity with very great rapidity—not, at any rate, as it was employed. It was therefore possible to deal with very simple subjects only.

Imagine now, in place of the selenium cell, a light-sensitive unit which will respond to the slightest change in light intensity in a millionth of a second, and we can understand how photographs containing the finest detail can be transmitted. The Bell system resembles in general principle the apparatus of Professor Korn; a transparent photograph is mounted on a glass cylinder, and light is passed through the photograph, falling then upon a photo-electric cell. The latter actually generates a minute current of electricity due to the emission of electrons when light falls upon the cathode—which consists of metallic potassium, sodium, or rubidium deposited upon the inner surface of a highly-evacuated glass bulb.

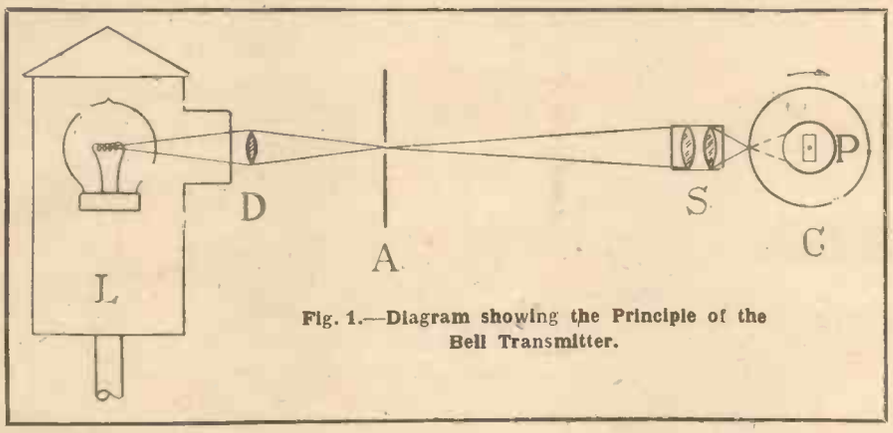


Fig. 1.—Diagram showing the Principle of the Bell Transmitter.

The method of operation is seen in Fig. 1, where the rays from the lamp L are brought to a focus by a lens D, a diaphragm A, and a further lens system S, so that they cross at a point on the periphery of the cylinder C. Here they pass through the photograph, the beam widening out and illuminating the photo-electric coil P. A photograph of the type of photo-electric cell used in the Bell system is seen in Fig. 2. The diagrams and photographs reproduced in this article appear by kind permission of the Bell Telephone Laboratories Inc.

Fig. 4.—Enlargement showing Composition of Telegraphed Picture.

The photo-electric current, after amplification, is not directly transmitted, but is impressed upon a vacuum-tube modulator jointly with a carrier current, the frequency of which is about 1,300 cycles per second. The transmitter thus puts into the line connecting it with the distant receiver a carrier wave modulated by the photo-electric wave.

We must now turn for a moment to the method of synchronising the cylinders of the sending and receiving instruments. These are driven by phonic wheels or impulse motors, which are controlled in speed by the impulses from an electrically operated tuning fork. The motors of both instruments are controlled by the *same* tuning fork, the currents having to pass, of course, through the line to the more distant one. A very ingenious method has been devised by which both the photo-electric and synchronising currents are sent over one circuit. The picture is sent on a high frequency of 1,300 cycles per second, and the synchronising pulses on a lower frequency carrier of about 400 cycles per second, the two carrier frequencies being obtained from two vacuum-tube oscillators. The two currents are kept separate by a system of electric "filters" at each end, so that while the current on the line consists of the two modulated frequencies, each current is filtered out and passed into its proper circuit for synchronising and operating the photographic recorder respectively.

How the picture is remade can be followed from Fig. 3. Here we see a lamp L in a light tight box, rays from which are converged by a lens D so that they cross, and then widen out to fall on

the second lens S, which concentrates them upon a piece of sensitive photographic film attached to the revolving drum C. The apparatus in the centre, V, has been termed by the inventors a "light valve"; actually it is a form of string galvanometer in which the flat ribbon-like conowing to the interaction of the current with the magnetic field. The amount of deflection being proportional to the strength of the current, the amount of light which gets through the valve is thus varied in intensity corresponding to the brightness at each instant of the photo-

Fig. 4. In the actual transmission a picture 7 in. by 5 in. is telegraphed in about seven minutes, and in it the lines are usually one hundred to the inch, and are scarcely visible to the eye, as will be readily acknowledged on examining the reproduction below.

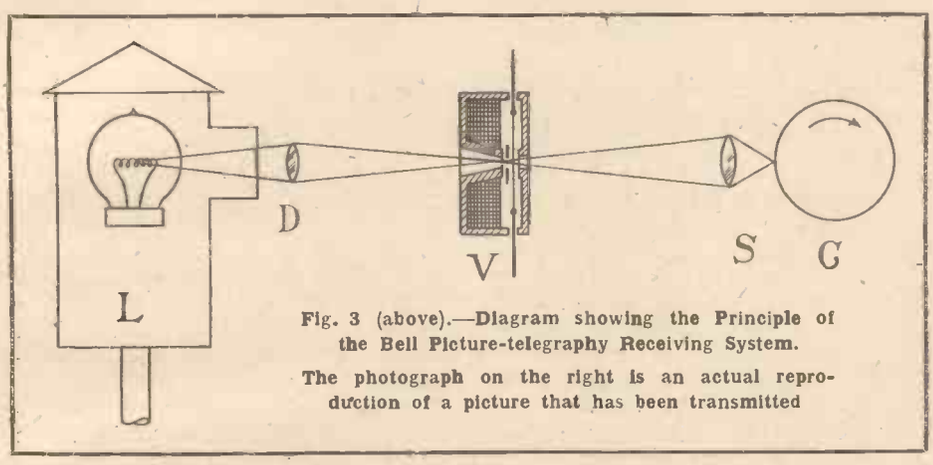


Fig. 3 (above).—Diagram showing the Principle of the Bell Picture-telegraphy Receiving System.

The photograph on the right is an actual reproduction of a picture that has been transmitted

ductor lies in the magnetic field in such a position as entirely to cover the small aperture through which the rays of light pass.

The incoming current is passed through the ribbon, which is thereby deflected

graph being transmitted. The result of this movement of the galvanometer ribbon is to form a line of light varying in width according to the depth of tones in the photograph, and such a picture with the lines very greatly enlarged is seen in

It is no exaggeration to say that already some hundred of photographs have been transmitted by this system, which has solved the problem of the telegraphed picture in the United States of America.

T. THORNE BAKER.

PORTABLE SETS

DURING the summer months the interest of the wireless enthusiast centres mainly on the possibilities of a portable set. Unfortunately in too many cases the term is somewhat of a misnomer. It is no unusual thing to find the combined weight of a so-called "portable" receiver, with batteries and other essential accessories, topping the scale at 40 lb. or over. This is certainly too much to be added light-heartedly to the luggage outfit except when a car is available.

On the other hand, there is no doubt that a set which is really light and compact enough to be easily carried about from place to place forms a delightful addition to any picnic outing or seaside holiday. At the present time there are several well-known makes of really portable sets available, which can be relied upon to give satisfactory service.

It is difficult to specify definite limits of range for such sets, as this depends so much upon the type of aerial used. In many cases a frame aerial is incorporated in the set itself, usually wound around the case or inside the lid. This is, of course, the most convenient form, but it involves the use of at least one H.F. and one detector valve for headphone reception at any range beyond ten and up to twenty-five or thirty miles of the nearest B.B.C. station. At least one and preferably two note magnifiers must be added for loud-speaker work.

If, however, the frame aerial is replaced by a 20-ft. length of insulated wire, slung over a branch of the nearest tree, a single back-coupled valve will serve quite well for telephone reception up to ten miles. The addition of one L.F. amplifier will then usually give quite reasonable loud-speaker strength. As an alternative, a nail driven into the trunk of a tree and connected up to the set will usually give better results than a small-sized frame aerial.

M. A. L.

CATWHISKER ADJUSTMENT

ADJUSTMENT of the catwhisker of the crystal detector is greatly simplified if the contact is easy to see. With many detectors the protecting cover or glass cylinder renders the adjustment quite a difficult matter, as it is almost impossible to see the fine wire. In order to make the catwhisker clearly visible against the protecting cover a spot of white paint should be placed on it a short distance from the actual contacting end of the wire. If a black band, either of paint or black paper, be placed on the glass cylinder the catwhisker will be clearly visible.

G.

The Haeren station, in Belgium, transmits at 13.00 B.S.T. daily (telephony) a meteorological forecast in both the French and Flemish languages. To this on certain days is added an aviation route report giving full statistics of the aeroplane traffic in Belgium.

DIRECTIONAL VAGARIES

THE difficulty of getting reliable results with wireless direction-finding apparatus increases enormously with distance. For short-range working up to, say, fifty miles, the chief source of error, particularly in an aeroplane or on a ship, is that caused by re-radiation from the metallic parts of the vessel. On land a similar effect may arise from the presence of trees, telegraph wires, or large metal structures in the neighbourhood of the receiver. This so-called quadrantal error is, however, easily determined and the necessary correction applied.

In long-range working the wave-front of the signal energy is frequently subject to serious deviations from other causes which are not so easily calculated. For instance, a pronounced break in direction may occur as the wave passes over the coastline, or an intervening range of hills will cause a deflection which varies with the line of approach of the wave-front.

Finally there is a mysterious "wandering" effect, the precise cause of which is still unknown, but which is probably due to the existence of variations in atmospheric ionisation along the path of the wave. This is not so noticeable during the day-time as it is at night, where it may easily cause an error of from 15 to 20 degrees in the bearings as recorded by the D.F. apparatus.

H.

Permission has been granted by the officials at Trinity House for wireless sets to be installed on board several lightships.

THE INVALID'S INDEPENDENT CRYSTAL RECEPTION

Interesting suggestions for a novel method of sharing the programmes are given in this article

THE usual arrangement in most households where there is a loud-speaker set is to install the wireless apparatus somewhere in the favourite living-room and to listen-in as a family circle. It sometimes happens, however, that there is an invalid who wishes to hear the programme, but is located in a distant bedroom. Or it may be that one would like the maid to share the entertainment.

There are, of course, several ways of meeting this situation. One might install as many separate loud-speakers as are necessary, and feed them all by leads run in parallel or series from the output terminals of the receiving set. This, of course, means considerable expense both as regards the supply of additional loud-speakers and also in the provision of a receiver powerful enough to give a satisfactory volume of sound throughout.

A cheaper method would be to provide separate crystal sets where required, but this plan is usually not feasible on account of the aerial difficulty.

Another obvious procedure is simply to provide headphones for the distant listener and to feed these either through special leads (or by making use of the house bell-wiring) from the family set in the living-room. The difficulty here is to make the necessary compromise between the loud-speaker strength required for the family circle and that suitable for giving agreeable results in the headphones.

If the distant listener is fed in series with the family loud-speaker a fair volume of strength in the latter will prove too much for comfort in the phones. This could, of course, be overcome by feeding the headphones in parallel with the loud-speaker and using a very high-resistance pair of phones so as to split the current in inverse proportion.

The main objection to the last-mentioned plan is that no reception can take place in the headphones except at such time as the loud-speaker is in operation. If for any reason the family circle are tired of any particular item, or if visitors drop in, the set may be switched off, in which case the distant listener is suddenly left stranded.

A very cheap and simple method of overcoming all these difficulties is to couple a separate tuned coil, feeding a crystal detector, to the aerial tuning-coil of the main valve set. This can be done in a variety of ways, one convenient method being described in detail below.

The coupled crystal unit has no appreciable effect upon the normal volume of sound given by the loud-speaker, any slight initial decrease being easily compensated by tightening the reaction coupling. The presence of the extra circuit may entail a slight readjustment of the tuning controls on the valve set, but that is all.

The diagrammatic circuit arrangement is shown in Fig. 1, in which A is the aerial tuning-coil of the loud-speaker set, B is the reaction coil from the plate of the first valve, and C is a separate coil, coupled to the coil A and feeding high-frequency energy to a crystal detector K, from which leads are taken to the distant phones.

It will be seen that the crystal circuit is fed continuously, so long as the aerial and earth connections are on the main set, irrespective of whether the valves are lighted or not. The aerial energy diverted into the crystal circuit will be found to make no difference to ordinary reception from the local B.B.C. station, any loss being made good by simply tightening the coupling between the coils A and B. The arrangement is not, however, favourable for long-distance reception, as the damping effect of the extra coil on the aerial then begins to make itself felt.

In many types of multi-valve receiver the tuning and reaction coils are plugged in on holders mounted at the side of the set as indicated in Fig. 2.

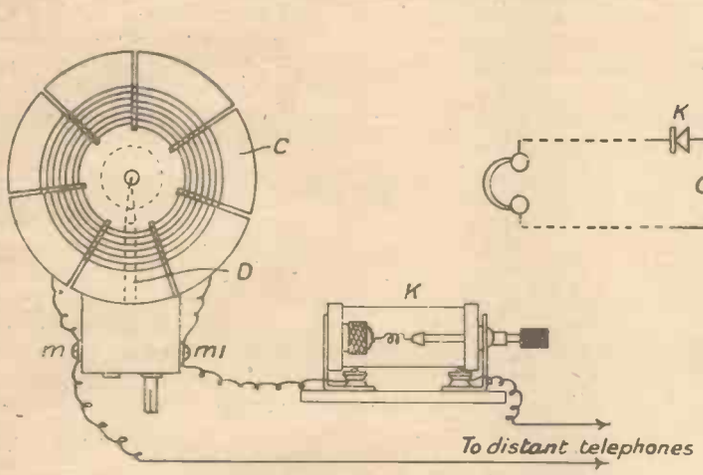


Fig. 4.—Connections of Coil and Detector.

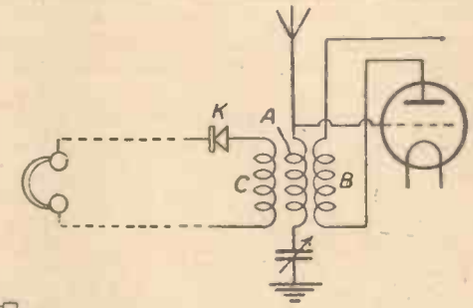


Fig. 1.—Circuit Diagram of Coupled Receiver.

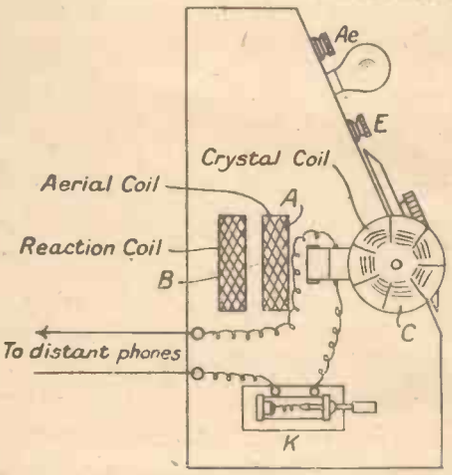


Fig. 2.—Suggested Arrangement of Coupling Coils.

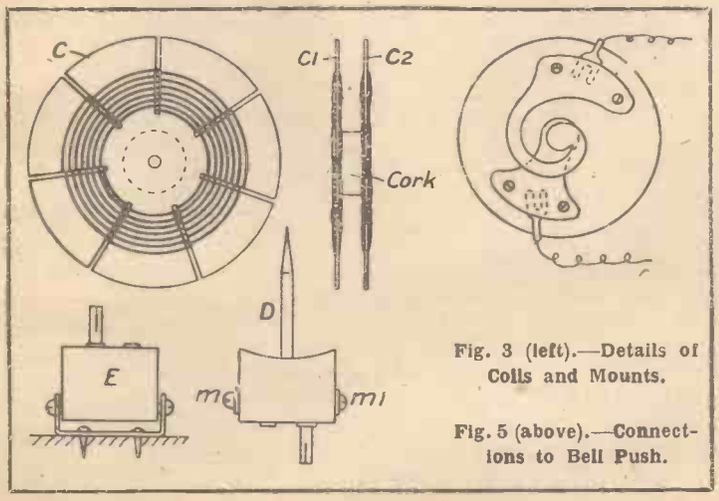


Fig. 3 (left).—Details of Coils and Mounts.

Fig. 5 (above).—Connections to Bell Push.

In this case the handiest way to couple up the crystal circuit is to mount the additional crystal coil C on a swivel-holder side by side with the other coils A B as shown, so that if necessary the coupling between the coils C and A can be readily adjusted to give a suitable strength in the distant phones. This arrangement also allows the crystal accessory circuit to be easily dismantled and removed from the main receiver should this be desirable for any reason.

The Coils

The coil C can take a variety of forms. One of the simplest and cheapest is that comprising a couple of pancake windings as shown in Fig. 3. Two circular discs of stiff cardboard or celluloid about 3 in. in diameter are slit radially and wound with No. 26 d.c.c. wire, the wire being passed over and under alternate segments in the well-known way.

Thirty turns of wire are laid on one disc C1 and eighteen turns on a second similar disc C2, the inside winding on one card being connected to the outside winding on the second. A small hole is made in each card to hold or anchor the two free ends of the variometer winding so formed.

A piece of cork three-quarters of an inch or so in diameter and slightly over half an inch thick forms the centre distance piece, each card being glued to the cork or attached to it by means of drawing-pins. The cork is then fixed to one of the spiked plug-mountings D, shown in Fig. 3, used for carrying basket coils. These can be purchased at most retailers' for a few pence.

Coil Holder

The swinging coil holder E is made from a dummy plug and a piece of ½-in. by $\frac{1}{16}$-in. brass strip, bent as shown, and screwed into the side of the cabinet side by side with the main coils, as indicated in Fig. 2. In assembling, one free end of the variometer winding is connected to each side of the side terminals *m*, *m*1 on the plug mounting D as shown in Fig. 4.

A connection is then made from the terminal *m*1 to one terminal on the crystal detector, the lead from the second crystal terminal going to the distant telephones, the return from which is taken back to the terminal *m*.

The crystal K can conveniently be mounted on the side of the cabinet of the valve set, together with two terminals for the distant leads, as shown in Fig. 2, though this arrangement can be varied to suit particular circumstances. It is necessary, however, to have the crystal somewhere near the coil C and not in the distant room, owing to the high-frequency losses that would otherwise take place over the long leads.

Permanent Crystals

This is a slight drawback, but a good-class crystal, once set, does not require frequent readjustment; moreover, if necessary, a permanent combination of the perikon or carborundum type can be used. The crystal is initially set to a sensitive point by tapping a pair of headphones across the outgoing leads, and an occasional test can be made locally from time to time in the same way.

Very little loss takes place once the high-frequency currents have been rectified by the crystal, and it will be found that quite good headphone strength can be distributed to any room in an average-sized house by means of the arrangement described.

Leads

If it is not desired to install permanent leads to any given room, an emergency line will be found in the ordinary bell-wiring of the house. The outgoing leads from the crystal circuit are connected to the two terminals inside the bell-push of the living-room, and the headphones are similarly connected to the bell-push in the distant room.

Fig. 5 shows the inside arrangement of the ordinary bell-push when the cover is removed. If two thin spade terminals are connected to the wire leads it will be found an easy matter to insert them under the brass-strip terminals of the bell-switch in the manner shown. As the telephones when inserted will shorten the bell batteries it is advisable to remove one of the zincs from the latter. This is not essential, as the resistance of the headphones is sufficient to prevent the passage of any appreciable current, but it will certainly obviate a certain amount of background noise in the phones.

M. A. L.

The Latest Photograph of the Savoy Orpheans Band.

TRANSFORMER LEADS

IT sometimes happens that the fine wires connecting low-frequency transformer windings to the terminals break off near the cheeks. If the wire breaks off very close to one of the cheeks a repair may appear impossible at first sight. Here is a simple method of remaking the connection.

Scrape away some of the insulation surrounding the broken wire (taking care not to damage the top layer of the winding, which may be exposed by scraping away the insulation) and cover the recess thus formed with a little non-corrosive flux. Drop a spot of solder into the cavity, keeping the iron as far away as possible from the transformer during the process. Tin the end of a short piece of copper wire and attach it to the blob of wire on the transformer. A simple test with a dry cell and a pair of phones will tell if the repair is successful.

U. J.

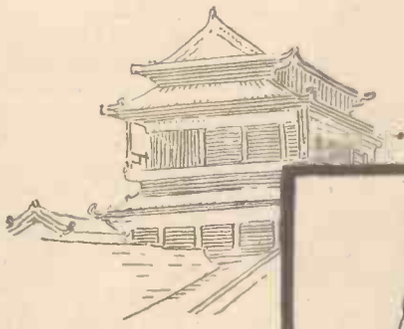
A condensed version of "The Way of an Eagle," Ethel M. Dell's popular novel, will be given from the London studio on June 16.

The Radio-Lyons broadcasting station is being closed down for a period of two to three weeks, in order to increase the power and efficiency of the transmitter.

The Government has decided to accept in general the recommendations of the Broadcasting Committee as to the constitution of a new authority to control the broadcasting services, and are now considering the method to be adopted to give effect to them.

The Chinese have a proverb which says—

"One picture is worth more than ten thousand words"



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On Your Wavelength!

More Please!

EVERYONE of my wireless friends that I have met lately is loud in his praises of the instrumental solo programme that 2 L O put on a short time ago. Those who are really musical enjoy them because they come through so exceedingly well, whilst those who are wireless maniacs in the first place and only incidentally lovers of music want this kind of programme repeated for quite another reason. They find that it is of the greatest help in enabling them to find out just what shortcomings, if any, are present in the low-frequency part of the receiving set. No set is perfect unless it will bring out the individual characteristics of each instrument. These depend mainly upon the overtones produced. The reason that a particular note played on the clarinet has the same pitch as when it is produced upon the violin, the flute or the oboe, yet sounds quite different, is simply that there is no such thing as a pure musical note; all those that we know are really chords, composed of the fundamental and a large number of harmonics.

Faithful Reproduction

For reception to be really good all of the harmonics within audible limits must be reproduced faithfully. It not infrequently happens, by the way, that people who are not satisfied with their reproduction place the blame wrongfully upon the note magnifiers. Modern L.F. transformers of good design are capable of dealing with the harmonics and give excellent reproduction. The trouble lies quite often in the high-frequency side of the set, and is due to the use of too much reaction, either magnetic or by capacity. The effect of overdone reaction is to make the set too selective, in which case the harmonics are filtered out before they actually reach the rectifier.

Still Wondering

It is sometimes more than a little difficult to follow the accounts of technical matters that appear in the lay press. At the present moment my head is going round and round after a vain attempt to discover the meaning of a paragraph headed "New Waves" which I came across in my morning paper. I have no doubt that it is a very wonderful discovery and I want to know all about it; but all that I can find out so far is that these waves "differ from the normal vibrations in the fact that their time period is determined by capacity and resistance—or relaxation time—not by self-induction and capacity." Do you grasp that? Splendid! Neither do I.

The Black List

The B.B.C. has once more brought into use the system of issuing district threats, warnings and requests to howlers which used to be a feature of every programme when 2 L O and other stations were in their infancy. This is, I think, a very good thing, and I only hope that it will do something to check the nuisance. It is curious to notice how howling comes in periodical spasms. For weeks you may be almost entirely free from it, then you strike a bad patch which may continue for some time. A period of peace and calm follows, after which it begins all over again. I am inclined to believe that a great deal of the howling that takes place nowadays is traceable to the misdeeds of those who are far from being beginners at the game. They are in many cases constructors who are trying out new circuits, and who are selfish enough to make their tests at a time when everyone else wants to listen to the programmes.

A Warning

One of the worst kinds of circuit for causing howling, paradoxical as it may seem to say so, is the neutrodyne. Once you have got it properly adjusted it should give no further trouble, but many people find it a long business to discover the setting which will give proper neutralisation. Here is the best way of setting the neutralising condensers without causing interference to your neighbours. With the aerial and earth disconnected, switch off the first H.F. valve. As the condenser tuning the plate circuit of the second H.F. valve is moved, "plocks" will be heard at certain points owing to the set going into oscillation. Adjust the neutrodyne condenser until these "plocks" disappear. Now treat the first H.F. valve in the same way. If the set is properly designed it should now be effectively neutrodyned when the aerial and earth are connected up. If, however, you find that with the aerial and earth connected the set still oscillates, then the trouble is probably due to interaction between inductances on the H.T. side. This can be minimised by separating the coils as far as possible and placing them at right-angles.

Still Unbeaten

There must be hundreds of people at the present time who are wondering what is the best all-round circuit for medium- and long-distance work. For long-distance reception of telephony with satisfactory quality it is essential to use high-frequency amplification. When the tuned-anode circuit first became generally known it leapt at once into popularity on account of its wonderful efficiency. The experts, however, became dissatisfied with it because it is necessary in most cases to introduce a certain amount of damping in the form of resistance or of a slight positive potential applied to the grid of each high-frequency amplifying valve. This damping, they explained, made the circuit inefficient, flattened tuning and reduced both range and selectivity. For a time the tuned-anode was eclipsed by the neutrodyne circuit. With a properly neutrodyned set you can work your high-frequency valves actually with a negative bias upon their grids; you can reduce resistance in the tuning circuits to a negligible figure, and yet you can make the receiving set perfectly stable.

Now I have been using a neutrodyne receiver for some little time, and I must admit that some of the claims made on its behalf are justified by results. Once it is properly adjusted you cannot make it radiate, though you may have to fiddle with the neutralising condensers if you wish to tune in a transmission whose wavelength is very much higher or very much lower than those for which the set is ordinarily used. But I have one quarrel with the neutrodyne. Despite the absence of the potentiometer and the elimination of resistance, its tuning becomes quite flat when it is duly neutralised. I have always maintained that with careful design it is possible to make receiving sets incorporating two tuned-anodes which are stable and selective—in fact I have myself made a great many of them. A slight positive bias on the grids and a little resistance in the coils are needed to produce stability, but when these are present the plain straightforward receiving set, despite its theoretical shortcomings, seems to me to tune more sharply and to be more sensitive than the neutrodyne. My own view is that the old tuned-anode circuit is still unbeaten, and that it will take a great deal of beating.

Coil Winding

Are you a coil-winding enthusiast? Most people take up this fascinating hobby at some period of their wireless careers. It is really a most interesting pastime, and there is a great deal of satisfaction to be obtained from making one's own coils, for one can construct them to meet one's requirements exactly. For some reason that I have never been able to understand it is most difficult to find amongst ready-made coils a set that will cover the broadcast waveband comfortably. It is ten to one that if the aerial coil will do it you have to change the anode coils when you want to tune in stations with wavelengths above 450 metres.

On Your Wavelength! (continued)

If you have not tried coil-winding, take my tip and have a shot at it. The materials needed are few and inexpensive, and there are so many ways of making coils that the hobby is full of variety. If you are of an inventive turn of mind you may possibly discover some entirely new method and reap a handsome reward. For those who are new to the game I would recommend to start with the basket-weave inductance. The former for this consists merely of an odd number of 2-inch nails equally spaced round the circumference of a circle drawn on a piece of board. Anyone can make these coils, and they are very satisfactory to use.

Catastrophe!

I had a terrible time the other evening. First of all my pet low-frequency amplifying valve gave up the ghost after two years' hard wear! I calculate that during this period it has done about 2,500 hours' service. It was a dull-emitter. I replaced the valve with a poor substitute, an ordinary bright-emitter, and the remainder of my broadcast programme was tasteless to me. After twelve o'clock I made ready for my orgy of amateur reception, the long-wave tuner being switched out of circuit. Then it was that "things happened." A spluttering and crackling came from the interior of the set, accompanied by an unpleasant odour of burning rubber. I dislike the smell of burnt rubber at any time, but more so at the dead of night in a wireless receiver. My valves lighted brilliantly for a few brief moments, and then as suddenly went out. It was all caused by a loose strand of flexible wire on the positive high-tension lead, which suddenly took a fancy to touching on the L.T. negative! The slight jar to the set occasioned by switching over to the short waves probably did the trick, and in a few brief moments I thus became deprived of four valuable valves! Moral: Always solder your flexible wires on to spade terminals.

Comfort

But we have always this comfort: We would never learn half so quickly as we do had we no accidents. I do not say this as an excuse for slovenly workmanship in wireless, but, on the contrary, such accidents as these make one careful. I am sure that no reader will deny that when once he has been bitten by a fault due to hasty or careless workmanship, such a catastrophe rarely occurs again.

Condemned Unheard

I well remember a few years back the loudly voiced convictions of a friend of mine who was convinced that the super-heterodyne receiver was useless. He had made hasty tests with all manner of shabby junk, and had expected extraordinary results from transformers and condensers which, to say the least of it, were sadly inefficient. Needless to say, this was not fair. Care has to be taken with the transformer design; intelligence must be exercised in the layout of the parts. Experience will lead us to cut down the lengths of connecting wires as though they were as valuable as gold. Yet in spite of all this, many experimenters still endeavour to use parts and valves which will not associate together, simply because they are not suitable for the job in hand. The net result is that the super-het is often condemned as a myth, a bogey or an interloper of all honest sets, and is, moreover, condemned unheard. If you are of the opinion that super-hets are overrated, take an early opportunity of visiting a friend who possesses one and see what he can do. I wager then that your ambitions will at once begin to balance themselves against your pocket!

Open-air Radio

Some there are who maintain that wireless is no pastime for the summer months, whilst there are others who are so devoted to the thermionic valve and its little idiosyncrasies that they uphold that there is no season for radio but that all times are radio times. I find even more attraction in radio in the summer than in winter. There is undoubtedly a great deal of interest attached to compressing valves, condensers, batteries and transformers into the smallest possible space for portable purposes, whilst to listen to a good broadcast programme on a quiet summer evening through the agency of a good loud-speaker takes a lot of beating. In order that I should not be debarred from enjoying fresh air whilst in the pursuit of this interesting hobby, I have built for myself a radio "dug-out" at the bottom of my garden, and in this is erected a transmitter, two or three receivers and many panels holding testing instruments of various kinds. The dug-out is fitted with two large windows which open to admit fresh air, whilst last but not least, a pair of large doors extending down one entire side of the hut can be thrown open. The hut is lighted by electricity and an electric fan plays in hot weather; during cold weather an electric radiator keeps the den at a comfortable temperature. Therefore I indulge in radio under ideal conditions, whilst others (maybe hesitatingly) throw aside the headphones during the summer, with disastrous results to accumulators and the like. The beauty of the whole thing is that the hut did not cost more to build than a good radio set, and it is more comfortable than any den in the house could be. These notes are written between experiments in this hut, and I can strongly recommend the outdoor wireless den.

London Clubs and Wireless

I see it reported in one of the dailies that though several of the West End clubs have installed wireless receiving sets, members make very little use of them. The inference drawn is that the programmes are not sufficiently interesting. With this, however, I do not agree at all. One goes to one's club to lunch, to dine, to play billiards, or to converse—and in some cases, to slumber. If one has got as far as the club, it requires no great effort to go to a theatre or a concert hall. The wireless set is therefore naturally not in great request. At home it is a very different business. The wireless set is there really to provide entertainment whenever it is wanted, and one can hear really good programmes—for they *are* really good—without the trouble or the expense of going out. My own club does not possess a wireless set, but I should be one of the first to vote against its installation if it were proposed to have one. In your own home you can always switch on or off when you want to, but at a club there is sure to be somebody who wants to hear the loud-speaker loud-speaking when you do not, and *vice versa*.

Strange, Isn't It?

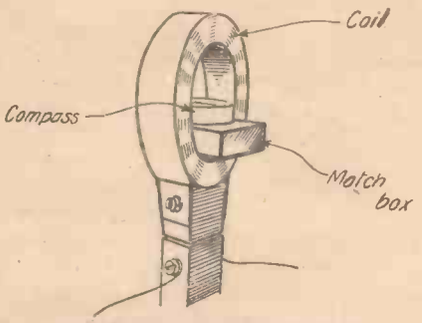
Wireless is full of curiosities, as you have no doubt observed for yourself. Here is an interesting instance. I have always regarded my own house as being rather a poor one for wireless reception. Telephone wires prevent me from getting aerial height, and for some reason that I do not know the frame aerial refuses to function in my wireless den. The other day one of my boys rigged up in a room upstairs an indoor aerial consisting of No. 26 d.c.c. wire suspended round the walls of a small room. The earth connection was made with the same wire to a water-pipe in the bathroom at the other end of a passage. Even in a favourable locality one would hardly have expected particularly good results to be obtainable with such a wave-catching system. Actually with a crystal set both Daventry and London came in at rather better strength than when the outdoor aerial was used.

I mentioned this apparently freakish case to a friend who has a three-valve set, which is operated normally in conjunction with a really good outdoor aerial. A night or two later he came round to tell me that he had tried the experiment of using an indoor wire, and that his results, so far from being worse than they had been, were actually a good deal better. He was able, for instance, to tune-in upon the loud-speaker two stations which he had previously never got at more than headphone strength. If you are not satisfied with your own outdoor system, you might try the effect of using an indoor aerial. THERMION.

PRACTICAL ODDS AND ENDS

An Emergency Galvanometer

WHEN one is trying to locate a fault in a receiving set a galvanometer of some kind is a very handy instrument. An emergency galvanometer is very easily provided, the only components required

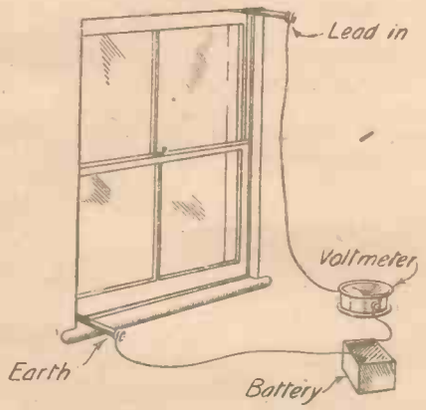


An Emergency Galvanometer.

being a pocket compass and a large tuning coil, the larger the better. Place the coil in a holder and place the compass on a matchbox. Turn the coil until the needle of the compass coincides with the north point on the scale. When current is passed through the coil the needle will be deflected by the current. W. H.

Testing the Aerial

IT is most important that the D.C. insulation between the free end of the aerial and earth should be perfect, as any leak in the aerial-earth system will cause weak signals. The diagram illustrates a method of testing the insulation of the aerial



Method of Testing Aerial Insulation.

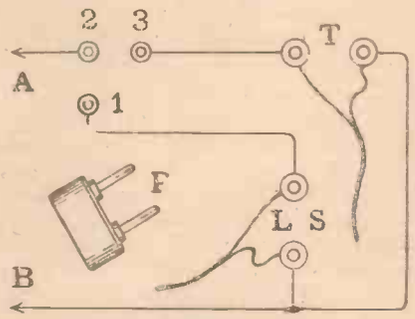
which does not necessitate expensive instruments. Simply connect an H.T. battery and a voltmeter in series across the aerial and earth leads-in. If the insulation is perfect the voltmeter will not register, apart from one single flick of the needle when the connections are first made. H.

The Master Filament Control

IN a large multi-valve set designed for pure reception of the local station critical control of filament temperature is not always necessary; nor is it desirable from the point of simplicity of operation. For this reason a master filament control is sometimes provided in series with all the filaments, and capable of simultaneous control of all valves. Often the master control consists of a simple on-and-off key switch by which the set is started and stopped. This sudden switching on and off of the filament current has a serious effect on the life of the valves, and it is therefore far better to wire a resistance in series with all the filaments, by means of which the current may be gradually turned on and off. R.

Simple Switching Device

THE diagram shows a very simple and effective method of changing over the phones to the loud-speaker, the switch consisting of a two-pin plug P and three flush-type valve sockets 1, 2 and 3. The spac-



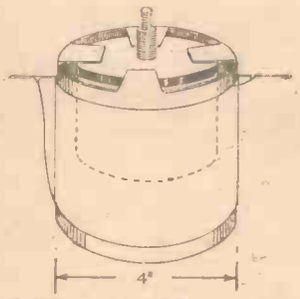
Simple Switching Device.

ing between the sockets 1 and 2 and 2 and 3 is equal to the spacing of the valve pins in the plug (about ½ in.), the latter being joined together by means of a link. The leads A and B are from the "output" terminals of the amplifier or from the existing phone terminals of the set. Separate terminals are provided for the phones T and the loud-speaker LS.

By simply inserting the plug-in sockets 2 and 3 the phones only are in use, and by transferring the plug to sockets 1 and 2 the phones are cut out and at the same time the loud-speaker is brought into use. O. J. R.

Coil Mounting

IT is often desirable to save panel space in a receiver (especially when the receiver is to be portable), and it is therefore very convenient when two components can be mounted on the same support. In the accompanying diagram it will be seen that the tuning coil (of the ordinary solenoid type) is mounted outside the variable condenser, shown in dotted lines. Tags are cut on the cardboard former, bent over and held under the condenser

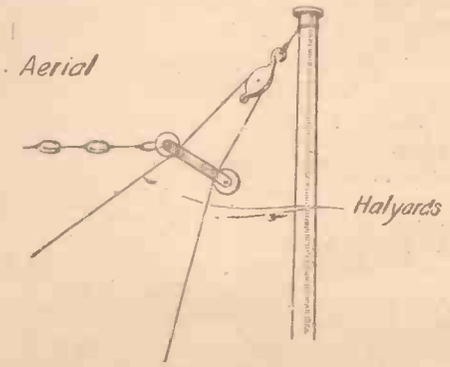


Neat Method of Mounting Coils.

end-plate. Connections to both components are made as shown in the sketch. This method of mounting is very convenient and efficient for all ordinary purposes, but should on no account be employed in a receiver for very short waves, say below 100 metres. C. E.

A Halyard Hint

A FAULT that is likely to occur with most amateur-erected aerials is the jamming of the aerial halyards in the pulley block at the top of the mast. Here is an easy method of erecting an aerial, even though the halyards become fast in the block, without lowering the mast. Two sash pulleys are connected together by two



Arrangement of Halyards and Pulleys.

strips of iron or zinc about 6 in. in length and a shackle is fixed on one end of the pulley block in order to attach the aerial wire. The halyard ropes are slipped over the pulleys as shown in the sketch; it will then be found that the aerial is raised as the halyards are pulled apart. N.

MAKING YOUR SET SELECTIVE

Some Useful Suggestions for Improving Existing Receivers

THOSE who have listened to the relaying of Continental stations recently done by the B.B.C., or who are themselves in the habit of reaching out on occasion for distant broadcast transmissions, will realise that success in long-distance broadcast reception depends very largely upon the degree of selectivity obtainable with the wireless set. If the receiver is of a not very selective type its owner may find that, even though he has four or five valves at his command, he is confined to one or two transmissions during broadcasting hours owing to the "blotting-out" effects of his local station, and to the fact that the others can be heard over quite a wide range of condenser settings. To be really satisfactory for DX work a receiving set must be capable of cutting out the local station entirely at settings a few metres above or below its own wavelength, whilst the tuning of more distant stations should be very sharp indeed.

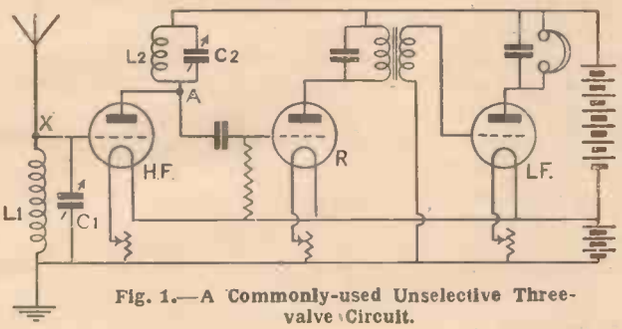


Fig. 1.—A Commonly-used Unselective Three-valve Circuit.

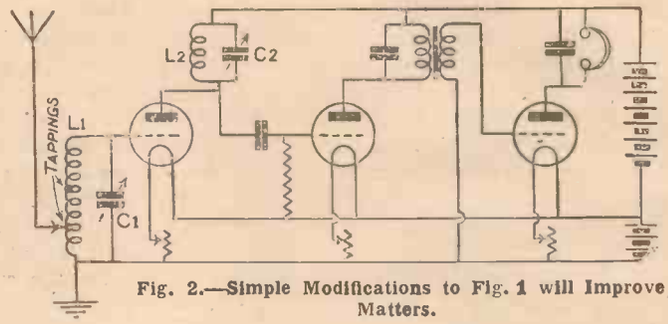


Fig. 2.—Simple Modifications to Fig. 1 will Improve Matters.

Simple Modifications

A type of receiving set very frequently used is that seen in the first diagram. Here a single-circuit tuner is used whilst the first valve, which is a high-frequency amplifier, is coupled to the rectifier by means of the tuned-anode circuit. With apparatus of this kind no great amount of selectivity is usually obtainable owing largely to the heavy damping from the aerial system introduced into the grid circuit of the first valve. Matters are made worse should either the A.T.I. or the anode-tuning inductance (or both of them) be coils wound with fine wire, which introduces an undesirable element of resistance into the tuned circuits. Selectivity will suffer again should either or both of these coils have a large self-capacity. In theory the tuner circuit when brought to resonance by careful adjustment should respond to no frequency but that desired. It would do so if we could eliminate from it all resistance and all losses. Actually it responds best to the desired frequency, but it also passes on to the grid of the valve impulses whose frequencies are somewhat greater and somewhat less than that of the desired transmission. The greater the resistance present and the higher the losses, the wider will be the band of frequencies to which the circuit responds. Very much the same considerations apply to the anode tuning circuit of the high-frequency valve.

What steps can be taken to improve the selectivity of such a circuit? We can tackle the problem in several ways. Supposing that we do not wish to make any considerable constructional alterations to the set, we may adopt the very simple method shown in Fig. 2. Here an auto-coupled tuner is seen, the aerial being connected to a tapping of the coil. Plug-in inductances with tappings brought out to terminals are now available quite cheaply, and all that one has to do is to substitute one of these for the original A.T.I. The aerial is disconnected from the point X in Fig. 1, and attached to one of the two terminals of the coil connected to the tappings. Experiment will show which tapping gives the better results. It will be found as a rule that this simple alteration brings about a considerable increase in the selectivity of the set. Sometimes a slight loss in signal strength occurs, but in many cases there is an actual increase. A further improvement may be made by substituting for L2 an inductance of special low-loss type.

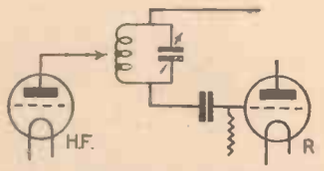


Fig. 4.—Tuned-anode Coupling.

A second way of increasing the selectivity of the Fig. 1 circuit is to leave the tuner as it stands, and to fit a reaction coil coupled to L1. The effect of reaction is to feed back into the grid circuit of the first valve energy supplied by the high-tension battery. Since the current-flow in the plate circuit of the rectifier is modulated by impulses brought in by the aerial, the reaction coil feeds both into the grid circuit of the first valve, and into the aerial itself, impulses which are exactly in step with those of the received signal. The result is that the effects of damping may be so counteracted that improved selectivity is obtained. If, however, the energy fed back is excessive, the set becomes unstable and goes into oscillation. The use of reaction in such a circuit, therefore, entails the risk of causing interference, and should not be employed except by those who are skilled in operating a receiving set, and take the greatest care to avoid causing interference through radiation.

To fit a reaction coil means scrapping the original single-coil holder and replacing it with a double one, which allows the coupling between the two inductances to be varied. If such an extensive alteration as this is contemplated I would rather recommend that the two-coil holder should be employed for a different purpose. In Fig. 3 the circuit seen is the same as that of Fig. 1, except that a loose-

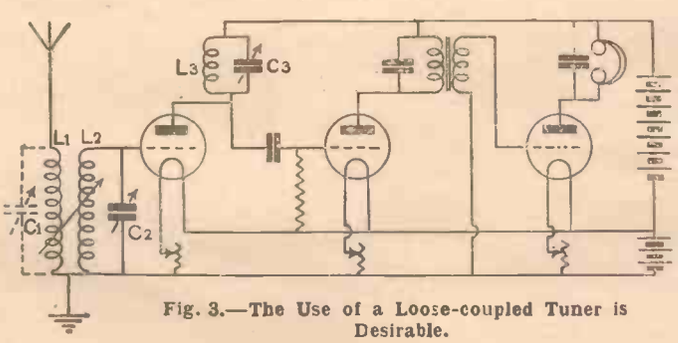


Fig. 3.—The Use of a Loose-coupled Tuner is Desirable.

(*Continued at foot of page* 819)

"A.W." TESTS OF APPARATUS

Conducted in the "Amateur Wireless" Research and Test Department

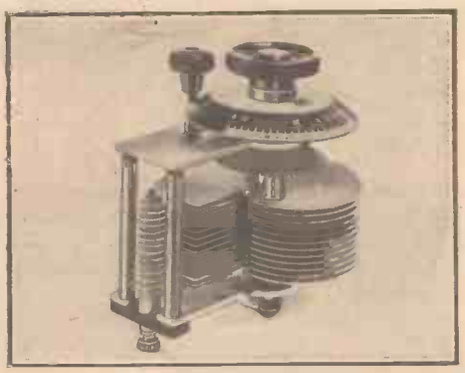
J.B. Variable Condenser

WE have received from Jackson Bros., of 8, Poland Street, London, W.1, samples of their low-loss variable condensers fitted with a slow-motion device which employs gearing. As is usual with low-loss condensers the moving plates are electrically connected to the metal frame by means of a flexible pig-tail connection. The amount of friction acting on the motion of the moving vanes is adjusted by a small screw and locking-nut.

The slow-motion control knob situated beside the main control operates the moving shaft through a reduction gear having a ratio of approximately 30 to 1, whilst the main dial gives a quick motion which is unaffected by the slow-motion mechanism.

Only two small ebonite strips are employed to insulate the fixed vanes, which are supported in two places. With such a small amount of dielectric situated outside the electrostatic field the losses due to absorption are negligible.

The minimum capacity of the condenser is small, giving a wide variation in capacity between the minimum and maximum values. There is a surprisingly small amount of backlash present in the slow-motion gear mechanism, and this is due to the construction of the latter. Only two holes are required for mounting the condenser on the panel.



J.B. Variable Condenser

New Loud-speaker Horn

FOR some time we have been using a loud-speaker for test purposes that has given extremely pure reproduction. The horn of this instrument is made of papier-mâché, and is supplied by Scientific Supplies, Ltd., of 80, Newington Causeway, London. The horn is designed to be fitted with a unit such as the Amplion gramophone attachment or the Lissenola loud-speaker unit. As would be expected from the material with which the horn is made the latter is extremely light and is entirely free from resonant effects usually found in horns made of metal. Indeed, the reproduction obtained is very mellow, but is not "woolly" on speech. It gives exceptionally faithful reproduction of wind and string instruments, but is inclined to

Papier-mache Loud-speaker Horn

accentuate the lower notes to a greater extent than the higher notes.

A base of ample proportions is provided and the horn is finished in black and gold. Altogether a loud-speaker constructed with this horn is not only cheap but gives results equal to many of the more expensive instruments.

Efficient Wander-plugs

A GREAT improvement over the usual type of wander-plug is to be seen in the new Clix wander-plug manufactured by Autoveyors, Ltd., of 84, Victoria Street, Westminster, London, S.W.1. Through the tubular plug a helical slot is cut which, by diametrical expansion and compression, ensures a full surface contact between the plug and the socket. A wire connection to the plug is inserted through the polished red or black insulator screwed on to the plug, and is passed round a channel cut in the side of the plug, through a bridge wiring aperture and up again, forming a loop. In this way a tidy connection is made which cannot come loose. The bottom of the plug is tapered to facilitate easy insertion into a socket, and the plug itself is made of hard spring-brass tube cut in the manner indicated.

We have found these plugs to give a contact having a negligible H.F. and D.C. resistance.

Standard Plugs and Sockets

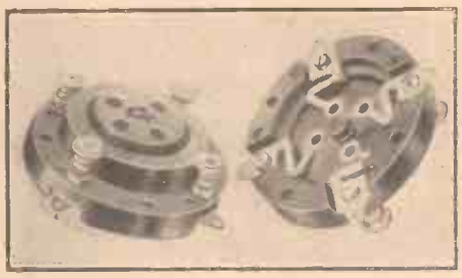
WE are glad to note that J. J. Eastick and Sons, of Eelix House, 118, Bunhill Row, E.C., are producing pins, plugs and sockets of standard sizes so that interchangeability is obtained. In this respect choice is left no alternative but to select the valve-pin size for the plug and the valve holder for the socket.

We have received samples of their eye, pin and spade-terminal ends, connecting bars, connections, etc., which possess the great advantage that they can be used with a special terminal that takes the Eelex standard plugs and sockets and is suitable for use as an ordinary pillar or phone terminal. This terminal is called the T2L type and possesses an almost unlimited number of uses.

Lotus Valve Holder

ONE of the neatest and most efficient valve holders of the anti-microphonic type we have yet examined is made by Garnett Whiteley and Co., Ltd., of Lotus Works, Liverpool, and is known as the Lotus Buoyancy valve holder. The valve filaments are subject to damage by the slightest vibration and are apt to produce a ringing noise if the valve is not mounted on some springing device that prevents the transmission of vibration to the valve.

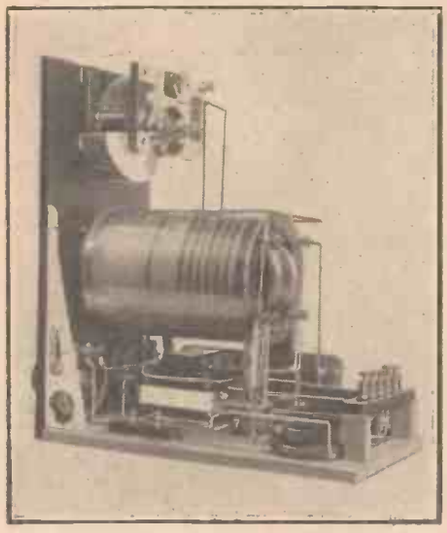
In the Lotus valve holder the springing effect is obtained by means of a "floating" holder attached to an outer bakelite moulding by means of nickel-silver springs making electrical contact with the phosphor-



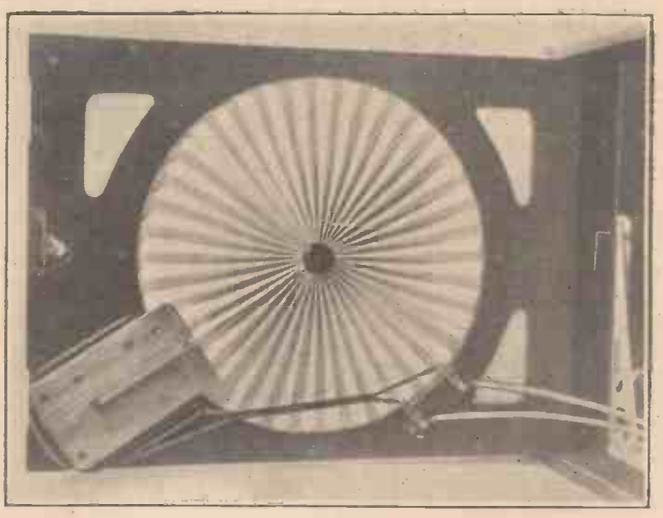
Lotus Valve Holder

bronze valve-leg sockets. External connections are soldered to those portions of the springs projecting from the bakelite moulding or, if desired, to terminals mounted on the moulding.

To test the anti-microphonic properties of this valve holder we inserted a valve which was known to be particularly prone to transform mechanical vibration into sound. The valve holder, however, entirely eliminated this tendency, and any vibration only caused the valve to swing slowly to and fro. Finish is excellent.



Three-quarter Back-of-panel View.



Rear View of Loud-speaker.

A SELF-CON TWO-V WI HOME-MADE L

A set which, in addition contained with batteries tuning range of 17

THE receiver described below is entirely self-contained, even to batteries and loud-speaker, and all parts are totally enclosed and consequently dustproof. The panel can be exposed by opening the side door, but once the receiver is tuned it can then be kept closed, unless it is desired to tune in another station.

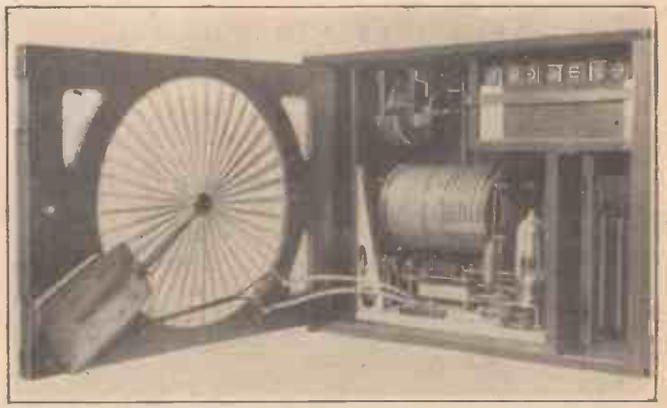
Behind the front doors is the pleated-paper diaphragm loud-speaker which is hinged on one side to the cabinet so that it can be swung open like a door, thus exposing the interior of the receiver.

The receiver employs two valves, a detector with reaction on the aerial, followed by an L.F. amplifier. No switching has been incorporated for cutting off the second valve as it is not usually possible to work a loud-speaker with a detector valve alone. If the receiver, being farther away from the station, is incapable of working the loud-speaker, phones can be used instead, for which a plug and jack is fitted.

The tuning arrangement consists of a solenoid coil tapped at frequent intervals, which with a .0005-microfarad condenser in parallel gives a tuning range of from 175 to approximately 4,000 metres. The tuner, moreover, possesses the advantage that a station can be tuned in with maximum of inductance and minimum of capacity in the circuit by suitable adjustment of a special tapping switch, which also eliminates dead-end effects. The tuner is fitted with a small reaction coil at one end, and this is operated from the panel front by bevel gearing. This coil provides smooth reaction control over the wide range covered by the tuner, thus simplifying tuning to a considerable extent.

Components

The following is the list of components required, with the names of the manufac-



Interior View, showing Components and Batteries.

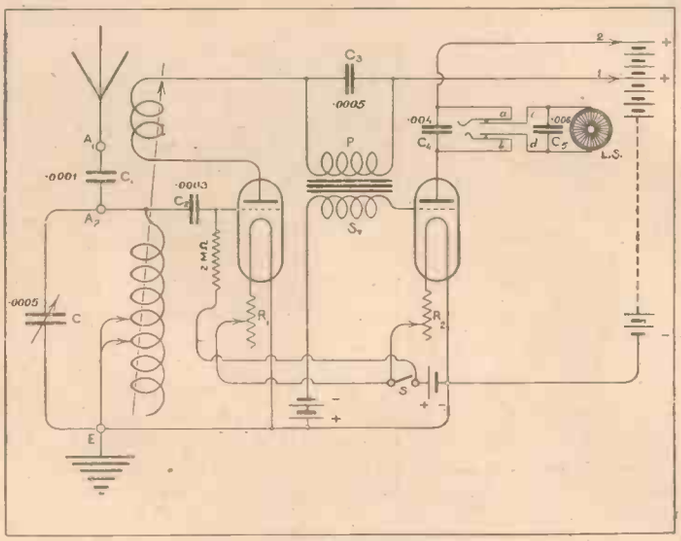
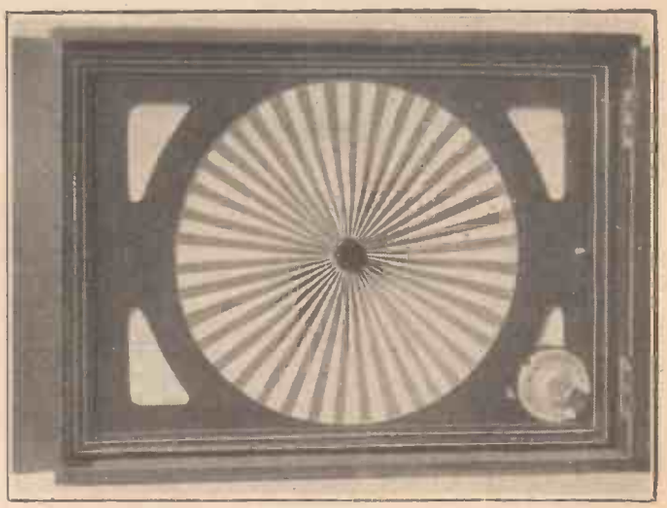


Fig. 1.—The Circuit Diagram.



Receiver Open, showing Front of Loud-speaker.

A
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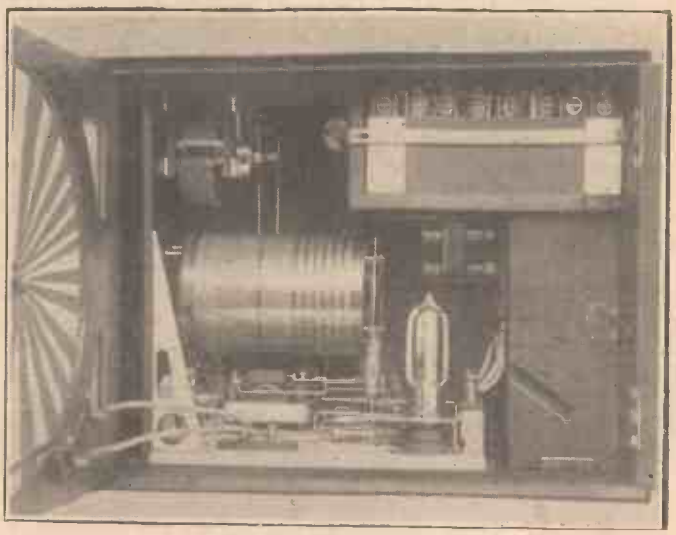
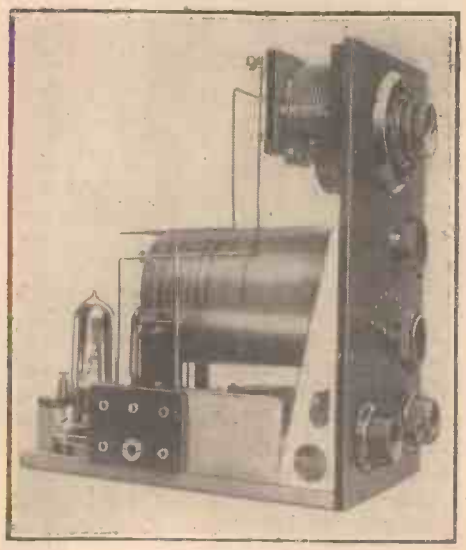
to being entirely self- and loud-speaker, has a 5 to 4,000 metres.



Close-up View of Interior.



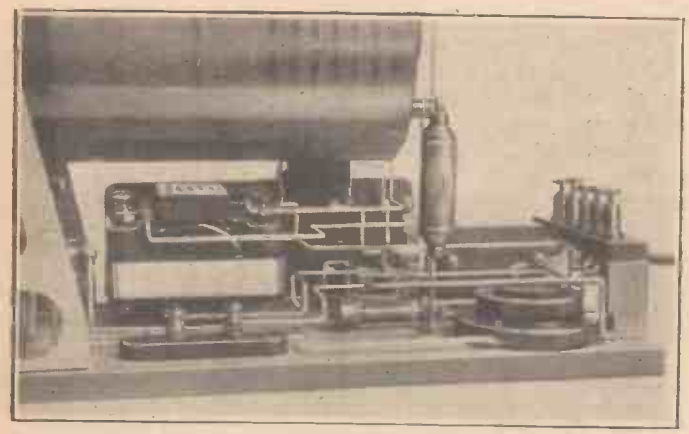
Side View without Case

turers, though in certain instances other makes could be used:

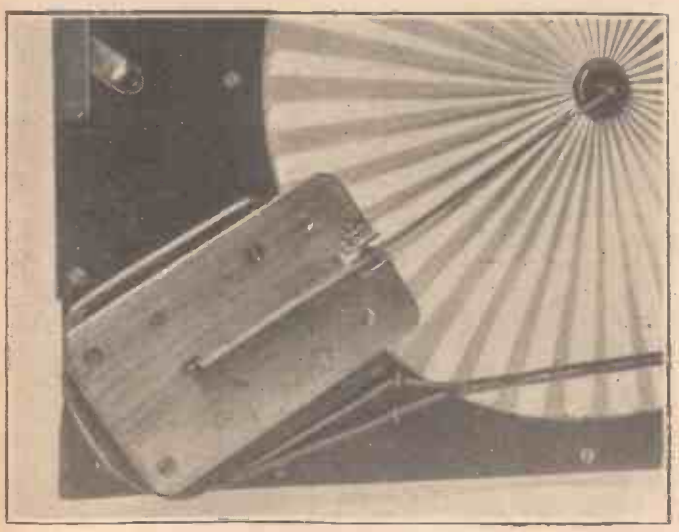
One R.I. retroactive tuner (Radio Instruments, Ltd.); one square-law low-loss variable condenser, .0005 microfarad (Ormond, slow-motion); one ebonite panel, 10½ in. by 5¼ in. and ¼ in. thick; one L.F. transformer, ratio 5 : 1 (Royal); two rheostats (6.5 ohms); one grid leak, with clips, 2 megohms (Dubilier); fixed condensers—C2 .0003 microfarad (Wates Bros.), C3 .0005 microfarad (Dubilier type 600A), C1 .0001 microfarad (Edison Bell), C4 .004 microfarad (Edison Bell), C5 .006 microfarad (Edison Bell); two anti-microphonic valve holders (Lotus); one push-pull switch; one double-circuit plug and jack; five plugs and sockets; five telephone terminals; two ordinary terminals; terminals; two 6-in. aluminium brackets; No. 16-gauge square tinned-copper wire; rubber-covered stranded copper wire; Brown A-type earphone; a piece of three-ply mahogany $\frac{3}{16}$ in. thick, 12 in. by 30 in.

The values of the condensers C4 and C5 should be determined individually by experiment. By reference to the circuit diagram (Fig. 1) it will be clear that these two condensers are shunted across the pleated-diaphragm loud-speaker, and hence their value depends largely on the nature of the paper diaphragm used. Once the suitable value is arrived at by trial it can be split into two capacities, C4 and C5.

When reception is being carried out on phones these are shunted by the condenser C4, while C5 is cut off by the plug and jack. The capacity of C4, consequently, will vary from .001 to .006 microfarad, and is a matter of individual opinion. Once this is fixed the value of C5 can be determined, so that the sum of two capacities C4 and C5 is equal to the total capacity required across the loud-speaker.



Close-up View of Components.



Lever Arm of Loud-speaker.

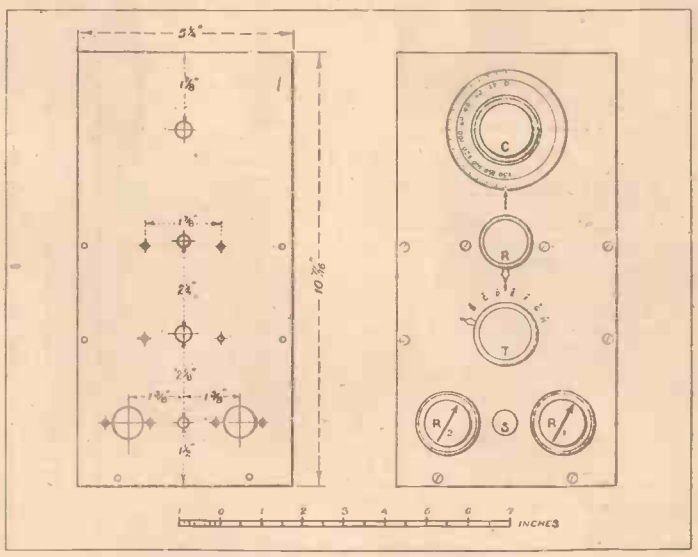
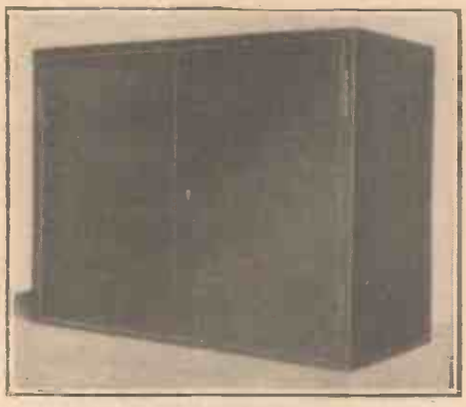


Fig. 2.—Layout and Plan of Panel.



Front of Case.

Back of Case.

Although rheostats of 6½ ohms are specified, their value will depend on the type of valve used. For .06 valves the resistance of the rheostats should be about 30 ohms, but for most of the other types the former value will be quite suitable.

The Panel

The layout of the panel, which is 10½ in. long by 5¼ in. wide and ¼ in. thick, is shown in Fig. 2, from which the positions of necessary holes can be marked. The length should be reduced by about $\frac{1}{16}$ in. in order to allow the panel and baseboard to be easily fitted in the cabinet.

The panel is fitted to the baseboard by aluminium brackets, as shown in Fig. 3. Opposite the panel on the other edge of the baseboard is fixed a strip of ebonite ⅝ in. wide, 3¾ in. long and ¼ in. thick, separated from the baseboard by rectangular wooden supports 1⅜ in. high. On this strip of ebonite are fixed five telephone-type terminals, for connecting the leads of the batteries to the receiver. A second ebonite panel, 2 in. by 2¾ in. by ¼ in. thick, is fixed on one side of the baseboard, supported by a brass bracket along one edge and screwed to a vertical wooden piece along the other. Five sockets and the jack are fitted on this small panel, the former serving as aerial, earth and low-tension terminals.

These extra low-tension terminals have been provided on the outside, so that any other low-tension supply, besides the accumulator contained in the cabinet, can be used. No spare high-tension terminals are provided, as the dry batteries contained in the receiver are extremely satisfactory.

The components to be mounted on the panel for the first stage of wiring are the two rheostats and the push-pull switch. Valve-holders and the transformer are fixed on the baseboard, the latter being screwed to the vertical wooden piece, which also holds the terminal panel (Fig. 4).

An ebonite strip 2¼ in. by ½ in. and ¼ in. thick is also screwed on the baseboard. On this strip are mounted two small terminals, to which are connected the leads from the loud-speaker.

Wiring

The panel when fitted with the above components is now ready for the first stage of wiring. Fig. 4 shows the actual wiring, while Fig. 1 gives the theoretical circuit diagram. The wire used for connections is No. 16 gauge square tinned-copper wire. The filament-lighting circuit should be wired first, followed by the rest of the wiring shown in the diagram.

Having finished the first stage of wiring, the R.I. tuner and the variable condenser are fixed on the panel.

The fixed condensers are held by soldering them directly to the connecting wires, as shown in the photographs, which not only makes the wiring simple, but keeps the lengths of the wires short. The tubular condenser C2 is fixed by forming the ends of the connecting wires into loops, which are then connected to the condenser by screws provided for the purpose.

M. J. C.

(To be continued)

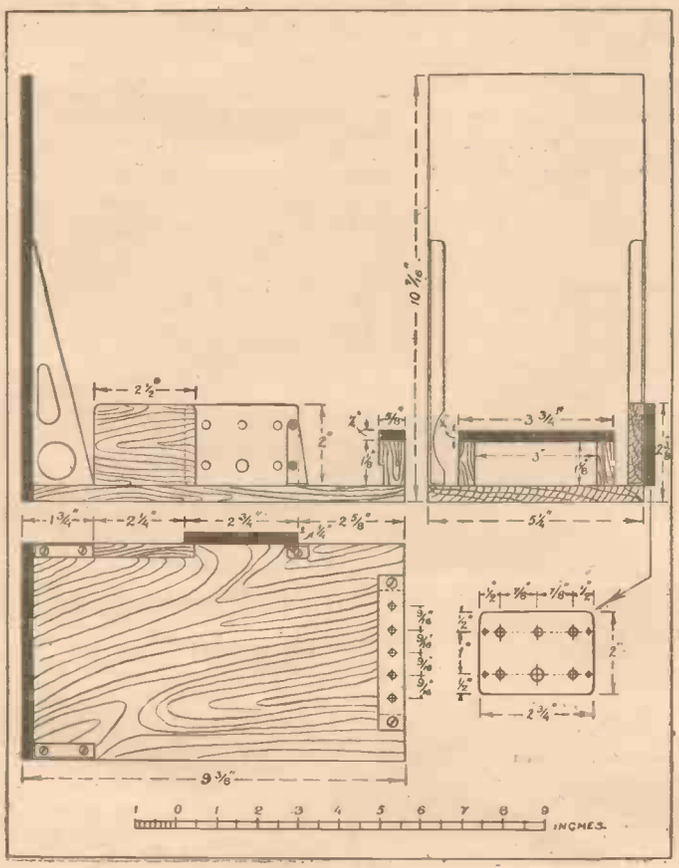


Fig. 3.—Details of Baseboard and Panel.

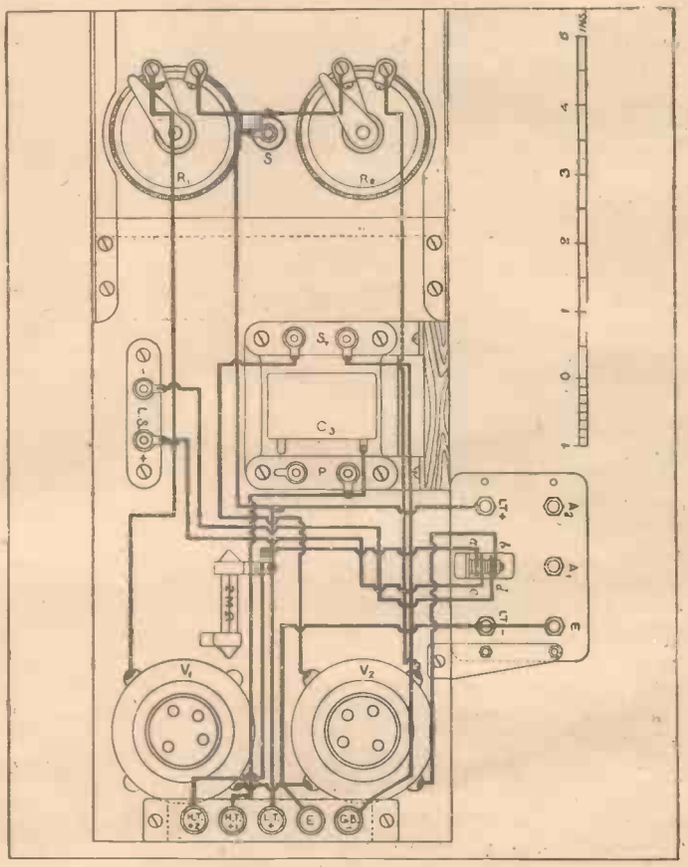


Fig. 4.—Wiring Diagram.

RELAYS AND THE ENTERTAINER

IT is common knowledge that the supply of humorous artistes for the provincial stations of the B.B.C. is still a matter of great difficulty. There exist two opposite factions among broadcasting authorities. The one faction believes that the solution of many difficulties—not only those of humour—can be overcome by centralising production in London and relaying by land-line a large percentage of provincial programmes.

In favour of this policy many points can be cited. In the first place, it is a much cheaper method owing to the absence of travelling and accommodation expenses, and is quite practicable from the engineering point of view.

Difficulties in Obtaining Artistes

Any artiste who possesses a reputation is disinclined to proceed to the provinces if alternative employment can be had in London. If the public sees an artiste's name billed for a provincial appearance they naturally think that the artiste in question is away from town, and so lucrative bookings are missed, and wireless is not a form of entertainment which permits of an extended contract; broadcasting is more or less of a side-line. Hence the faction in favour of centralising production points out that there are many advantages to the company and to the artiste.

The opposite faction retaliates by pointing out that such a policy is an admission that provincial stations, as at present constituted, are a mistake. They quite rightly add that by "centralisation" the field of discovery is narrowed and that, further, variety of type, due to one authority engaging artistes, will be lost. These statements may contain a good deal of truth, but by care and scrutiny such dangers would be avoided.

It is a very difficult task to obtain famous humorous artistes for single appearances. As such people do not perform for the good of their health, it is essential for them to book well ahead and for as long periods as possible. Under present arrangements the B.B.C. obtain artistes when and how they can, sandwiching their bookings in between the artistes' other engagements. Such haphazard arrangements are detrimental to both parties.

Relaying to the Provinces

Listeners may have noticed the method adopted by the B.B.C. in regard to plays and revues. The dramatic department of the company put into rehearsal a number of plays and a revue. These are then booked to provincial stations and included in their programmes at certain dates and times. The performances are done in one of the London studios, and with the land-line system of simultaneous broadcasting the play or revue is radiated in the provinces as if it were a local production. With revues three or more stations take the transmission, but with plays each station takes the play in turn. This method has been found to ensure a higher standard of production.

An Extension of Relays

As this system has been successful, it is thought that herein may lie the solution of the dearth of humour in the provinces. As a minimum there are a dozen variety programmes a week. If the supply of the star artistes for these was centralised in London, it would admit of a fortnight's booking of two celebrated performers. The performances of these could be relayed to stations in turn and appear in their programmes as a local item. Such a procedure would "stiffen up" the provincial standard, and the extended period would make it worth while for the artiste to leave a gap in his or her bookings.

There would appear to be no doubt that such a system is contemplated in the immediate future, and it would be welcomed by artistes, as the present method of simultaneous broadcasting soon exhausts the repertoire of an individual.

ROBERT GLENDINING.

AMATEURS IN ARCTIC EXPERIMENTS

THE Rawson-MacMillan Sub-arctic Expedition of the Field Museum of 1926 will sail from Wiscasset, Maine, on June 19 for a three months' exploration trip through the Sub-arctic in the interest of science. Commander MacMillan has always paid tribute to the American amateurs by taking with him each year a boy amateur. In the selection personality is the first qualification, physique second, and ability third.

The MacMillan Arctic schooner *Bowdoin* is the smallest ship to ever enter the Arctic, and is now going back on its fourth trip. It carries a total personnel of only ten men. Every man on board, including the scientists, must do their trick at the wheel, stand a deck watch, and handle the canvas when necessary.

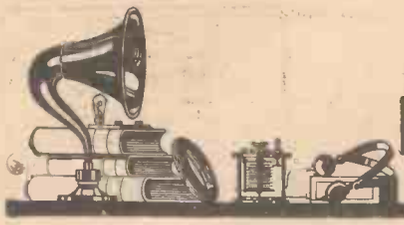
Commander MacMillan on his previous expeditions has made more wireless history under difficult conditions than any other individual, operating as he did during the 1925 expedition in twenty-four hour daylight, and consistently and daily maintaining communication, not only with the United States but most of civilisation, including New Zealand and Australia. The section into which he is to enter this year is one of the most difficult, if not the most difficult, section in the world for radio communication, namely, that between 55 and 65 degrees north latitude in Davis Straits.

The expedition will carry the same radio equipment this year as in the past, with the developments and improvements of the past year incorporated. All work will be confined to short waves. A 37-metre wavelength will be used while the *Bowdoin* is in daylight and the United States is in darkness; 16 to 17 metres will be used while both ends are in daylight. Communication will be maintained by the expedition with the amateurs of the United States, Canada and the rest of the world, and all amateurs receiving messages from WNP are requested immediately to forward them to the Field Museum of Chicago.

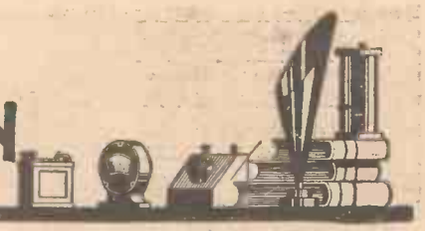
TRANSFORMER TERMINALS

A NUMBER of low-frequency transformers have their connecting terminals mounted in a single row on top of the core, and it is therefore not a difficult matter to make a slip when connecting up. If the positive terminals (either H.T. plus or anode) come in contact with the secondary connection to negative L.T., a burnt-out valve may result. A small ridge of insulating material, such as ebonite or fibre, should be placed between primary and secondary terminals on transformers liable to "short," and secured in position by means of a little Chatterton's Compound.

F.



OUR INFORMATION BUREAU



RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, layouts, diagrams, etc., on separate sheets containing your name and address. Always send stamped, addressed envelope and attach Coupon (p. 828).

Emergency Earth

Q.—*Can you suggest any good method of improvising an earth connection for use when out on a picnic ?—G. P. (Denton).*

A.—Very little difficulty should be experienced in this respect. An ordinary earth-tube may be carried and driven into damp ground at a convenient spot, connection may be made to any earthed metallic object, or a bundle of wire may be thrown into a pond or stream.—J. F. J.

Bright and D.E. Valves Together

Q.—*I have a "bright" valve requiring .75 amps. at 4 volts and a D.E. valve requiring .06 amps. at 3 volts. Can I use them both off a 4-volt accumulator in a set comprising a detector and L.F. stage ?—R. T. E. (Swansea).*

A.—It will be quite correct to do this if you use no rheostat for the bright-emitter and a rheostat of from 15 to 30 ohms to control the D.E. filament current. It will be better to use the bright valve as detector and the D.E. as an L.F. amplifier with the rheostat in the negative filament lead.—J. F. J.

Adjusting Loud-speaker

Q.—*What is the proper method of adjusting the magnets of a loud-speaker by means of the knob provided for that purpose ?—E. D. (S.W.4).*

A.—The nearer the magnets are to the diaphragm the more sensitive will the loud-speaker be, but if they are too close the diaphragm will rattle against the pole-pieces. Therefore the knob should be turned gently until the diaphragm is heard to touch the magnets, when these latter should then be moved back a shade and this will be the best working condition. It will be observed that the weaker the signals are the closer to the diaphragm should the magnets be. If the polarity of the loud-speaker terminals are not indicated in any way the magnets should be moved until they are just touching the diaphragm, and if reversing the connections frees the diaphragm the first method of connection was correct. If not the second method of connecting up is the one to be used.—J. F. J.

Trees as Aerials

Q.—*I understand that trees have been used as wireless aerials. If this is true, can you tell me how they were so utilised ?—C. P. (E.7).*

A.—This has been done fairly successfully and the method employed was to drive two copper nails into the trunk at different heights from the ground. The higher of these nails was connected to the aerial terminal of the set and the lower nail to the earth terminal. Fairly good results were obtained and they became better as the distance between the nails was increased. The explanation is that wireless waves produce oscillatory currents in any conductors or semi-conductors which lie in their path. The trunk of the tree is a partial conductor, and as it has a very high resistance the potential difference between two points a few feet apart is considerable, and these differences of potential are communicated to the grid and filament of the first valve through the nails and the leads which connect these to the aerial and earth terminals of the set.—B.

Switching Off

Q.—*When switching off a valve receiver is it sufficient to turn out the valve filaments or must the wander plugs also be removed from the H.T. and G.B. batteries ?—B. C. (Hastings).*

A.—Provided that there is no faulty insulation anywhere no current is drawn from either the H.T. or G.B. batteries when the valve filaments are not alight. There is thus no need to disconnect them. In most cases it will be sufficient to turn off the rheostats unless a potentiometer is used. A switch should then be provided unless the winding of the potentiometer is connected in series with one of the rheostats.—B.

OUR WEEKLY NOTE

DISTORTION

Very much has been written during the past few months on the distortion which occurs in the inter-valve couplings of an L.F. amplifier. Great controversy has raged as to the relative methods and merits of transformer resistance and choke-coupling.

It can be stated quite definitely that distortion is bound to occur when any of these three methods is used. The distortion caused by a transformer has been so much discussed that further mention of it is unnecessary here. The other two methods fail in giving absolutely distortionless results, as each employs a condenser between each pair of valves and the impedance of a condenser varies with the frequency.

The fact should not be lost sight of that while choke- and resistance-coupling have been receiving close attention from experimenters, transformer design has improved most wonderfully. In fact, it may be doubted whether, at the present time, choke- or resistance-couplings are preferable to the use of really first-class transformers from any point of view other than that of cost.

Even here the case is not proved when it is remembered that with transformer-coupling less valves are needed to give a certain volume than when either of the other methods is employed. In fact, if bad distortion is experienced when the best of modern transformers are in use the cause of the trouble is very unlikely to lie with these instruments.

THE BUREAU.

A BAD LEAD IN!

Neon-tube Wavemeter

Q.—*Can you give me any further details of the neon-tube wavemeter referred to by "Thermion" in the issue of "A.W." for January 23 ?—J. H. (Ilford).*

A.—The wavemeter comprises an ordinary tuning coil with the neon lamp in circuit, to glow when the transmitter is in resonance with the instrument. Should you want an ordinary receiving wavemeter you may make a simple one by merely putting a condenser across a coil of the desired inductance. If this arrangement is placed near an oscillating receiver and the two are in tune a loud click will be heard in the phones as the wavemeter absorbs the energy in the coils of the receiver.—THERMION.

H.T. for L.F. Amplifiers

Q.—*The quality of reproduction obtainable with my three-valver is not very good and I intend to change the second two valves to resistance coupling instead of transformer-coupling. How much should the H.T. voltage be increased above the amount used when transformer coupling is employed ?—R. B. (Wanstead).*

A.—It is really desirable to use special valves for resistance-coupled L.F. amplification, but quite good results are obtainable with ordinary L.F. amplifying valves. For all normal purposes the voltage of the H.T. battery should be increased from 50 per cent. to 100 per cent., according to the value of the anode resistance employed.—B.

Power Valves

Q.—*I have been told to use a power valve in the L.F. stage of my two-valve receiver in order to obtain greater signal strength. I am compelled to use an indoor aerial and, with two ordinary general-purpose valves, I am not receiving the local station at good phone strength. Shall I get louder signals by using a power valve in the last stage ?—B. B. (Wimbledon).*

A.—A power valve should only be employed when signals are so strong that there is danger of the last valve being overloaded. There is nothing to be gained by using a valve of this type in a small receiver, especially if the strength of the rectified signals is not great. A power valve requires a greater amount of power to operate it than does an ordinary general-purpose valve and you are therefore not likely to obtain an increase in signal strength. A decrease in strength may even be experienced. It is probable that by careful arrangement of the aerial system and the use of low-loss components you will obtain louder signals. If it is found necessary to add a second stage of L.F. amplification a power valve may then be used when the voltage-swings on the grid of this third valve would doubtless be large enough to overload a valve of the general-purpose type.—P.

Harold Williams

NEXT WEEK AT 2LO

By "THE LISTENER"

Jack Hylton

APART from the strictly classical concert of the series being held at the Chenil Galleries, Chelsea, the texture of next week's programmes is fairly light.

On Sunday afternoon the Wireless Military Band will play. The soloist is the well-known violinist, Daisy Kennedy. The evening programme is an orchestral one by the Wireless Symphony Orchestra. Amongst the works is included a Bach concerto for piano and string orchestra, the soloist being Adolphe Hallis. This brilliant young pianist is shortly leaving for a South African tour.

During the day on Monday we are promised the orchestras of De Pietro, with Joan Revel, at the New Princes, Alex Fryer's at the Rialto, and in the evening song duets by Vivien Lambelet and Dorothy King, accompanied by Signor Baraldi. Later follows the fifth of the Chenil chamber concerts, the main portion of the programme being devoted to the setting of the *Stabat Mater* of Pergolesi. The soloists are Vivienne Chatterton and Dorothy Helmrich. The 10 o'clock feature will be a burlesque operetta entitled *Hearts Adrift,* by a new writer, John J. Melhuish.

New-comers again will be heard on Tuesday, when a new instrumental combination known as the Cruft Octet will be heard. Songs will be contributed by Violet Godfrey. The Aldershot Command Searchlight Tattoo is promised for 9.20, and will include the entry of massed bands.

Camille Couturier's orchestra will be heard on Wednesday, as well as the New Gallery and Alex Fryer's orchestras. At 8 o'clock is announced a studio version of the play based on "The Way of an Eagle," by Ethel M. Dell. It has been taken from the play produced at the Adelphi in 1922. Later follows a short Schubert programme, with Franklyn Kelsey as vocalist.

A variety entertainment is announced for Thursday, in which "Datas," the "man with a memory," will be heard. The variety element will also be well represented by Doreen Reed (syncopated singer), Teddie Brown (xylophone soloist) and Johnson and Gresnop. At 9.30 a short unannounced orchestral programme will be given, followed at 10 o'clock by a song recital given by Harold Williams, the well-known Australian operatic singer, and late a member of the B.N.O.C.

On Friday listeners will welcome another performance by Albert Sandler, relayed from the Grand Hotel, Eastbourne. The singer during this programme is Stuart Robertson. Another early broadcaster will be heard at 9 o'clock in the person of Adelina Leon, a distinguished 'cellist; she will play the Beethoven A Major 'Cello Sonata.

The 10 o'clock feature consists again of an Hour of Variety given by Munro and Mills (syncopated duettists), Eddie Reed, Mabel Constanduros and Elsa Macfarlane. Two more new-comers to the microphone are Phyllis Gibbs and partner in songs and syncopation, and the banjoist, Scala.

Contrast will be provided on Saturday by the performance of an orchestral concert by the Wireless Orchestra from 8 to 9, when William Michael of the B.N.O.C., Jack Salisbury (solo violin) and Laurence Anderson (raconteur) will be the soloists, followed later by the first appearance of the first English cabaret. This has been formed at the Cavour Restaurant, utilising English artistes only, and includes Helen Chappy, Sidney Nesbitt with his ukelele, Elsa Lanchester (burlesque artiste), Florence Oldham and Henry Carne.

"MAKING YOUR SET SELECTIVE" (*continued from page* 812)

coupled tuner has been fitted. L1 is the aerial-tuning inductance, whilst L2 is the closed-circuit inductance tuning the grid of the high-frequency valve. The coil L1 may be either aperiodic or tuned by the condenser C1. The best results, as regards selectivity, are generally obtained if the aerial is left aperiodic, the coupling between L1 and L2 being as loose as possible and L1 being quite a small coil. Whether the aerial is tuned or not, it will be found that selectivity is greatly increased by this arrangement.

When working with a double-circuit tuner of this kind it will be found that a given transmission of fairly good strength can be tuned in with the coils quite close together. When they are in this position the signal will be heard when the condenser C1 is turned several degrees in either direction from the point which gives the best strength. Now move L1 away from L2. The signal decreases in strength, but it can be brought up again by a slight adjustment of C1 and C2. The tuning of C2 will now be rather more critical than it was when the two coils were closely coupled. Separate them still further. Again signal strength declines, and again it is brought back by means of C1 and C2. The tuning of C2 will now be still more critical, and as the coupling is loosened a point will be found at which good signal strength is obtainable, combined with very sharp tuning.

Other Methods

One of the advantages of using a double circuit tuner is that you can increase or decrease the selectivity of the set.

If the desired degree of selectivity is not obtained by any of the methods so far described, attention may be turned to the tuned-anode coupling between the first and second valves. A coil with tappings similar to that used in the Fig. 1 circuit may be employed as anode-tuning inductance, the anode of the high-frequency valve being connected to whichever of the two terminals gives the better results. Fig. 4 shows how this may be done. The anode of the first valve is disconnected from the point A in Fig. 1. The tapped coil is then substituted for the original anode inductance, and the plate of the first valve is connected to one of its terminals.

It will very possibly be found that as the selectivity of the set is increased by the use of a loose-coupled tuner or of tapped inductances, there is a certain tendency towards instability owing to the elimination of damping whose presence has a steadying effect upon the high-frequency valve. Should this occur the lower end of the inductance tuning the grid of the high-frequency valve should be connected, not to low-tension negative, but to the slider of a potentiometer wired across the low-tension leads. The set can now be stabilised without difficulty, and its selectivity very finely varied by means of the potentiometer. Should it be necessary to apply a large amount of positive bias to the grid of the first valve in order to hold the set down, then most probably interaction is taking place between the anode-tuning inductance and that which tunes the grid of the first valve. These two should be well separated, and they should be placed so that they are at right-angles, for when they are in this position the coupling between them is at a minimum.

It is not always realised that the nature of the aerial itself plays an important part

(*Concluded in first column of next page*)

IN view of the B.B.C.'s contention that there is no political bias in the "Editorials" which have aroused controversy, they will be continued until further notice.

In the interesting series of "Shakespeare's Heroines," to be broadcast on Sunday afternoon, June 13, Miss Laura Cowie will take the part of Viola in *Twelfth Night*.

Hearts Adrift is the title of a burlesque operetta, by a new writer, John J. Melhuish, to be broadcast from 2LO and 5XX on June 14.

Several dates in June have been fixed for the relay of Continental programmes to British listeners, but these will be subject to atmospheric conditions at the time. Should there be undue interference, the transmission will be replaced by one from a B.B.C. main station.

The dance-band transmissions on Fridays between 11 p.m. and midnight in future will be broadcast by the high-power station only.

Nightly at 10 p.m. B.S.T. the Prague station broadcasts at the end of its programme a time-signal consisting of a long dash and six dot-seconds.

"MAKING YOUR SET SELECTIVE" (*continued from preceding page*).

as regards the selectivity obtainable with any set attached to it. Many people imagine that they will get the best results by having as much wire as possible in the aerial. Experiments have shown that this is quite a fallacy.

There is a further point. The long low aerial is inefficient and leads to loss of selectivity. If your present aerial is, say, 20 ft. high, with a suspended wire 80 ft. in length, you will probably obtain much sharper tuning if you reduce the length by one-half. Results will be vastly better if you can increase the height to 30 ft., making the suspended wire from 40 to 50 ft. long.

A further increase in selectivity is often to be had by substituting a counterpoise for the existing earth plate.

Those who live very near a main broadcasting station may find that, despite all their efforts, it is impossible to arrive at such a degree of selectivity that stations working on wavelengths even 20 or 30 metres above or below that of the local station can be tuned in without interference. In such cases the only course to adopt is to fit a wavetrap. R. H.

A small commercial company composed of bank clerks in Vienna has installed wireless receiving apparatus in over twenty parks and public squares in that city. Each receiver is equipped with a number of phones, which can be hired for short periods. By this means the public is able to hear the Ravag concerts in the open air, and during the afternoons many students listen to the English and French language courses broadcast by the Vienna transmitter.

Every Sunday morning the sacred service broadcast by the Copenhagen station is also relayed by the ordinary telephone system to all subscribers desirous of receiving this transmission.

An organ recital at the prize distribution of the Royal College of Organists will be broadcast from Daventry on July 24.

Crystal control of the wavelength of transmitting stations is at present in use at six broadcasting stations in Chicago.

Broadcasting has made considerable progress in Sweden, where at the end of January already 150,000 licences had been distributed. The city of Stockholm alone numbers 37,160 receivers, or 62.1 per thousand inhabitants. This figure, however, is exceeded by Malmo, with 89.5 licences issued per thousand.

The first broadcast organ recital by a woman is announced for June 18, when Miss Marjorie Renton will preside at the organ of the Church of St. Mary-le-Bow, Cheapside.

During the summer, dance music will be given from Daventry every evening until midnight, and from London every Tuesday, Thursday and Saturday evening until 12 o'clock.

The band performance at the Royal Air Force Air Pageant, at Hendon, will be relayed on the afternoon of July 3.

Sunderland Corporation are to have a Marconiphone installation for the broadcasting of wireless concerts in the corporation parks.

The literary section of Radio-Belgique's programmes is to be considerably improved, and in June there will be two extra literary items every month, on Mondays.

A new broadcasting station is being built at San Paulo, Brazil. The date of opening is at present uncertain, but considerable progress is being made with the construction of the transmitting apparatus and the aerial mast.

The number of broadcast licence-holders in Russia has now exceeded the million mark. Receivers have been installed in most hospitals.

To meet the changing requirements of seasons, the B.B.C. has decided to reduce the number of the talks broadcast. The instructive talks in series will end in about a month's time until the beginning of October. Nearly all the monthly and fortnightly statements by societies and Government departments will also lapse.

A special concert, dedicated to British listeners, was broadcast on June 1 from Barcelona, the station being that of Radio-Catalana (460 metres).

The B.B.C. is going yet a step further in tracking down oscillation fiends, and is announcing the names of the streets in various districts in which oscillating receivers are at work.

A proposal to establish an all-Welsh broadcasting station (or, failing this, bigger all-Welsh programmes) has been submitted by the National Union of Welsh Societies to the B.B.C.

The B.B.C. announce that Act II of Verdi's opera *Otello* was not broadcast owing to copyright difficulties. The copyright on the latest Verdi operas, such as *Otello, Falstaff* and *Aïda* has not expired yet.

The tax on receiving sets is having a very bad effect on the wireless trade in the Irish Free State. The tax is one-third of the value, and applies to component parts and complete sets. Listening to broadcasting was becoming very popular in the Free State.

Early next month PCGG, the well-known Dutch station, will resume transmissions on its old wavelength of 1,150 metres. It is also intended to try to get into touch with the Dutch East Indies on a wavelength of 130 metres.

It has been decided that the Aldershot Command Searchlight Tattoo will be broadcast at 9.20 and 11.20 p.m. on June 15. The playing of the massed bands and the musical drive are among the items listeners are to hear.

An interesting relay, to take place on June 19, will be that from the Crystal Palace of the National Union of School Orchestras, numbering some 4,000 performers.

It is proposed to broadcast on June 2 the service held at Lincoln Cathedral, which will include an address by the King's Chaplain.

Time-signals from the Neuchâtel Observatory are daily broadcast by the Berne station at 13.00, 16.00 and 20.00 B.S.T.

The Ravag Broadcasting Company of Vienna proposes to install a microphone in St. Stephen's Cathedral to relay organ recitals.

A microphone has been installed in the tower of Glasgow University to broadcast the chimes.

NOTE.—*In the following list of transmissions these abbreviations are observed: con. for concert; lec. for lecture; orch. for orchestral concert; irr. for irregular; m. for metres; and sig. for signal.*

GREAT BRITAIN

The times given are according to British Summer Time.

London (2LO), 364 m. 1-2 p.m., con.; 3.15-4 p.m., transmission to schools; 3.30-5.45, con. (Sun.); 4.15 p.m., con.; 5.15-5.55, children; 6 p.m., dance music; 7-8 p.m., time sig., news, music, talk; 8-10 p.m., music; 9.0, news (Sun.); 9.30 p.m., time sig., news, talk; 10 p.m., special feature (Mon., Wed., Fri.). Dance music nightly (exc. Fri.) until midnight.

Aberdeen (2BD), 495 m. **Belfast** (2BE), 440 m. **Birmingham** (5IT), 479 m. **Bournemouth** (6BM), 386 m. **Cardiff** (5WA), 353 m. **Glasgow** (5SC), 422 m. **Manchester** (2ZY), 378 m. **Newcastle** (5NO), 404 m. Much the same as London times.

Bradford (2LS), 310 m. **Dundee** (2DE), 315 m. **Edinburgh** (2EH), 328 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 321.5 m. **Liverpool** (6LV), 331 m. **Nottingham** (5NG), 326 m. **Plymouth** (5PY), 338 m. **Sheffield** (6FL), 301 m. **Stoke-on-Trent** (6ST), 306 m. **Swansea** (5SX), 482 m. **Daventry** (25 kw.), high-power station, 1,600 m. Special weather report 10.30 a.m. and 10.25 p.m. (weekdays), 9.10 p.m. (Sun.); 11.0 a.m., light music (exc. Sat. and Sun.); relays 2LO from 4 p.m. onwards, own con. on Mon. Dance music daily (exc. Sun.) till midnight; on first Friday in each month until 2 a.m.

IRISH FREE STATE.

Dublin (2RN), 397 m. Daily, 7.30 p.m. Sundays, 8.30 p.m. until 10.30 p.m.

CONTINENT

The Times are according to the Continental system; for example, 16.30 *is* 4.30 *p.m., and* 08.00 *is* 8 *a.m. B.S.T.*

AUSTRIA.

Vienna (Radio Wien), 582.5 m. and 531 m. (temp.) (10 kw.). 11.00, con. (almost daily); 15.30, con.; 19.25, news, weather, time sig.; con., lec., news; 20.00, con.; 22.00, dance (Wed., Sat.).

Graz, 402 m. (1 kw.). Relay from Vienna. Also own con. (Tues., Wed., Fri.), 20.10.

BELGIUM.

Antwerp, 265 m. (100 w.). Relays Brussels.

Brussels, 486 m. (1½ kw.). 17.00, orch. (Tues., Thurs., Sat. only), news; 20.00, lec., con., news (opera, Mon. and Wed.).

CZECHO-SLOVAKIA.

Prague, 368 m. (5 kw.). Con., 20.00-23.00, daily. Also tests on 397.5 m.

Brunn (OKB), 521 m. (2.4 kw.). 10.00, con., news (Sun.); 19.00, lec., con. or dance (daily).

DENMARK.

Copenhagen (Radioraadet), 347.5 m. (2 kw.). Sundays: 15.30, lec.; 17.30, children; 20.00, play; 21.15, news, con.; 21.15, news, Esperanto (Mon.), silent night. Weekdays (Tues., Fri., Sat.); 20.00, lec., con., news, con.; 21.30, dance (Sat.).

Ryvang, 1,150 m. (1 kw.). Sundays: 09.00, sacred service.

Odense, 810 m. Relays Copenhagen.

Sorö,* 1,150 m. (1½ kw.). Relays Copenhagen.

FINLAND.

Helsingfors (Skyddskar), 504 m. (500 w.). Temporarily closed down.

Helsingfors, 440 m. Con., 18.00 (Tues., Thurs., Sat., Sun.).

***Tamafors**, 368 m.

***Jyvaskyla**, 561 m. (200 w.).

***Uleaborg**, 233 m. (200 w.).

* Relay Helsingfors.

GRAND DUCHY OF LUXEMBURG.

Radio Luxemburg (LOAA), 1,200 m. Con.: 14.00 (Sun.), 21.00 (Thurs.).

FRANCE.

Eiffel Tower, 2,650 m. (5 kw.). 06.40, weather (exc. Sun.); 07.15, 08.00, physical exercises; 11.00, markets (exc. Sun. and Mon.); 11.20, time sig., weather; 15.00, 16.45, Stock Ex. (exc. Sun. and Mon.); 18.00, talk, con., news; 19.00 and 23.10, weather; 21.00, con. (daily).

Radio-Paris (CFR), 1,750 m. (about 3 kw.). Sundays: 12.45, con., news; 16.30, Stock Ex., con.; 20.15, news, con. or dance. Weekdays: 10.40, news; 12.30, con., markets, weather, news; 16.30, markets, con.; 20.15, news, con. or dance.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 458 m. (800 w.). 07.15, 08.00, physical exercises; 14.00 or 15.00, studio con. or otuside relay; 20.30, lec. (almost daily); 21.00, con. (daily).

Le Petit Parisien, 333 m. (temp.) (1 kw.). 21.15, con. (Tues., Thurs., Sat., Sun.).

Radio L.L. (Paris), 350 m. (250 w.). Con. (Mon., Wed., Thurs.), 20.30.

Radio-Toulouse, 430 m. (2 kw.). 12.30, con., time sig. (daily); 17.30, news (exc. Sun.); 20.45, con.; 21.25, dance (daily). Also operatic relays on 500 m., occasionally.

Radio-Lyon, 280 m. (2 kw.). 20.20, con. (daily). Temporarily closed.

Radio Agen, 318 m. (250 w.). 12.40, weather, Stock Ex.; 20.00, weather, Stock Ex.; 20.30, con. (Tues., Fri.).

***Lyon-la-Doua**, 488 m. Own con., 20.00 (Mon., Wed., Sat.).

***Marseilles**, 351 m. (500 w.).

***Toulouse**, 280 m. (2 kw.).

***Bordeaux**, 411 m.

* Relays of PTT Paris.

Montpelier, 220 m. (1 kw.). Relays Radio Toulouse.

Angers (Radio Anjou), 300 m. (500 w.). Daily: 20.30, news, lec., con.

Bordeaux (Radio Sud-Ouest), 330 m. Con., 22.00 (Mon., Fri.).

Mont de Marsan, 390 m. (300 w.). Con. (weekdays only), 20.30.

GERMANY.

Berlin, on both 504 and 571.5 m. (4 kw.). 06.30, con. (Sun.); 09.00, sacred con. (Sun.); 11.00, con. and tests; 12.55, time sig., news, weather; 15.00, educ. hour (Sun.), markets, time sig.; 17.30, orch.; 20.30, con., weather, news, time sig., dance music until 24.00 (Sat., Sun., Thurs). Relayed on 1,300 m. by Königswusterhausen and Stettin (241 m.).

Königswusterhausen (LP), 1,300 m. (8 kw.). 11.30-12.50, relays Berlin (Sun.); 15.00, lec. (daily); 18.30, relay of Berlin (Vox Haus) con. (daily). 2,525 m. (5 kw.), Wolff's Buro Press Service: 06.45-20.10. 2,880 m., Telegraphen Union: 08.30-19.45, news. 4,000 m. (10 kw.), 07.00-21.00, news.

Breslau, 418 m. (4 kw.). 12.00, con. (daily), Divine service (Sun.); 12.55, time sig. (Sun.), weather, Stock Ex., news; 16.00, children (Sun.); 17.00, con.; 19.00, lec.; 20.30, con., weather, time sig., news, dance (relays Berlin). Relay: Gleiwitz, 251 m.

Frankfort-on-Main, 470 m. (1½ kw.). 08.00, sacred con. (Sun.); 11.55, time sig., news; 12.55, Nauen time sig.; 16.00, con. (Sun.); 16.30, con.; 18.00, markets, lec.; 20.00, lec., con., weather. Dance: relays Berlin. Relay: Cassel, 273.5 m.

Hamburg, 392 m. (4 kw.). Relayed by Bremen (279 m.), Hanover (294 m.), Kiel (233 m.) Sundays: 07.25, time sig., weather, news, lec.; 09.15, sacred con.; 13.15, con.; 18.00, con.; 19.15, sports, weather, con. or opera, dance. Weekdays: 05.45, time sig., weather; 07.00 and 07.30, news, weather; 12.55, Nauen time sig., news; 14.00, weather, con.; 16.15 and 18.00, con.; 19.00, lec.; 19.55, weather and con.; 22.00, dance (Sun., Thurs., Sat.).

Königsberg, 462 m. (1 kw.). 09.00, sacred con. (Sun.); 12.55, time sig., weather, news; 16.30, con.; 17.00, con. (Sun.); 19.30, lec.; 20.00, con. or opera, weather, news, dance (irr.).

Leipzig, 452 m. (700 w.). Relayed by Dresden (294 m.). 08.30, sacred con. (Sun.); 11.00, educ. hour (Sun.); 12.00, con. (daily); 12.55, Nauen time sig., news; 16.30, con., children (Wed.); 20.15, con. or opera, weather, news, cabaret or dance (not daily).

Munich, 487.5 m. (3 kw.). Relayed by Nuremberg (340 m.). 11.30, lec., con. (Sun.); 14.00, time sig., news, weather; 16.00, orch. (Sun.); 16.30, con. (weekdays); 18.30, con. (weekdays); 19.15, lec.; 19.30, con. (Sun.).

Munster, 412 m. (1 kw.). Relayed by Elberfeld (259 m.), Dortmund (283 m.). 11.45, radio talk, Divine service; 12.00, news (Sun.); 12.30, news (weekdays); 12.55, Nauen time sig.; 15.30, news, time sig.; 16.00, con.; 17.00, children (Sat.); 19.40, news, weather, time sig., lec., con.

Norddeich (KAV), 1,800 m. 24.00 and 04.00, weather and news.

Stuttgart, 447 m. (1½ kw.). 11.30, con. (Sun.); 16.30, con. (weekdays); 17.00, con. (Sun.); 18.30, time sig., news, lec., con. (daily); 21.15, time sig., late con. or cabaret.

HOLLAND.

Amsterdam (PCFF), 1,955 m. (1 kw.). Daily: 06.35-15.30 (exc. Mon. and Sat., when 12.30-13.30), news, Stock Ex.

Hilversum (HDO), 1,050 m. (2½ kw.). 09.00, sacred service (Sun.); 19.10, con.; 21.00, news, etc. Testing on 25 kw.

HUNGARY.

Buda-Pesth (Csepel), 560 m. (2 kw.). 09.00, news; 12.00 and 15.00, weather, news; 17.00, dance music; 20.00, con. or opera, dance.

Kosice, 2,020 m. (2½ kw.). 19.00, con.

ICELAND.

Reykjavik, 327 m. (700 w.). Tests: 22.30, 24.30.

ITALY.

Rome (IRO), 425 m. (3 kw.). 10.30, sacred con.; 13.15, official communique; 17.00, children; 17.30, relay of orch. from Hotel di Russia; 17.55, news, Stock Ex., jazz band; 20.30, news, weather, con.; 22.15, late news.

Milan, 320 m. (2 kw.). 20.00-01.00, con., jazz band.

JUGO-SLAVIA.

Belgrade (Rakovitza) (HFF), 1,650 m. (2 kw.). 17.00, news (daily), con. (Tues., Thurs., Sat.).

Agram (Zagreb), 350 m. (500 w.).

LETTLAND.

Riga, 488 m. (2 kw.). Con. daily, 21.00-22.00.

NORWAY.

Oslo, 382 m. (1.2 kw.). 11.00, Divine service (Sun.), Stock Ex. (weekdays); 13.15, markets; 19.15, news, time, lec., con.; 22.00, time, weather, news, dance relayed from Hotel Bristol, Oslo (not daily).

Bergen, 358 m. (1½ kw.). 19.30, news, con., etc.

POLAND.

Warsaw, 480 m. (6 kw.). Daily: con., 11.00-13.00; 15.00-23.00, daily.

RUSSIA.

Moscow (RDW), 1,450 m. (12 kw.). Weekdays: 12.30 and 17.55, news and con.; 23.00, chimes from Kremlin.

(Popoff Station), 1,010 m. (2 kw.). 10.00, 11.00, lec.; 13.00, 19.00, con. (Tues., Thurs., Fri.).

Radio Peredacha, 410 m. (6 kw.).

Trades Union Council Station, 450 m. (2 kw.). 18.00, con. (Mon., Wed.).

Leningrad, 940 m. (2 kw.). Weekdays: 16.00.

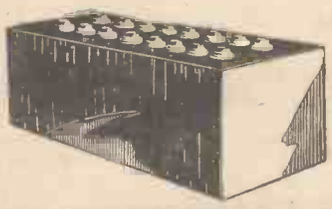
Nijni Novgorod, 1,400 m. (1.2 kw.). 21.30, con.

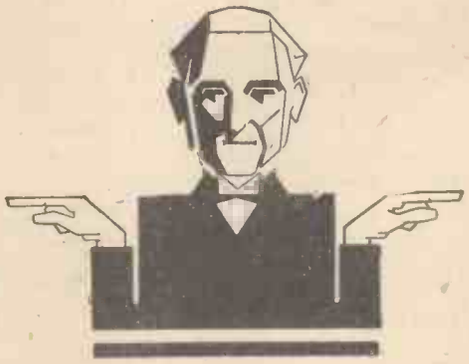
SPAIN.

Madrid (EAJ6), 392 m. (1½ kw.). Daily: con. (times vary daily). Closes at 24.00 on Sun., Wed., Sat.

Madrid (EAJ7), 373 m. (4½ kw.). 17.30-24.00, con. (almost daily).

(*Continued in second column of page* 824)





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The Dubilicon is a multiple condenser containing eight separate units, the terminals of each unit being brought out to sockets on the lid. By using Clix plugs (made by Messrs. Autoveyors, Ltd., 84, Victoria Street, S.W.1) of which two are given with every Dubilicon, the units can be connected in a variety of series, parallel, and combined series-parallel arrangements giving a very large number of different capacities ranging from zero up to 0·011μF.

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Every purchaser of a Dubilicon is entitled to enter for the £200 competition. All you have to do is to buy your Dubilicon from a Wireless dealer, and find out the total number of different capacities you can get by using the first five units. Full instructions are given with every Dubilicon sold.

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CONDENSER CO (1925) LTD

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E.P.S.193

An Amplifier Danger

SIR,—On reading through the article entitled "A Useful One-valve Amplifier—and How to Use It," in your issue of May 22, I notice that your contributor has, very wisely, drawn the attention of readers to the danger of shorting the L.T. accumulator by connecting H.T. – to L.T. + in the amplifier and to L.T. – in the receiver, or *vice versa*.

May I suggest a way of dodging the difficulty?

When an amplifier is to be used with a valve receiver before it, *there is no need to have an "H.T. –" on the amplifier at all*, because H.T. – is already connected, either to L.T. + or to L.T. –, within the receiver itself, and no purpose is served by duplicating this connection.

By this simple means the danger mentioned by your contributor cannot arise, and the amplifier can be connected up at once to any receiver without bothering in the least about its internal connection. More than this even, the amplifier can be transferred at will from one receiver to another even if their "H.T. –" connections are different.

Should it at any time become necessary to attach an amplifier with no "H.T. –" terminal to a crystal set, the negative terminal of the H.T. battery simply has to be connected to the filament accumulator direct, outside the set, so that even here no difficulty need arise. A universal adoption of the rule that no auxiliary apparatus should have an "H.T. –" terminal would, I am sure, make for simplicity in handling.—A. L. M. S. (London, W.).

The Best L.F. Coupling?

SIR,—Is it not about time that all the silly talk about the horrible distortion inevitably caused by L.F. transformers and the wonderful purity which must necessarily be obtained if resistance coupling be used ceased? It can very easily be demonstrated that resistance coupling is *incapable* of giving an even amplification of different frequencies. An essential part of this type of coupling is the fixed condenser which connects the plate of one valve to the grid circuit of the next. The signal impulses are transferred from the first to the second valve through this condenser, but as the impedance of a condenser is dependent on the frequency, the higher frequencies are bound to be accentuated. Though resistance coupling might have been far better than the best available transformers a few years ago, it seems to me that at the present time the position is entirely reversed.—S. D. (Bedford).

"BROADCAST TELEPHONY" (*cont. from page 822*)

Madrid (EAJ4), 340 m. (3 kw.). 16.60, con.

Barcelona (EAJ1), 324 m. (3 kw.). 17.00-21.00, news, lec., con. (Sun.); 18.00-23.00 (daily).

Barcelona (Radio Catalana) (EAJ13), 462 m. (4½ kw.). 19.00-23.00, con., weather, news.

Bilbao (EAJ9), 415 m. (1 kw.). 19.00, news, weather, con. Close down 22.00.

Bilbao (Radio Vizcaya) (EAJ11), 418 m. (2 kw.). 22.00-24.00, con. (daily).

Cadiz (EAJ3), 357 m. (550 w.). 19.00-21.00, con., news. Tests daily (exc. Sun.), 24.00.

Cartagena (EAJ15), 335 m. 19.00-22.00, con. (daily).

Seville (EAJ5), 357 m. (1½ w.). 21.00, con., news, weather. Close down 23.00.

Seville (EAJ17), 300 m. 19.00-22.00, con. (daily).

San Sebastian (EAJ8), 343 m. (500 w.). 17.00-19.00, 21.00-23.00 (daily).

Salamanca (EAJ22), 405 m. (1 kw.). 17.00 and 21.00, con. (daily).

Saragossa, about 325 m. Testing.

SWEDEN.

Stockholm (SASA), 430 m. (1 kw.). 11.00, sacred service (Sun.); 12.30, weather; 14.00, con. (Sun.); 17.00, children (Sun.); 18.00, sacred service; 19.00, lec.; 21.15, news, con., weather. Dance (Wed., Sat.).

Relays.—Boden (SASE), 1,200 m.; Eskilstuna, 250 m.; Falun (SMZK), 370 m.; Gothenburg (SASB), 288 m.; Gefle, 325 m.; Helsingborg, 235 m.; Joenkoeping (SMZD), 265 m.; Kalmar, 253 m.; Karlsborg, 1,250 m.; Karl-Sundsvall (SASD), 545 m.; Trollhattan scrona (SMSM3), 196 m.; Kristinehamm (SMTY), 202 m.; Karlstadt (SMXC), 221 m.; Linkoeping, 467 m.; Malmo (SASC), 270 m.; Norrkoeping (SMVV), 260 m.; Orebro, 218 m.; Ostersund, 720 m.; Säffle (SMTS), 245 m.; (SMXQ), 322 m.; Umea, 215 m.; Varborg, 340 m.

SWITZERLAND.

Lausanne (HB2), 850 m. (1½ kw.) (temp.). 20.00, lec., con. (daily).

Zurich (Hongg), 513 m. (temp.) (500 w.). 11.00, con. (Sun.); 12.00, weather; 12.55, Nauen time sig., weather, news, Stock Ex.; 13.30, piano solo; 17.00, con. (exc. Sun.); 18.15, children, women; 19.00, news, weather; 20.15, lec., con., dance (Fri.).

Geneva (HB1), 760 m. (2 kw.). 20.15, con. (daily).

Berne, 434 m. 10.30, organ music (exc. Sat.); 16.00, 20.30, con.

Basle. Testing.

"Lewcos" Inductance Coils.—In the advertisement of these coils on page 751 of the May 29 issue there was an unfortunate omission. The sizes and prices of the coils were not mentioned, so we give them here for the benefit of everybody: Coils Nos. 25, 35 and 40, 4s. 6d. each; Nos. 60 and 75, 5s. 6d. each; No. 100, 6s. 9d.; No. 150, 7s. 6d.; No. 200, 8s. 6d.; No. 250, 9s.; and No. 300, 10s. Readers in need of further information should apply to the London Electric Wire Co. and Smiths, Ltd., Playhouse Yard, Golden Lane, E.C.1.

TRADE NOTES AND CATALOGUES

THE British Thomson-Houston Co., Ltd., have acquired new premises at 10 and 11, Snow Hill, Birmingham (telephone Central 8301). Reconstruction of a portion of the premises is still in progress, but when complete will provide showrooms in which will be displayed the complete range of B.T.H. wireless apparatus.

Hobbies, Ltd., of Dereham, Norfolk, can supply parcels of good-quality ⅜-in. mahogany cut and planed to the necessary dimensions for making up wireless cabinets. Full particulars of this handy and time-saving scheme are given in a leaflet obtainable from Hobbies, Ltd.

The Athol Engineering Co., of Seymour Road, Crumsall, Manchester, manufacture an anti-microphonic base for attachment to the well-known Athol valve holder. The combination forms an efficient anti-microphonic valve holder. A back-of-panel bracket is also supplied to enable the holder to be mounted at the rear of a vertical panel.

Geographia, Ltd., of 55, Fleet Street, E.C.4, have produced, in conjunction with the *Daily Express*, a useful broadcasting map of Europe. The map (the price of which is 1s. on paper and 3s. on cloth) shows the position of all broadcasting stations, their wavelengths, call-signs and direct magnetic bearings from the most important British stations to the chief Continental stations.

The Manchester branch of C. A. Vandervell and Co., Ltd., has now been transferred to that of Joseph Lucas, Ltd., of 277, Deansgate, Manchester, where ample stocks of all C.A.V. radio apparatus and accumulators are now available.

Two illustrated pamphlets describing respectively the Igranic universal coil holder and the Igranic tone control and damping resistance have been issued by the Igranic Electric Co., Ltd., of 149, Queen Victoria Street, W.C.1.

On May 1 the number of receiving licences current in this country was 2,012,000.

CHIEF EVENTS OF THE WEEK

SUNDAY, JUNE 13

London	Shakespeare's Heroines.
Birmingham	British Composers.
Bournemouth	Symphony Concert.
Manchester	Chamber Music.
Newcastle	Orchestral Concert.

MONDAY

London	Chamber Concert.
Aberdeen	Ballad—Opera—Drama.
Birmingham	Scenes from Famous Comedies.
Bournemouth	Irish Songs and Melodies.
Belfast	Musical Comedy.
Manchester	Hungarian Songs.

TUESDAY

London	Aldershot Tattoo.

WEDNESDAY

Birmingham	Light Classics.
Edinburgh	An Evening of Variety.
Glasgow	Grieg Programme.
Newcastle	*The Nightingale.*
Nottingham	A Leicester Night.
Sheffield	*Sherwood's Queen.*
Stoke-on-Trent	Musical Festival Winners.

THURSDAY

London	Variety Programme.
Birmingham	Excerpts from Lighter Operas.
Belfast	Gounod Anniversary.
Cardiff	"The Merrymakers" Concert Party.
Glasgow	Orchestral Concert.

FRIDAY

Glasgow	*Remnant Acre.*
Manchester	Polish and French Composers.

SATURDAY

London	Popular Orchestral Programme.
Aberdeen	Scottish Programme.
Cardiff	"A Cornish Pasty."
Glasgow	Popular Variety.
Manchester	The Shaw Prize Brass Band.
Newcastle	"The Merries" Concert Party.

MORE RADIOGRAMS

THE new Frankfort-on-Main broadcasting station, working with a power of 10 kilowatts, will be opened within the next two months.

The 150th anniversary of the famous Burgtheater in Vienna was recently celebrated by the performance in German of Galsworthy's well-known play *Windows*.

Sea chanties sung by members of the Seven Seas Club will be heard from London on June 25.

Mr. A. J. Alan, the popular story-teller, will broadcast from 2 L O on June 29.

Dominion Day, July 1, will be celebrated by a special programme from several stations.

WIRELESS IN SCANDINAVIA

THE three Scandinavian kingdoms have hitherto been somewhat behind in wireless developments, but at the present time they are actively engaged in overtaking their arrears.

The Swedish Government has constructed five broadcasting stations, which since June have been worked by a company called Radiotjänst (Radio Service). The stations are at Stockholm, Göteborg, Malmö, Sundswall and Boden, and work on various wavelengths from 270 to 1,200 metres. In addition, there are ten small relay stations.

In Norway there is a large station at Oslo (formerly called Christiania). Its programmes, transmitted at 8 p.m. on a wavelength of 382 metres, are already well known in England. The broadcasting is in the hands of a company having a capital of 350,000 kroner. This company takes 80 per cent. of the revenue from licences, which are required both for selling and possessing wireless apparatus. There are licences for receiving apparatus (20 kroner), with an extra fee for public loud-speakers. The selling licence is 120 kroner. Fees are also payable by all purchasers. They range from 3 to 10 kroner for crystal sets, and 10 to 100 kroner for valve sets, while purchasers of parts have to pay anything from ½ to 50 kroner (the kroner is worth about tenpence).

The situation in Denmark has always been of peculiar interest. Previous to 1923 the possession of receiving sets was prohibited under heavy penalties, but these proved unavailing, and broadcasting came with a rush. Receivers are now installed in all Post Offices, and a committee, representing manufactures, education, science and art, manages the programmes broadcast from Copenhagen and Ryvang.

Out of the income received from licences for receiving, amounting to a million francs and a half, one-third goes to technical working, one-half to artistes, and one-sixth to the State. The recently-erected Lynby station is one of the few new stations worked by means of the Poulsen arc, but this in Denmark is rather a matter of national self-respect. F. D'A.

THE BEGINNING OF SELECTIVITY

THE interest taken in Sir Oliver Lodge's new "N" circuit recalls the fact that he was the first to introduce the idea of "tuning" in wireless signalling. Marconi's first transmitter and receiver were plain aerials which, although oscillating principally on a fundamental frequency, were quite incapable of being tuned in the present sense of the word.

Sir Oliver secured a master patent in 1897 (a year later than the first Marconi patent) for the use of inductance and capacity for the purpose of confining the radiation to a definite frequency, thereby making it possible for several messages to be transmitted and received simultaneously on different wavelengths without mutual interference.

The patent would normally have expired in 1911, but owing to the fundamental importance of the principle involved, and to the inadequate financial remuneration that had so far been secured by the holders, the Courts granted an extension of seven years. W. T.

The Arrochute, a new toy combining an arrow and a parachute, is the subject of a well-illustrated article in the current issue of "The Amateur Mechanic and Work" (3d.). Other articles appearing in the same number are: "Laying and Polishing Oak Floors," "Imitating Woods in Distemper," "Screws Used in Woodwork," "A Model Railway Station with Double-span Roof," "Fitting New Handle to Garden Fork," "A Neat Wireless Cabinet," "A Good Method of Plugging-in to Aerial, Earth and Set," "Making a Club Fender," "Overhauling the Fishing-tackle," "Garden Drainage: The Drainage of Small Land Plots," etc. etc.

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As the Publishers cannot accept responsibility for the bona fides of Advertisers in this publication they have introduced a system of deposit which it is recommended should be adopted by readers when dealing with persons with whom they are unacquainted. It is here explained.

Intending purchasers should forward to the Publishers the amount of the purchase money of the article advertised. This will be acknowledged to both the Depositor and the Vendor, whose names and addresses must necessarily be given. The Deposit is retained until advice is received of the completion of the purchase, or of the article having been returned to and accepted by the Vendor. In addition to the amount of the Deposit, a Fee of 6d. for sums of £1 and under, and 1s. for amounts in excess of £1, to cover postage, etc., must be remitted at the same time. In cases of persons not resident within the United Kingdom, double fees are charged.

The amount of the Deposit and Fee must be remitted by Postal Order or Registered Letter (Cheques cannot be accepted), addressed to

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THE SIMPLEST VALVE RECEIVER

LONG-DISTANCE CRYSTAL RECEPTION

Amateur Wireless
And Electrics

Vol. VIII. No. 210 SATURDAY, JUNE 19, 1926 Price 3d

PRINCIPAL CONTENTS

WELL ILLUSTRATED

Registered at G.P.O. as a Newspaper.

THE FIRST TELEVISION AERIAL.

The photograph shows Mr. J. L. Baird (left) erecting an aerial for use with his system of wireless television.

Amateur Wireless and Electrics

The Leading Radio Weekly for the Constructor, Listener and Experimenter

Edited by BERNARD E. JONES

Technical Adviser: SYDNEY BRYDON, D.Sc., M.I.E.E.

Vol. III. No. 210 — JUNE 19, 1926

Chief Contents

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General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets.

Contributions are always welcome, will be promptly considered, and if used will be paid for.

Queries should be addressed to the Editor, and the conditions printed at the head of "Our Information Bureau" should be closely observed.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

LONG-DISTANCE CRYSTAL RECEPTION —FACTS AND FALLACIES

A GOOD deal of misconception seems to exist with regard to the ranges obtainable with an unaided crystal set. Most manufacturers of crystal receivers content themselves with claiming a range for good headphone reception of 100 miles from the high-power station, of 30 to 40 miles from a main broadcasting station, and of five miles only from a relay station. Yet, on the other hand, one reads occasionally of experimenters picking up stations which are distant several hundreds, or even one or two thousands, of miles.

Range Undefinable

The general public has long since passed the stage when it believed range to be a readily definable thing, and realises—as, indeed, the manufacturers' figures show—that it is to a great extent dependent upon the power of the transmitter. Most people also know that the kind of aerial used, the efficiency of the earth connection, and even the locality in which the set is used, as well as many other factors, all play their part in limiting the range of the set.

Apart from all this, however, some further explanation is necessary to account for a set, having an advertised range of 30 miles, being able to pick up a station some hundreds of miles away, as occasionally happens.

Spark Signals

Then again, there must be some reason why the morse signals from a ship a hundred miles away may interfere strongly with the reception of a main broadcasting station at only a third of that distance, although both stations are using the same power. This great difference between the range over which morse signals and telephony can be transmitted under identical conditions is so puzzling to many that we will deal with it first.

When a ship is transmitting morse signals with, say, 1 kilowatt in the aerial, the whole of this energy is being liberated as long as the key is depressed, and the whole of the energy picked up by the receiving aerial, save only that dissipated in the receiver circuits, is available for operating the telephones.

When telephony is being transmitted conditions are quite different. The transmitting apparatus may be capable of putting 1 kilowatt into the aerial, but the actual power being radiated is constantly varying, in accordance with the sound-waves reaching the diaphragm of the microphones. As the strongest sound-waves must not be allowed to stop the radiation altogether (which would result in very serious distortion) adjustments must be made accordingly. This means that weak or medium-strength sound-waves will only "modulate" a portion of the emitted energy, and it is the amount by which the "carrier wave" is modulated which determines the effect on the telephone diaphragms at the receiving end.

Cases of undoubted reception of telephonic transmissions from stations of low power fall generally into three broad classes. These may be termed true long-distance reception, freak reception, and reception of re-radiated signals.

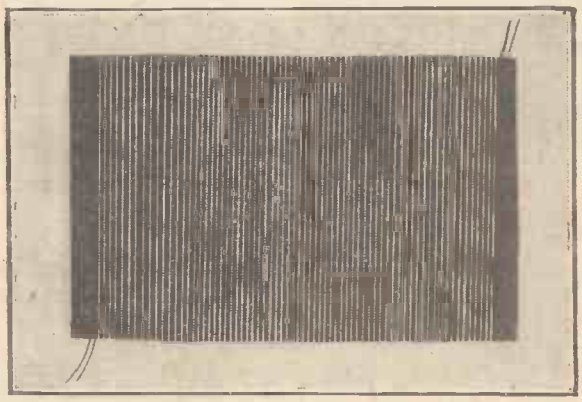
Reception at Sea

It is no uncommon occurrence for a ship at sea to receive signals from a main broadcasting station at distances of over 100 miles while the same receiver would fail to give any better results than a home-made set if used on the average broadcast listener's aerial. The only things that can account for this difference are the ultra-efficiency of the ship's aerial system, the absence of screening, and the fact that wireless waves travel much better over water than over land. The principal factor is the aerial system, which on the average is almost ideal. The aerial is supported by two high masts well above surrounding earthed objects, while the whole metal hull

(*Concluded at foot of next page*)

MAKING A SELENIUM CELL

THE selenium cell is the simplest form of light-sensitive element that can be used for any form of television or similar experiment. Its electrical resistance is so great in the dark that with a potential of, say, 50 volts from a dry battery, only a few micro-amperes will be obtained, whereas if the light from a twenty-candle-power lamp held a foot away be suddenly allowed to fall upon the cell, the current will increase instantly by as much as 150 or 200 per cent.



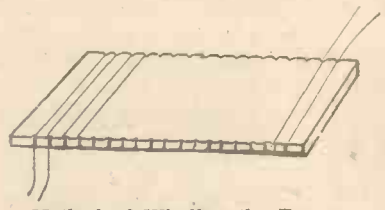
Photograph of Selenium Cell in the Course of Construction.

Sensitivity

By choosing a suitable cell and a suitable voltage it can be arranged that the cell when "dark" does not allow sufficient current to pass to actuate a relay in the circuit, whereas if a flash of light be thrown upon it, the current will rise and the relay will respond. In this way automatic buoys have been lighted up and extinguished at dusk and dawn by the French coastal authorities, and many other ingenious mechanical devices have been controlled by light.

Selenium can be bought from any chemical apparatus firm, such as J. J. Griffin and Sons, Baird and Tatlock, Hopkins and Williams, etc., and enough can be obtained for a shilling or two for many experiments. It is usually sold in the form of a black powder, and is a substance somewhat akin to sulphur, which is a non-metal akin to the metal tellurium. Warmed over a spirit lamp or Bunsen burner, it will soon become a sticky plastic mass, but if when in this molten state it is suddenly cooled it becomes converted into the more or less crystalline form which, after annealing, is sensitive to light.

The simplest way to make a cell is to cut out a piece of thin slate about 2 in. by ¾ in. and to polish this with fairly



Method of Winding the Former.

fine sandpaper. It is then notched at the long edges as shown in the sketch. Two spirals of gold wire (copper can be used for experiment) about No. 36 or 38 gauge are then wound one between the other so that the turns are always parallel but not touching. A glass rod is heated in the flame and dipped into the selenium until a blob about the size of a pea is formed on the end, and while the selenium is still "runny" it is wiped over the wires until the surface of the cell is covered with a thin film of selenium. The cell is now laid on a thick sheet of iron warmed by a Bunsen or spirit flame at one end so as to be at a temperature of about 200 degrees Centigrade. As this temperature must not be exceeded, the purchase of a cheap chemical thermometer reading to 200 degrees Centigrade must be made. Better still is to anneal the cell after preparation in a hot-air oven at the right temperature, letting it stay at about 200 degrees for a time varying from half an hour to two or three hours, and then allowing the oven to cool down very gradually.

The Finished Article

If the experiment succeeds the selenium will change in appearance to a greyish crystalline substance with a metallic lustre. Before this change takes place its resistance is enormous; it has, indeed, been recently applied to the manufacture of wireless resistances of many megohms. When properly made, it will sometimes allow a milliampere or two to pass when dark at a voltage as low as 20 or 30, and its "light resistance" may be as little as one-sixth its "dark" resistance.

There are many ways of making selenium cells, and a good description of many are given in Prof. Fournier d'Albe's delightful book, "The Moon Element." T. T. B.

"LONG-DISTANCE CRYSTAL RECEPTION—FACTS AND FALLACIES (*continued from preceding page*)

of the vessel serves as a gigantic earth-plate. The lesson to be learned from this is obvious.

Freak reception is not yet properly understood, but in most cases it is due to refraction or reflection of the wireless waves, These electro-magnetic waves are identical with light waves in everything except their length. They are capable of being refracted and reflected by conducting or semi-conducting bodies in the same way as light waves are by lenses and mirrors. A large cloud-area or an ionised portion of the upper atmosphere may serve to concentrate a large proportion of the energy radiated by a transmitting station on to one particular portion of the earth's surface, with the result that a listener who happens to be situated at the "focus" is surprised at the strength of reception. In such a case the listener will probably find that although he receives a station situated perhaps a thousand or more miles away perfectly well, he is quite unable to pick up much nearer and more powerful stations!

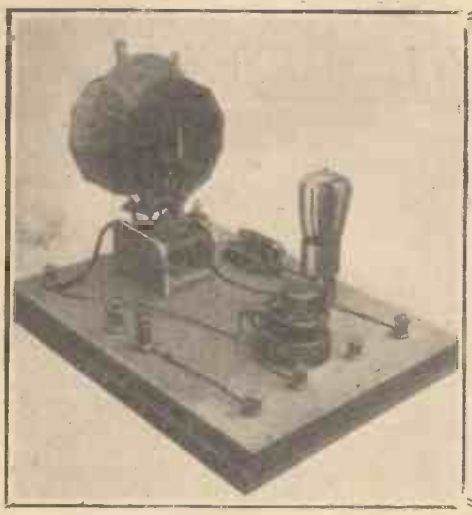
Re-radiation

Re-radiated signals have probably given rise to more claims for long-distance crystal reception, especially of low-powered American stations, than anything else. If a valve receiver is being worked with excessive reaction coupling it may be acting as a miniature transmitter. The feeble continuous waves it would emit would not normally be detected by a crystal receiver, but if the valve set is receiving a station, the signals, by causing the grid of the valve to vary, could modulate the emitted energy and so turn the valve set into a low-power relay station. A near-by crystal set would then be capable of receiving the signals sent out *by the valve set,* and, as these would be a reproduction of the signals received from the distant station, the unwary listener could be excused for believing that his crystal set had suddenly developed an enormous range. In such a case, however, the tuning of the crystal set would not usually be very selective, and one station might fade and another come in without the crystal set tuning adjustments being touched were the valve-set operator to vary his tuning.

J. F. JOHNSTON.

PANEL PROTECTION

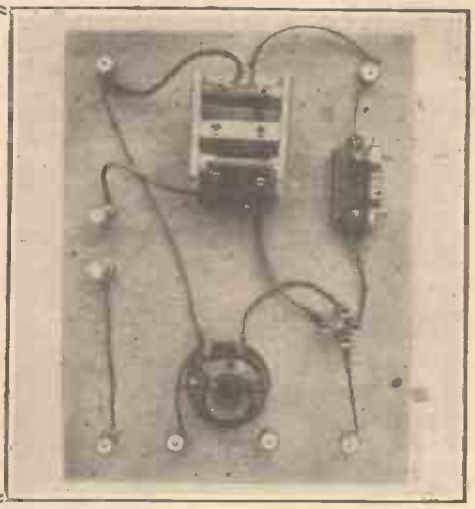
CARE should always be taken to keep the ebonite panel protected from strong sunlight. An ugly discoloration is caused by the sun's rays which quite spoils the appearance of the receiver. The discoloration is due to a chemical action which occurs and seriously affects the insulating properties of the ebonite. W.



The "Hook-up" Complete.

THE MOST SIMPLE ONE-VALVE RECEIVER

A Set for the Absolute Novice



Plan View showing Wiring.

IT is a very good idea for the absolute novice who wants to acquire the art of building sets to commence by assembling his first on a board in such a manner that the wiring may be done easily and be plainly seen.

When once a set has been made up in this way, a valuable lesson has been mastered, and the novice can plan the rebuilding of the set into a cabinet.

The Simplest One-valve Set

Here is perhaps the very simplest form of one-valve set that can be built. It will be noted that the rheostat and combined grid leak and fixed condenser are the ordinary commercial articles, for though it is true that these parts can be "home-made," they can be bought so cheaply that it scarcely seems worth while to go to the trouble of making them.

On the other hand, it will be noted that the two-way coil holder is a home-made concern, as also are the coil plugs. Such a coil holder can be made easily for a few pence, and when made it possesses one great advantage over any coil holder on the market. The coils can be reversed instantly, whereas if an ordinary coil holder and plugs are used, and it is found necessary to reverse one of the coils, it is a matter of removing the ends of the coil

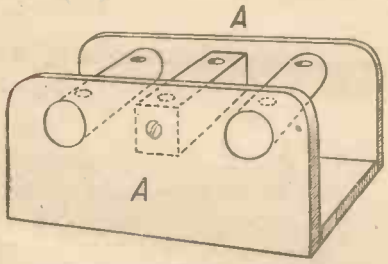


Fig. 2.—Adjustable Coil Holder.

from the screws which hold them and resetting them on opposite sides of the plug. In this home-made coil holder, the coil plug is simply taken out and inserted the other way round, an operation that takes a few seconds.

The materials required are as follow: Six pillar and two telephone terminals; four ordinary valve sockets; six flush valve sockets; one combined grid leak (2 megohms) and fixed condenser; one 35-ohm rheostat; odd scraps of wire; and a panel of three-ply wood. Total cost, about 4s. 6d.

The three-ply wood measures 10½ in.

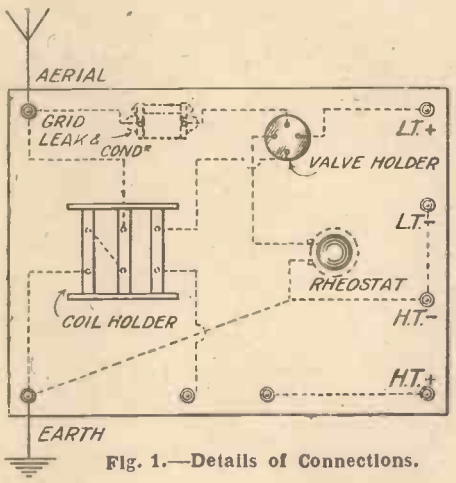


Fig. 1.—Details of Connections.

by 8 in. It is mounted on an old picture frame which happened to be at hand, but four wooden blocks 1 in. high would suit.

The rheostat was altered slightly for baseboard mounting. The knob and centre rod were taken out and put in upside down, a small hole was drilled through the end of the rod, and a very small split-pin was inserted in it underneath the panel to keep it in place.

The wiring can be made out quite plainly from the photograph, with the exception that the L.T. – and H.T. – terminals are joined by a wire underneath the panel. No soldering is necessary (see also Fig. 1). The wires to the valve sockets, for example, are twisted round the shanks, and pinched tightly between the sockets and the baseboard by the nuts underneath.

To make the coil holder, two pieces of three-ply wood, 2½ in. long by 1¾ in. high, are cut to the shape shown in Fig. 2, and two ½-in. holes are cut with a bit at each top corner. These two side pieces are fixed to a base which is 1¾ in. wide. A small rectangular bar A A is screwed in the centre to hold a fixed coil. It measures 1¾ in. by ⅜ in. by ⅜ in., and carries two of the flush valve sockets whose centres are exactly 1 in. apart. Next two pieces of ½-in. wooden rod—those in the photograph were cut from an old umbrella stick—2⅛ in. long are cut to fit into the pair of holes on each side of the centre bar. These also carry sunk valve sockets, with centres 1 in. apart.

There is no difficulty in drilling holes in these bars to receive the sockets; they should fit tightly into the holes in the sides.

Note that the rod nearest the outer edge of the baseboard has one of the sockets connected to one of those in the centre bar with a piece of flexible wire. This may be seen in Fig. 1. The other connections (all made of similar wire) between the coil holder and valve, phones, aerial

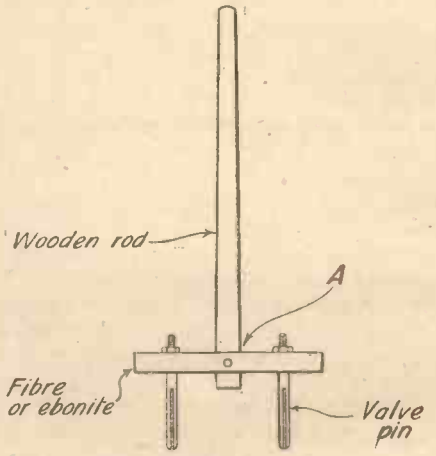


Fig. 3.—Support for Coil.

and earth may be followed in the diagram. As for the coil plugs upon which the various coils for use are mounted, each one consists of a strip of ebonite or fibre 1¾ in. by ⅜ in. by ⅜ in. (Fig. 3), each

(*Continued at foot of next page*)

FROM MY POST-BAG

By BOSPHOR PRONZ

The "Unison-one"

MY DEAR PRONZ,—I enclose herewith a photograph of my new Unison-one wireless receiving set in all its pristine booty. Do you think you could find a space for this photograph amongst all those wonderful photographs of wireless sets you have designed on your mantelpiece? My Unison-one is a gem. Never a night passes but I pick up at least one new station with it. Of the Continental stations, Boulogne and the Gard du Noir, Paris, are my most consistent. Coming nearer home, Manchester and Liverpool are my best stations; I live about half-way between those two cities, but not at Warrington. I am much bothered by spark telephony from the direction-finding stations which assist ships to navigate the Ship Canal. O. HECK.

P.S.—I am sorry to say that my soldering-iron very rudely spluttered at the photograph and caused it to break out in spots, so I am not enclosing the photograph after all. I am sending you two cigarette-cards instead. O. H.

The "Goak" Receiver

DEAR B.P.,—I cannot help writing to you to tell you that I have actually made a wireless set from a recent article of yours in *The Interferer*. I had never before attempted to build a wireless receiver, but I set out with the set purpose of setting your set before the wireless set to which I belong, and I am thoroughly set up with the set down to the last terminal.

My previous experience with a wireless set was ten seconds with an eight-valver, after which I sold the set minus the valves to a second-hand dealer and invested the proceeds in a valve-repairing company.

I have one criticism to make, and that is with regard to the name of the set. Why in the world did you christen the set "The Goak"? Is there some hidden significance in this peculiar name? One member of my wireless set is of the opinion that Goak is a printer's error for Goat. Anyhow, he says the set has got *his* goat.

By the way, my aerial is of the "bird-cage" type with water-pots and seed containers complete. I find that I can vary the capacity of my aerial considerably by varying the contents of the seed-boxes. The idea came to me after reading Queerton's "Wild Birds and the Food They Eat."—Yours, etc., D. C. C. (Hons.).

The "Balmy-four"

DEAR OLD CRYSTAL,—You will be astounded to hear the results I am obtaining with the "Balmy-four" wireless set I have constructed from your lucid specifications. Never have I heard a set which gives such quiet and subdued signal strength. When hooked up to my "Balmy-four," my Bellowphone loud-speaker throws out about the same volume as an old lady whispering in church to another old lady just before the collection. Now I rather like loud-speaker volume of such quiet and dignified strength. The only disadvantage I can see is that it is not possible to put more than one ear to the loud-speaker spout at a time.

How about a loud-speaker with a spout big enough to accommodate two or three heads? Or what about a loud-speaker with a number of spouts each big enough to take one seven-and-a-half size head? Seems to me as if some enterprising manufacturer might take the idea up for next winter and turn out two new types of loud-speaker, the Multi-head and the Multi-spout.

I must tell you of the few refinements I have added to my Balmy-four. First of all, I use a variable filament rheostat with the detector valve. Helps the tuning a little. Then I employ several terminals with adjustable screw-tops, also to help tuning. And I use a variable condenser with a fine how-d'you-do adjustment plate.

My coils are wound on low-loss formers with copper wire in its birthday suit, and tuning is D sharp to say the least of it.—Yours, etc., ADAGIO SCENARIO.

From South Africa

DEAR BOSPHOR PRONZ,—I am sending you exclusive information as to some very queer happenings which have happed recently on my ostrich farm on the South African veldt. A few months ago a very tall bird developed a most alarming taste for wireless. His first wireless meal consisted of a filament resistance, six terminals and a complete set of plug-in coils. Thinking the bird would suffer badly from wireless indigestion, we gave him a grid leak and condenser, hoping thereby to rectify matters.

The bird's second meal of this kind consisted of an ebonite panel, a variable condenser, a valve holder and a hank of No. 18 tinned-copper wire. We thought the bird had tired of wireless after this second meal, but no, a few weeks later he partook of a valve, the coloured rings on which evidently attracted him, a dry battery and a small accumulator. Other small component parts were missed from the bench.

Now here is the strangest part of my story. A most persistent form of interference began to make itself felt on all wavelengths. Wireless enthusiasts in the locality began to complain. So troublesome was the interference that we decided to track down the offender with our Bellini-Tosi direction-finders. The first result of our tests was to establish the fact that the culprit was travelling about with a portable transmitting set. Sometimes we located him to the north of my house, sometimes to the west and occasionally to the south, *but never to the east.* This made me suspicious, but I kept my suspicions to myself.

We went on with our D.F. work and, to cut a long story short, what do you think the final result was? You would never guess in a thousand guesses. Without the faintest shadow of a doubt, we proved that the interference came from that ostrich with the wireless appetite. How the several component parts he had swallowed had become hooked up into a transmitting set is beyond me to explain, but there are the facts.

I am very thankful that this did not happen in England, where I should have been compelled to take out a transmitting licence for the ostrich.—Your old friend, JAN.

"THE MOST SIMPLE ONE-VALVE RECEIVER"
(*continued from preceding page*)

carrying two valve pins 1 in. apart, to which, of course, the ends of the coil are attached. The simplest way of arranging for the coil to be held is to drill a hole in the centre of the ebonite strip and pass through it a small rod of wood or bone (a skewer or a knitting-needle, for example). This can be glued into position, or a fine brad may be put through the ebonite (see A in Fig. 3).

For stations up to a wavelength of 390 metres the two connected coils should have about 36 turns and the other about 60. For stations above that wavelength, in place of the 36-turn coils two others of between 40 and 45 turns should be used. For 5 X X the two connected coils might be a 250 and a 50, while the third could be about 150. As a matter of fact, those used by the writer for 5 X X consisted of a basket coil of 50 turns connected to an Oojah Daventry coil, whilst the third was a small Daventry coil, which cost one shilling. Any ordinary detector valve will function, but the 35-ohm rheostat is intended for a dull-emitter valve.

To operate the set, having connected the aerial and earth and attached the leads to the L.T. and H.T. batteries, set the coils almost as far apart as they will go, and move the third or innermost coil slowly towards the central one. A rushing sound in the phones will indicate that the valve is oscillating, but if no sound is heard, reverse the coil on the holder and try again. When the sound is heard, move the outermost coil until signals are at their best. S. N. S.

THE BAIRD TELEVISOR

SOME RECENT DEVELOPMENTS

READERS will remember that from time to time during the past three years we have described and illustrated the apparatus devised by Mr. J. W. Baird for his system of television. Some details of the system were given as recently as last month (No. 206). Though Mr. Baird has actually succeeded in transmitting a picture or scene so that it can be viewed at the receiving end at the instant of transmission, and thus has accomplished television in the strict sense of the term, he would be the last to claim that his experiments have reached finality; the photographs on this page of portions of the latest apparatus, however, provide interesting comparison with the earlier and somewhat crude devices used.

Optically and mechanically the problem of television does not present any insuperable difficulties; the real problem has been to make a light-sensitive cell which would be capable of responding to light impulses of a duration of a very minute fraction of a second. Continuous experiments have been made to find a suitable cell, and it has long been realised that the ordinary type of selenium cell was too slow in response and also too slow in recovery to be of practical use. For obvious reasons secrecy is maintained regarding the nature of the cell used in the Baird system, but judging from the results achieved, there is no doubt regarding its efficiency at the speeds which the mechanical construction of the apparatus will permit.

The mechanical speed attained up to the present has a somewhat similar effect upon the transmitted picture that a low speed would have in the case of the cinematograph, and it remains to be seen whether, when an increase is made by further improved mechanical construction the cell will respond equally well. It may be remarked that the inventor does not foresee any difficulty in this respect, and he is now conducting experiments to this end.

The Baird Televisor

Three interesting new photographs showing portions of the apparatus used in the Baird system of television. The first picture shows the transmitting end and the second how the transmitted picture is viewed by an audience. The third photograph shows Mr. Baird (right) making some adjustments.

PRACTICAL ODDS AND ENDS

Dual Phone Tags

THE phone tag illustrated in the accompanying diagram is suitable for making connection with terminals either of the normal screw-down or of the pillar type. The straight tag should be bent so that a

Dual Phone Tag.

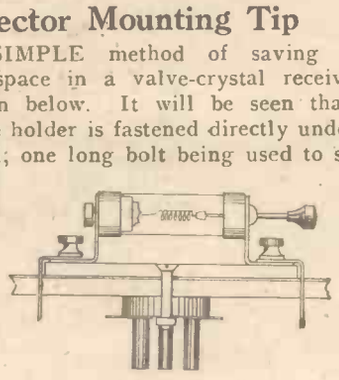
loop is formed as at *b* in the diagram. The straight end *a* can be inserted in terminals of the ordinary phone type, while the loop may be held under the nut of a pillar-type terminal. Tags made in this way can be quickly connected to almost any shape of terminal and save a great deal of time when rapid changes of circuits are being made. P.

Filling Holes in Ebonite

IF a mistake is made when drilling ebonite there is no need to scrap the whole panel. Many fillings are available which can be used for covering up the wrongly drilled hole. Chatterton's compound, for instance, can be obtained from almost any wireless store, and will make an almost invisible repair. The pitch from the top of an old flashlamp or H.T. battery can also be used for filling up small holes. C.

Detector Mounting Tip

A SIMPLE method of saving panel space in a valve-crystal receiver is shown below. It will be seen that the valve holder is fastened directly under the panel, one long bolt being used to secure



Method of Mounting Detector.

both components in position. The leads from the crystal detector pass through two small holes in the panel drilled as shown, though terminals or sockets may be mounted on the panel if desired. A further advantage of this method of mounting is that the valve is beneath the panel. C. E.

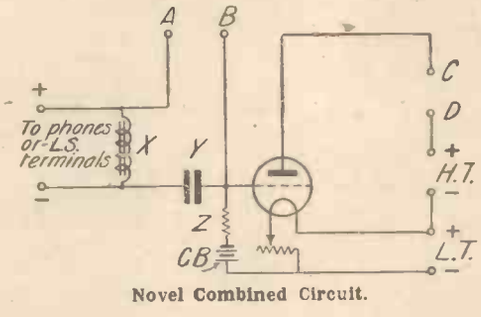
Fixing Condensers

A TIP, which may save considerable trouble, for fastening a fixed condenser to the back of a panel without the unsightly appearance of screwheads on the front is to let a little wax (from a discarded H.T. battery) drip on to the back of the condenser and then to press it into position. It will be found to hold quite firmly. F. R.

A Combined Circuit

A HANDY circuit, which can be used either as a choke-coupled amplifier or as a phone-circuit filter, is shown herewith.

In the diagram X is the secondary of an old intervalve transformer, Y is a condenser having a value of .006 to .25 microfarad, and Z is a grid leak of .5 megohm to 2 megohms. When in use as a phone-filter circuit the "hook-up" is connected to



Novel Combined Circuit.

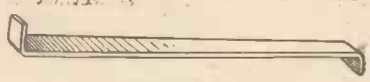
the ordinary phone terminals of the receiver and the phones or loud-speaker are connected across the terminals A and B. For amplification the loud-speaker is connected across terminals C and D and the valve is turned on. Slight variations of the values of the grid leak and coupling condenser may be necessary. A. W. D.

The Master Rheostat

MANY sets are fitted with a variable resistance in series with a number of valves, acting as a kind of "master" control, by means of which the set may be switched on or off without disturbing the setting of the individual rheostat. It should be remembered when fitting a rheostat for this purpose that the whole of the filament current of the receiver has to pass through it, and it should therefore be designed to pass the necessary number of amperes without overheating. A rheostat mounted on a porcelain former should be obtained if possible, as a small increase of current above the normal value will then have no ill effect. J.

A Handy Screwdriver

A HANDY type of "spanner-screwdriver" is illustrated in the accompanying sketch, which will be found invaluable for manipulating screws situated in awkward places. When fitting certain components to the under side of the panel, for instance, it is impossible to use the ordinary type of screwdriver. The tool



A Handy Screwdriver.

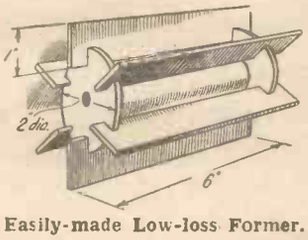
consists simply of a strip of $\frac{1}{16}$-in. sheet steel about $\frac{1}{4}$ in. wide, the ends of which are filed off to a chisel point and bent over at right-angles. A number of these screwdrivers should be made up in various sizes. K. P.

The Negative H.T. Connection

IT may sometimes be desired to use an L.F. amplifying panel on which the H.T. negative lead is connected, for example, to the L.T. positive, in conjunction with a set in which H.T. negative is connected to positive L.T. If the sets are connected up in the ordinary way, the L.T. accumulator will, of course, be short-circuited. The difficulty may, however, be overcome by the simple expedient of disconnecting the leads from the H.T. minus terminals on both sets, and connecting the negative socket of the H.T. battery to one or other of the accumulator terminals. H. P.

Low-loss Former

AN efficient former for a low-loss coil can be made quite easily in the following manner. The only materials required are six strips of ebonite about 6 in. in length, grooved to support the



Easily-made Low-loss Former.

turns of the coil, and an empty $\frac{1}{4}$-lb size wire bobbin with end-cheeks. Slots should be cut in the ends of the bobbin to take the grooved strips, which are placed in position and held firmly with a little Seccotine. The former when complete will be found to hold about 80 turns of No. 18 d.c.c. wire. A. H. S.

Only the new Cossor Point One can give you these three advantages

WHEN a man buys a Valve three questions flash through his mind. The first is "Will it be cheap to run? I cannot afford to use a valve that consumes a lot of current." Then follows "Is its filament strong? A valve that becomes useless after the first slight blow is expensive at any price." And finally "Can I be sure that it will give as good results after twelve months as on the first day I use it?"

These are the three essential needs of every wireless enthusiast. In this new low consumption Valve, Cossor is enabled to offer a Dull Emitter which utilises principles of construction so strikingly new that the whole future trend of valve design is likely to be influenced. Read below how this wonderful new valve, consuming only ·1 of an ampere (hence its name) will satisfy your most exacting requirements.

1 Current consumption cut to one-third

Ever since the days of the bright emitter the whole resources of Science have been enlisted in ceaseless efforts to reduce current consumption. In the new Cossor Point One a further tremendous cut has been made. This new valve now requires only one-tenth of an ampere at a voltage of 1·8. That means that a Super-Heterodyne using seven of these new valves would still consume less current than a one-valve Set using one Bright Emitter. Or to make the comparison still more striking the same accumulator which served the one-valve Set for, say, one week, would—with its cells connected in parallel to give two volts only—last longer than two months on a charge. Even then it would only need re-charging to prevent sulphation of its plates. This phenomenally low current consumption renders the Cossor Point One quite suitable for use with dry cells when required.

2 A shockproof filament suspension system

The system now evolved by Cossor offers outstanding advantages and automatically ensures for the valve a greatly increased life. Whereas in many valves the filament, being straight, is held under tension, that in the new Valve is arched and retained in position by a fine wire which is secured to a seonite insulator situated immediately above it. It is not held under tension. The fine wire provides exactly the degree of elasticity required to enable the filament to withstand harmlessly the sharp concussion caused by an accidental blow. A knock which would shatter the filament in an ordinary valve is easily absorbed by this amazingly efficient shockproof suspension system.

3 Long life uniformity due to Co-axial Mounting

If a number of valves were made with identical filaments, grids and anodes without due regard to the exact spacing between these elements, all the valves would show very considerable variations in performance. Absolute uniformity in results can only be obtained among valves of the same class when the relative positions of their elements are identical.

In the new Cossor Point One the system of mounting infallibly aligns the filament, the grid and the anode at the top as well as at the bottom. Even the hardest shock will fail to displace their exact relative positions.

Frequently the working characteristics of a valve will change as time goes on—perhaps due to filament sag or to the grid or anode being moved out of position through an accidental blow. This cannot possibly happen in a Cossor Point One. Users of Neutrodyne Receivers employing two or more stages of *matched* H.F. amplification will appreciate the immense importance of this exclusive Cossor feature.

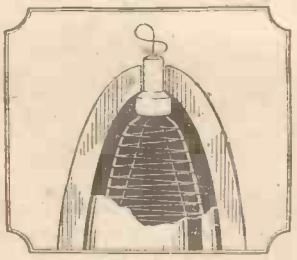
Cossor Point One

RED TOP:
For H.F. use consuming ·1 amp at 1·8 volts. 15/6

PLAIN TOP:
For Detector consuming ·1 amp at 1·8 volts. 15/6

Cossor Stentor Two

GREEN TOP:
For Power Valve consuming ·15 amp at 1·8 volts. 18/6



Observe how the seonite insulator securely aligns and holds in their correct relative positions, the filament, the grid and the anode. Through the centre of the insulator will be seen the fine wire which supports the filament and safeguards it against shocks.

Cossor Valves

Issued by A. C. Cossor, Ltd., Highbury Grove, London. N. 5.

Gilbert Ad. 5349

On Your Wavelength!

A Rearrangement?

VARIOUS rumours have been current for some time about impending changes in the B.B.C. wavelengths. So far as one can ascertain, nothing has been definitely fixed yet, though a tentative scheme has been drawn up for changes which include the Continental stations as well as our own. Heterodyne interference is considerably less upon the broadcast waveband than it was some months ago, though it still exists to some extent. On three recent evenings, when trying round to see what could be done in the DX line in summer-time, I picked up in all thirty-eight foreign stations, only nine of which were appreciably heterodyned. A few months ago a similar trip round would probably have produced twenty-nine heterodynes and nine clear stations. But the picture is not quite so rosy as it looks, for of the twenty-nine received clear of heterodynes this month, no less than fifteen had their transmissions ruined by either spark or C.W. harmonic interference. It seems to me that the morse interference question is even more urgent than that of heterodynes.

The Exhibition

The wireless exhibition, which is to be held this year from September 4 to 18 in the new hall at Olympia, promises to be a very great success. I am delighted to see that it will not on this occasion be confined only to one section of radio manufacturers. It is in fact to be open to all makers and distributors of British wireless goods. This means that those who go to it, as all wireless enthusiasts are sure to do if they can, will have a wonderful opportunity of seeing in the most convenient way just what is being done in the development of components, as well as of complete receiving and transmitting gear. In past years there was the feeling that one was missing a great deal, since so many manufacturers were not represented. The B.B.C., I hear, is to have a very striking display, having made arrangements to reserve the whole of one of the side galleries. The whole thing is certain to be a splendid show, and now that there are more than two million of us there should be a record crowd.

In the Parks

So successful was the recent broadcasting from the Temple Gardens band stand that the L.C.C. has decided to make another experiment at an early date in Battersea Park. There is, however, no intention of replacing the bands by loud-speakers. Certain items from the broadcast programmes are to be given with the idea of introducing rather more variety into the musical fare provided in the parks. It is quite likely that loud-speakers may be installed in some of the open spaces where there are no band stands and where music is not now provided.

A year or two ago one would have viewed any suggestion concerning open-air broadcasting with rather mixed feelings, since the big loud-speakers of those days were apt to produce sounds that were anything but musical. Do you remember the one at the first wireless exhibition, which caused a piano solo to sound like a herd of elephants jazzing on a gigantic dulcimer? The giant loud-speaker of to-day, thanks largely to the work of Captain Round, is a really musical instrument capable of reproducing faithfully both speech and music.

Unlucky

Poor 2 L O has been rather badly "in the wars" of late, having had two separate and distinct breakdowns this month already. The first took place on June 3, when a defect developed in the transmitting plant at Oxford Street. There was only a short interval of silence, for the engineers were luckily able to switch over pretty quickly to the old transmitting plant at Marconi House. I realised at once what had happened when, on restarting, the programme came through at very much less than its normal strength. Numbers of my neighbours (and yours too, I expect!) put the decrease in signal strength down to some slight alteration in the wavelength, and leapt as one man to their reaction and tuning controls. I do not think that I have ever heard quite so much concentrated howling in so short a time. The Marconi House transmitter came to the rescue again for an hour on June 7, when another fault occurred in the Oxford Street plant. Once again there was an outburst of squealing, though it was not quite so bad as on the previous occasion, since many listeners understood this time what had occurred.

The Difference

One did not realise until these breakdowns occurred what an enormous difference there is between the power of the new 2 L O station and that of the old. Though I am nearly thirty miles from London, I am within quite comfortable crystal range of the Oxford Street transmitter. I do not mean to say that you can hear the programmes "with the phones on the table," unless, of course, your head is inside them. But you can receive clearly every spoken word and every note of music without having to strain your hearing in the process. During the recent breakdowns, when the old transmitting plant was pressed into service, I tried a crystal set and found that a prolonged search for a really sensitive spot produced only faint speech and music.

I expect that hundreds of listeners who are just on the fringe of the Oxford Street crystal range found that their sets remained silent during the whole period of the breakdowns, since the Marconi House transmitter was unable to "get across" to them. It would be interesting to know how the old transmitter was received on the Continent. Its range used to be extraordinarily good in the old days, but that was in the happy time when there were comparatively few stations working upon the broadcast wavelengths.

Have You Noticed It?

I have been rather struck recently with the growing popularity of the crystal-note-magnifier combination amongst those who like to receive the local station to perfection on the loud-speaker. Many people who keep a set with one or two stages of high-frequency amplification for DX work are now using a crystal followed by one, two or three note magnifiers for ordinary household purposes. Where I live, three note magnifiers are needed behind the crystal, the most satisfactory combination of intervalve couplings being a transformer for the first stage and resistance-capacity or choke-capacity for the other two. With a well-made set designed on these lines the purity of the reproduction obtainable is really remarkable, and there is the further very great advantage that any member of the family may tune the set when necessary, since there is absolutely no possibility of causing interference by radiation.

You cannot beat the crystal as rectifier of fairly strong signals; the valve must always introduce a certain slight distortion, especially if the grid-leak-and-condenser method is employed. It is, however, very important to use the right transformer for coupling the detector to the first valve. I have obtained the best results by using a small transformer with a low-impedance primary and a big step-up ratio (9 or 10 to 1) between the primary and secondary.

Portables

One notices, too, that the portable set is increasing rapidly in popularity. When taking one's walks abroad in the country on Saturday or Sunday afternoons one quite often comes across people enjoying 2 L O's afternoon concert. In many cases the

On Your Wavelength! (continued)

valve filaments are heated by the lighting battery of the car, the set itself remaining on the running-board, whilst the loud-speaker is brought to the desired spot by means of long leads. I have an idea that the receiving set of the future may be of the "portable-at-will" type. That is to say, it will be a compact affair housed in a case that can be easily carried. At home it will work in conjunction with an outdoor aerial and its own accumulator. In the open, a frame, probably contained in the cabinet, will be used and the car batteries will supply the filament current.

Give Them a Trial

Comparatively few wireless enthusiasts realise the extraordinary convenience of plugs and jacks either for making connections from batteries, telephones or loud-speaker to the set or for switching amplifying stages in or out of action as required. Jacks should never be used on the high-frequency side of the set, but for note magnifiers they are invaluable. A large variety of jacks is available at very reasonable prices at the present time, and with them one can do all kinds of handy things. It is possible, for example, so to arrange the set that when the loud-speaker plug is pushed in to any jack only the valves in use light up. And there are all sorts of other possible combinations that any enthusiast who turns his attention to plugs and jacks will rapidly discover.

Worth Trying

The jamming on the broadcast wavelengths above 400 metres is so bad just now that it is impossible to receive the transmissions of a large number of the German main stations. As these frequently put on first-rate programmes, the position is rather tantalising if you have a set capable of getting the range and can tune in nothing but sparks, C.W. harmonics and heterodyne whistles, unless, of course, you happen to know the relay tip. Nearly all of the German stations are relayed. Berlin is retransmitted by Königswusterhausen on 1,300 metres. This is an 8-kilowatt transmission, very easy to pick up and there is usually not much interference.

The other relays are mostly on the shorter waves between 250 and 300 metres; with two exceptions they are 1.5-kilowatt stations and come in at surprising strength. If you cannot, for example, get Frankfort on 470 metres owing to the interference which is prevalent in this region, tune in Cassel on 273 metres. It is well worth while to provide a set of coils that will take you down to 250 metres, for you will find that between that mark and 300 metres there are many good stations to be picked up. There is little interference down at the bottom of the broadcast waveband.

Theatre Broadcasts

I was sitting in the stalls of a theatre the other night being thoroughly amused. The thought struck me that here was an ideal piece to broadcast. I shut my eyes and still enjoyed myself thoroughly. Later in the evening I met one of the people responsible for the excellent show I had seen. After some complimentary remarks, I mentioned that the show was a first-class broadcast proposition. All I got for my pains was a very bland smile, accompanied by a shrug of the shoulders. The conversation which followed rather shed a light on the absence of theatre broadcasts from the B.B.C. programmes.

The position seems to be that a successful production—that is, one with a box-office draw—has no need for wireless publicity. If the house is full, broadcasting can do the receipts no good, while, on the other hand, there is always the chance that the listener may not get a good impression by wireless. At present it appears that the B.B.C. as a general rule are not in a position to pay managers for broadcasting theatrical productions. This being so, it follows that "shows" in need of publicity are more accessible than those with the "House Full" notices displayed at their doors.

This conversation proved somewhat illuminating. One began to see the difficulties. If the B.B.C. are dependent on bartering publicity, it means that they are limited in their field and that out of several possibilities the majority will be totally unsuited to broadcasting, while to the remainder the transmission of an excerpt may be detrimental.

H.T. Batteries

Now that something resembling summer weather is really with us it behoves enthusiasts to look after their H.T. batteries. It is sad to relate, but the advent of warm or hot weather inflicts heavy casualties, as unusual heat speedily ruins the best of them, and for this reason care should be taken to place the battery somewhere where the temperature is relatively low. Needless to say, the installation of a refrigerator or meat safe is hardly a necessary additional expense; if the battery is kept in a cool shady spot this will suffice.

Radio in Hot Countries

The reader will naturally wonder what happens in tropical and semi-tropical climates. The answer is that radio has a very bad time in these countries, what with the disturbances caused by atmospherics and the extra "statics" put in by a dry battery which has become heated. One enterprising British firm has produced an extremely fine H.T. unit which, however, obviates this latter trouble. It consists of a rotary transformer comprised of two parts directly coupled, the driving motor and the H.T. generator. The motor is fed at 6 volts from the low-tension accumulators, whilst the H.T. end delivers pressures ranging from 100 to 600 volts. The speed of the motor is regulated by a rheostat, thus allowing intermediate voltages to be obtained. The whole is enclosed in a sound-proof aluminium case which stands on rubber feet, so that no noise or vibration is heard in the room.

Statics

We are apt to take our etheric disturbances, which we term atmospherics, somewhat seriously, but we have very little to complain about considering the conditions which pertain in other countries. Our near, yet far, neighbour America is greatly troubled by statics, especially as the ultra-sensitive super-heterodyne and neutrodyne sets are so popular. Other countries, notably India, also have the same difficulty.

Statics or "strays" provide one of the oldest of radio problems, and despite the fact that the inventor of a method of overcoming the difficulty is likely to reap a rich harvest, little progress towards their elimination has been made. The use of a high-pitched note such as is used in pure continuous-wave morse renders it easier to differentiate between a "stray" and a dot or dash of the morse code. In radio telephony, however, owing to the fact that a flatly-tunable receiver in conjunction with flat-peak low-frequency transformers for amplification purposes is an ideal combination, it makes itself very apparent, since note tuning, as is possible in radio telegraphy, cannot be used without distortion arising.

Using the Mains

Ever since wireless valve sets came in people have been endeavouring to evolve satisfactory systems of using current from the electric-lighting mains for the heating of valve filaments as well as for the provision of plate and grid voltages. There are several quite satisfactory systems in use at the present time for both direct and alternating current. There is, however, one great difficulty that faces the would-be user of power from the mains for wireless purposes. No station's voltage is ever quite constant. Sometimes it is slightly above the average, and sometimes a little below. This renders it no easy matter to obtain perfectly smooth and constant working of the receiving set when current from the mains is used. I am inclined to think that the most satisfactory method for those who have electric lights is to install a charging device and to continue to use accumulators. There are numbers of excellent little chargers on the market to-day, and they would soon save their small initial cost. THERMION.

PERFECTING THE CONE LOUD-SPEAKER

Some Useful Hints for the Amateur Constructor

Photograph showing Composition of the Cone.

TWO radio components which give excellent reproduction are of the simplest possible type —the crystal detector and the cone loud-speaker.

A cone seems very simple to make, but its very simplicity is deceptive; the paper used for the cone must be of the right quality, the driving unit powerful; and last but not least the set feeding the speaker must supply clear and undistorted signals and must have plenty of power.

Fascinated by the wonderful results obtainable with a cone-speaker, the writer spent several months in systematic experiments. But before we discuss the cone itself, we must decide what driving unit is to be used. Principally on account of the convenient design, the writer used a Lissenola in his experiments. If the special reed with screwed extension rod is employed, the connection between cone and speaker unit will give no trouble. Other units can be adapted for a cone by soldering a thin screwed rod to the centre of the diaphragm. Care must, however, be taken that the rod is at right-angles to the plane of the diaphragm.

The first experiments were made with small cones, varying from six to twelve inches in diameter. All of them were unsatisfactory, the volume was quite insufficient, and the rendering by no means satisfactory. The first cones were made of drawing-paper of different thickness, and all the cones had a tendency to "drum."

Seeing a reference in an American wireless magazine to the effect that thick blotting-paper made excellent cones, a good supply of this material was obtained without delay, and several cones were constructed. But still the results were unsatisfactory. In addition to fixed cones supported at the rim, free cones were tried. These were simply clamped to the extension of the Lissenola reed. To get a good grip on the centre of the cone, small conical washers were made from thin aluminium as shown in the sketch.

The small tins in which some makes of shaving soap are sold are made of aluminium of the right gauge. Since the sheet is very thin, it can be easily cut with the household scissors.

Some of the free cones proved better than previous models, but all of them were inferior to the horn loud-speaker used for comparison. The next step was to try larger cones; a few of eighteen inches diameter were made—and discarded, as all of them had a tendency to "drum." These cones were made from blotting-paper as well as fairly thick drawing-paper, various thicknesses being tried.

The larger cones were of the fixed type, as with a free cone the strain on reed and extension rod of the loud-speaker unit would be too severe. As it was, the little Lissenola saw some rough handling, but it survived and is still giving good service.

The writer must admit that he was on the point of discontinuing his cone experiments, when he ran across a sheet of thick brown wrapping-paper, unfortunately folded and badly creased in several places. Merely out of curiosity, a 25-in. cone was made up from this material; the height of the cone measured from base to apex was about 7 in. (The paper is kraft brown, glazed on one side and rough on the other.—ED.)

The centre of the cone was stiffened by gluing on to it discs of thick paper about 2 in. in diameter. The circumference of the cone was secured to a child's wooden hoop, drawing pins spaced about 2 in. apart being used, as this seemed the quickest way.

The Lissenola unit was held by three wires fastened to the rim of the hoop; in short, the whole arrangement was merely experimental and as simple as possible.

Although made from old material, and with but little care, this cone worked beautifully. It still suffers from some minor defects, but they can no doubt be cured in a later and more finished type.

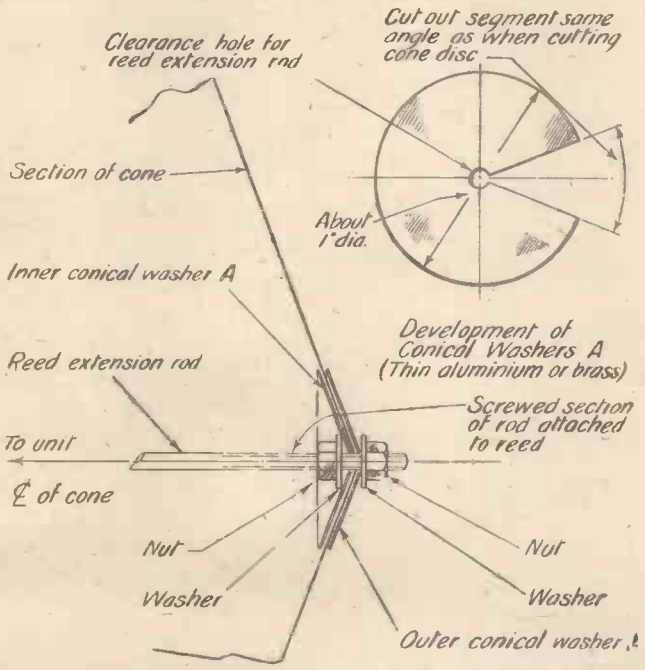
These experiments have shown that the secret of a good cone lies principally in the paper used. It is surprising that our paper manufacturers do not come forward and tell us what kind of paper to use for a cone of given size. Quite a number of American radio supply houses market special cone paper; according to the advertisements, a kind of parchment paper is used.

An unsatisfactory cone can often be improved by making it a composite one, consisting of a fairly flexible inner section and a stiffer outer one. The photograph shows a cone of this type; the inner part is tracing linen, the outer of stiff drawing-paper. This proved one of the best cones of the first series.

For this alteration the original cone must be cut along the line of joining and opened out flat. A disc having a diameter of about one-third the total cone diameter is then cut out, and a disc of tracing linen prepared to fit over the opening. An overlap of ⅛ in. will suffice for the joint. After the two sections have been cemented together, the cone is trimmed along the line of the joint and once more bent into shape and finally joined.

Seccotine is an ideal cement for joining cones; it holds well and dries quickly provided only a small quantity is used and it is spread thinly.

C. A. O.



Diagrams showing how the Cone is Built Up.

RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, layouts, diagrams, etc., on separate sheets containing your name and address. Always send stamped, addressed envelope and attach Coupon (p. 856).

Anode Condenser

Q.—*What is the largest permissible maximum capacity for a variable condenser tuning the anode circuit of an H.F. valve?—N. C.* (*S.E.*8).

A.—This depends upon the wavelength of the signals to be received, but the capacity should be small in comparison with the inductance of the circuit. For wavelengths below 250 metres, .0001 or .0002 microfarad is the highest that it is advisable to use, while for broadcast wavelengths .0003 microfarad can be employed. For wavelengths above 600 metres little loss of efficiency will be noticed if the size of the anode condenser is increased to .0005 microfarad.—J. F. J.

Super-heterodyne Transformers

Q.—*I intend to construct the super-heterodyne receiver described in No. 193, on p. 475. Can you tell me the best method of winding the secondary so as to keep down the capacity effects in such a small transformer?—F. H.* (*S.W.*4).

OUR WEEKLY NOTE

TELEPHONE CONNECTIONS

Are you sure that your telephone or loud-speaker connections are correct? If you are using a crystal set only, the phone connections do not matter in the least, but when valves are employed and the anode current to the last valve has to pass through the windings of the phones or loud-speaker, great care should be taken that it does so in the right direction.

This current is usually very small, but as the number of turns on the pole-pieces is large the magnetic field set up may be considerable. No difference in the results will be apparent if the connections are wrong, at least for a considerable time. Slowly, however, the permanent magnetism of the phones or loud-speaker will be neutralised by the electro-magnetic field of the windings. This will result in an otherwise inexplicable falling off both of volume and sensitivity.

On the other hand, a little trouble taken in ensuring that the connections are correct will be amply repaid as the permanent magnet is in no danger of losing its strength when it is constantly reinforced by a magnetic field in the same direction as itself.

THE BUREAU.

ENTERTAINERS ENTERTAINED!

Sonnie Hale and Evelyn Laye listen-in on an A.J.S. four-valver.

A.—A good method of winding the transformer to ensure a minimum capacity is as follows: Wind the turns in even layers from one end only; that is to say, when one layer is complete bring the wire direct back to the starting end and wind on a second layer. Do not wind back on the first layer. This will ensure that the potential is graded across the coil in small steps of one turn at a time, and also that there is the minimum possible voltage between the ends of each layer.—L. C. G.

Tuning Coil Sizes

Q.—*If a station is tuned in with greatest strength when the moving plates of the variable condenser are completely inside the fixed plates, does it indicate that the coil in use is too large or too small?—N. D.* (*Dunstable*).

A.—As the wavelength to which a circuit is tuned increases when either the inductance or capacity is made larger, the greatest wavelength that can be reached with any given coil and condenser will be reached when the variable factor (in your case the condenser) reaches its greatest value. As you tune in the station best at the maximum wavelength adjustment possible with the coil now in use, it is an indication that a larger coil should be used and the condenser set at a less capacity.—J. F. J.

Aerial and Earth Connections

Q.—*Why can signals still be received when the aerial and earth connections to the set are reversed?—C. W.* (*Wigan*).

A.—The function of these connections is merely to transfer the voltage variations set up by the signals across the tuning coil to the grid and filament of the first valve. This they will do even if the connections mentioned are reversed. However, best results should always be obtained with these leads connected up in the orthodox manner, as if they are reversed the batteries and phones will act as a capacity to earth in parallel with the tuning coil and help to by-pass some of the H.F. energy.—J. F. J.

Earpiece as Microphone

Q.—*How is it that an ordinary telephone earpiece can be used as a microphone?—K. A. D.* (*Glam.*).

A.—The function of a microphone is to turn the energy of sound-waves into impulses of electric current. When a telephone earpiece is used as a microphone it is really acting as a kind of dynamo. The windings are placed over two pole-pieces which are bridged at one end by a permanent magnet. The field of this magnet passes through the pole-pieces and through the diaphragm. It should be observed that the magnetic circuit contains two air-gaps between each of the pole-pieces and the diaphragm, and the strength of the magnetic flux depends upon the length of these gaps. When sound-waves cause the diaphragm to vibrate it approaches and recedes from the pole-pieces, thus varying the length of the air-gaps. The intensity of the magnetic field therefore varies and induced currents flow through the windings which correspond to the sound-waves reaching the diaphragm. Unlike the carbon microphone, a telephone earpiece does not require a local battery when acting as a microphone.—J. F. J.

"A.W." TESTS OF APPARATUS

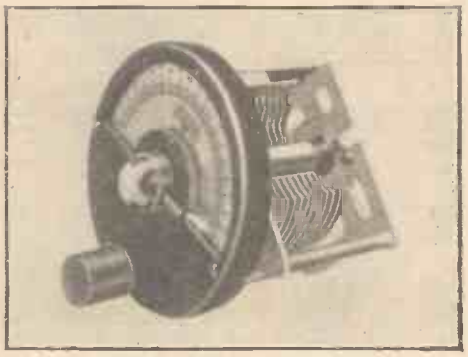
Conducted in the "Amateur Wireless" Research and Test Department

Cleartron Dikast Condenser

CLEARTRON Dikast variable condensers are manufactured under direct licence from the Western Electric Co., of London, under the registered design of S. A. Lamplugh, of Birmingham. This condenser is a distinct innovation in condenser design in that both sets of moving and fixed plates are die-cast—that is, each set of plates is cast in one solid piece of metal—thus entirely eliminating the H.F. resistance losses that occur between each plate and the spacing washer.

Other more usual low-loss features are to be seen in the skeletonised metal frame to which the moving plates are connected by a flexible pigtail and the small amount of insulation used to support the fixed vanes. The vanes are so shaped as to give even wavelength spacing over the dial.

Perhaps the only point that could with advantage be improved is the method of mounting the instrument on a panel. Apart from the fact that three holes are



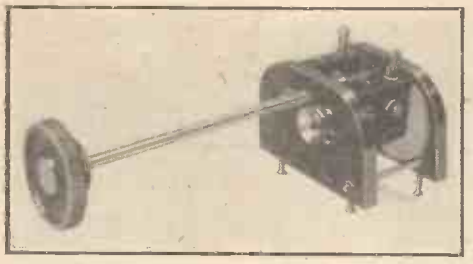
Cleartron Dikast Condenser.

required for fixing the condenser and two more for the dial—five holes in all—it is no easy matter to engage the two fixing screws with the special nuts. This is a small point, and, of course, has no bearing on the actual efficiency of the condenser, which is exceptionally good.

On test we found the actual minimum capacity of a .0005-microfarad (rated) model to be less than .000012-microfarad—a very low figure. The dial gives a beautifully smooth action and possesses a friction drive the gearing of which is not too low nor too high. The address of the manufacturers is 1, Charing Cross Road, London, W.

Penton Coil Holder

THE Penton two-way coil holder, made by Penton Engineering Co., of 15, Cromer St., London, W.C.1, posseses some points worthy of note. The type-A geared coil holder, as illustrated, has an adjustable interlocking metal-to-metal reduction gear giving a ratio of 8 to 1. Backlash, which is usually so prevalent in metal-geared devices, is practically eliminated by an adjustable bearing which pushes one of the tapered gear wheels into mesh. Any wear in the gear mechanism can be taken up by



Penton Coil Holder.

a readjustment of this bearing. Another feature is the locking device fixed to the moving socket which regulates the friction acting on the moving socket, thereby preventing the latter from falling when a heavy coil is inserted. A long control arm is provided.

Etherplus Valve Holder

THE accompanying photograph illustrates an Etherplus anti-vibratory valve holder which was submitted to us by M. and A. Wolff, of 9 to 15, Whitecross Street, London, E.C.1. This valve holder is made in two parts, an outer moulding which is screwed down to the baseboard

Etherplus Valve Holder.

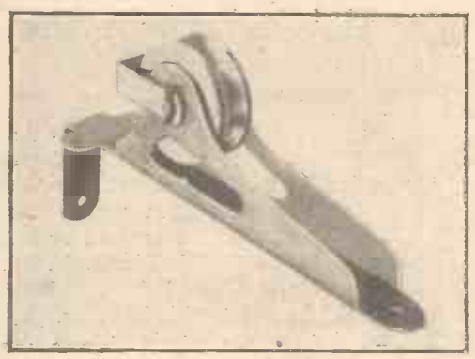
and which carries the four terminals, and the actual valve sockets mounted on a disc of what is claimed to be non-deteriorating pliable rubber. Connections to the four valve sockets mounted on the rubber disc are effected by four resilient strips of brass which are bolted to the terminals on the rigid moulding. These strips, besides making contact with the valve sockets, also serve the purpose of giving a "floating" support to the rubber disc.

Any mechanical vibration or shock is absorbed by the floating rubber disc and prevented from reaching the valve inserted in the sockets. In this respect the valve holder is very efficient, and the sockets being free to move from their normal positions if necessary, very effectively take up any irregularity in the spacing of the valve pins.

We would suggest, however, that either the brass strips be made of softer material or else some stop be provided to prevent the disc being pressed out of position so far that the brass strips cannot snap in the case of unduly rough treatment. The component is beautifully finished and has a low self-capacity.

Novel Aerial Pulley

THE Collett self-hoisting aerial pulley, manufactured by the S. H. Collett Manufacturing Co., of 52 to 54, Hampstead Rd., London, N.W.1., consists of a brass pulley having two grooves in the sheave mounted



Collett Aerial Pulley.

in a special tackle which is screwed to the top of the aerial mast. With the pulley is provided 30 ft. of endless halyard which runs in the smaller groove and enables the aerial to be erected in a few minutes without lowering the mast. The aerial is attached to the endless halyard and hauled up, the halyard being passed over the larger groove. A metal guard is fitted over the pulley to prevent the halyards from slipping off.

In this manner a broken aerial may be repaired and re-hoisted in a very short time without the necessity of lowering the mast.

The attachment is made of brass which is tinned to resist climatic conditions.

The pulley is attached to the side of the aerial mast by the right-angled bracket, one limb of which passes over and is screwed to the flat top of the mast. In this respect we recommend the use of large wood screws or, where possible, bolts, for the aerial exerts a considerable strain on the pulley.

"TRIGGER" AM

A System giving Rem... Great ...

THE history of broadcasting has been marked by several distinct phases. In the early days it was the aim of every experimenter to make his set give as much volume as possible, with, unfortunately, little regard for the quality of the reproduction. Then followed the craze for distance, to be followed in its turn by the two present idols, selectivity and purity of reproduction. It is with the latter that this article is mainly concerned.

Low-frequency Distortion

It is generally recognised that it is not a very difficult matter to design a high-frequency amplifier which will work well without introducing distortion, but when we come to the detector and low-frequency amplifier the problem becomes very much more difficult. The leaky-grid detector and transformer-coupled low-frequency amplifiers, even when the greatest possible care is taken to avoid interaction and self-capacity, are really not satisfactory when a large degree of amplification is desired, such as one requires for public demonstrations. The crystal detector and resistance-capacity coupled amplifiers will, if properly designed and suitably operated, give a very good distortionless amplification, but this method suffers from the disadvantages that at least three stages of amplification are required and also that most people prefer to eliminate the crystal.

Volume with Purity

The method known as "Trigger Amplification" combines a very high degree of amplification with a purity of reproduction hitherto unequalled. The main principles of this new method are covered by several patents, due to G. W. Pierce, E. W. B. Gill and Major C. E. Prince. These circuits will be dealt with in order.

Fig. 1 shows the original Pierce circuit. The input is of high frequency, either from the aerial circuit or from a previous high-frequency amplifier. The detector valve V1 is coupled to the valve V2 by means of a battery B1, the positive being connected to the plate of the detector and the negative to the grid of V2. The plate V2 is connected through the phones to the ordinary high-tension battery. It will be noticed that if the valve V1 is in a non-conductive condition, then the grid of V2 is at approximately zero potential; but if V1 becomes conductive then the grid of V2 will have a fairly high negative potential applied to it. Hence it will be seen that incoming signals, by varying the conductivity of V1, will cause large differences of potential to be applied to the grid of V2.

The Gill Circuit

The circuit due to Gill is shown in Fig. 2.

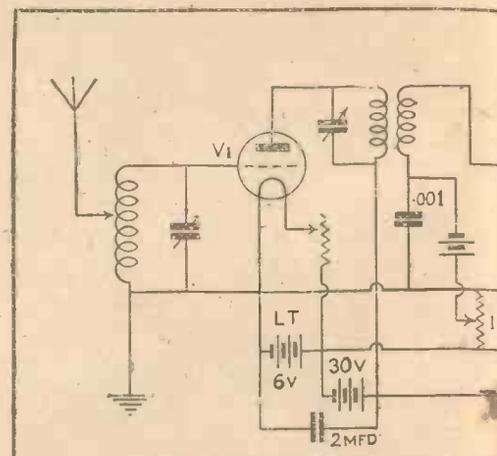


Fig. 6.—Experimental Circuit Incor...

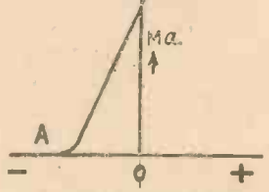


Fig. 4.—Curve showing Working Point of Valve V1.

Here the coupling battery has been omitted and a potentiometer is fitted to control the grid potential of V1. The action here is very similar, for as V1 becomes more conductive the grid of V2 will receive a negative charge and its plate current will be similarly reduced.

Trigger Action and Grid Control

Fig. 3 shows the circuit due to Major Prince. This combines the trigger action of Pierce's circuit with the grid control of Gill's circuit. The action of the circuit is as follows: By means of the battery B1 and the potentiometer, the amount of negative bias on the grid of the detector valve V1 can be varied. If this is made sufficiently negative to render the valve non-conductive, then the grid of V2 will be at some slightly negative and constant potential and the current in the plate circuit of V2 will have a definite value depending on the type of valve used and the high-tension voltage of the battery B3. That is to say, that the valve V1 is adjusted to the point A on its characteristic curve (see

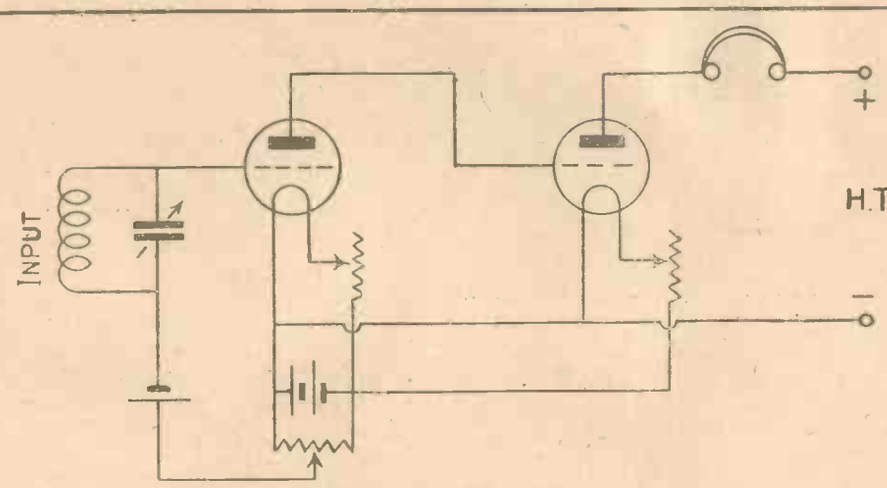


Fig. 2.—The Gill Circuit.

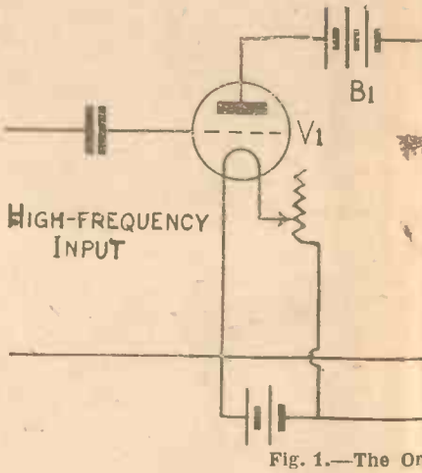
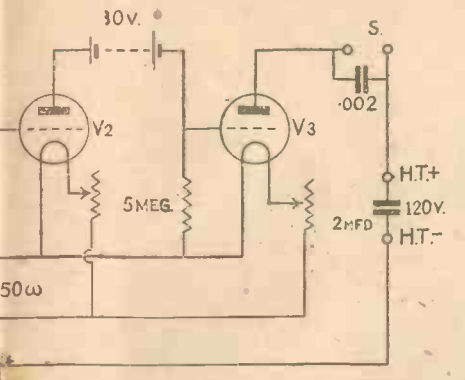


Fig. 1.—The Or...



porating "Trigger" Amplification.

MPLIFICATION

arkable Volume with Purity

enough to operate the trigger, can release an enormous amount of energy and cause a very large amplification.

Now this method can be applied to the audio-frequency amplification of telephony signals, and in particular to wireless work, in connection with the undistorted reception of broadcasting.

The "Trigger" in Practice

In applying this circuit in practice there are a number of important considerations. First of all with regard to the valves which are to be used. For the detector a valve with a very sharp bend at the bottom of its characteristic is required, and for this either a soft valve or one that has been specially designed for anode rectification

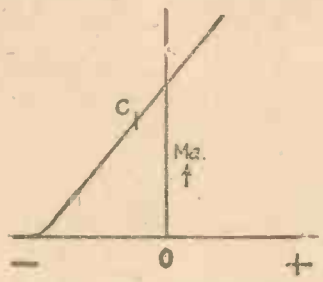


Fig. 5.—Curve showing Working Point of Valve V2.

Fig. 4) and the valve V2 is at the point C on its curve (see Fig. 5).

When an incoming signal reaches the grid of the detector, if it is sufficiently powerful it will make the valve conductive by reducing the negative grid bias. The effect of this is to place a large negative potential on the grid of V2 and the plate current of this valve will fall, any amount down to zero, depending on the size of the battery B2. This constitutes the so-called "trigger action" of the circuit, where the incoming signal, if it is just powerful

should be used. The amplifying valve should be a large power valve, with a long straight characteristic, and should be worked with not less than 120 volts H.T. To facilitate the escape of electrons from the grid of the second valve the grid leak is fitted, and this should be of a fairly low value. The intervalve battery should have a voltage of about 30 and should be variable.

The Intervalve Battery

One point of great importance with regard to this battery is that, owing to the unique position it fills in the circuit, it must be very carefully insulated from earth. The writer finds it best to insulate the battery carefully on an ebonite base and to make the connections as short as possible and avoid the proximity of other apparatus. Just as the trigger of a rifle requires a certain amount of force to operate it, so this amplifier requires distinctly strong original signals to make it function. For any but the local or high-power station it is necessary to use high-frequency amplifiers first, and a suitable circuit is shown in Fig. 2.

Operation

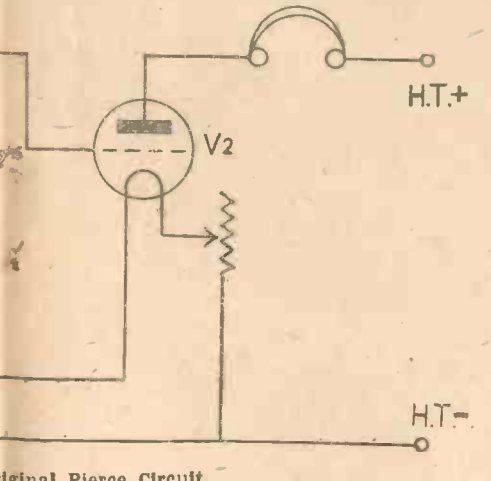
The circuit is a peculiar one to operate, as it will often appear quite dead, and will then suddenly commence working as the signal is tuned in sufficiently powerfully to operate the trigger, and then it will give an enormous degree of amplification, entirely free from distortion. It is hardly a circuit to recommend to the novice, but to the experimenter with a fair amount of experience it is really a circuit worth persevering with.

J. P. B.

A FEW PRACTICAL NOTES

A few practical hints concerning the components that should be employed in constructing a set built on the principles shown in Fig. 6 would be of some value. Of the three valves, V1 should be an Osram DE3B; V2, the detector, should, as indicated by the author, function as an anode rectifier, for which purpose an Osram DEQ is very suitable. Finally, for the amplifying valve V3, an Osram DE4 is recommended with 120 volts on the plate.

With regard to the inter-valve battery inserted between the plate and grid of the detector and L.F. amplifying valves respectively, it is most important that this be free from faulty cells.—"A.W." CONSTRUCTIONAL DEPT.



iginal Pierce Circuit.

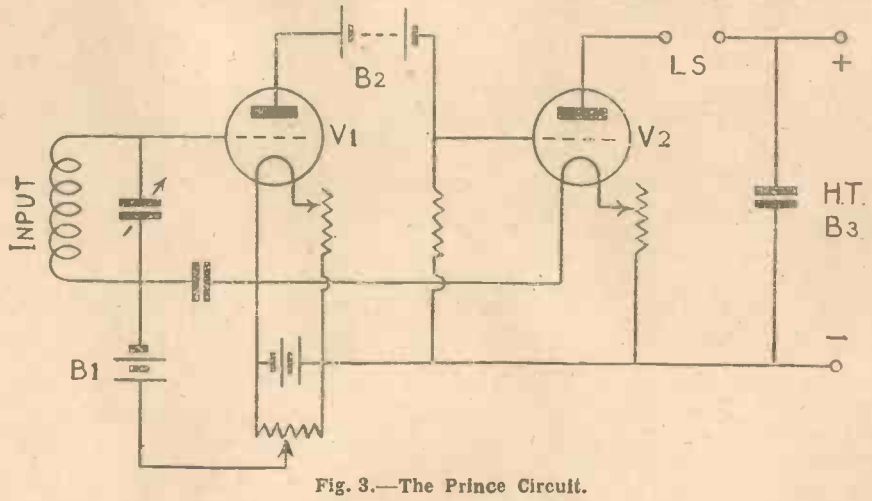


Fig. 3.—The Prince Circuit.

THE B.B.C. "editorials" are to be discontinued. The Postmaster-General states that he has been in communication with the B.B.C. regarding the wireless editorials, and the company has agreed to avoid broadcasting any matter which might be regarded as of a controversial character.

All the papers in New York published photographs of Coronach, the Derby winner, which were transmitted by wireless. The pictures arrived in record time, and the reproductions are excellent.

Low-frequency power-amplifiers have been used successfully to overcome the poor acoustic properties of Cologne Cathedral.

The Marconi Co. state that there is no truth in the report that technical difficulties have prevented the completion of the Australian-English beam wireless stations and that a radical modification of the original plans may be necessary. The delay in the completion of those stations has been caused by the difficulty in obtaining delivery of material from the contractors.

Seaforth Radio Club has written to the director of the Liverpool station thanking him for prompt steps taken, at the request of the club, to abate Morse interruption during the reading of the news bulletins.

A communication from the B.B.C., asking for the appointment of a representative to a religious advisory board being constituted for the purpose of advising the company on religious matters in general, is being considered by the General Assembly of the Free Church of Scotland in Edinburgh.

KDKA (Pittsburg) now possesses a music library said to be worth £1,000. It includes the scores for oratorios, grand and comic operas, chamber music, concertos, dance and classical selections, hymns and roundelays, and dirges.

The National Radio Exhibition is to be held in the New Hall, Olympia, from September 4 to 18. The whole of one side of the gallery is being reserved for the British Broadcasting Co., which is organising a striking display.

The Postmaster-General stated recently in Parliament that wireless licences now total 2,050,000.

The B.B.C. are arranging a special broadcast to celebrate Co-operators' Day on July 2; the programme will be relayed through all stations.

The British Broadcasting Co. now receives about 8,000 letters a week from listeners.

On Wednesday, June 16, the anniversary of the birth of Grieg in 1843, a special Grieg programme is being provided by the Glasgow station. Norwegian songs will be rendered by Johanne Larsen.

Rapid progress is being made in the equipment of Scottish hospitals with wireless. Recent installations have been made in institutions in Arbroath and Wemyss, the funds in both cases having been provided by subscription.

The strike interrupted the inauguration of a series of programmes from Glasgow dealing with incidents in the lives of famous Scots, and it has now been decided not to commence the series until the early autumn. There will be two Burns' programmes to start with, followed by James Hogg and Sir Walter Scott.

A recent effective musical programme at Glasgow was entitled "Dignity and Impudence." Light orchestral pieces and songs were sharply contrasted with some of the works of the great masters. A Scottish outdoor relay, which was also highly successful, took the form of a camp-fire sing-song on the banks of Loch Lomond.

The wireless club of Strassburg (Alsace-Lorraine) has installed a small telephony transmitter in that city; concerts, news bulletins and lectures are broadcast twice weekly between 9.15 and 11 p.m. on Tuesdays and Thursdays. The wavelength is 205 metres and power about 120 watts.

The Oslo station has been authorised to devote 15 per cent. of its daily transmissions to broadcast publicity upon payment from the interested parties.

Broadcasting has made but little progress in Lettland and Esthonia; in the former roughly 4,500 licences have been issued, in the latter barely 1,000. In Esthonia new taxes have been issued by which owners of crystal sets pay 7s. per annum and valve receivers for private use are subject to a tax of 20s. to 30s. yearly.

In order to effect repairs and alterations to the transmitting plant, CNRO (Ottawa) will be closed from June 16 to 30.

The General Electric Co. of America is considering the advisability of increasing the power of the WGY transmitter at Schenectady to 500 kilowatts.

The Magna Charta anniversary will be celebrated at Runnymede on June 20 by an open-air service at 3.15 p.m. on the actual spot where the barons met King John. An address will be given by Lord Hewart, Lord Chief Justice of England, and the ceremony will be relayed from the London station.

On July 17 excerpts from the concerts given at the Dome, Brighton, on the occasion of the musical festival will be relayed to some of the B.B.C. stations.

For the first time on June 19 an English cabaret will be broadcast from the Cavour Restaurant, in which several favourite radio "stars" will appear.

On June 26 Mr. R. E. Jeffreys is producing a new edition of the revue *Winners*.

The Königswusterhausen high-power station, apart from relaying the Berlin evening concerts, will in future take one programme weekly from each German main broadcasting station in turn.

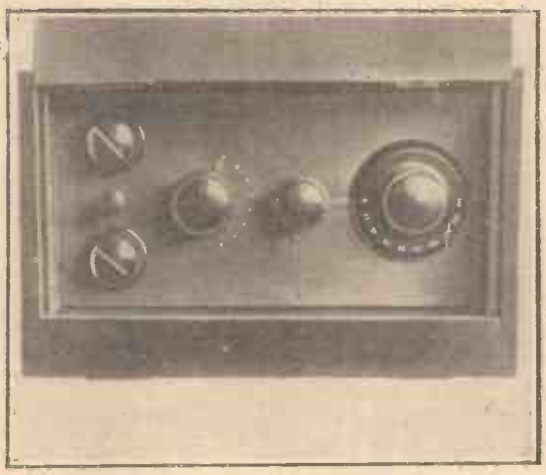
The Swedish Government has now passed the plans for a high-power broadcasting station to be erected in the neighbourhood of Motala, a little town situated on Lake Vetter, approximately 42 miles west of Norrkoeping on the Göta Canal. It is more than likely that the wavelength of 1,350 metres will be adopted, as it has been proved by the Karlsborg transmission that it is a particularly favourable one. The transmitting plant to be installed will possess a power of about 30 kilowatts.

The new Radiopolis wireless telegraphy station installed in the neighbourhood of Santa Cruz (Brazil) was formally opened recently.

The Nijni-Novgorod (Russia) Laboratory is making transmissions on wavelengths of 83, 102 and 104 metres.

The Belgian Government proposes to increase the wireless tax hitherto collected by the postal authorities from listeners, although in the proposal no mention is made regarding any subsidy to the broadcasting stations.

A SELF-CONTAINED TWO-VALVER
WITH HOME-MADE LOUD-SPEAKER.—II *(Conclusion)*



Photograph of Front of Receiver.

THE second stage of the wiring of the receiver is shown in Fig. 5.

The loud-speaker is of the pleated-paper diaphragm type, in which the magnetic system, consisting of Brown A-type earphone, is mounted in a corner of the frame, so that the adjustment can be made from the front. The vibrations of the reed are transmitted to the diaphragm by means of a lever. One end of the lever, which is pivoted in the middle, is fixed to the centre of the diaphragm, while the other is fixed to the vibrating reed. The two arms of the lever being unequal in length provide an appreciable increase in volume.

The attachment consists of a thick brass plate, to which is fixed the Brown A-type earphone. The lever is also attached to this plate, which as a whole is fitted to the frame of the loud-speaker. Fig. 8 shows the details of the brass plate B, which is 4 in. long, 2½ in. wide and $\frac{1}{16}$ in. thick, with a rectangular groove cut in one side for fixing the lever. The lever L is 7 in. long and $\frac{3}{64}$ in. thick, with a maximum width of ¼ in. and tapering near the ends. At one end is soldered a short length of 6 B.A. rod C, which passes through the centre of diaphragm, while the other end is formed into a loop to allow the threaded rod V, screwed in the vibrating reed, to pass through.

A small hole is drilled in the lever at a distance of 2⅝ in. from the centre of the loop. Through this hole is passed a short length of 6 B.A. rod R, clamped in position by two nuts N, one on each side of the lever. The projecting portions of the rod R are pointed at the ends, as shown in the enlarged view. The upper arm of the lever is bent in the shape shown in Fig. 8, in order to prevent it from touching the glass bulb of the valve. The distance between the centre of the loop hole and the centre of the 6 B.A. rod soldered at the other end of the lever should be 6½ in. As this distance should be exact, it will be advisable to solder the rod C after the lever has been bent and its lower end formed into a loop.

The Pivots

An L-shaped brass piece A, ½ in. wide and $\frac{1}{16}$ in. thick, is soldered to the brass plate (Fig. 8). A hole is next drilled in the centre of the vertical limb of this L-shaped piece and tapped 4 B.A. Opposite this piece is soldered another brass strip S, ½ in. wide and $\frac{3}{64}$ in. thick, bent into the shape shown in the diagram. A conical hole is drilled to half the thickness of this strip, and in line with the tapped hole in the brass piece A. Through the tapped hole passes a 4 B.A. screw T provided with a lock-nut M, so that it can be securely clamped in position. The inside end of this screw is filed flat, and a conical hole drilled in its centre.

The lever is now fixed in position. The pointed ends of the rod R fit into the two conical holes, which should be exactly opposite one another. The screw T is screwed in until the brass strip S, which also acts as a spring, presses firmly against the pointed rod, and is then clamped in position by the lock nut M.

The ebonite cap of the earphone E, after being filed flat on the top, is fixed to the brass plate by 6 B.A. screws and nuts, and as the central hole in the cap is not large enough for the threaded rod to pass through, it should be widened a little. The rest of the earpiece is then screwed in

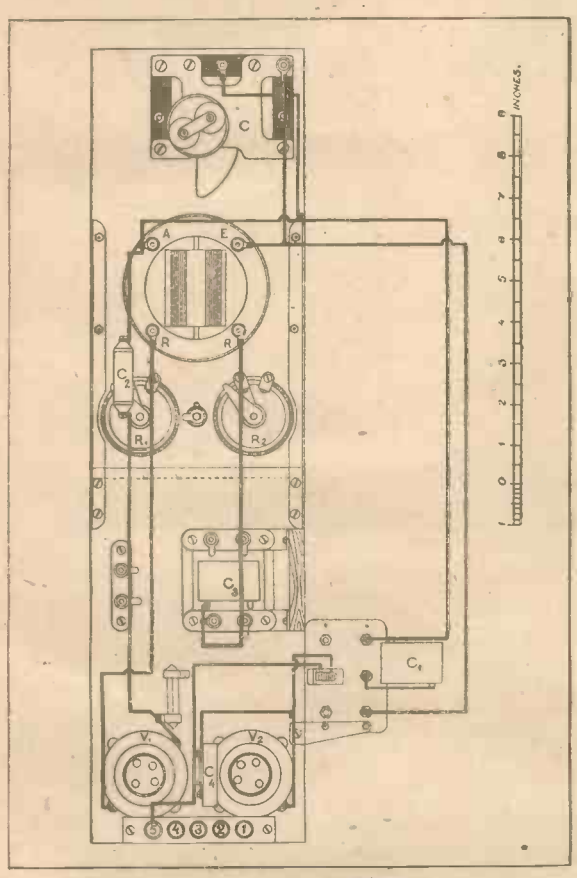


Fig. 5.—Diagram of Second Stage of Wiring.

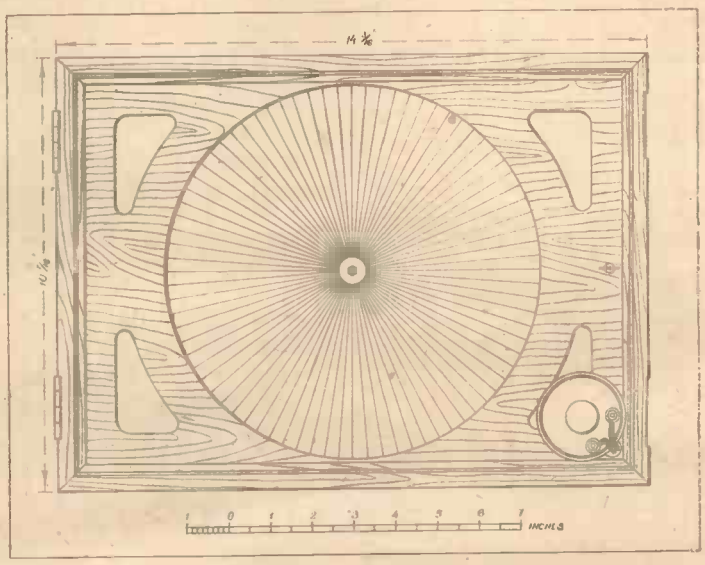


Fig. 6.—Loud-speaker Panel.

the cap, and locked in position by the set screw provided for the purpose. The 8 B.A. threaded rod V, one end of which is screwed in the vibrating reed, passes through the loophole in the lever arm, and is fixed to it by two small nuts. The projecting length of the rod is filed off.

frame of the loud-speaker. Two pieces of three-ply mahogany $\frac{3}{16}$ in. thick are screwed together, and the outline of the holes marked. A fretsaw is used for cutting these holes, which are finished with sandpaper, and the two boards are then parted to allow the diaphragm to be fitted.

As shown in Fig. 8, the brass plate B, to which are fixed the earphone and the lever, is separated from the back of the frame F by a rectangular piece of wood $\frac{3}{8}$ in. thick. This makes the earphone project less in front of the loud-speaker and saves space in the cabinet. Lastly,

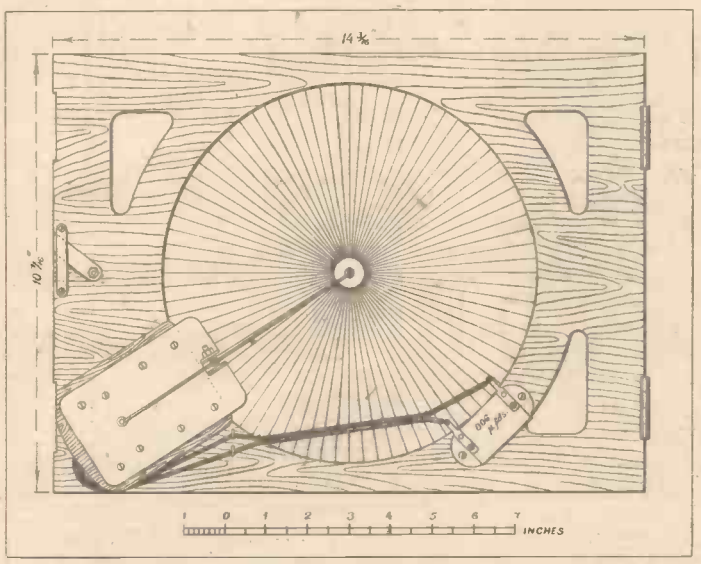


Fig. 7.—Back of Loud-speaker Panel.

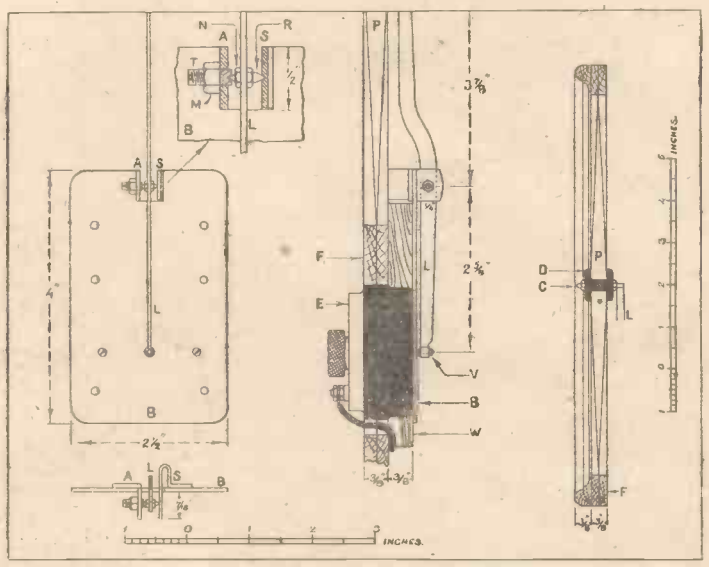


Fig. 8.—Details of Lever Arm, etc.

The attachment is fixed to the frame F by ordinary wood screws. An ebonite disc D, ¾ in. in diameter and ⅛ in. thick, is fixed on each side of the centre of the pleated diaphragm P, and secured in position by nuts, as shown in Fig. 8.

Figs. 6 and 7 show the details of the

The diaphragm is glued to the back board, covering the central hole, which is 9 in. in diameter. The edges of the corner holes are thinly coated with glue, and pieces of silk larger than the actual holes are stretched across them. The front board is then screwed in position.

the condenser C5, previously mentioned, is fixed at the back of the loud-speaker, and the wires from the terminals of the earphone are soldered to the tags of this condenser, the terminals of which are connected to the output terminals of the

(*Continued on page 854*)

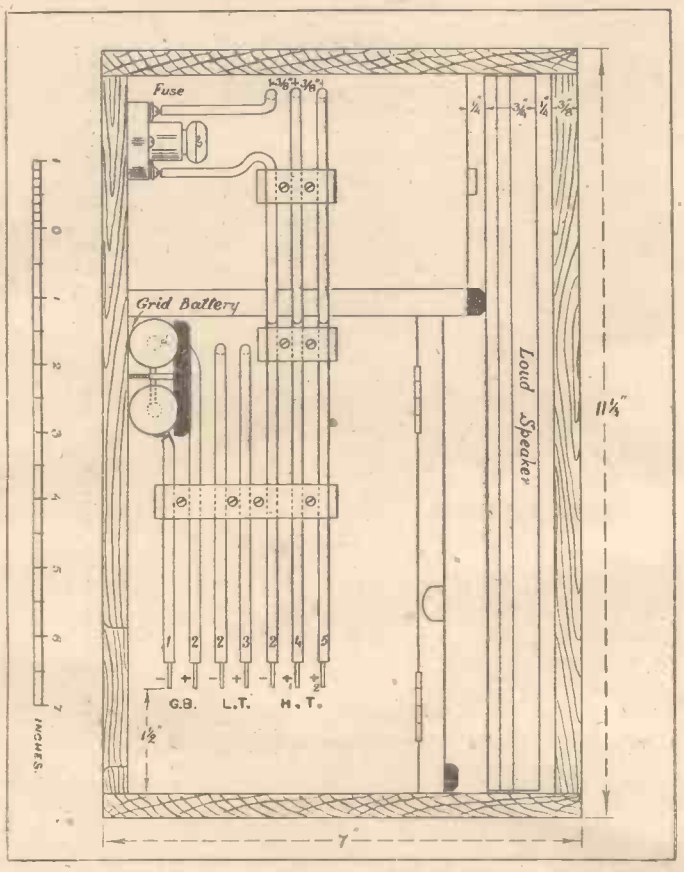


Fig. 9.—Section showing Construction of Cabinet.

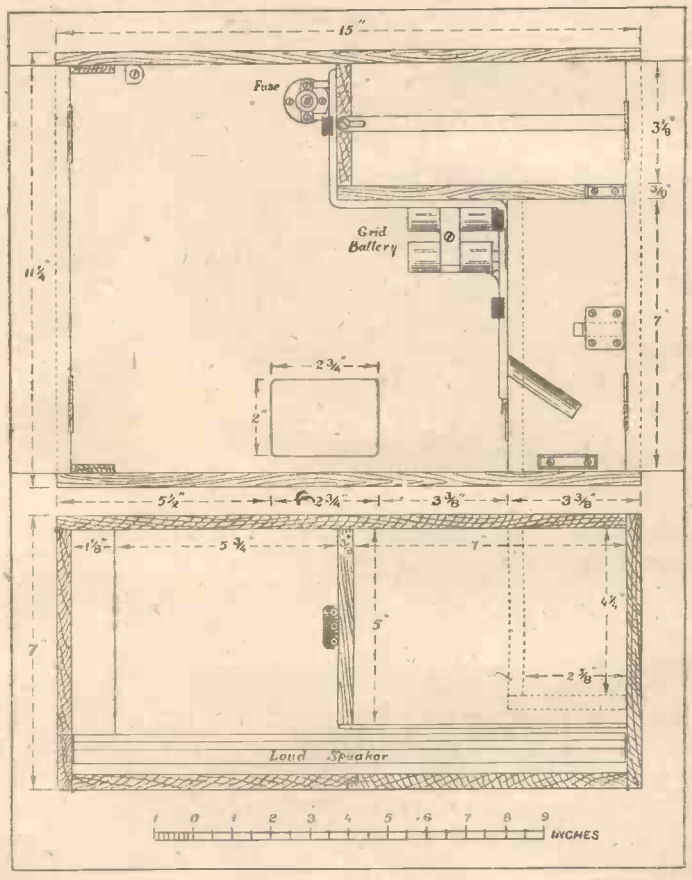


Fig. 10.—Elevation and Cross Section of Cabinet.

Doris Vane

NEXT WEEK AT 2LO

By "THE LISTENER"

IN THE PROGRAMMES

ON Sunday, June 20, the programme begins at 2.45 with a light orchestral concert conducted by John Ansell, who was connected for so long with the Alhambra, Winter Gardens Theatre and other great London places of entertainment. Few know also that he is a clever composer. The soloists are Ellis Burford (soprano) and Percy Heming, of *Lilac-Time* and operatic fame. At 3.15 there will be a relay from Runnymede of a service to commemorate the signing of Magna Carta, and an address is promised by the Lord Chief Justice. The light concert of the day will be carried out by Signor Emilio Colombo from the Hotel Victoria, with Silvio Sideli and Pauline Grey as vocalists.

On Monday there is the last of the chamber music concerts from the Chenil Galleries, Chelsea, the executants being the Virtuoso String Quartet, led by Marjorie Hayward, with Sidonie Goossens, harpist, and Dale Smith, vocalist. Much contrast will be provided by the Beethoven Quartet Op. 18 No. 2 and works of Eric Fogg. The latter includes his "Ode to a Nightingale," written for quartet, voice and harp. Later from the studio will be heard the Royal Tank Corps Band.

Two new-comers are promised for Tuesday's variety concert in the persons of Reg. Palmer, a patter comedian (not to be confused with "Uncle Rex"), and Mamie Watson, of syncopation fame. The classical element will be supplied later by the pianoforte duets of Isabel Gray and Claude Pollard.

"The Roosters" give a short programme on Wednesday evening, followed by a light symphony concert with the Wireless Orchestra, conducted by the noted violinist and leader of the London Symphony Orchestra, W. H. Reed. Doris Vane, one of the most popular of our early broadcasters and but recently returned from America, will be the vocalist.

The St. Hilda's Colliery Band will be heard on Thursday, followed by a play entitled *Remnant Acre*, by Dion Titheradge. The cast includes Phyllis Panting, Henry Oscar and Michael Hogan. The feature at ten o'clock is by Helen Henschel together with Mildred Dilling, a well-known harpist.

We are to be taken on a musical tour "Round the World" on Friday. At 9.40 we return to hear the Sea Shanties sung by members of the Seven Seas' Club at Anderton's Hotel. Act III of Massenet's opera *Manon* will be relayed from Covent Garden at 10.15 until 10.35, when Mabel France, one of the best-known lady entertainers, will give some of her character studies. Later we are to hear melodies played by Sidney Firman, who is a capable violinist.

On Saturday evening a new edition of *Winners* will be given, the cast including new-comers in Olive Groves, Harold Kimberley, Kepple and Handley, and Raymond Trafford.

The pianist of the week is Edward Isaacs, the Manchester artiste.

MELBA'S FAREWELL

ALMOST six years ago to the day, on June 5, 1920, to be exact, Dame Nellie Melba drove into the Marconi Works at Chelmsford, and that night those of us who possessed receiving apparatus listened to her by radio for the first time. We must eternally be grateful to Dame Nellie Melba. She, one of the greatest prima donnas of all time, certainly of living memory, has given a great deal of her time in furthering the cause of broadcasting, and since that first occasion a Melba broadcast has been an event in the lives of every listener.

And now we have heard her for the last time. On June 8, before the King and Queen and what must be the largest and most distinguished audience since the war, Dame Nellie Melba gave her last operatic performance. Wireless listeners did not hear that wonderful duet from Act II of *Romeo et Juliet*, nor were they "present" when she sang part of Act IV from *Otello*. She was superb in those; her voice, except for one or two top notes, still retained all that sweetness and effortlessness which is its charm, for Dame Melba sings with the ease with which most people speak.

Then, after the last two Acts of *La Bohème* came the end. What a pity that her vast unseen audience could not join in the mighty applause which followed. It was more than applause—it was homage. The Montmartre garret—the last scene from *La Bohème*—was literally full of flowers at the final raising of the curtain. One of the most impressive floral tributes took the form of a ship, a model in which the wireless aerial was not overlooked. After Lord Stanley of Alderley's speech, Dame Melba said: "It has been such a great, such a glorious evening, but how sad. . . . I have only one more word to say, 'Farewell' . . fare thee well."

Can there be a wireless listener who does not share her sadness at farewell? I think not.

R. B. H.

A NEW B.B.C. STATION

LISTENERS will be interested to hear that a new high-power broadcasting station is to be erected at Daventry, quite close to the present 5 X X. The new station, which is to operate on a short wavelength between 300 and 400 metres, will not supplant 5 X X, but is to be used with the object of obtaining data about the control of short-wave high-power stations. It is hoped that the experiments to be conducted at this new station will make crystal reception possible everywhere, and enable crystal-set users in populous districts to have a choice of programmes.

SAVOY CHAPEL

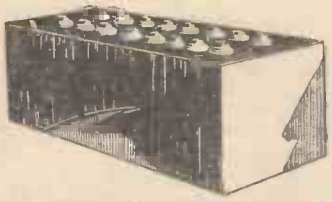
LISTENERS may have noticed that the broadcast service on June 6 was held in the Royal Chapel of Savoy. It would appear that it has long been felt that, beautiful as the studio services are, their value would be increased from the listener's point of view if it were known that the transmission emanated from a place of worship. The Savoy Chapel, overlooked as it is by the B.B.C. headquarters, is very convenient for the holding of these services.

This chapel is not the one connected with the Palace of Savoy, but is a subsequent structure. Its picturesque tombs were destroyed by fire, but the exterior, graced by a unique tower, is still a thing of beauty. In glaring contrast are the surrounding buildings.

From such a hallowed and beauteous church it is hoped to continue the wireless services. The present arrangements are in the nature of an experiment, and their continuance depends on the acoustic properties of the building.

R. G.

The Japanese Government proposes to erect a high-power station at Tokio.



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NOTE.—*In the following list of transmissions these abbreviations are observed: con. for concert; lec. for lecture; orch. for orchestral concert; irr. for irregular; m. for metres; and sig. for signal.*

GREAT BRITAIN

The times given are according to British Summer Time.

London (2LO), 364 m. 1-2 p.m., con.; 3.15-4 p.m., transmission to schools; 3.30-5.45, con. (Sun.); 4.15 p.m., con.; 5.15-5.55, children; 6 p.m., dance music; 7-8 p.m., time sig., news, music, talk; 8-10 p.m., music; 9.0, news (Sun.); 9.30 p.m., time sig., news, talk; 10 p.m., special feature (Mon., Wed., Fri.). Dance music nightly (exc. Fri.) until midnight.

Aberdeen (2BD), 495 m. **Belfast** (2BE), 440 m. **Birmingham** (5IT), 479 m. **Bournemouth** (6BM), 386 m. **Cardiff** (5WA), 353 m. **Glasgow** (5SC), 422 m. **Manchester** (2ZY), 378 m. **Newcastle** (5NO), 404 m. Much the same as London times.

Bradford (2LS), 310 m. **Dundee** (2DE), 315 m. **Edinburgh** (2EH), 328 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 321.5 m. **Liverpool** (6LV), 331 m. **Nottingham** (5NG), 326 m. **Plymouth** (5PY), 338 m. **Sheffield** (6FL), 301 m. **Stoke-on-Trent** (6ST), 306 m. **Swansea** (5SX), 482 m. **Daventry** (25 kw.), high-power station, 1,600 m. Special weather report 10.30 a.m. and 10.25 p.m. (weekdays), 9.10 p.m. (Sun.); 11.0 a.m., light music (exc. Sat. and Sun.); relays 2LO from 4 p.m. onwards, own con. on Mon. Dance music daily (exc. Sun.) till midnight; on first Friday in each month until 2 a.m.

IRISH FREE STATE.

Dublin (2RN), 397 m. Daily, 7.30 p.m. Sundays, 8.30 p.m. until 10.30 p.m.

CONTINENT

The Times are according to the Continental system; for example, 16.30 is 4.30 p.m., and 08.00 is 8 a.m. B.S.T.

AUSTRIA.

Vienna (Radio Wien), 582.5 m. and 531 m. (temp.) (10 kw.). 11.00, con. (almost daily); 15.30, con.; 19.25, news, weather, time sig.; con., lec., news; 20.00, con.; 22.00, dance (Wed., Sat.).

Graz, 402 m. (1 kw.). Relay from Vienna. Also own con. (Tues., Wed., Fri.), 20.10.

BELGIUM.

Antwerp, 265 m. (100 w.). Relays Brussels.

Brussels, 486 m. (1½ kw.). 17.00, orch. (Tues., Thurs., Sat. only), news; 20.00, lec., con., news (opera, Mon. and Wed.).

CZECHO-SLOVAKIA.

Prague, 372 m.(5 kw.). Con., 20.00-23.00, daily.

Brunn (OKB), 521 m. (2.4 kw.). 10.00, con., news (Sun.); 19.00, lec., con. or dance (daily).

DENMARK.

Copenhagen (Radioraadet), 347.5 m. (2 kw.). Sundays: 15.30, lec.; 17.30, children; 20.00, play; 21.15, news, con.; 21.15, news, Esperanto (Mon.), silent night. Weekdays (Tues., Fri., Sat.); 20.00, lec., con., news, con.; 21.30, dance (Sat.).

Ryvang, 1,150 m. (1 kw.). Sundays: 09.00, sacred service.

Odense, 810 m. Relays Copenhagen.

Sorö, 1,150 m. (1½ kw.). Relays Copenhagen.

FINLAND.

Helsingfors (Skyddskar), 504 m. (500 w.).

Helsingfors, 440 m. Con., 18.00 (Tues., Thurs., Sat., Sun.).

***Tamafors**, 368 m.

***Jyvaskyla**, 561 m. (200 w.).

***Uleaborg**, 233 m. (200 w.).

* Relay Helsingfors.

GRAND DUCHY OF LUXEMBURG.

Radio Luxemburg (LOAA), 1,200 m. Con.: 14.00 (Sun.), 21.00 (Thurs.).

FRANCE.

Eiffel Tower, 2,650 m. (5 kw.). 06.40, weather (exc. Sun.); 07.15, 08.00, physical exercises; 11.00, markets (exc. Sun. and Mon.); 11.20, time sig., weather; 15.00, 16.45, Stock Ex. (exc. Sun. and Mon.); 18.00, talk, con., news; 19.00 and 23.10, weather; 21.00, con. (daily).

Radio-Paris (CFR), 1,750 m. (about 3 kw.). Sundays: 12.45, con., news; 16.30, Stock Ex., con.; 20.15, news, con. or dance. Weekdays: 10.40, news; 12.30, con., markets, weather, news; 16.30, markets, con.; 20.15, news, con. or dance.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 458 m. (800 w.). 07.15, 08.00, physical exercises; 14.00 or 15.00, studio con. or otuside relay; 20.30, lec. (almost daily); 21.00, con. (daily).

Le Petit Parisien, 333 m. (1 kw.). 21.15, con. (Tues., Thurs., Sat., Sun.).

Radio L.L. (Paris), 350 m. (250 w.). Con. (Mon., Wed., Thurs.), 20.30.

Radio-Toulouse, 433 m. (2 kw.). 12.30, con., time sig. (daily); 17.30, news (exc. Sun.); 20.45, con.; 21.25, dance (daily).

Radio-Lyon, 280 m. (2 kw.). 20.20, con. (daily). Temporarily closed.

Radio Agen, 318 m. (250 w.). 12.40, weather, Stock Ex.; 20.00, weather, Stock Ex.; 20.30, con. (Tues., Fri.).

***Lyon-la-Doua**, 486 m. Own con., 20.00 (Mon., Wed., Sat.).

***Marseilles**, 351 m. (500 w.).

***Toulouse**, 280 m. (2 kw.).

***Bordeaux**, 411 m.

* Relays of PTT Paris.

Montpelier, 220 m. (1 kw.). Relays Radio Toulouse.

Angers (Radio Anjou), 300 m. (500 w.). Daily: 20.30, news, lec., con.

Bordeaux (Radio Sud-Ouest), 330 m. Con., 22.00 (Mon., Fri.).

Mont de Marsan, 390 m. (300 w.). Con. (weekdays only), 20.30.

GERMANY.

Berlin, on both 504 and 571.5 m. (4 kw.). 06.30, con. (Sun.); 09.00, sacred con. (Sun.); 11.00, con. and tests; 12.55, time sig., news, weather; 15.00, educ. hour (Sun.), markets, time sig.; 17.30, orch.; 20.30, con., weather, news, time sig., dance music until 24.00 (Sat., Sun., Thurs). Relayed on 1,300 m. by Königswusterhausen and Stettin (241 m.).

Königswusterhausen (LP), 1,300 m. (8 kw.). 11.30-12.50, relays Berlin (Sun.); 15.00, lec. (daily); 18.30, relay of Berlin (Vox Haus) con. (daily). 2,525 m. (5 kw.), Wolff's Buro Press Service: 06.45-20.10. 2,880 m., Telegraphen Union: 08.30-19.45, news. 4,000 m. (10 kw.), 07.00-21.00, news.

Breslau, 417 m. (4 kw.). 12.00, con. (daily), Divine service (Sun.); 12.55, time sig. (Sun.), weather, Stock Ex., news; 16.00, children (Sun.); 17.00, con.; 19.00, lec.; 20.30, con., weather, time sig., news, dance (relays Berlin). Relay: Gleiwitz, 251 m.

Frankfort-on-Main, 470 m. (1½ kw.). 08.00, sacred con. (Sun.); 11.55, time sig., news; 12.55, Nauen time sig.; 16.00, con. (Sun.); 16.30, con.; 18.00, markets, lec.; 20.00, lec., con., weather. Dance: relays Berlin. Relay: Cassel, 273.5 m.

Hamburg, 392 m. (4 kw.). Relayed by Bremen (277 m.), Hanover (297 m.), Kiel (233 m.) Sundays: 07.25, time sig., weather, news, lec.; 09.15, sacred con.; 13.15, con.; 18.00, con.; 19.15, sports, weather, con. or opera, dance. Weekdays: 05.45, time sig., weather; 07.00 and 07.30, news, weather; 12.55, Nauen time sig., news; 14.00, weather, con.; 16.15 and 18.00, con.; 19.00, lec.; 19.55, weather and con.; 22.00, dance (Sun., Thurs., Sat.).

Königsberg, 462 m. (1 kw.). 09.00, sacred con. (Sun.); 12.55, time sig., weather, news; 16.30, con.; 17.00, con. (Sun.); 19.30, lec.; 20.00, con. or opera, weather, news, dance (irr.).

Leipzig, 452 m. (700 w.). Relayed by Dresden (294 m.). 08.30, sacred con. (Sun.); 11.00, educ. hour (Sun.); 12.00, con. (daily); 12.55, Nauen time sig., news; 16.30, con., children (Wed.); 20.15, con. or opera, weather, news, cabaret or dance (not daily).

Munich, 488 m. (3 kw.). Relayed by Nuremberg (340 m.). 11.30, lec., con. (Sun.); 14.00, time sig., news, weather; 16.00, orch. (Sun.); 16.30, con. (weekdays); 18.30, con. (weekdays); 19.15, lec.; 19.30, con. (Sun.).

Munster, 412 m. (1 kw.). Relayed by Elberfeld (259 m.), Dortmund (283 m.). 11.45, radio talk, Divine service; 12.00, news (Sun.); 12.30, news (weekdays); 12.55, Nauen time sig.; 15.30, news, time sig.; 16.00, con.; 17.00, children (Sat.); 19.40, news, weather, time sig., lec., con.

Norddeich (KAV), 1,800 m. 24.00 and 04.00, weather and news.

Stuttgart, 446 m. (1½ kw.). 11.30, con. (Sun.); 16.30, con. (weekdays); 17.00, con. (Sun.); 18.30, time sig., news, lec., con. (daily); 21.15, time sig., late con. or cabaret.

HOLLAND.

Amsterdam (PCFF), 2,125 m. (1 kw.). Daily: 06.35-15.30 (exc. Mon. and Sat., when 12.30-13.30), news, Stock Ex.

Hilversum (HDO), 1,050 m. (5 kw.). 09.00, sacred service (Sun.); 19.10, con.; 21.00, news, etc. Testing on 25 kw.

HUNGARY.

Buda-Pesth (Csepel), 560 m. (2 kw.). 09.00, news; 12.00 and 15.00, weather, news; 17.00, dance music; 20.00, con. or opera, dance.

Kosice, 2,020 m. (2½ kw.). 19.00, con.

ICELAND.

Reykjavik, 327 m. (700 w.). Tests: 22.30, 24.30.

ITALY.

Rome (IRO), 424 m. (3 kw.). 10.30, sacred con.; 13.15, official communique; 17.00, children; 17.30, relay of orch. from Hotel di Russia; 17.55, news, Stock Ex., jazz band; 20.30, news, weather, con.; 22.15, late news.

Milan, 320 m. (2 kw.). 20.00-01.00, con., jazz band.

JUGO-SLAVIA.

Belgrade (Rakovitza) (HFF), 1,650 m. (2 kw.). 17.00, news (daily), con. (Tues., Thurs., Sat.).

Agram (Zagreb), 350 m. (500 w.).

LETTLAND.

Riga, 488 m. (2 kw.). Con. daily, 21.00-22.00.

NORWAY.

Oslo, 382 m. (1.2 kw.). 11.00, Divine service (Sun.), Stock Ex. (weekdays); 13.15, markets; 19.15, news, time, lec., con.; 22.00, time, weather, news, dance relayed from Hotel Bristol, Oslo (not daily).

Bergen, 358 m. (1½ kw.). 19.30, news, con., etc.

POLAND.

Warsaw, 480 m. (6 kw.). Daily: con., 11.00-13.00; 15.00-23.00, daily.

RUSSIA.

Moscow (RDW), 1,450 m. (12 kw.). Weekdays: 12.30 and 17.55, news and con.; 23.00, chimes from Kremlin.

(Popoff Station), 1,010 m. (2 kw.). 10.00, 11.00, lec.; 13.00, 19.00, con. (Tues., Thurs., Fri.).

Radio Peredacha, 410 m. (6 kw.).

Trades Union Council Station, 450 m. (2 kw.). 18.00, con. (Mon., Wed.).

Leningrad, 940 m. (2 kw.). Weekdays: 16.00.

Nijni Novgorod, 1,400 m. (1.2 kw.). 21.30, con.

SPAIN.

Madrid (EAJ6), 392 m. (1½ kw.). Daily: con. (times vary daily). Closes at 24.00 on Sun., Wed., Sat.

Madrid (EAJ7), 373 m. (4½ kw.). 17.30-24.00, con. (almost daily).

(*Concluded at foot of page* 852)

Testing Earth Systems

SIR,—May I make a few remarks regarding THERMION'S notes on "Testing Earth Systems" in "A.W.," No. 207?

The method suggested by him for comparing the earth resistances is fairly sound in itself; but when he accounts for the drop in anode current I think his explanation is wrong and misleading. He says, "The reason for the meter indicating a drop in the current flowing in the plate circuit is because the grid becomes slightly positive, thus blocking the flow of current between the anode and cathode of the valve." Does not the current flow from the filament to the plate? And is not the drop in current due to the grid becoming *negatively* charged?—F. P. (Haworth Brow).

The Right Transformer

SIR,—I read THERMION'S remarks on "Is it a Good Transformer?" in No. 207, and agree with him that the functioning of the transformer depends largely upon the conditions under which it is used, especially with regard to the impedance of the preceding valve.

Amateurs have become too accustomed to buying transformers by their step-ratio, and, of course, this method is ridiculous. We ought to buy them largely by the primary impedance, this being chosen to suit the impedance of the valve it is to be used with. For instance, if we use a DE5B type of valve the impedance of the transformer should be very high, whereas for a DE5 type the impedance may be lower.

I admit that the primary impedance should govern the step-up ratio; but, unfortunately, this is not always the case with cheap instruments. If the primary impedance is very high the step-up must be low, otherwise the self-capacity of the secondary winding would be so great as to ruin both the amplification and quality of reproduction.

May I suggest that makers state the primary impedance of their transformers as well as the type of valve for which they are designed. If this were done I am sure amateurs would obtain far more satisfaction from their amplifiers.—2 BJO (Keighley).

The Wet H.T. Battery

SIR,—Your notes regarding the practicability of using wet cells for high-tension supply are particularly interesting to me, as I have a battery of this type in use for my own four-valve set, and I am very pleased with the results.

A friend of mine has been using a 72-volt battery of this type for three years, during which time three cells only have had to be replaced, and the battery is still in perfect condition.

My own H.T. supply used to cose me about 50s. per annum, so profiting by my friend's experience I purchased six dozen Ediswan sac cells, type WL 102, at 7s. 6d. per dozen, which I soldered up in series, making in all a 108-volt battery; the first 7½ volts is used for grid bias, leaving 100 volts for the plate voltages.

For the accommodation of the battery I made a shallow wooden box 11 in. by 16½ in. by 3½ in. deep, and partitioned this off with strips of three-ply in the manner adopted in egg-boxes. There are seven partitions across and eleven down the length. Over the whole box I have fitted a sheet of $\frac{1}{16}$-in. thick ebonite, provided with wander-plug sockets. To these sockets I have taken tappings every 6 volts from 45 volts. Before screwing the ebonite top down I greased all the metallic parts, leads, cell tops, etc., with vaseline; inspection to-day shows no signs of creeping.

I have had this battery in use several months now, and it requires no attention at all except the replenishment of sal ammoniac every six months or so. It is very satisfactory in use, gives a good, steady current, and stands up well. An actual test showed only 6 volts drop after five hours' continuous working.—A. J. H. (Reading).

SIR,—May I, as one of the veriest novices in wireless, offer a little advice, because I always read "A.W.," and profit much by it?

You say the wet H.T. battery is probably a nuisance. Well, it isn't.

I took all the information from "A.W." and only made one alteration—that is, I used Bovril 4 oz. bottles as cells. These were chosen as they pack neatly, hold plenty of liquid, and there is very little of the surface of the liquid exposed to the air.

My 100-volt battery is rather large, but it has worked my four-valve set for the last three months without attention.—O. B. R. D. (Devonport).

Crystal Purity

SIR,—After considerable experiment I have come to the conclusion that the oft-quoted "crystal purity" is a fallacy, and that a crystal gives no better reproduction than does a detector valve worked under suitable conditions. When receiving from the local station the "purity" can always be apparently increased by detuning the set, and it is only the fact that crystal signals are weaker that gives rise to the quite undeserved reputation of the crystal. Just as a delapidated building may appear quite imposing when seen from such a distance that the cracks in its walls and other defects cannot be distinguished, so may distorted telephony be almost pleasing when the hoarse and discordant notes have been softened down by sufficiently reducing the strength of reception.—P. M. H. (Liverpool).

Other Correspondence Summarised

The Editor of the *Irish Radio Journal* states that he will be pleased to forward cards to Irish experimenters from amateurs in England and Scotland. Cards should be addressed to the Station, c/o *Irish Radio Journal*, 34, Dame Street, Dublin.

"BROADCAST TELEPHONY" (*cont. from page* 850)

Madrid (EAJ4), 340 m. (3 kw.). 16.00, con.

Barcelona (EAJ1), 324 m. (3 kw.). 17.00-21.00, news, lec., con. (Sun.); 18.00-23.00 (daily).

Barcelona (Radio Catalana) (EAJ13), 462 m. (3 kw.). 19.00-23.00, con., weather, news.

Bilbao (EAJ9), 415 m. (1 kw.). 19.00, news, weather, con. Close down 22.00.

Bilbao (Radio Vizcaya) (EAJ11), 418 m. (2 kw.). 22.00-24.00, con. (daily).

Cadiz (EAJ3), 360 m. (550 w.). 19.00-21.00, con., news. Tests daily (exc. Sun.), 24.00.

Cartagena (EAJ15), 335 m. 19.00-22.00, con. (daily).

Seville (EAJ5), 357 m. (1½ w.). 21.00, con., news, weather. Close down 23.00.

Seville (EAJ17), 300 m. 19.00-22.00, con. (daily).

San Sebastian (EAJ8), 346 m. (500 w.). 17.00-19.00, 21.00-23.00 (daily).

Salamanca (EAJ22), 405 m. (1 kw.). 17.00 and 21.00, con. (daily).

Saragossa, about 325 m. Testing.

SWEDEN.

Stockholm (SASA), 430 m. (1 kw.). 11.00, sacred service (Sun.); 12.30, weather; 14.00, con. (Sun.); 17.00, children (Sun.); 18.00, sacred service; 19.00, lec.; 21.15, news, con., weather. Dance (Wed., Sat.).

Relays.—Boden (SASE), 1,200 m.; Eskilstuna, 250 m.; Falun (SMZK), 370 m.; Gothenburg (SASB), 287 m.; Gefle, 325 m.; Helsingborg, 235 m.; Joenkoeping (SMZD), 265 m.; Kalmar, 253 m.; Karlsborg, 1,250 m.; Karlscrona (SMSM), 196 m.; Kristinehamm (SMTY), 202 m.; Karlstadt (SMXC), 221 m.; Linkoeping, 467 m.; Malmo (SASC), 270 m.; Norrkoeping (SMVV), 260 m.; Orebro, 218 m.; Ostersund, 720 m.; Säffle (SMTS), 245 m.; Sundsvall (SASD), 545 m.; Trollhattan (SMXQ), 322 m.; Umea, 215 m.; Varborg, 340 m.

SWITZERLAND.

Lausanne (HB2), 850 m. (1½ kw.) (temp.). 20.00, lec., con. (daily).

Zurich (Hongg), 515 m. (temp.) (500 w.). 11.00, con. (Sun.); 12.00, weather; 12.55, Nauen time sig., weather, news, Stock Ex.; 13.30, piano solo; 17.00, con. (exc. Sun.); 18.15, children, women; 19.00, news, weather; 20.15, lec., con., dance (Fri.).

Geneva (HB1), 760 m. (2 kw.). 20.15, con. (daily).

Berne, 435 m. 10.30, organ music (exc. Sat.); 16.00, 20.30, con.

Basle. Testing.

"A SELF-CONTAINED TWO-VALVER" (*continued from page 846*)

receiver by rubber-covered stranded copper wire, as shown in the photographs.

The Diaphragm

As it is essential to get the centre part of the pleated diaphragm absolutely flat, a ⅜-in. length of ebonite tube ¼ in. in diameter is put in the centre, after being liberally coated with Seccotine; the diaphragm is then held in position between two discs of thick cardboard about 2½ in. in diameter, and clamped by a long 6 B.A. screw with nuts passing through the ebonite tube. The cardboard discs are prevented from sticking to the diaphragm by placing discs of paper ¾ in. in diameter one on each side of the central ebonite tube. The diaphragm should be left for at least two days, by which time the Seccotine will be dry. It should then be mounted in the frame by using glue all round its edges.

Thin strong paper is found to give excellent reproduction. The paper should be cut 4½ in. wide and 29⅝ in. long, including the overlap at the ends. The pleats are ⅜ in. wide.

The Cabinet

The overall dimensions of the cabinet are 15 in. long, 11¼ in. high and 7 in. deep, the thickness of the wood being ⅜ in. throughout. The exact dimensions and working details are given in Figs. 9 and 10, which are drawn to scale.

The compartment for the high-tension battery is fitted with a thick strip of brass in front, so as to prevent the battery from falling on the loud-speaker.

Sixteen pocket-lamp batteries, connected in series by brass connectors, constitute the high-tension battery, giving 72 volts approximately. The batteries, which fit into a cardboard box, are separated from each other by waxed paper.

A door, which is always kept bolted, is fixed in front of the L.T. compartment in order to prevent the acid fumes from the accumulator coming in contact with the internal fittings of the set. The lever of the loud-speaker is prevented from touching this door by cutting in its front a groove ¼ in. deep (Fig. 10).

A 2-volt 30-ampere hour (actual) accumulator fits in this compartment and supplies the current to the valve filaments, the valves being of the A.R.D.E. type.

Rubber-covered stranded copper wire is used in the wiring of the cabinet. The wires are fixed in position by ebonite strips ½ in. wide and ¼ in. thick, with grooves cut in them for holding the wires. Amongst the other fittings of the cabinet are the high-tension fuse, consisting of a pocket-lamp bulb screwed into a holder, which is wired in series with the H.T. negative lead, and the grid-bias battery, consisting of two cells connected in series, which are taken out of an ordinary pocket-lamp battery (see Figs. 9 and 10).

Further constructional details will be apparent from the photographs and diagrams, which are drawn to the given scales. If any dimension is accurately needed, the distance to be measured is marked on the edge of a strip of paper, which is then placed along the scale given under the diagram, and the required length read between the two marks.

Assembling

The panel and the baseboard are inserted inside the cabinet by opening its front doors and the loud-speaker, and fixed in position by ordinary screws. The ends of the wires coming from the batteries are then connected to their respective terminals, as shown in Figs. 4 and 9, H.T. –, L.T. – and G.B. + being all connected to the second terminal.

In connecting the free ends of the wires to the H.T. battery care should be taken to tap the battery for the detector valve at a suitable point, which can be determined by experiment. H.T.2 +, which goes to the second valve, should be connected to the last positive terminal.

Tuning

Fig. 2 shows the plan of the panel, C being the condenser knob, R the knob for reaction adjustment, while R1 and R2 are the rheostats controlling the first and second valve respectively. S is the switch for controlling the L.T. supply to the valve filaments, and T is the tapping switch for the aerial inductance.

The aerial is connected to the terminal

(*Concluded in second column on page 856*)

"A SELF-CONTAINED TWO-VALVER" (*continued from page 854*)

A2, but if constant aerial tuning is desired it should be connected to A1. To use the receiver, connect the earth lead to the receiver, light the filaments of the valves by pressing in the switch S, regulating them afterwards by the rheostats. Signals are then tuned in by placing the tapping switch of the tuner on the first stud and turning the condenser dial slowly and completely round. This is repeated for different positions of the switch until the desired station is tuned in. The reaction knob, which is previously set in the centre, is then slowly moved on one side until the signals become sufficiently strong. This is followed by a finer adjustment of the condenser. If, however, the signals become weaker by moving the reaction coil, it should be moved in the opposite direction, when an increase in signal strength will result.

At approximately four miles from 2LO this station is received on the loud-speaker with ample volume and exceptionally pure reproduction. Daventry comes in with slightly less strength than London. Several other B.B.C. and Continental stations can be tuned in on the phones. M. J. C.

CHIEF EVENTS OF THE WEEK

SUNDAY, JUNE 20

London	Shakespeare's Heroines.
Birmingham	Classical Programme.
Bournemouth	Popular Symphony Concert.
Cardiff	Light Classical Programme.
Glasgow	Symphony Concert.
Manchester	Radio Star Concert.
Newcastle	Popular Orchestral Concert.

MONDAY

London	Chamber Concert.
Aberdeen	"A Gather Round."
Birmingham	Fantasia on the T.T. Races.
Bournemouth	*Memories.*
Belfast	The Belfast Radio Players.
Glasgow	Offenbach Programme.

TUESDAY

London	Variety and Folk Songs.
Aberdeen	Ballad Concert.
Birmingham	Mystery Request Items.
Bournemouth	Poetry Reading.
Belfast	In Lighter Vein.
Cardiff	Light and Shade.
Glasgow	Wingate Temperance Band.
Manchester	Haworth Public Prize Band.

WEDNESDAY

London	"The Roosters."
Birmingham	String Orchestral Concert.
Bournemouth	Popular Programme.
Belfast	*Remnant Acre.*
Cardiff	Musical Comedy.
Edinburgh	Instrumental and Vocal Programme.
Manchester	Music and Farce.
Newcastle	Reminiscences of Opera.
Nottingham	A Midsummer Eve Programme.
Plymouth	Midsummer Scenes.

THURSDAY

London	*Remnant Acre.*
Birmingham	Studio Community Singing.
Bournemouth	A Sussex Evening.
Glasgow	Symphony Concert.
Manchester	Light Symphony Concert.
Newcastle	A Midsummer Programme.

FRIDAY

London	*Manon* (Act III.).
Aberdeen	Ladies' Night.
Glasgow	Chamber Music.

SATURDAY

London	Revue Memories.
Birmingham & Newcastle	Lester's New Revue.
Swansea	Aberystwyth Musical Festival.

ADVERTISEMENT INSTRUCTIONS for "Amateur Wireless" are accepted up to first post on Thursday morning for following week's issue, providing space is available.

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Advertisements under this head are charged FOURPENCE PER WORD, minimum charge FOUR SHILLINGS.

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As the Publishers cannot accept responsibility for the bona fides of Advertisers in this publication they have introduced a system of deposit which it is recommended should be adopted by readers when dealing with persons with whom they are unacquainted. It is here explained.

Intending purchasers should forward to the Publishers the amount of the purchase money of the article advertised. This will be acknowledged to both the Depositor and the Vendor, whose names and addresses must necessarily be given. The Deposit is retained until advice is received of the completion of the purchase, or of the article having been returned to and accepted by the Vendor. In addition to the amount of the Deposit, a Fee of 6d. for sums of £1 and under, and 1s. for amounts in excess of £1, to cover postage, etc., must be remitted at the same time. In cases of persons not resident within the United Kingdom, double fees are charged.

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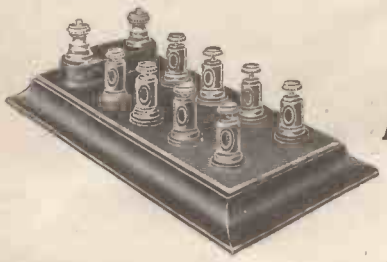

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12/6

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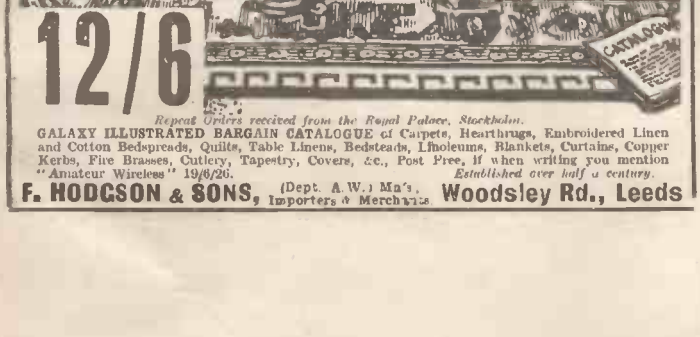
Mr. W. L. Stanton writes—"Send me one of your Prudential Brusselette Carpets and Rug. I was interested to see that one of your customers stated she had a carpet from you 19 years ago that was not worn out. You can also state that I have now in my bedroom one in fairly good condition which I bought at your place well over twenty years ago."



12/6

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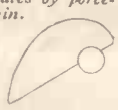
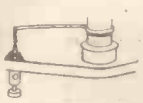


Rotor vanes of decrement shape



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ENTER FOR THE INTERNATIONAL SET COMPETITION *(See p. 861)*

THE TRUTH ABOUT LOW-LOSS COILS

Amateur Wireless And Electrics

Vol. VIII. No. 211 SATURDAY, JUNE 26, 1926 Price 3d

PRINCIPAL CONTENTS

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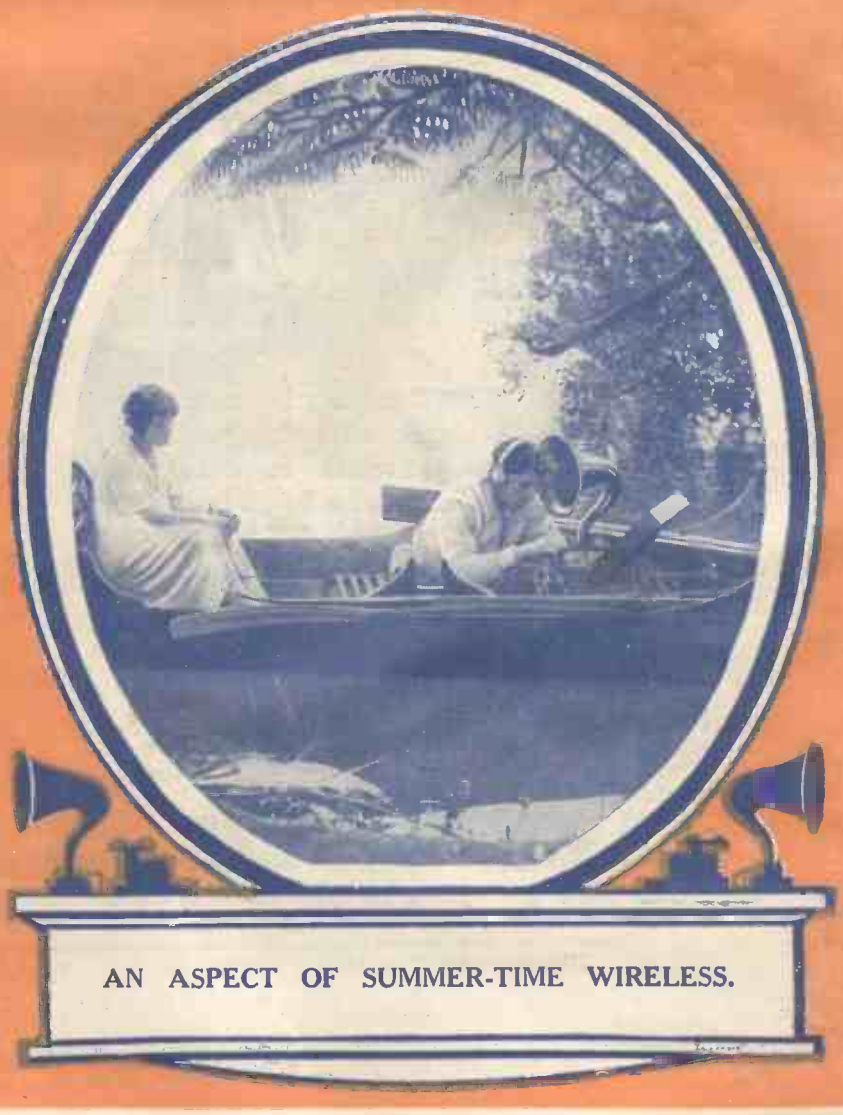

AN ASPECT OF SUMMER-TIME WIRELESS.

Amateur Wireless and Electrics

The Leading Radio Weekly for the Constructor, Listener and Experimenter

Edited by BERNARD E. JONES

Vol. VIII. No. 211 — Technical Adviser: SYDNEY BRYDON, D.Sc., M.I.E.E. — JUNE 26, 1926

Chief Contents

"Amateur Wireless and Electrics." Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. Post free to any part of the world: 3 months, 4s. 6d.; 6 months, 8s. 9d.; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to the Proprietors, Cassell and Co., Ltd.

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Queries should be addressed to the Editor, and the conditions printed at the head of "Our Information Bureau" should be closely observed.

Communications should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," La Belle Sauvage, London, E.C.4.

WHICH WAY DOES YOUR AERIAL POINT?

Some Notes on Aerial Direction and Results

ALTHOUGH the directional effects of the average amateur aerial are not usually very marked, that is no reason why they should not be utilised to the best advantage. Of course it must be admitted that a choice of direction is not always possible, as it must often happen that a really good aerial can be erected only in one particular position. As, however, two or three positions will usually be available, a few words of advice on the subject may be of assistance in helping some people in making the final choice.

Directional Properties

In the great majority of cases the amateur uses the inverted L-type aerial, though sometimes the T aerial is employed. The "parrot-cage" aerial is non-directional, while the frame can be made directional to any desired point of the compass at will by merely rotating it on its axis.

The L- and T-type aerials derive their directional properties from the fact that the free ends of the wireless waves, in the upper atmosphere, travel with greater facility through the air than do the feet of the waves over the surface of the earth. Consequently at some distance from the transmitting station the upper parts of the waves are in advance of the feet of the same waves or, in other words, the waves have become bent into the shape of an inverted L.

Obviously the maximum results will be obtained when the shape of the aerial coincides exactly with the shape of the waves, and an inverted L aerial will receive best from a station situated in the opposite direction to that in which the free end points. Just as the tops of the waves become bent over in the direction of travel—that is, away from the transmitting station—so also should the free end of the aerial point away from the station it is desired to receive

We have been speaking of the inverted L-type aerial, but the same remarks apply to T-type aerials. This will be understood when it is pointed out that a T aerial is, to all intents and purposes, equivalent to two L aerials pointing in diametrically opposite directions and connected in parallel. While, however, the L aerial is decidedly directional in one direction only, the directional properties of the T aerial are not quite so strongly marked, but it is directional in two opposite directions.

It should be pointed out that the directional properties in either case become the more strongly marked as the proportion of the length of the horizontal portion to the down-lead is increased.

In most cases the direction in which the aerial may most advantageously be erected will now be clear. It is merely a question of deciding which station it is desired to receive with greatest signal strength and then of ascertaining the exact direction in which this station lies with regard to the location of the receiver.

Common sense should, however, be given full play when deciding how and where the aerial is to be erected. It would obviously be very unwise to erect a poor aerial with its free end pointing exactly in the direction of the desired station, when by slightly altering the line of the horizontal portion a very much better aerial would be possible. In fact it will usually pay to consider the questions of height and length first and the directional effects afterwards.

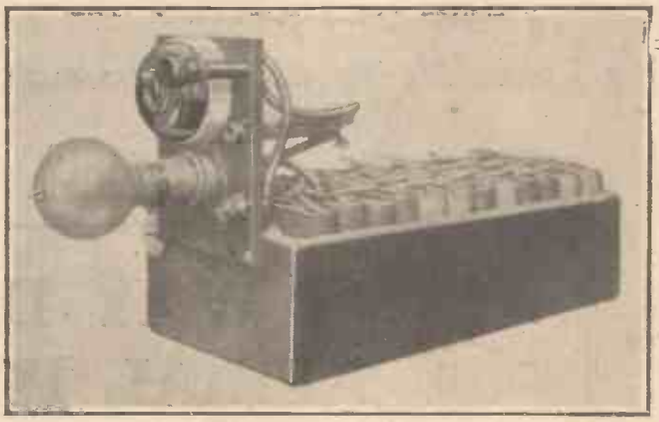
The Other Side of the Question

Although in most cases the directional properties (when they are considered at all) will be used to obtain maximum reception from a particular station, it may often be of great advantage to adopt the reverse procedure. Just as signals will be

(*Continued at foot of next page*)

DOES YOUR H.T. BATTERY LEAK?

Points Which Will Help You to Economise



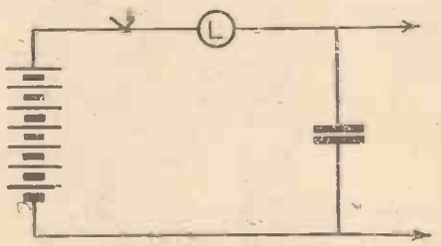
A Suggestion for an Efficient H.T. Unit.

THE amateur often finds that his high-tension battery runs down, even though it has had comparatively little use. Apart from the well-known fact that dry batteries deteriorate to some extent when placed "in stock," this may often be traced to leakage. It is fairly common practice to include a small electric lamp in series with one load of the high-tension battery, so that if a short circuit occurs in the set the lamp will light up and thus give a visible indication of the trouble. It is not, however, generally realised that the lamp will be a source of resistance if a set employing a number of valves is being used, and that the resistance of the lamp increases very rapidly with a slight increase of temperature caused by a flow of current. The result of this may cause howling in a similar manner to that experienced when the high-tension battery is running down.

The Use of a Condenser

To eliminate this it is necessary to put a condenser of about 2 microfarad capacity across the H.T. battery, as shown in the diagram, to pass the high-frequency currents. It is important that the position of this condenser should be as is shown in the diagram, and that it is not placed on the other side of the lamp. Another point is that the switch should be close to the battery, as leakage is often experienced in the condenser.

Now, although the lamp will give an indication of the existence of a short circuit it will not detect a small leak, as the resistance of the leak will be too high to pass sufficient current to cause the filament of the lamp to glow. It may be pointed out here that a small current of a quarter



Method of Checking Leakage.

to a half a milliampere will be sufficient to cut down the life of an H.T. battery considerably if it is flowing continuously.

Tracing Leakage

In order to check for leakage it is necessary to connect a low-reading milliammeter in series with one of the H.T. battery leads. When the set is in operation a deflection will be obtained on the meter, showing the current being drawn from the battery; but when the filaments are turned off the needle should drop back again to zero. If even a small deflection is noticed the source of leakage should be traced out, and in most cases it will be found in a small by-pass condenser or a holder, particularly when soldering flux has been allowed to run over the surface of the ebonite panel and has not been wiped off.

Using the Meter

It will be noticed in cases where a large condenser has been put across the H.T. battery that a momentary deflection will take place when the switch is first put on. This is caused by the charging current of the condenser, and must not be confused with leakage. It is not good practice to leave the meter in circuit permanently, as an accidental short circuit on the set may ruin it. A convenient method used by the writer is to employ a telephone plug and jack, and to solder the two inner "ringer circuit" connecting tags together. By this means the circuit is closed when the plug is not inserted, and the insertion of the plug puts the milliammeter in series with the battery. A neat battery box can be made up on these lines as shown in the photograph. A. H. H.

"WHICH WAY DOES YOUR AERIAL POINT?"

(*continued from preceding page*)

most readily received from a station when the free end of the aerial points away from it, so will a station be received with least effect when the free end of the aerial points directly towards it.

This fact is often of great advantage as an aid to cutting out the local station—the great problem which confronts nearly all owners of powerful valve sets. Such receivers may be relied upon to bring in the nearest station in whichever direction the aerial is pointing, but it will be easier to cut out this station if the aerial is directional away from it. Turning the aerial through 180 degrees may have the same effect as increasing the distance between transmitter and receiver by several miles. When erecting a T aerial with the object of reducing interference from the local station to the minimum, the horizontal portion of the aerial should, of course, be at right-angles to the direction of the station concerned.

While on the subject of directional effects, reference may be made to that most directional of all aerials—the frame. This aerial, like the T, is directional in two opposite directions at the same time, though for quite different reasons. When using a frame for direction-finding purposes it should, however, be remembered that the position of the frame for maximum results indicates only the direction of travel of the waves at the time they are reaching the frame. It may not show the true direction of the transmitting station, as the course of the waves may have been greatly diverted by the presence of large metallic objects lying between the transmitting and receiving stations. Gas pipes in the same room as the receiver have a distorting effect. J. F. W.

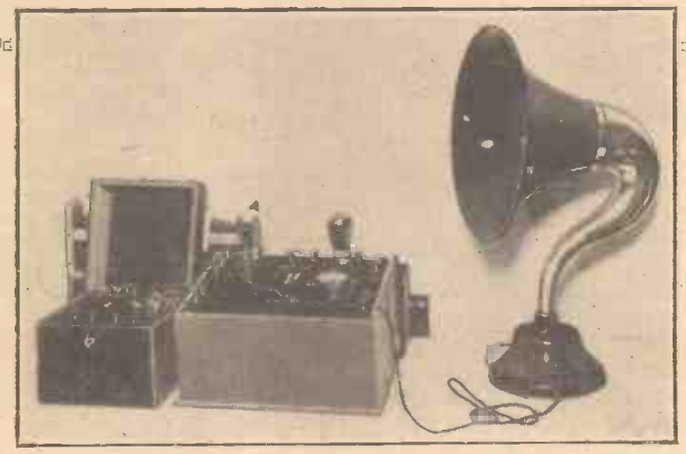
FRAME AERIAL HINTS

AT this time of the year frame aerials are in considerable demand, and a great many amateurs build one with a view to using a portable set during the summer months. No trouble should be experienced in the construction of such an aerial.

It is generally found best to use a large frame with only a few turns for short-wave reception, and for the long waves a small frame with a large number of turns. The square type of frame is the most suitable for broadcast reception, and to reduce capacity effects between the ground and the aerial it is always advisable to build the frame with one corner towards the ground. Although the size of wire to be used is not of great importance, low resistance should be aimed at, and nothing less than No. 22 S.W.G. employed. E.

MAKING A REAL POWER AMPLIFIER

The amplifier described in this article will be found of inestimable value for a variety of uses



Photograph of Amplifier Connected to Crystal Set.

THE power amplifier shown in the photograph was designed to step up the local broadcast transmissions after rectification by a crystal so as to obtain comfortable loud-speaker strength. In conjunction with a valve detector it is very suitable for L.S. reproduction out of doors or in medium-sized halls, the amplification being of excellent quality and strength.

Design

The transformers intended for use in a unit of this description must be chosen with due regard to the conditions under which they have to operate. The first transformer should have a low ratio and high impedance, as it is included in the crystal or plate circuit of the detector. The second transformer, which is connected in the anode circuit of the first valve (which has a moderately low impedance) can have a high step-up ratio.

Provision is made for the application of grid bias, and also for extra H.T. to the anode of the last valve should this be necessary. A switch enables one or two valves to be used, the act of switching out the second valve also cutting out the extra H.T. A closed-circuit jack is provided in the plate circuit of each valve so that the plate current and distortion can be checked up by the insertion of a milliammeter. This is a refinement which need not be included, but is of real value to the experimenter when different makes and types of valve are being tried out.

The names of the manufacturers of the components used in the original and the accessories used by the writer in the tests of this instrument are specified, though other makes could be used if preferred and allowance is made for any difference in size.

Components

Ebonite panel, 12 in. by 9 in. by $\frac{3}{16}$ in. (Radion); two C.C. jacks and one plug (ex-W.D. material); two intervalve transformers (British Thomson-Houston Co.), ratios 1-2 and 1-4; two Lissen Minor rheostats; one Utility D.P.D.T. switch; two anti-microphonic valve holders (Bowyer-Lowe); fourteen terminals; transfers; No. 16 gauge bare tinned-copper wire.

The panel is marked off and drilled according to Fig. 1. A drilling template is included in the valve-holder cartons and should be used for marking off the positions for these components. The plate of the switch is used as a template and the slot for the arm cut by drilling a series of $\frac{3}{8}$-in. holes and cutting between them with a sharp knife, after which the slot formed is smoothed up by the application of a small file and emery-cloth. The transfers are attached at this stage, after which the components are mounted in position.

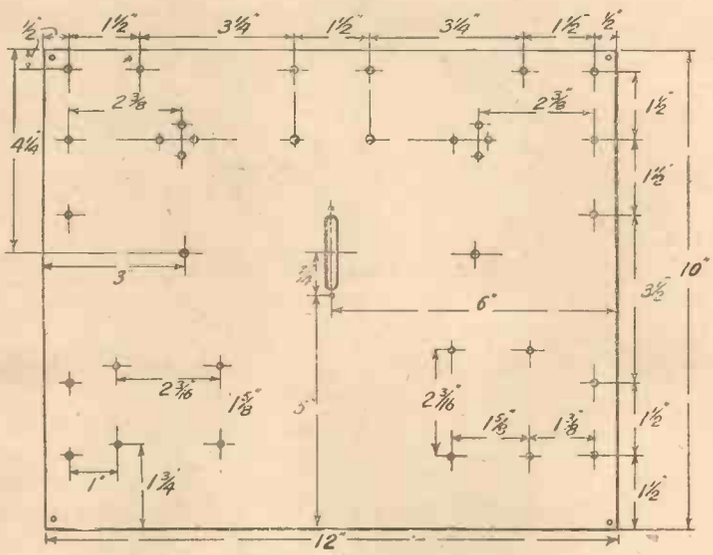
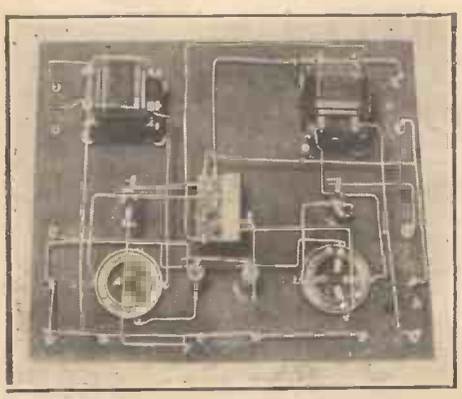


Fig. 1.—Layout of Panel.



Under Side of Panel showing Wiring.

Wiring

No. 16 bare tinned-copper wire is used throughout, all points of contact (with the exception of those to the transformers) being cleaned and tinned preparatory to soldering. Copper connectors are soldered to the transformer leads, these being attached to the instruments between the washers provided.

The circuit diagram is shown in Fig. 2 and should be carefully followed out. The second photograph shows an under-panel view of the completed wiring. In the case of B.T.H. transformers, the connections to the P and S terminals, as indicated in the diagram, are correct for this particular make of instrument.

Cabinet

The cabinet measures 12 in. by 10 in. by 6 in. internally, with a ¼-in. square fillet 5¾ in. long glued into each corner to support the panel, which is screwed down to them with four ½-in. fine wood screws. It can be stained and polished as desired.

Accessories

The valves used in the original were B.T.H. B4 type. The H.T. battery should be of generous capacity, as the plate current of these power valves is high. Where dry-cell batteries are used they should be shunted externally with the usual large-capacity fixed condensers.

Operation

The battery circuits being correctly connected, the detector output terminals are bridged over to the amplifier input. The filament rheostats are then carefully

(Concluded at foot of next page)

A NEW LOUD-SPEAKER DIAPHRAGM

Details of a Novel Construction Which You Can Try

AS a result of a series of experiments with loud-speakers Dr. Fisher, well known in French musical circles, has produced a new diaphragm, which the writer has tested and found to give infinitely better reproduction, together *with an increased sensitivity.*

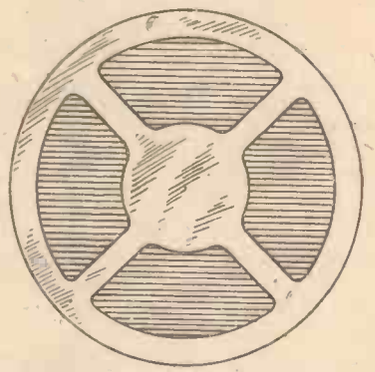
A Composite Diaphragm

With the usual all-metal diaphragm, which has been in use ever since loud-speakers were invented, there are stresses and strains set up under working conditions that may detract under certain conditions from faithful reproduction. By cutting away a certain amount of the metal diaphragm and pasting over the back a piece of parchment (cartridge paper will do), cut to the size of the diaphragm, results, in the writer's opinion, are very much improved. The composite diaphragm is naturally much thicker in certain parts than in others, as will be apparent from the photograph and sketch. On the proper dimensions and support of the centre circular portion of the metal diaphragm depends the tone of the loud-speaker. The greatest mass of metal being at the centre allows the latter to vibrate at the maximum amplitude.

If the diaphragm were composed solely of parchment it would be not only flexible, but would also be free from overtones. A magnetic substance as a part of the diaphragm is essential, and this at the same time reduces the "drumming" inherent in many paper-diaphragm loud-speakers. The resultant combination of the metal with the parchment diaphragm gives an

New Diaphragm Ready to be Fitted to Loud-speaker.

exceptionally fine tone to a loud-speaker and reproduces the lower notes of the musical scale excellently. Also owing to the reduced weight of the diaphragm considerably less energy is required to attract and repel it, and greatly increased sensitivity is thus obtained.



Details of Composite Diaphragm.

The flat metal diaphragm should be removed from the loud-speaker and the superfluous metal removed by making out the pattern (shown in the sketch) with a pair of steel compasses and a scriber. Small holes are drilled round the portions to be removed, so that the smallest amount of metal exists between one hole and its neighbours. By connecting the holes together with a saw or a chisel the pieces of metal may be removed. The diaphragm will now present the appearance of a cross inscribed in a ring of metal. Where the superfluous metal has been removed the ragged edges should be filed down with a half-round file. During these operations the diaphragm may become bent, in which case it must be carefully flattened, otherwise it may touch on the poles of the magnet. The diameter of the circular piece of metal should be a little less than a third of the total diameter.

A piece of parchment, cut in the form of a circle having the same diameter as the diaphragm, is then fixed to one side of the latter by shellac varnish and allowed to dry, when it may be replaced in the loud-speaker unit with the parchment surface upwards.

The idea is simple to carry out, and it will repay any trouble incurred. A. L. P.

"MAKING A REAL POWER AMPLIFIER" (*continued from preceding page*)

adjusted to pass the correct working potential for the valves in use. Adjustment of the H.T. and G.B. values can then be made to secure the best results from the speaker. When a crystal receiver is used for detection it may be found necessary to earth the L.T. negative, particularly if the leads to the speaker are of considerable length.

Results

In conjunction with a low-loss crystal receiver, the local transmission ten miles distant comes in with great volume and purity using two valves. The quality of reproduction is particularly pleasing, speech being very distinct. A test was conducted in a local cinema theatre to determine the value of the amplifier for clear reproduction over large areas. A temporory 30-ft. aerial was erected in the theatre 30 ft. above the floor and a valve was used for rectification, the only convenient earth being an electric conduit pipe. A B.T.H. C2 model loud-speaker was used in this test, and a 120-volt Oldham accumulator H.T. battery. With 110 volts on the first valve and 6 volts grid bias, the local transmission was pleasantly audible all over the theatre, but speech was rather indistinct due to the use of reaction coupling.

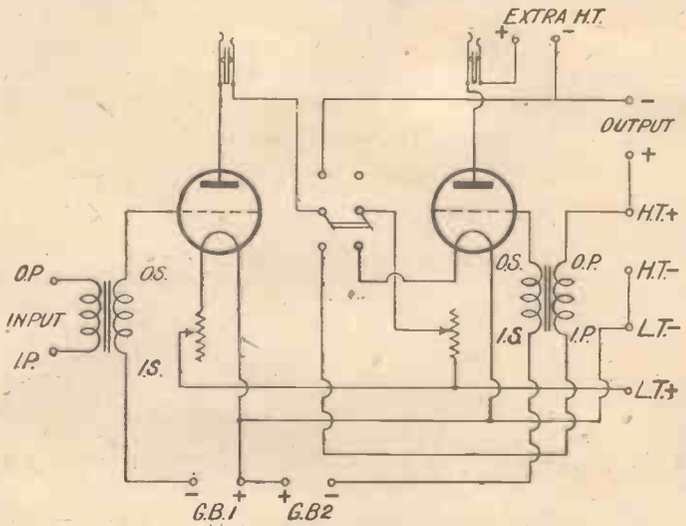


Fig. 2.—Circuit Diagram of Power Amplifier.

The second valve was switched in and the reaction dispensed with; with 120 volts on the last valve and 10 volts G.B., the milliammeter needle was perfectly steady and speech was quite clear and readable in any part of the auditorium. Music was reproduced with volume and clarity equal to that of the orchestra employed in the theatre.

The writer has no hesitation in stating that this amplifier will prove ideal for outdoor loud-speaker work in the garden or tennis court, where good-quality reproduction with volume is desired, and it is equally suitable for public entertainment in halls and concert rooms. W. A. A.

Memo. to the Reader: I have personally arranged with American authorities for amateur British-built sets to be sent over the Atlantic to compete against American sets.

THE EDITOR, *Amateur Wireless.*

The Editor to The Reader

A Great International Set Competition

When I was in America in April and May, a most interesting challenge was thrown out to me. I was discussing matters with the Secretary of the Radio Manufacturers' Show Association and we were commenting upon the essential differences between American and British sets. He suggested that the American public would like to see a number of representative British receivers, as to which there was much curiosity but little knowledge. Suddenly we alighted upon the idea that there might be very active support for an international competition in which American and most certainly British amateur set-builders would take part, and in which it was hoped that French and German constructors might also be represented.

The upshot was that I expressed my willingness to take the responsibility of organising a British Elimination Competition for the purpose of finding 25 sets to send to New York to represent this country, and I now have pleasure in inviting every skilled home-constructor to take part in such an Elimination Competition.

I want valve sets of every kind, as long as they are well-designed, well-made and representative of thoroughly up-to-date practice. I do not mind what the origin of the set is, whether the design first appeared in the pages of AMATEUR WIRELESS, WIRELESS MAGAZINE or any other periodical, or whether the design has never been published at all. That is quite immaterial. Certainly, I do want readers of this paper to support the competition in great strength, and I want the designs published in this paper and in the WIRELESS MAGAZINE to be well represented too. But I want *every* home-constructor who has produced a set of outstanding quality to enter it for the Elimination Competition.

WHERE AND WHEN

I wish to send the 25 sets to the United States during the first week of August, that is, in not more than five weeks' time. There is, therefore, not a moment to lose. I propose to hold the Elimination Competition just as quickly as it can be organised. I have had prepared a printed entrance form and set of rules (there is nothing irksome in the rules), and what I want qualified readers to do is to send me straightaway an application for the entrance form and rules. These I shall send in duplicate—one entrance form to be returned completed with as little delay as possible, and the other to be retained for the competitor's reference.

Not until I have received the completed entrance form shall I be in a position to send the necessary printed labels, inasmuch as before I can decide where the sets are to be sent I must first form some idea, however approximate, of the number of sets there will be.

I want all the sets entered for the Elimination Competition to be on public view for a short time.

I repeat then: Let the qualified reader write me immediately for entrance form and rules. In due course, I will send to him all the necessary information.

PRIZES

Twenty-five sets will be selected to go to the United States. The owner of each will be awarded by us a BRONZE MEDAL. The American organisers will distribute three prizes among the British Competitors, and in addition will award either

AN INTERNATIONAL CUP OR MEDAL

for the best amateur-built set exhibited, whether by American, British or other nationals.

Should the International Prize be awarded for a British-built set that has passed through our Elimination Competition and been sent by us to the United States, then, in addition to the International Prize, we ourselves will award

A GOLD MEDAL SPECIALLY STRUCK FOR THE PURPOSE

So you see that the prizes are worth having and anybody may be well proud of them. I have great hopes that my readers will seize upon this opportunity of taking part in the first international competition of this sort that has ever been organised.

The rules which will be sent to every applicant will be found to cover, it is hoped, almost every possible contingency, and in themselves they are simple and encouraging, but perhaps there are a few points upon which I may make a public note.

AMATEUR WIRELESS and the WIRELESS MAGAZINE are responsible for the Elimination Competition only. The American authorities are responsible for the organisation and judging of the International Competition in the U.S.A.

No wireless manufacturer or salesman, no employee of any wireless manufacturer or salesman, and no other member of the wireless industry may compete; neither may any employee of the proprietors of AMATEUR WIRELESS and the WIRELESS MAGAZINE.

Do not send me the set until the proper formalities have been complied with; in other words, first apply for the entrance form, upon receiving it complete it, return it to me and await the supply of labels which I will send you.

The 25 sets selected to go to the U.S.A. will be sent and returned free of all expense to the competitors and will be insured from the moment they leave London until they are returned to the competitors.

No crystal set is eligible.

Please post me immediately the application for entrance form and rules. Address your application to:

INTERNATIONAL COMPETITION,

THE EDITOR,
"Amateur Wireless,"
La Belle Sauvage,
Ludgate Hill, London, E.C.4.

THE IMPORTANCE OF THE GRID LEAK

BECAUSE it is the smallest of the components that go to make up a valve receiving set the importance of the part played by the grid leak is not always realised. Yet in many cases the shortcomings of a faulty receiving set are due to the use of an unsuitable grid leak.

IN whatever circuit it is used, the main function of the grid leak is to act as a stabiliser of the grid potential. If you will examine the diagram in Fig. 1, you will have little difficulty in seeing how it carries out its duty. Outside the valve we have a fixed resistance R1 in the shape of the grid leak. Within the valve there is a varying resistance R2 between the filament and the grid. If the grid is made

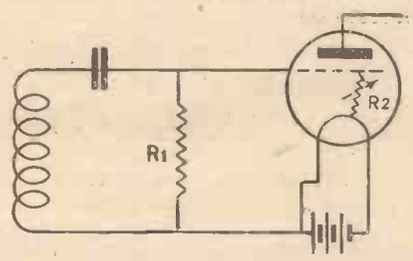


Fig. 1.—Diagram showing how the Grid Leak Functions.

strongly positive—remember that the terms positive and negative when used for the grid refer always to its potential with respect to the negative leg of the filament—the inside resistance is reduced and a flow of grid current takes place. By charging the grid negatively we can so increase the inside resistance that it becomes infinity and no flow of grid current occurs.

A Parallel

The circuit shown by Fig. 1 is exactly equivalent to that in Fig. 2, the point X representing the grid itself and Y the negative leg of the filament. If R1 is exactly equal to R2 and B is a 6-volt battery, then the voltage drop round the circuit will be 6 volts, one-half of which will take place across R1 and one-half across R2. In this case the point X, or the grid of the valve, will be 3 volts positive to Y, the negative filament leg. If R2 is reduced in value, then the positive potential of X will fall. On the other hand, as the value of R2 is increased, X will become more and more strongly positive.

When the set is switched on, and before tuning is done, the grid leak enables the grid of the valve to set itself at a certain definite potential. Now let us suppose that a signal is tuned in. The upper half of each wave brings a positive charge to the grid, thus reducing the grid-filament resistance. Hence the positive potential applied by the battery is reduced. Similarly when the next half wave brings a negative charge to the grid the inside resistance rises so that the positive battery potential is increased. The grid leak thus acts as a stabiliser of the grid potential.

So long as the resistance of the grid leak is definite and fixed, the valve will function properly, but should tiny variations occur, as they do in leaks of faulty design, the balance will be upset and parasitic noises will occur in the telephones. We see now how important it is that the grid leak should be of really good quality.

Fixed or Variable?

Some years ago, when practically the only valve used by amateurs was the R type of bright-emitter, the 2-megohm grid leak became almost a standard fitting. To-day, though the number of valves runs into scores and though their characteristics are widely different, the old 2-megohm tradition still persists, and at least ninety per cent. of the grid leaks in use are of this value, though the 2-megohm leak is by no means universally suitable. It will certainly give results with almost any kind of valve used as rectifier, but it may not give the best results.

Not a few amateurs who have experimented either with variable grid leaks or with fixed ones of different resistances have convinced themselves that altering the value of the grid leak makes, as a rule, no difference whatever to the performances of a receiving set. But most of those who are of this way of thinking go simply and solely upon signal strength. The fact is that, as a rule, the value of the grid leak makes very little difference to the strength of the signals received; it will be very much the same whether the leak used has a resistance of .5 megohm or 5 megohms. But if you will abandon the signal-strength test you will find by experiment that the value of the grid leak

Fig. 2.—The Circuit Equivalent of Fig. 1.

has a very great deal to do with two of the most important qualities of the receiving set—stability and selectivity. The smaller the value of the grid leak of a rectifying valve the higher will be the positive potential at which the grid sets itself, and the higher the potential the greater will the damping in the circuit be. Hence an unruly set can often be tamed by a change of grid leak.

Effect on Selectivity

To see the effect that grid-leak value has upon selectivity try the following experiment, using either a variable leak that really is variable (some of them become fixed owing to "packing" after a certain amount of use) or a set of fixed leaks of different values. Tune in a moderately strong signal, using first of all a leak of rather low resistance. Note carefully over how many degrees of your condenser dial settings it is audible. Next substitute a grid leak of higher resistance and see over what portion of the dial the signal is audible. As a rule selectivity will be found to improve considerably as the resistance is increased, though it must not be expected that an enormous improvement in this direction will take place in a receiving set that is naturally very unselective.

In sets containing two stages of H.F. amplification coupled by the tuned-anode method, the value of the grid-leak has an important bearing upon stability and selectivity. Greatly improved results can sometimes be obtained by using a condenser and a leak in the grid circuit of the first as well as that of the second H.F. valve. When a note magnifier is installed and prone to emit howls it may often be stabilised by wiring a grid leak between IS and the grid battery.

J. H. R.

Another great contribution to the Science of Radio by Cossor

Red Top :
For H.F. use.

Plain Top :
For Detector or L.F. use.

15/6
For 2-volt Accumulators.

The new Cossor Point One

—the ·1 amp. Valve which utilises Co-axial Mounting

Cossor Stentor Two
Power Valve
Consumption ·15 amp
18/6
For 2-volt Accumulators

IT was a flash of genius that enabled Simpson eighty years ago to discover chloroform. Genius, too, helped James Watt to read the lesson of the steam engine in the escaping steam from his mother's kettle. Assuredly it was genius that caused Montgolfier to visualise in the floating remnants of a burning paper bag the world's first balloon—the prelude to man's conquest of the air.

And once again a touch of genius has been responsible for an entirely new method of valve construction that bids fair to produce results which, but a year ago, would have been considered impossible.

The new series of Cossor valves employ—for the first time in the history of Radio—a method which, accurately and for all time, ensures perfect alignment for the filament, grid and anode. At the same time it provides a shockproof support for the filament.

Thus throughout the whole life of the valve its working characteristics cannot alter. Age cannot cause filament sag nor can hard wear disturb the exact relative positions of the filament, grid or the anode.

But this is not all. The improved Cossor filament consumes but a moiety of the current required by other Dull Emitters—its consumption at 1·8 volts being barely one-tenth of an amp. A seven-valve Super Heterodyne, for example using these new Cossor Point One Valves would not consume as much current as a little one-valve set using a single bright emitter.

As can be imagined, the filament used in this new Cossor is no ordinary filament. Owing to its exceptional length and its scientific method of preparation a great latitude in working voltages is permitted. Satisfactory results are obtainable at a voltage as low as 1·2, so that the valve can, if required, be used with dry cells. Further, its operating temperature is lower than that of any other valve on the market. And everyone knows that low temperature means long life.

The Cossor system of Co-axial Mounting has now finally abolished the last bug-bear of dull emitter valves—microphonic noises. Individual movement of either the grid or the anode in the Cossor Point One is utterly impossible. The seonite insulator holds them both in a vice-like grip which defies the hardest shock.

With its handsome pipless glass bulb, its re-designed low loss moulded base, and its new positive contact pins the introduction of these new valves represents one of the most important events in the progress of the Valve. See your Dealer about them to-day—we can promise you new delights in radio reception. A greater economy, improved sensitivity, a wonderful richness of tone, with a length of life and uniformity of performance which will positively astonish you.

Cossor Valves

—The new Dull Emitters with the long-life ·1 amp. filament.

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5. *Gilbert Ad.* 5353.

On Your Wavelength!

A New Station

THE new station of the Norwegian Broadcasting Co. at Bergen—I will not attempt to give the company's real name, as I doubt if I can spell it properly—has already been heard well in Newcastle and other northern cities and towns. As it is on 359 metres, it is not very likely that listeners within the radius of 2 L O will hear much of it, though, considering that it is using about 2 kilowatts and most of the path is over the sea, it should be quite strong when London is not working. I understand that a change in wavelength is to be made very soon, but as the powerful German stations between 400 and 500 metres are well received in Norway, the change is more likely to be to a lower rather than to a higher wavelength. I have heard this station testing, and the quality of the transmission is distinctly good.

The Norwegians are distinctly alive to the fact that many of their stations are well heard over here, and they are at present indulging in an advertising campaign, setting forth the advantages of their country to holiday-makers. At 9 p.m. B.S.T. on Mondays and Fridays for the next few weeks English talks on "Tourists' Tours in Norway" are to be delivered from Porsgrund on 405 metres and relayed from Oslo on 382 metres. These talks should give listeners over here who have not yet succeeded in picking up these stations a chance to hear and identify them.

Königswusterhausen

The famous German high-power station Königswusterhausen, which uses a wavelength of 1,300 metres, is shortly to commence an interesting departure which might well be adopted by Daventry to a greater extent than it is. Once a week the programmes from the provincial stations will be relayed in their entirety. The stations to be relayed will be chosen in turn, and arrangements will be made to take programmes of widespread interest. The idea is to give those in other parts of the country a chance of hearing stations they could not get without employing excessive reaction or high-power sets. Many people in this country would be glad if definite arrangements could be made for Daventry to do something more ambitious in this line than it does. On the other hand, those who cannot normally get the London programmes seem quite content that the bulk of the Daventry programmes should be those of London.

Short-wave Working

Most amateur investigators of the extremely interesting curiosities of short-wave working are cramped by the lack of expensive and delicate testing instruments. They have done a tremendous amount in developing the 45-metre band and also the 90-metre band; but there is need for really systematic work with proper instruments. Various official bodies in this country have at last awakened to this need, and there is to be some intensive and extensive work done. It is a fact that when working on short waves, between 10 and 90 metres, the audio-frequencies of telephonic communication are variously and curiously affected by the frequency of the carrier wave, so that speech and music on some wavelengths is badly broken up even when the utmost care is taken with the transmission. If possible the cause of this will be discovered. At any rate, it should be possible to discover which of the short waves are least affected by this phenomenon. Another subject for extensive tests is the degree to which atmospherics affect short-wave work. The 45-metre band is generally pretty bad; but we know that "statics" hardly exist on 5 metres—the amateurs discovered this—and there is reason to believe that the band between 10 and 15 metres is also a good one in this respect.

A Busman's Holiday

I spent last week-end in the country with a friend who has recently installed a four-valver in his bungalow. My friend does not profess to know much about the scientific side of wireless, but he certainly is able to handle his set efficiently. On Sunday afternoon we had the loud-speaker out on the lawn, and, although it was something of a busman's holiday for me, I must confess I thoroughly enjoyed the "Peer Gynt" programme from beginning to end.

Later in the evening the set was again switched on, but almost at once the unmistakable symptoms of battery exhaustion set in, and the performance came to a premature end. As the bungalow was lighted by electricity, I asked my friend why he did not charge his accumulator from the supply mains and so avoid being stranded for lack of "juice." He seemed quite keen on the idea, and asked for further details.

A.C. or D.C.?

"Do your mains carry alternating or direct current?" I inquired. He confessed that he did not know. "That's a point that can easily be settled," said another member of the party. Taking a small sheet of white notepaper, he waved it to and fro in front of one of the electric bulbs. "It's alternating current right enough, and you will need a rectifier," was the verdict.

Somewhat puzzled, I asked him to explain. "Well," he said, "it isn't usually possible to distinguish the 'flicker' in a lamp fed by alternating current because the *time*-interval is too short; but if you spread it out in *space* the eye is able to see the effect. For instance, a sheet of paper moved fairly rapidly across a lamp supplied with direct current is drawn out into a streak of uniform brightness. If, however, the lamp is supplied with alternating current the streak is broken up by darker zones caused by the momentary flicker as the current reverses." I tried the experiment myself, and after a little practice against a dark background was able to confirm what appears to be quite a useful test.

Land-line Transmissions

I was interested to note that recent transmissions from the northern stations were much clearer than was the case at this time last year. I was listening, via Belfast, to a performance which was taking place in London, and was agreeably surprised at the clearness of reception. On switching back to London there was little, if any, noticeable difference. This state of affairs is undoubtedly due to the re-grouping of the system of lines along which the London transmissions are sent to the provinces.

At Leeds a "refilling point" has been established. All lines for northern stations pass through this point, and it is here that the transmissions coming from London are reamplified and sent on their way through the Leeds switchboard to their respective aerials. By this means the London broadcasts are "cleared" of extraneous noises and given renewed strength, with the effect that, given a normally clear line, reception of a London transmission in the north is frequently equal to that from 2 L O.

To gain efficiency in the West of England, I learn that a similar system on a more limited scale is to be set up at Gloucester.

This point will be further used for tapping the west country for topical broadcasts. At present these transmissions must travel to Savoy Hill along an ordinary line. This "undoctored" line will be shortened by connecting up the function that is being broadcast with the new point at Gloucester. Whatever the net result, this method of periodic line amplification has proved its value to the remote provincial stations.

Amateur Enthusiasm

I have recently had the pleasure of coming into contact with several American amateurs, and I am minded to remark upon the difference existing between the

On Your Wavelength! (continued)

enthusiasm displayed by these amateurs and those of our own country. I suppose it is that our temperaments are different, for the keenness displayed by them is truly wonderful. They have a habit of holding in America what are termed amateur conventions, at which all the leading enthusiasts are able to expound their ideas concerning wireless matters. These conventions generally last two or three days, and one of the leading hotels is booked up for that period, the convention generally ending up with a banquet, at which also some form of popular entertainment is given. The convention breaks up with a mutual determination on the part of the participants to meet again under similar circumstances the following year.

The willingness of the American amateur to be enthusiastic in this manner is not solely a question of the ready supply of cash. I heard of one case where one of the conventionists had only sufficient money to pay for his hotel accommodation and his final dinner, but who, although he lived three hundred miles away, overcame the difficulty by cycling.

Where in England have we such enthusiasm? The Transmitters' Section of the Radio Society of Great Britain is about to hold its first amateur convention, and I think that we may then be better able to gauge the enthusiasm of our own amateurs.

Passing the Time

There was a distinctly modern touch about some of the cars conveying débutantes to the recent Court. They were fitted with portable receiving sets, and their occupants wiled away the time during their long wait in the Mall by listening to the strains of 2 L O. Some of those who had not portable sets found the time hang heavy on their hands, and were very envious of their more fortunate sisters. The fact that portable sets were used in this way was, I think, a sign of the times. This kind of receiver was at one time regarded with a certain amount of derision in this country, for a variety of reasons; but now it is coming rapidly into its own, and one sees more and more of them installed in cars or strapped to the carriers of motor-cycles. There were many reasons why portable sets failed to make much headway in previous years: They were heavy, they were bulky, their valves would not stand the jolting to which they must be subjected, and last but not least, there was very little in the way of musical entertainment to listen to in the afternoons.

A Change

To-day things are very different. The portable set as we know it now is light and compact. Valve manufacturers are turning out really efficient valves capable of standing up to any amount of rough usage and consuming so little filament current that there is no need to lug heavy accumulators about. There is plenty to listen to during the afternoons, and if only the sun would consent to forget about his spots and shine upon us once more, the country would see numbers of picnic parties enjoying the entertainment provided by the loud-speaker.

One interesting development of the portable set is that the modern tendency is to design such receivers for use either with the outdoor aerial at home or with a self-contained frame in the open. They are thus really two sets in one. In the drawing-room they give as good results as can be expected from a non-portable outfit, and there is the enormous advantage that they can be taken into the country, on to the river or to the house of a friend who has no aerial.

A Lucky Escape

Radio-Paris was most unfortunate in being damaged by lightning during the week of thunderstorms, and it was exceedingly lucky that no one was injured, for the storm was of a particularly violent character and did considerable damage in Paris and its neighbourhood. If you have ever seen the aerial masts of Radio-Paris—travelling by the Newhaven-Dieppe route you cannot help noticing them on your left just as you are running into Paris—you realise what a fine target they would offer for lightning unless proper precautions were taken. Had the station been closed down at the time there would probably have been no mishap at all, since the aerial would have been connected direct to the very efficient earth system. As it was, a concert was in progress, which came to an untimely end. Radio-Paris was able to resume transmissions on the following day, and when I tuned him in he seemed to be going quite strong.

AN important announcement of great interest to all constructors appears on page 861. Have you seen it?

Daventry had a similar stroke of ill-luck last year, if you remember, when the aerial was damaged. The fact that it is the rarest thing for any of the thousands of huge transmitting aerials to be struck by lightning—and this occurs only when they are not directly earthed—is pretty good proof of two things. First of all, the properly erected aerial is a protector rather than a source of danger in thundery weather, and, secondly, it should on no account be used for either transmitting or reception if thunder is about.

Queer Conditions

We have had a very queer mixture of receiving conditions this month. The opening week of June was one of the best that I can remember for summer long-distance reception. Station after station could be tuned in without the slightest difficulty, whilst distant foreigners that had not been heard for months suddenly reappeared and showed in most cases considerable strength. I was able to get, for example, several of the Swedish stations, which were often shy birds even during the winter.

The following week showed precisely the reverse of the medal. Thunder occurred on almost every day, with the result that atmospherics were constant and violent. In the few calm intervals that occurred one found that the ether appeared to be absolutely dead. As an example, I may say that a band of wavelengths that had produced fifteen stations on the loud-speaker in the previous week showed not the slightest sign of being "inhabited" when explored on several evenings prior to the moment of writing. Certainly atmospherics have not been so bad in any summer that I can remember—and I achieved my first wireless reception in 1912—as they have been this year from the early days of April onwards. Sunspots? Well, I rather fancy so.

Improving 5 X X

I hear that an important series of experiments is shortly to be undertaken at Daventry with a view to seeing how the whole of our home broadcasting system can be recast and improved. The aim of the B.B.C. is eventually to provide every owner of a wireless set, whether crystaliser or valvite, with at least two alternative programmes at all times during normal broadcasting hours. They want also to cut down the number of the existing stations in order to be able to fit in with the latest suggestions of the Geneva Bureau, which proposes to allot a number of exclusive wavelengths to each country in proportion to its total population. It is hoped to achieve this end by a form of concentration. The medium-powered stations and the relays will have to go, and in their stead we shall have a small number of high-powered stations which between them will provide a wonderful service for the whole country.

It is by no means as easy a matter as it might seem to plan out these islands into high-power areas. You cannot just put a number of dots on the map, draw a hundred or hundred and fifty mile circles round them so that they intersect, and say "there you are." In certain areas a certain plan might answer, but there are others where the broken nature of the country vastly reduces expected ranges in certain directions. The scheme is a very big one, which will entail an enormous amount of labour.

THERMION.

SUPERSONIC RECEPTION—WHAT ARE ITS MERITS?

THE relative merits of high-frequency and low-frequency amplification is a favourite bone of contention between wireless enthusiasts. One school asserts that long-range work is practically impossible without the aid of one or more high-frequency stages, whilst others hold that, given a carefully designed aerial circuit, any distance can be covered with a simple back-coupled detector valve followed by one or more low-frequency stages.

The super-heterodyne receiver may be regarded as a compromise between the two rival systems. Instead of amplifying the incoming signals directly, the received energy is first converted into a lower wavelength of supersonic frequency, and in this form is amplified to an enormous extent before the voice or musical frequencies are separated out.

Taken separately, both the older systems have disadvantages. For a detector followed by L.F. amplification to be successful, a certain minimum strength of incoming signals is essential, so that the range of reception of such a set is undoubtedly limited, particularly when a frame aerial is used, and the modern tendency is distinctly in favour of this type of aerial as against the inconvenient outside or garden wire.

On the other hand, high-frequency amplification is extremely difficult to handle owing to the capacity leakage that occurs across the electrodes inside the glass bulb of the valve. This is particularly the case when several H.F. stages are applied in sequence to short-wave signals, such as those used in broadcasting. In these circumstances the set is very prone to break into oscillation and become useless for receiving telephony. Even the ordinary straight set comprising only one stage of high-frequency exhibits this tendency.

The super-heterodyne circuit eliminates the capacity leakage, inherent to all short-wave receivers, by converting the received oscillations into oscillations of a lower order of frequency (say 50,000 cycles per second, or a wavelength of 6,000 metres), before passing them to the amplifiers. At this lower frequency there are no stray capacity effects and consequently no liability to self-oscillation.

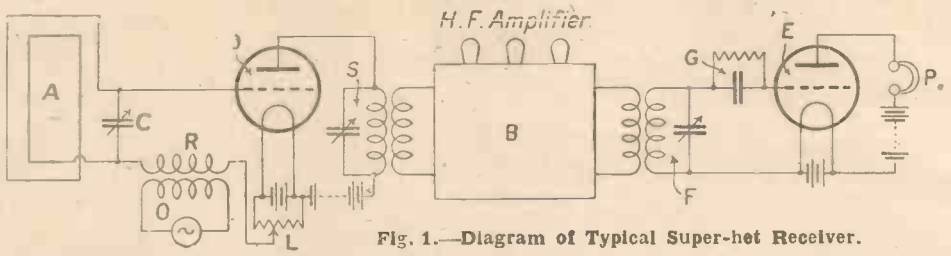


Fig. 1.—Diagram of Typical Super-het Receiver.

The intermediate frequency so produced does not interfere with or confuse the reception of telephony, as the upper limit of audibility does not extend beyond 20,000 cycles per second. For this reason the 50,000 cycle frequency is termed "supersonic" or above audibility. In fact the super-heterodyne circuit as a whole is often referred to as the supersonic amplifier.

In order to convert the incoming waves, they are combined with locally-produced oscillations of a slightly different frequency with which they produce a "beat" or heterodyne effect. For example, if the received waves are on 100 metres, or a frequency of 3,000,000 per second, the local oscillator is adjusted to generate a frequency of 3,050,000 cycles per second. The signal and local waves are then combined on the grid of a rectifying valve, and the "difference" or "beat" frequency of 50,000 (corresponding to a wave of 6,000 metres) is then separated out in the tuned plate circuit of that valve. During this "first rectification" process the telephonic or signal modulations present in the original carrier wave are not distinguishable as low-frequency currents, but are transferred bodily to the supersonic oscillations. After the latter have been passed through several successive stages of supersonic amplification, the final output is applied to a second detecting valve, where the low-frequency or audible components are separated out by means of an ordinary grid leak. A telephone is inserted in the plate circuit of this second detector, or one or more stages of low-frequency amplification can be added as desired if this is found necessary.

Fig. 1 shows a typical super-heterodyne receiver in diagrammatic form. The frame aerial A is tuned to the incoming oscillations by a condenser C, which is connected across the grid and filament of the first detector valve D. The grid potential of the valve D is adjusted by means of a potentiometer L. The grid circuit is also coupled at R to a local oscillator O, which in practice is invariably a back-coupled thermionic valve. The plate circuit of the detector valve includes a circuit S tuned to the difference or supersonic frequency of 50,000 cycles, and coupled to the input of an amplifier B, shown as comprising three separate H.F. valves.

The intervalve couplings in the amplifier B are all permanently tuned to the 50,000 frequency. The output from the last amplifying valve is fed to a second detector valve E fitted with a grid condenser and leak G, and having the phones P in its plate circuit.

One notable feature of the super-het

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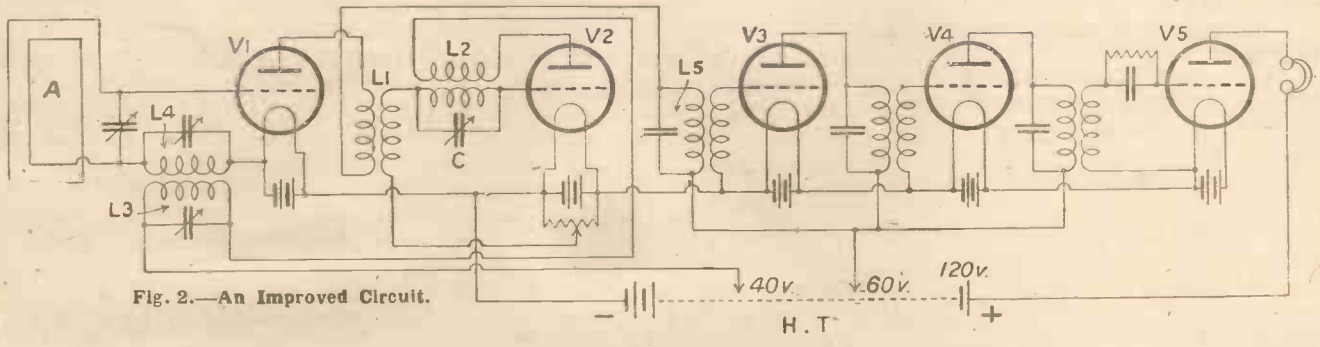


Fig. 2.—An Improved Circuit.

"UNDER-AND-OVER" WIRING

A Suggestion for an Improved System

THE tendency at the present time in building receiving sets seems to be that of a vertical panel with flush controls, the valves, transformers, coil holder and coils, etc., resting on a baseboard inside the cabinet out of danger.

The advantages of this arrangement are many and lend themselves to the receiving set becoming a part of the home furniture instead of "that old wireless" which the housewife dare not attack with the duster.

With the vertical panel there are two ways of making leads to the parts which are generally extraneous to the cabinet, one being that of having the terminals on the face of the panel or by having another narrow strip of ebonite attached to the back of the baseboard about 2 in. in width, carrying the necessary connecting terminals. This latter method is to be recommended. The absence of these terminals on the front of the panel certainly enhances the effect of neatness, and the leads are not continually getting into one's way when tuning.

If the coils are placed inside the cabinet, it will be at once seen that plenty of room must be left for the swinging coil to operate freely without disturbing any of the fixed wiring, so to avoid bunching of the wires and thereby impairing the efficiency owing to induction, the following method is suggested: That is, the wood baseboard be lifted about 1 in. from the foot of the ebonite panel and secured in this position by means of brackets sold specially for the purpose, or screwed from the front and a piece of wood dowelling screwed to the baseboard at the rear corners, which will be found quite adequate. It will now be apparent that holes will have to be bored through the wood base to allow of the connecting wires passing from one component to another, which may seem a lot of trouble, but really after deciding where the components are to be, it is only a matter of a few moments to run the drill through; the result fully justifying the small amount of trouble taken.

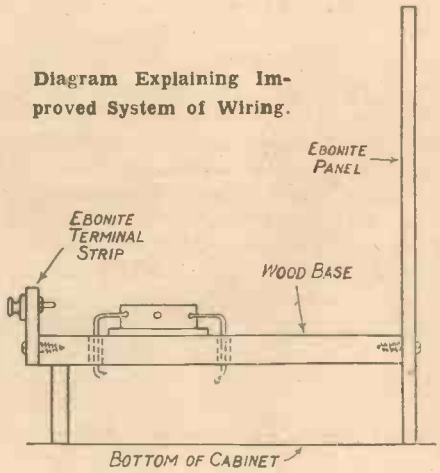


Diagram Explaining Improved System of Wiring.

Less Confusion

The illustration will give a good idea of what is meant exactly. A small point that will be at once apparent is that a few wires will cross each other underneath the panel, and as it is not intended that they should touch each other, to obviate this all that is necessary is to place on the wire a few inches of systoflex. As the wires are not carrying H.F. currents the close proximity will not be detrimental.

T. V. L.

"SUPERSONIC RECEPTION—WHAT ARE ITS MERITS?" (*continued from preceding page*)

receiver is the small number of adjustments to be made when tuning-in a station. All the tuned circuits in the amplifier B, the circuit S, and the input circuit F of the second detector E are set by the makers, once and for all, at the chosen supersonic frequency, say 50,000. All that is then necessary when tuning-in to a station is first to adjust the aerial condenser C to the signal frequency and then to set the local oscillator O so that its frequency differs from that of the aerial by the required figure of 50,000 per second. This setting, in practice, is simply and automatically determined by the rise or fall in signal strength as the tuning condenser of the oscillator O is rotated.

Some Improvements

The main drawback to the superheterodyne receiver lies in the number of valves involved in the circuit. Originally from seven to ten of these were required, including the local oscillator, and one or more stages of L.F. amplification for loud-speaker work. Certain modifications have recently been made in the original form of circuit in order to reduce the number of valves and to lessen the difficulty of filament-current supply.

In the first place the separate oscillator O has been eliminated by back-coupling the grid and plate circuits of the first detector valve D so that that valve is now used (1) to amplify the incoming signals, (2) to supply the local oscillations, and (3) to rectify the resulting beats.

Preventing Loss

Next, in order to prevent loss of signal strength due to de-tuning the valve and aerial circuits (necessary in securing the heterodyne effect) and also to avoid re-radiation from the aerial, it was found convenient to employ one of the harmonics, instead of the fundamental frequency, of the local oscillations used to "beat" with the incoming signals.

Finally one stage of H.F. amplification was interposed between the oscillator-rectifier and the aerial, and the circuit reflexed so that the interposed valve operated as a dual amplifier.

These improvements are shown in the simplified circuit, Fig. 2, of a modern five-valve supersonic receiver, in which separate filament batteries have been inserted for the sake of clearness. Signals received on the frame aerial A are applied to a high-frequency amplifier V1, the amplified currents being transferred through a coupling L1 to the grid of the valve V2. The plate and grid circuits of this valve are back-coupled at L2, the condenser C being set so as to build up a harmonic of the fundamental oscillation.

The two currents supplied from L1 and L2 respectively are rectified on the grid of the valve V2, and the beat, or supersonic frequency, appears in the plate circuit L3, which is tuned to that frequency and is back-coupled to a coil L4 in the grid circuit of the first valve. The supersonic frequency is therefore fed back on to the grid of the valve V1 and is amplified there simultaneously with the incoming waves from the frame aerial A.

The amplified supersonic frequency appearing in the plate circuit of the valve V1 is passed on to the coil L5, shown coupled to the input circuit of the valve V3, which now becomes the second supersonic amplifier. A third stage of high-frequency amplification is supplied by the valve V4, the output of which is then fed to the second and last detector valve V5.

The net result of the five-valve combination upon the received signal waves is therefore seen to be: one stage of radio-frequency amplification, V1; one stage of combined heterodyne, rectification and partial amplification, V2; three stages of supersonic amplification, V1, V3, V4; and one stage of second or low-frequency rectification and partial amplification, V5.

B. A. R.

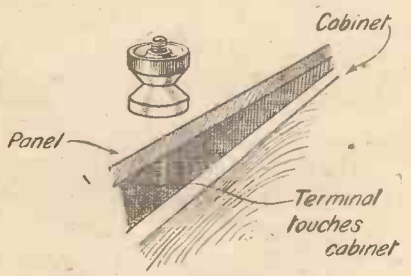
PRACTICAL ODDS AND ENDS

Terminal Leakage

ANNOYING crackling noises in a receiver are often caused by leakage between various terminals mounted on the panel.

The leakage path is often very difficult to trace, especially when the ebonite is proved to be of good quality, and for this reason the disturbing noises are allowed to continue. Very frequently, however, the whole trouble is caused through mounting the terminals too close to the edge of the panel, thus allowing leakage to take place through the terminal shanks and the side of the wooden cabinet.

It is advisable to allow a slightly larger panel than will fit the cabinet when the receiver is being built, as the terminals can then be mounted at a safe distance from the wooden sides. P.



Terminal Leakage to Cabinet.

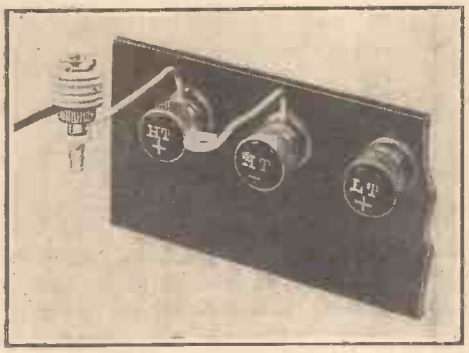
Square Wiring

MANY amateurs do not consider it advisable to wire up receivers with square wire and form sharp right-angle bends, as they believe that H.F. currents have a tendency to "jump" at the corners and acute angles, thus adding to the total capacity of the receiver. Although this may be true in connection with ultra short-wave receivers (for wavelengths below about 50 metres), there is certainly no loss noticeable on the broadcasting band, that is, above 250 metres. On the other hand, many practical advantages are to be gained from the use of stiff square-sectioned wire and the formation of neat right-angle bends. The stability of the wiring thus obtained is likely to have a much greater influence on signal strength than would be caused by the attempt to minimise almost negligible capacity effects.

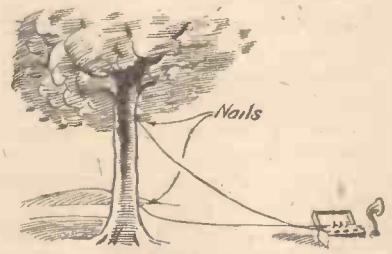
The wires should, however, be spaced well apart in order to reduce the internal capacity of the receiver to as low a value as possible. An additional advantage, of course, is that the wiring is easy to trace and a fault is easily located. N.

Handy Sockets

HANDY sockets, which can be used for receiving plugs of the Clix type, are easily made from stiff tinned-copper wire. It is not recommended, of course, that improvised sockets of this description should be used permanently in the receiver in place of the proper sockets made for the plugs, but the amateur will generally find that he is in greatest need of a few sockets at the very moment when they are not on hand. The wire, which must be stiff enough to keep its shape, is bent into a ring at one end in order to hold the plug; the other end is bent at right-angles and attached to the receiver terminal. P.



Handy Terminal Sockets.



Arrangement of Outdoor Aerial.

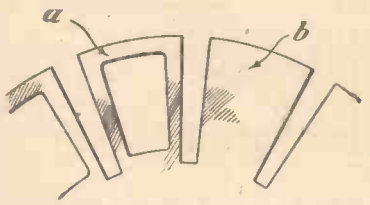
The Outdoor Aerial

THE amateur who wishes to take his receiver out into the open during the summer months is faced with the difficulty of selecting a suitable aerial for the portable set. The frame aerial is not always entirely satisfactory, as it is insensitive and necessitates the use of extra stages of H.F. amplification if reception from a distant station is desired. A length of rubber-covered cable, slung over two trees, acts as a very efficient collector of signals, but is not always convenient to erect. It is quite possible, however, to use the tree itself as an aerial; the sap renders it partly conductive and, by reason of its height, it is usually capable of attaining a considerable difference of potential to earth.

Connection to the "aerial" is made by inserting two nails into the trunk of the tree, one a few inches from the ground and the other at as great a distance from the roots as possible. Rubber-covered wire should be used for joining the nails to the aerial and earth terminals of the receiver, and the two leads should be carefully spaced one from the other. G. C.

Improving the Basket Coil

THE ordinary type of basket coil is very efficient in theory, as the method of winding is such that turns having the least difference of potential lie close together. In practice, however, excellent "low-loss" results are not always obtained owing to the high capacity caused by the use of unsuitable material for the former. For this reason it is advisable to cut away a portion of the former as shown at *a* in the diagram and thus to reduce the amount of useless material in the field of the coil. A short-wave coil wound on a former shaped as at *a* will very probably give a marked increase in signal strength over that produced by a coil wound on a solid former as at *b* in the diagram. G.



Method of Improving Basket-coil Former.

L.F. Distortion

A PECULIAR form of distortion is often noticeable in low-frequency amplifiers employing transformer coupling. Such items as partial rectification, overloading of valves or incorrect grid bias (causing the valves to operate on the wrong portion of the curves) can all cause distortion and prevent pure reproduction of speech and music. The distortion referred to above, however, is not caused by any of these items and may present a certain amount of difficulty in tracking down. The securing bolts of the transformer may work loose in time and allow the laminations forming the core to vibrate at audio-frequency. This gives rise to an annoying buzzing sound in the phones or loud-speaker. B. D.

The Truth Abou

LITTLE did the American amateur who first coined the term "low-loss" dream that his innocent slogan would start a world-wide craze for low-loss coils and components, such as condensers, high-frequency transformers, valve holders, etc. Experts have worn out miles of typewriter ribbon and covered acres of paper while attacking the low-loss question theoretically.

New coils of all sorts of shapes have made their appearance, heavy coils wound with thick wire on large formers look down upon their elder honeycomb sisters, and coils of medium size wound with comparatively fine wire rub shoulders with spidery creations said to be wound on air. To cap all, the toroidal coil recently made her bow to the, by now, highly-strung experimenter!

To select the "really best" coil for a given purpose from the many varieties described is not an easy task for the average amateur, all the more as "still better" coils often appear upon the scene when one's mind is almost made up.

Several American radio engineers have at last taken the right step; they tested numerous coils under similar conditions and gave the public the benefit of these tests by publishing them. The results are most interesting, and many amateurs will now see the "low-loss" question in a new light. Certainly these tests give us a definite clue regarding the possible efficiency of a projected low-loss coil.

Some of the coils tested are shown to scale in Figs. 1 to 8, so that the relative sizes of the coils may be readily compared. Coils Figs. 1 to 7 were tested in the Popular Science Institute of Standards, New York (*Popular Science Monthly*, November, 1925). The most efficient coil was No. 1, a single-layer solenoid wound with No. 22-gauge wire on a former consisting of a celluloid film. This coil had an inductance of 276 microhenries and a high-frequency resistance of 5.5 ohms at a wavelength of 400 metres.

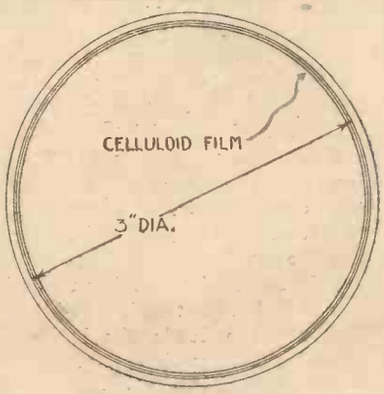


Fig. 1.—Single-layer solenoid, wound with No. 22 s.s.c. wire, spaced half diameter of wire. Length of winding, 2⅜ in. Inductance, 276 microhenries. H.F. resistance at 400 m. = 5·5 ohms. Figure of merit, 50.

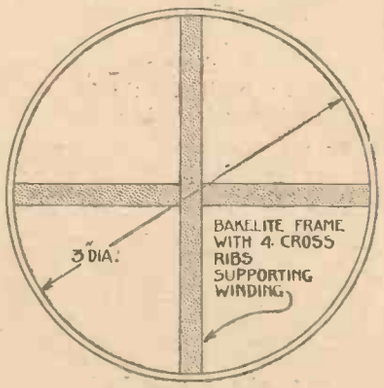


Fig. 2.—Single-layer solenoid, wound with No. 22 d.c.c. wire. Length of winding, 2⅛ in. Inductance 246 microhenries. H.F. resistance at 400 m. = 5·7 ohms. Figure of merit, 43.

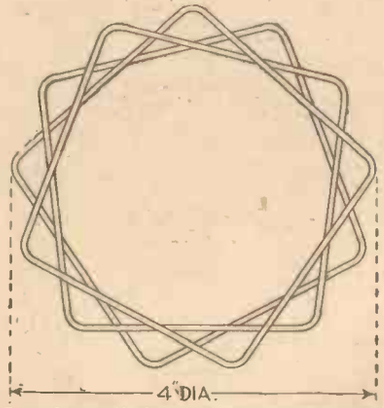


Fig. 3.—Cylindrical basket-weave coil, wound with No. 18 d.c.c. wire. Length of winding, 1¾ in. Inductance, 182 microhenries. H.F. resistance at 400 m. = 4·5 ohms. Figure of merit, 40·5.

Comparisons of Efficiency

To compare the efficiency of the various coils, a figure of merit was introduced; this is merely the ratio of inductance divided by resistance at a certain frequency. The figure of merit for coil No. 1 is therefore $\frac{276}{5.5}$, or about 50. In other words, at a wavelength of 400 metres the inductance is fifty times as great as the H.F. resistance of the coil. The various data for the other coils are given in the illustrations, and are not repeated here. (See Figs. 1 to 8.) The second best coil was again a single-layer solenoid; the winding was supported by a bakelite frame with four cross ribs. Next came coil No. 3, our old friend the cylindrical basket-weave coil, or Lorenz coil, wound with thick wire.

With decreasing efficiency followed: Coils Nos. 4 and 5, single-layer solenoids wound on bakelite tubes using No. 22-gauge wire; then No. 6, a commercial toroidal coil; and, finally, No. 7, a honeycomb coil.

Many readers will no doubt be surprised at the low efficiency of the toroidal coil, but we must remember that this type scores heavily in other directions, for it has a very small external field.

The Walbert Coil

Similar tests were carried out by the Walbert Manufacturing Co., a well-known American firm of wireless-set builders. Most of these results agree fairly well with the above (*Popular Radio*, December, 1925).

This concern introduced a new type of

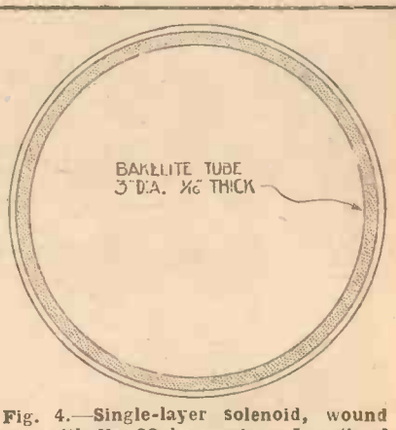


Fig. 4.—Single-layer solenoid, wound with No. 22 d.c.c. wire. Length of winding, 1⅛ in. Inductance, 154 microhenries. H.F. resistance at 400 m. = 4·0 ohms. Figure of merit, 38·5.

ut Low-loss Coils

coil, the Walbert coil, which is shown in section by Fig. 8. The former is an ebonite tube of 2½-in. diameter; this is wound with fairly fine wire, namely, 50 turns per inch. When wound, the coil is enclosed in a metal shield (Fig. 9) to prevent interaction with adjacent coils. A remarkable feature of this design is that the shielded coil shows an even higher efficiency than the unshielded coil.

The relative efficiency of the various coils can be readily ascertained by referring to the diagram Fig. 10. The height of the vertical lines indicates the efficiency of the coil; the higher this line the better the coil. The coil numbers are identical with the figure numbers.

With the aid of this graph, the selection of a low-loss coil should not present any difficulties. Just one hint, however. If the difference in efficiency between an easily-made and a more elaborate type is but slight, select the coil more easy to construct and make as good a job of it as you can.

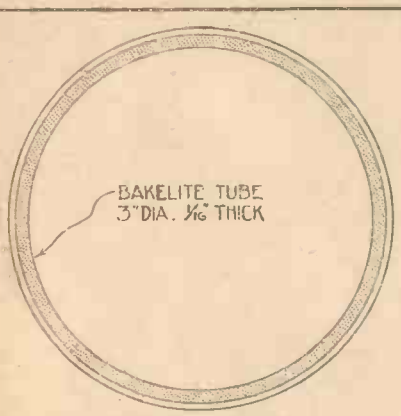


Fig. 5.—Single-layer solenoid, wound with No. 22 d.s.c. wire. Length of winding, 1¼ in. Inductance, 153 microhenries. H.F. resistance at 400 m. = 5·2 ohms. Figure of merit, 29·5.

Shortly after these notes had been written two further accounts of coil tests made by American engineers came to hand. In the first case, twenty-four coils were tested and only one of them was home-made. Peculiarly enough, the home-made coil came out best! It was quite a simple affair, a tubular bakelite former wound with ordinary bell wire. The second best coil was the Walbert coil shown by Fig. 8 and also in Fig. 9 (*Radio News, January,* 1926).

Further Tests

The second series of tests was carried out by Mr. W. W. Harper, a radio consulting engineer of Chicago. These coil tests took nearly one year to complete (*Radio Broadcast,* February, 1926).

His tests confirm the above results in many respects, and his conclusions are briefly as follows: The coil should be small and compact and have a small external field. The completed coil must be shielded. This shield must not take up much space, to allow compact set construction. The wire used for the secondary winding must not be covered with cotton or silk, but enamelled wire should be used.

His researches led to the design of the Harper Metaloid coil, which is shown in Fig. 11. This coil is a tuned high-frequency transformer, and if the secondary is shunted by a .00025 variable condenser it will cover the broadcast wave band.

Effects of Shielding

Both primary and secondary are wound on ebonite tubes, the primary coil is inside the secondary. Both primary and secondary are wound with No. 28-gauge wire; for the primary d.s.c. wire is used, the secondary being wound with enamelled wire. The former of the secondary is grooved; the wire is wound into these grooves so that the turns are separated by a distance equivalent to the thickness of the wire. An enlarged view of the winding showing the grooved former is given in Fig. 12. A box-like shield made from 12-oz. copper sheet encloses the coil and confines its field within the casing. In plan the shield measures 3 in. sq.; its height is 5 in.

The resistance of this Metaloid coil, measured at average broadcasting frequencies is 9.5 ohms, as the inductance value of the secondary is 320 microhenries; the figure of merit is therefore $\frac{320}{9.5}$, or 33.7.

It was briefly mentioned above that shielded coils prevent interaction between coils. This is, however, not the only advantage of shielded coils. All ordinary coils act as miniature aerials, and we know

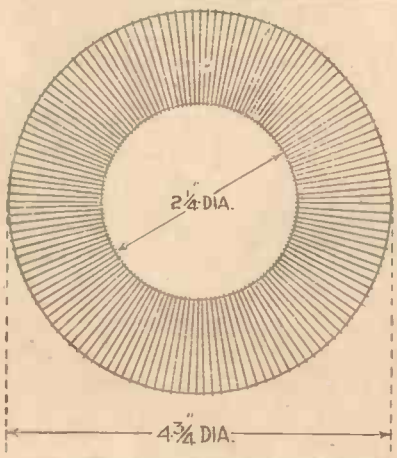


Fig. 6.—Toroid coil, wound with No. 20 d.c.c. wire, supported by Bakelite frame. Inductance, 120 microhenries. H.F. resistance at 400 m. = 9·8 ohms. Figure of merit, 18·4.

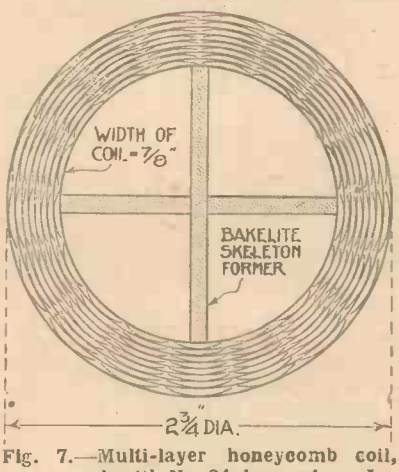


Fig. 7.—Multi-layer honeycomb coil, wound with No. 24 d.s.c. wire. Inductance, 320 microhenries. H.F. resistance at 400 m. = 22·5 ohms. Figure of merit, 14·2.

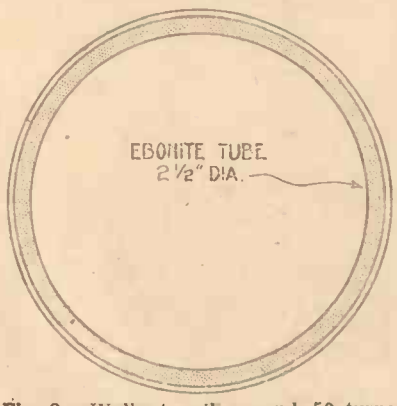


Fig. 8.—Walbert coil, wound 50 turns per inch. Length of winding, 2 in. Figure of merit (not shielded), 38·5. Figure of merit (shielded), 40·5.

that sensitive sets can pick up signals from near-by stations without being connected to the aerial or earth at all. Unfortunately the coils do not only pick up signals, but also all kinds of interference; for instance, morse and C.W. messages and the interference caused by electric motors and dynamos. Shielded coils are free from this disadvantage; although in some cases the wiring of the set will pick up interference, the latter will be far less serious.

A further advantage of shielded coils is that they can be placed close to each other in a set. If we have a conventional set equipped with solenoid coils, say with an aerial coil and one H.F. transformer, we must take care to mount these coils in the same plane and with their axes at right angles to each other, else the field of one coil will interfere with that of the other.

Shielded coils may also be placed close to metallic components of the set without loss of efficiency. Ordinary coils must be kept well away from such components as L.F. transformers, etc, otherwise eddy currents may be set up and the coil efficiency decreased.

It is therefore obvious that a shielded coil is a distinct advance, and leading American manufacturers are employing them more and more. The results obtained have been very satisfactory, and no doubt great progress will yet be made in the design and manufacture of these coils. Here is a new and promising field for the amateur experimenter, and the data given in this article will no doubt assist him in the construction of his first shielded coil.

More critical amateurs may say: "This is all very well, but the Harper coil, for instance, is not quite as good as some solenoids without shields." True enough, if we go by the values shown in the graph, but these values suffer from one defect: they show only the efficiency of a coil by itself, and not that of a coil built into a typical set. Although the writer could not find any reference to tests made on coils built into sets, he is sure of one thing, namely, that all unshielded coils will show less efficiency when tested in a set than when tested by themselves, well away from all metal parts and other coils which can affect them.

We know that the shielded coil will retain its high efficiency when built into a set, no matter how close to other coils or metal objects it is placed. This point is greatly in favour of the shielded coil, and we may find it to be the coil of the future.

C. A. O.

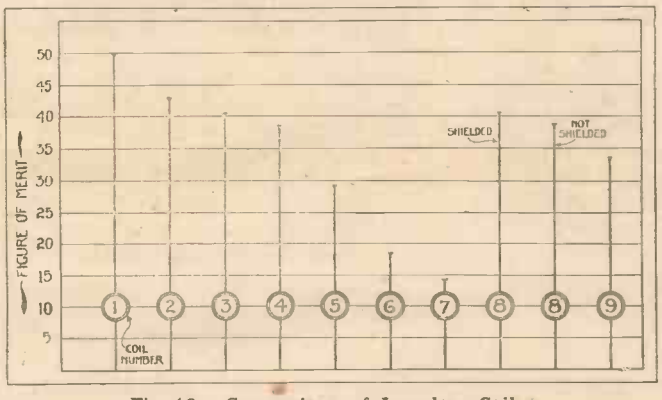


Fig. 10.—Comparison of Low-loss Coils.

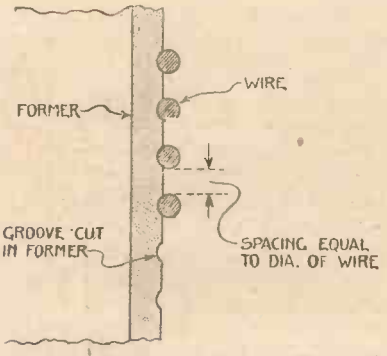


Fig. 12.—Method of Spacing Turns of Metaloid Coil.

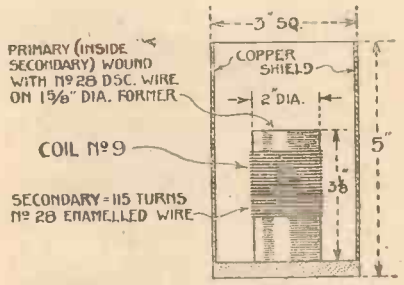


Fig. 11.—Metaloid coil in sectional elevation. Inductance of secondary, 320 microhenries. Resistance (average), 9·5 ohms. Figure of merit, 33·7.

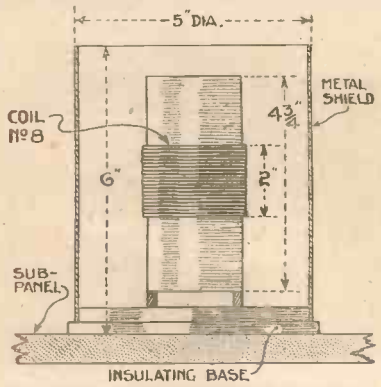


Fig. 9.—Details of Walbert Shielded Coil.

LICENCES IN RUSSIA

NOW that broadcasting has made a very wide appeal to the general public and that over one million licences have already been granted by the Soviet authorities, the *Radio Peredacha* has decided to issue several classes of permits, the cost of which in some instances has been reduced. The tax has not been based on the kind of wireless receiver used, but is proportionate to the social status of the listener. Soldiers and sailors of the Soviet Army or Navy, war invalids, incurables in hospitals or other institutions, as well as the lower grades of State officials and poor peasants, have been placed in one category, for which the very low charge of 50 kopeks (about 1s.) per annum is made. Skilled artisans, higher-grade officials, and military or naval officers must pay 1 rouble for a crystal set or 2½ roubles (about 6s.) for a valve receiver. In the third class are found commercial clerks and business men, who are charged respectively 5 and 10 roubles for the same privileges. Workmen's clubs and reading-rooms generally are only taxed 3 roubles per receiver, but industrial or Stock Exchange concerns, which may derive a commercial benefit from the market or financial reports broadcast may be mulcted to the extent of 300 roubles per annum. Most of the passenger steamers on the inland waterways, as well as restaurant cars on the railways, are now being fitted for the reception of wireless, and in these instances a fee of 75 roubles is collected by the authorities.

GRIDDA.

A suggestion has been made that the B.B.C. intends to abolish 2LO under its new scheme of fewer stations with higher power, and erect two new places outside London. It may be said quite definitely that no such change is contemplated and that no alteration will be made with the Oxford Street transmitter.

DOUBLE REACTION

MANY amateurs use sets employing a circuit enabling the reaction coil to be coupled to the anode coil. In such cases the aerial coil is usually placed in a single coil holder at some distance from the reaction and anode coil. A slight alteration to such sets will enable reaction to be applied simultaneously to both the aerial and anode coil, causing in most cases an improvement of signal strength.

The only extra fitting required to effect such alteration is a three-way coil holder, which should be mounted in place of the existing two-way holder. The centre holder should be used for the reaction coil, and one side of the coil holder should be employed for the anode coil. The other side of the coil holder should be wired up to the existing plug and socket of the aerial coil holder on the front of the panel. Temporary connections should be employed to find the correct wiring of holder.

M. E.

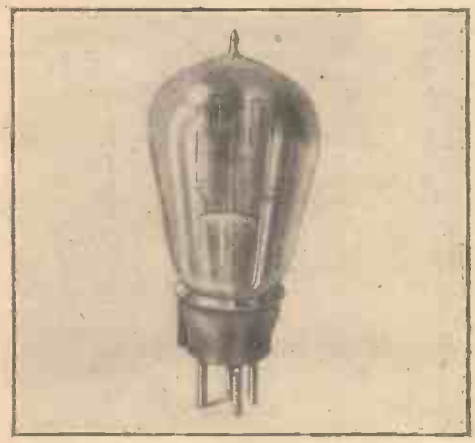
"A.W." TESTS OF APPARATUS

Conducted in the "Amateur Wireless" Research and Test Department

Accumulator Vaseline Cups

THE corrosion of accumulator terminals, due to the creeping of acid, is a constant source of trouble with many accumulators. An ingenious device has just been placed on the market by A. F. Bulgin and Co., Ltd., of 9 to 11, Cursitor Street, E.C.4, which is designed to cure the trouble. The Deckorem vaseline cap, as it is called, consists of a small lead recessed washer and an ivorine disc coloured red or black. The terminal and locking nut of the accumulator are removed and the ivorine washer is placed on the lead lug of the plates. Vaseline is then placed in the recessed portion of the cup, and this latter is fitted over the brass stem, the locking nut and terminal being replaced.

We have fitted four of these cups on two accumulators, rather apt to leak and allow creeping of the electrolyte, with excellent results.



Osram DE8 Valve.

Osram DE8 Valves

OSRAM valves, types DE8 H.F. and DE8 L.F., are designed to provide very economical and efficient operation from a six-volt accumulator. They are made by The General Electric Co., Ltd., of Magnet House, Kingsway, London, W.C.2.

On test we found the DE8 H.F. valve is not only an excellent H.F. amplifier, but is very suitable as a detector with about 50 volts on the plate. With its high amplification factor the valve makes a good resistance- or choke-coupled amplifier, provided the plate voltage is increased to about 120 volts and a suitable negative bias applied to the grid. Good quality amplification is obtained due to the amplification factor remaining very constant over a wide range of voltages.

As indicated by the manufacturers, the DE8 L.F. valve should be used for transformer-coupled L.F. amplification. Here again the amplification factor remains constant, ensuring good quality reproduction. With 100 volts on the plate and a negative grid bias of 4½ to 6 volts excellent power amplification is produced.

The electrical characteristics of both valves are given in the accompanying table:

Characteristics		DE8 H.F.	DE8 L.F.
Overall	length	125 mm.	125 mm.
	diameter	56 mm.	56 mm.
Filament	voltage	5.6–6	5.6–6
	current	.12	.12
Anode volts		40–100	20–100
Impedance		25,000	8,000
Amplification factor		16	7

A New Loud-speaker

WE have just completed tests on the new International loud-speaker manufactured by The International Electric Co., Ltd., of 161A to 166, Strand, London, W.C.2. The horn of this instrument follows the conventional swan-neck curve and is made of a light metal painted a chocolate-brown colour merging into black. In appearance the loud-speaker is very striking, having an overall height of 26 in. and a flare of 14 in. diameter.

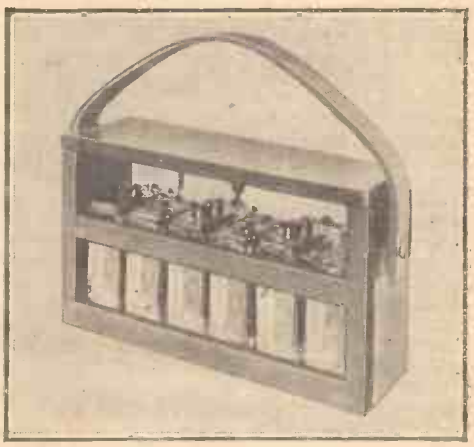
Triple magnets of great power, ending in laminated pole-pieces, are employed together with a flat diaphragm of ample proportions which is adjusted by means of a nickel-plated lever projecting from the base.

International Loud-speaker.

Both on comparative tests with other loud-speakers and on a more exacting test, involving the measurement of response to frequencies between 100 and 1,500 cycles per second, the loud-speaker showed itself well above the average. Especially is a good response shown to the notes of the lower frequencies on the audible scale, and this response is fairly constant up to about 1,000 cycles per second, after which it falls off slightly. The volume obtained on a standard input is, with the exception of two other well-known instruments, the greatest we have heard. We can thoroughly recommend this instrument as one having exceptional reproducing qualities for the price.

Ediswan H.T. Accumulator

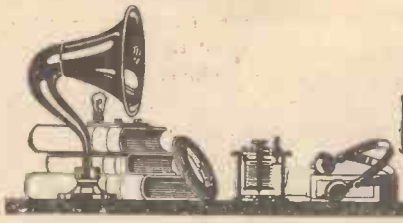
THE Edison Swan Electric Co., Ltd., of Ponders End, Middlesex, have submitted to us for test one of their Hymeg H.T. accumulators, the actual capacity of which is rated at 2 amperes at the 10-hour rate, thus giving a satisfactory discharge of .2 ampere. This is an ample figure for the plate supply of the largest multi-valve receiver. High insulation between the cells is ensured by the horizontal and vertical ribs moulded on the sides of the glass containers, whilst easy inspection is arranged for through the glass lids. Facilities for tappings are made by means of wander plugs at every two volts. The use of separators has been eliminated by having internal ribs moulded on the inside of the cells, which effectually separate the plates.



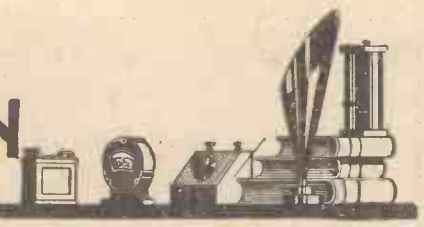
Ediswan Accumulator.

Another point of interest is the makers' claim that the cells have been designed to stand on open circuit for exceptionally long periods without fear of sulphation, and may be charged up once only in six months. The charging rate is .25 ampere for 40 hours.

The photograph illustrates the Hymeg accumulator grid-bias battery, which possesses six 2-volt cells identical in construction and appearance to those employed in the H.T. battery.



OUR INFORMATION BUREAU



RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, layouts, diagrams, etc., on separate sheets containing your name and address. Always send stamped, addressed envelope and attach Coupon (p. 884).

Dull-emitter Temperatures

Q.—*I find that the brightness of my dull-emitter valve filaments can be varied within fairly wide limits without appreciably affecting the strength of reception. How can I be sure that I do not run the valves too brightly?—P. L. (Brighton).*

A.—The filaments of all valves, whether dull-emitters or not, should always be run as dully as possible consistent with good reception. On no account should the brightness of the filaments be increased if this is not followed by an increase in the strength of reception. A very slight reduction in the temperature at which the filament is run greatly increases the useful life of any valve.—B

Measuring Rectified Current

Q.—*Can a milliammeter reading up to 10 milliamps. be used to measure the rectified current in a simple crystal circuit? If so, how?—W. R. (Birmingham).*

A.—Except when the receiver is situated very close to a powerful transmitting station it will be quite impossible to obtain a deflection of the needle in the type of instrument you mention, as the rectified current will be of the order of microamps only. The correct instrument to use for the purpose of measuring the rectified current is a microammeter, which is a fairly expensive instrument. It is connected either in place of the phones or in series with them.—J. F. J.

Resistance of Telephones

Q.—*If the effect of resistance is to waste energy why is it that high-resistance phones are more sensitive than low-resistance phones?—G. S. (Durham).*

A.—The term "resistance" as applied to phones is unfortunate, but dates from the earliest days of wireless. It would be much better to speak of phones as having so much inductance, as it is the intensity of the magnetic field due to the signal currents which is important. As the size of the earpieces is limited for reasons of convenience so also is the space available for the windings. In order to obtain a high inductance it is necessary to use a great many turns of fine wire which unfortunately but inevitably results in the windings having a fairly high resistance.—B

Neon Tubes

Q.—*Can a neon tube be used as a rectifier so that H.T. may be derived from the A.C. house-lighting mains?—P. L. (Bedfordshire).*

A.—A neon lamp is too imperfect a rectifier to be of much use for this purpose. All it does is to allow about four times as much current to flow through it in one direction than in the other. Although this is quite suitable for charging H.T. accumulators of small capacity, the smoothing difficulties would be great if it were desired to obtain the H.T. supply directly from the mains, as you suggest. If three or four lamps were used in series better rectification would result, but the voltage drop across the rectifier would be considerable. Some type of thermionic rectifier would be much more suitable for your purpose and may be either a special two-electrode rectifying valve or a receiving valve of the power type with the plate and grid connected together.—J. F. J.

Reception Without an Earth

Q.—*I find it is quite a simple matter to receive London on my crystal set with the earth connections disconnected. How is this possible?—R. T. (Ealing).*

A.—The fact that you can receive 2 L O without an earth connection is proof that your aerial system is efficient. An actual connection to earth, however, is by no means essential to good reception. In your case the wiring of the set and the various leads are acting as a "counterpoise" earth, the capacity of which is sufficient to balance the aerial capacity. The phone leads, for instance, may be of sufficient length for a difference of potential to be set up between them and the aerial and reception is thus possible.—B.

OUR WEEKLY NOTE

REACTION

Although the introduction of reaction has perhaps done more to make long-distance reception possible than any other single discovery, a great proportion of the trouble experienced by amateur possessors of valve receiving sets is due to its abuse.

Although nearly everyone is now familiar with the effects of oscillation, the disadvantages of using even a moderate amount of reaction do not seem to be fully realised. It is not exceeding the truth to say that some distortion is bound to occur whenever reaction is used, no matter how slight the degree of coupling. When reaction is introduced into any circuit the effect, of course, is to decrease the damping of that circuit. When the damping becomes zero the circuit becomes unstable, while when the damping attains a negative value self-oscillation occurs.

Now increased sharpness of tuning is one of the more important consequences of a reduction in the damping of a circuit and, however desirable in the direction of cutting out interference, it most certainly does not make for improved quality of reception. For long-distance reception reaction is permissible and often essential. But when one is striving for the utmost purity from a station situated at only a moderate distance it is better to omit reaction altogether. THE BUREAU

Inductance Coils

Q.—*If, say, a 100-turn coil is specified for a particular purpose, will it answer equally well to use two similar coils containing 50 turns each instead?—H. S. (Harrow).*

A.—It can by no means be taken for granted that such would be the case. The inductance of a coil, or series of coils, depends upon the total number of lines of force which interlink, with all the turns. In the case of the single 100-turn coil all the lines of force interlink all the turns, but the lines of force of each 50-turn coil will not interlink with the turns of the other coil unless the two coils are coupled together. Even if the coils are coupled all the lines of force will not interlink, unless the coupling is very close indeed. If this latter is the case the coils will to all intents and purposes act as a single large coil having a number of turns equal to that of the large coil, provided the coils are so coupled that the two fields tend to reinforce each other.—B.

She: "Well, can yer 'ear the nightingale?"
He: "No. Nothing but 'owls!"

Resistance Amplifier

Q.—*What is the cause of a series of "plops" at regularly spaced intervals which occur in a resistance-capacity coupled L.F. amplifier?—H. G. (Fulham).*

A.—This is rather a common trouble and is due to the coupling condensers or the grid leaks, or both, having too high a value. Constructors often make the mistake of using a two-megohm grid leak (such as is used for the rectifier) in conjunction with a large condenser of .025 microfarad or more. The grid leak in such a case should not have a resistance greater than half a megohm. The resistance of the grid leak should be so chosen that the electrons are allowed to leak away from the grid of the valve as fast as they gather there. If the leak is too high for the particular coupling condenser in use, the accumulation of electrons on the grid goes on increasing until the grid is so negative that the action of the valve is arrested. They can then leak away, and it is this periodic discharging of the grid which gives rise to the regular series of "plops" mentioned.—J. F. J.

Choke Coupling

Q.—*Why is it possible to obtain purer results with choke-coupled amplifiers than with ordinary transformer-coupled amplifiers? An iron core is used in both cases and I do not see why one method should give better results than the other.—K. B. (Thornton Heath).*

A.—Low-frequency transformers usually have a step-up ratio of between 1 to 3 and 1 to 6. A choke may be regarded as an auto-coupled transformer having a ratio of 1 to 1. It is well known that the best results as regards purity of reproduction are obtained with transformers having low step-up ratios, and for this reason the choke-coupled amplifier is usually capable of giving purer signals than the transformer-coupled amplifier. Control of grid current is more easily effected with choke than with transformers, but it should be noted that it is not possible to obtain such great amplification with choke coupling as it is with the more usual transformer coupling. Choke coupling is generally only to be preferred on account of its greater simplicity of construction and consequent cheapness. Resistance coupling is capable of giving a volume of sound equal to that produced by a stage of choke coupling (provided a special valve having a high amplification factor is employed) and is quite as simple in construction and operation as choke coupling.—B.

LISTENERS will hear Sir Austen Chamberlain's speech, proposing the toast of British-Italian Friendship, from New Prince's Restaurant, on June 28.

The B.B.C. engineers hope to give realistic illustrations from the Zoological Gardens on July 3.

It is hoped to broadcast from 2 L O the display by the London Auxiliary Air Defence, in Hyde Park, on the evening of September 27.

Miss Gertrude Elliott (Lady Forbes-Robertson) will play Cleopatra in *Antony and Cleopatra* on June 27.

The Prince of Wales will again be heard on June 29, when he visits the Enham Village Centre for Disabled Ex-Service Men.

The song of a roller canary will be broadcast from the London station on July 8.

In Wigtownshire and the adjacent counties in the south-western part of Scotland it is found that transmissions from Belfast are much louder and clearer than from any of the broadcasting stations in Britain.

Great interest was taken in the relay to all Scottish stations, from the offices of a Scottish newspaper, of a demonstration of how a daily paper is produced. The broadcast was switched over to the various departments of the newspaper while work was in progress.

Signor Marconi has informed the Australian Government that the coal strike has delayed the delivery of materials necessary for the completion of the Australian stations in the Imperial wireless chain. Communication between England and Australia is expected to be completed in October.

Pigeon fanciers are becoming alarmed by the increasing frequency of accidents to their racing pigeons due to wireless aerials.

The sanction of the Dean and Chapter of Westminster Abbey has been obtained to the broadcasting of evensong from the Abbey on Thursday in each week as from July 22. The time of the service is 3 p.m. The B.B.C. engineers are undertaking a thorough investigation of the acoustics of the Abbey.

The Leeds and Bradford station will play a part in the Leeds Tercentenary celebrations next month. A number of distinguished persons in the city have promised to give short talks.

The B.B.C. states that nearly 80 per cent. of the technical inquiries received daily refer to the oscillation trouble.

A five-valve wireless set, with loud-speakers and phones, has been installed at the workhouse of Market Bosworth, Leicestershire.

Speeches at the annual luncheon of the National Industrial Alliance of Employers and Employees on June 30 are to be broadcast from the London station.

A series of interesting experiments at South Foreland, which Signor Marconi and his assistants have been carrying on for more than a year, have now been completed satisfactorily. By means of the beam system Marconi has been able to send out signals for a hundred miles on a 6-metre wavelength and with a power of only about 40 kilowatts.

On July 3 Sir Harry Lauder will make his third appearance at 2 L O and will broadcast to all stations.

The Glasgow Children's Radio Circle recently held a successful public concert in aid of the Wireless for Hospitals Fund. A wireless installation, complete with phones for each bed and for the nurses' quarters, has been presented to Galashiels Cottage Hospital.

During the recent annual General Assemblies of the Established Church and the United Free Church of Scotland in Edinburgh, important parts of the proceedings were relayed to all Scottish stations.

The Radio-Paris broadcasting station at Clichy was struck by lightning during a recent storm and considerably damaged. A concert which was being given at the time had to be suspended.

A station is being erected in the Free City of Danzig. Building operations have just been started, and it is hoped to have the station in working order at the beginning of August.

On June 22 Mrs. Stanley Baldwin will broadcast from King's College Hospital on the occasion of the installation of wireless equipment for the staff and patients in connection with the Wireless for Hospitals Fund.

For the evening of July 3 a special humorous entertainment will be provided by the London station. It includes the new revue *Tune In,* comprising sketches by Sewell Collins, and a burlesque of *Hamlet* by Adrian Johnson.

An excerpt from the musical comedy *Yvonne,* as performed at Daly's Theatre on June 25, will be relayed to several B.B.C. stations.

Members of the 2 L O staff will contribute to a short concert broadcast on June 26.

It is proposed to relay from Dover on July 11 and 17 band performances by the King's Own Yorkshire Light Infantry.

On June 25 Mr. Dan Godfrey, with the assistance of the Wireless Orchestra, will broadcast a "Musical Tour Round the World."

In the ninth series of "Shakespeare's Heroines," to be broadcast from the London station on June 27, Miss Gertrude Elliot will take the part of Cleopatra, with Wilfred Walter as Antony.

Well-known writers who will give readings from their own works are Cosmo Hamilton on June 21, Stacy Aumonier on June 28 and E. Maschwitz on July 5.

P C G G, the Hague broadcasting station, which was responsible for some of the concert transmissions in 1922, is expected to resume operations at the close of the Radio Exhibition to be held at Scheveningen this summer. The wavelength will be 1,150 metres, and transmission will be made alternately with the Hilversum station.

On a recent occasion the small Reform Church at Emden (East Friesland) found itself without a minister. By means of a telephone land-line and wireless amplifier, a service was relayed from a neighbouring Dutch township, and the congregation listened to the service broadcast by a loud-speaker placed in the body of the church.

Work has already been started on the new 500-watt telephony transmitters to be installed at Innsbruck and Klagenfurt. It is hoped to bring these stations into operation this year, when they will act as relays of the Vienna programmes.

Both the Berlin and Frankfort-on-Main stations broadcast short announcements handed to them by the local labour exchanges, in which information is given regarding the various industrial concerns requiring labour. By this means the solving of the unemployment problem in Germany has been considerably facilitated.

Radio-Toulouse has now made all arrangements for the regular relay of services from the Cathedral of Ste. Etienne.

The thirtieth anniversary of the granting of the first Marconi wireless patent was celebrated at Bologna on June 14, all the authorities taking part in the ceremony. The King sent a message of congratulation, and the Minister of Economy represented the Government and Signor Mussolini.

The programmes of W G Y (Schenectady, New York) are now also broadcast on a wavelength of 32.79 metres. The call-sign for this transmitter is **2 X A F.**

NEXT WEEK AT 2LO

By "THE LISTENER"

Mabel France

THE Hyde Park Band has proved very successful in previous transmissions, and on Sunday afternoon a programme will be transmitted, with studio interludes by Gordon Bryan, pianist, and Leonard Gowings, the well-known tenor. The evening programme is devoted to a performance of Dvorak's *Stabat Mater,* the English adaptation by Frederic J. W. Crower entitled "At the Foot of the Cross," the principals being Elsie Suddaby, Gladys Palmer, Spencer Thomas and Herbert Heyner, all famous artistes and familiar broadcasters.

The Welsh National Council of Music, in co-operation with the university authorities at Aberystwyth, hold their sixth and final Festival Concert on Monday at Aberystwyth, and this will be relayed at 8 o'clock. Contrast is provided later by the variety programme in which Lawrence Bascomb, Scala the banjoist, Alma Barnes, and Clapham and Dwyer will take part.

A popular orchestral concert, conducted by Dan Godfrey, is promised for Tuesday, the vocalist being Glyn Eastman. At 8.15 a short play entitled *The Test,* specially written by J. A. Shepherd, will be given. It is on Grande Guignol lines of the Aztec Empire in Mexico. Later will follow Mr. Fred Chester, and at 10.10 Mr. A. J. Alan has promised us a veracious tale of "The First of April."

Last year we heard Robert Carr and his Georgian concert party quite frequently from the studio. On Wednesday we shall hear a performance relayed from Ramsgate.

Thursday being Dominion Day of Canada, a special Canadian programme is promised.

The seaside is again in evidence on Friday, when a programme will be relayed from Brighton, consisting of a talk from the Hotel Metropole, followed by a performance of the Royal Dragoons Band on the West Pier.

On Saturday night we are to have the first production of *Tune In,* the new radio revue produced by James Lester, the cast including the favourites, Iris White, Olive Kilgour, Eddie Morris and Tommy Handley. Sketches by George Murray and music by Stanley Holt are the great features. Later the classical element is represented by the performance of a Haydn Concerto, just recently revived by Ada St. John Wright, and at 10 o'clock follows a recital by Sir Harry Lauder. The pianist for the week for the 7.15 recitals is Edward Isaacs, the Manchester pianist, who concludes the Beethoven Sonatas.

Leonard Gowings

THE COST OF BROADCAST PROGRAMMES

NOW that criticism of broadcasting programmes is so rife it is interesting to consider the question of cost.

In the early days of broadcasting the programme consisted of perhaps a pianola recital and a few others items, and the cost fell well within a five-pound note. The average daily cost of one of London's present-day programmes approximates to three hundred guineas!

Why the Increase?

The question arises as to the reasons for this enormous increase in expenditure. In brief the cause is evolution. Daily, even hourly, the listener's ear becomes more delicate. To-day it detects faults which yesterday passed unnoticed. The same is to be said of the originator of the broadcast production. Broadcasting was a toy; it has become a necessity; it will become an art. Thus one detects two critics working in parallel—the one the listener, the other the producer. The listener's ear demands better music, better finish, better artistes. The producer has like desires and dreams of greater scope.

Artistes' Fees

To emphasise the point, let us consider the case of an obscure artiste who, possessing the necessary attributes, rises to the height of a wireless star. Originally he was glad to earn two humble guineas. Slowly his rise to fame increased his fee to seven or eight times the original amount. This is but natural and right.

Then again, in the early days of broadcast transmissions were not continuous, and the duration was small in comparison with the present-day broadcasts.

The novelty of wireless for some considerable time gained for it partial immunity from authors', composers' and publishers' charges. This benign attitude on the part of these people has completely gone, so that young Mr. Radio, with a fixed, expendable income, must needs plan his development and yet meet the cost of his newly gained manhood. A case in point is the recent increase in the charge of copyright on operas. For broadcasting purposes these have advanced from modest figures to 700 per cent. over the charges made at first.

Wireless Humorists

Then there is the case of entertainers. The listener is constantly demanding the supply of that subtle form of humour which alone "gets over" adequately. The clever type of entertaining, depending as it does purely on the material and voice, can be found only among high-priced artistes or a few individuals who have made wireless reputations. These artistes cannot afford to exhaust their humour in one night, unless the remuneration is commensurate. Their appearances must necessarily be few and far between unless the B.B.C. can see their way to meet them by writing up their material. Yet would this material suit the artiste, and would the method be cheaper?

Every progressive step which the wireless entertainment industry makes carries with it an increased bill. There must needs be a ruthless pruning both on the technical and the programme production side, but such economies will never keep pace with the present demand for better quality.

ROBERT GLENDINING.

WIRELESS IN PARLIAMENT

From Our Own Correspondent.

SIR A. SINCLAIR asked the Postmaster-General whether, in view of the statements by the managing director of Amalgamated Wireless (Australasia), Ltd., that Australia had wireless stations capable of conducting experiments in wireless telephony with those in this country, that the stations were ready, and that they were willing to co-operate on receipt of an invitation from Great Britain, he would say whether that invitation would be extended, and, if not, for what reason?

Sir W. Mitchell-Thomson said that he had communicated with the Australian authorities, and he understood that the Australian Wireless Co. had no stations which could undertake suitable radio-telephonic transmission to this country. Two-way experiments were therefore impracticable; they had offered to receive the experimental transmissions from Rugby and to report their strength. He had informed them that he welcomed this offer, and he had furnished the necessary particulars of the Rugby transmissions. Unfortunately, however, it had been necessary to suspend the Rugby experiments during the present emergency in order to economise coal.

Asked by Mr. Day if he was in a position to make any statement on the matter of the editorial reviews now being broadcast by the British Broadcasting Co., Sir W. Mitchell-Thomson said that he had been in communication with the British Broadcasting Co. on this subject, and he understood that care was now being taken to avoid the broadcasting of statements which might be regarded as being of a controversial character.

Asked by Mr. Day whether it was proposed to introduce wireless concerts in London parks as a substitute for bands, Capt. Hacking said he could only answer for the Royal Parks, which were in the charge of the Office of Works. It was not proposed to introduce wireless concerts as a substitute for bands in any of these parks.

Sharp Tools are Essential for Good Work, and how this may be brought about is fully illustrated and described in the current issue of "The Amateur Mechanic and Work" (3d.). Other articles appearing in the same number are: "Repolishing Carved Work," "Stopping Leaks in Ironware," "Making Toy Pistols and a Bow," "Preparing Perfume from Flowers," "Fine Points in Driving a Motor-cycle," "Plaster Working by Practical Methods," "A Simple Two-way Switch," "Making a Light Occasional Table," "Cutting Paper Letters with Scissors," "Things to Make with Three-ply," "Measuring the Diameter of Wires with Simple Appliances."

"Banish your Battery Troubles"

SIR,—You have sent me the gist of correspondents' criticisms of my article "Banish Your Battery Troubles," appearing in your issue of May 29. Might I say that I had intended adding a few lines concerning the actual circuits criticised on the proofs, which, however, I did not receive. [The article was received and prepared by us during the strike period. —ED.]

With regard to the lead pencils, the whole success of using these as a resistance depends on the quality of the lead. If the lead contains a high percentage of plumbago, it will certainly split and chip. Pencils having soft fat leads of 50 ohms or so are useless, and so are many types of lead of higher resistances of 500 or 600 ohms. Moreover, this system should not be used on high-voltage mains. I used it very successfully in the country on 110-volt D.C. mains and experienced no trouble at all. This, unfortunately, was omitted in my article, and I apologise for the omission.

Again, if — H.T. and + L.T. are connected together in the set, not the slightest damage will be done, either to the mains or to the set. The added resistances of the choke and the lead pencil (32,000 turns of thin wire plus about 200 ohms) will certainly prevent the main's fuses from blowing. The choke will not even become warm.

Lastly, I distinctly wrote in my article that a fixed condenser of large capacity should be inserted in the earth lead from the set, *so that it matters not whether L.T. + or — is connected to the earth terminal of the set.* I am afraid that some correspondents missed this point.—A. L. P. (London, S.W.).

Coupling L.F. Valves

SIR,—With reference to the recent correspondence in your columns on the best method of coupling low-frequency valves, I would like to emphasise one or two points in favour of both transformer and resistance-capacity coupling.

While the transformer method is to-day of a very high order, and also gives maximum volume with a given number of valves, it is almost impossible to obtain perfect quality with more than two stages; on the other hand, a considerable drop in volume is found with a resistance-coupled amplifier of the same number of valves.

Resistance-capacity coupling gives without doubt very much better reproduction as a whole, but has, of course, its drawbacks.

The point raised by "S. D." in your issue of June 12, *re* the impedance of the coupling condenser changing with the frequency and thus causing a certain amount of distortion, is, of course, quite correct; but does this not also happen in the case of a transformer, where we have primary and secondary windings to consider instead of a coupling condenser?

In conclusion the writer would say that he finds the ideal arrangement to be the first stage coupled with a good low-frequency transformer, with a moderate step-up, followed by one or more stages of resistance-capacity coupling; this does not require a high anode voltage, or special valves, ordinary L.F. or general-purpose valves and 100 volts H.T. giving every satisfaction both as regards quality and quantity.—C. W. S. (Cheltenham).

Valve Coupling and Purity

SIR,—May I add a few remarks to those already expressed in your columns regarding L. F. transformers and purity of reproduction?

I think we are all agreed that the impedance in the anode circuit of a valve should at least be proportional to the impedance of the valve. Experiment usually shows that maximum amplification with minimum distortion is obtained when the impedance in the anode circuit is from two to three times that of the valve. Of course, in the case of a choke or transformer, the impedance must be measured at some definite frequency, say 250 cycles.

Bearing the above points in view, it is difficult to use a transformer for the first L.F. stage following a high-impedance detector because, if the transformer primary had the requisite impedance, its self-capacity would be so great as to nullify its advantages. The same is true of a choke except that capacity may be cut down slightly by increasing its overall size.

In designing an amplifier I had considered these points, and decided upon a more novel method of achieving my object. For the first stage, following the high-impedance detector, I used a 100,000-ohm resistance connected in shunt with the primary of a transformer which had a .006 condenser in series. This proved a splendid combination and gave the purity of the resistance-capacity coupling with the amplification of the transformer. Of course the principle is not new, and several of us use it for connecting our loud-speakers, but I have never before heard of this application, which appears to be the most useful coupling in such circumstances.—F. P. (Keighley).

Other Correspondence Summarised

G. C. L. (Plymouth), writing with reference to a statement to the effect that a dealer in Plymouth had to stop broadcasting news during the strike on account of objections made by strikers, states that he ceased putting the news out entirely on his own initiative and that there was no intimidation whatever.

NOTE.—*In the following list of transmissions these abbreviations are observed: con. for concert; lec. for lecture; orch. for orchestral concert; irr. for irregular; m. for metres; and sig. for signal.*

GREAT BRITAIN

The times given are according to British Summer Time.

London (2LO), 364 m. 1-2 p.m., con.; 3.15-4 p.m., transmission to schools; 3.30-5.45, con. (Sun.); 4.15 p.m., con.; 5.15-5.55, children; 6 p.m., dance music; 7-8 p.m., time sig., news, music, talk; 8-10 p.m., music; 9.0, news (Sun.); 9.30 p.m., time sig., news, talk; 10 p.m., special feature (Mon., Wed., Fri.). Dance music on Thurs. and Sat. until midnight.

Aberdeen (2BD), 495 m. **Belfast** (2BE), 440 m. **Birmingham** (5IT), 479 m. **Bournemouth** (6BM), 386 m. **Cardiff** (5WA), 353 m. **Glasgow** (5SC), 422 m. **Manchester** (2ZY), 378 m. **Newcastle** (5NO), 404 m. Much the same as London times.

Bradford (2LS), 310 m. **Dundee** (2DE), 315 m. **Edinburgh** (2EH), 328 m. **Hull** (6KH), 335 m. **Leeds** (2LS), 321.5 m. **Liverpool** (6LV), 331 m. **Nottingham** (5NG), 326 m. **Plymouth** (5PY), 338 m. **Sheffield** (6FL), 301 m. **Stoke-on-Trent** (6ST), 306 m. **Swansea** (5SX), 482 m. **Daventry** (25 kw.), high-power station, 1,600 m. Special weather report 10.30 a.m. and 10.25 p.m. (weekdays), 9.10 p.m. (Sun.); 11.0 a.m., light music (exc. Sat. and Sun.); relays 2LO from 4 p.m. onwards, own con. on Mon. Dance music daily (exc. Sun. and Tues.) till midnight; on first Friday in each month until 2 a.m.

IRISH FREE STATE.

Dublin (2RN), 397 m. Daily, 7.30 p.m. Sundays, 8.30 p.m. until 10.30 p.m.

CONTINENT

The Times are according to the Continental system; for example, 16.30 is 4.30 p.m., and 08.00 is 8 a.m. B.S.T.

AUSTRIA.

Vienna (Radio Wien), 582.5 m. and 531 m. (temp.) (10 kw.). 11.00, con. (almost daily); 15.30, con.; 19.25, news, weather, time sig.; con., lec., news; 20.00, con.; 22.00, dance (Wed., Sat.).

Graz, 402 m. (1 kw.). Relay from Vienna. Also own con. (Tues., Wed., Fri.), 20.10.

BELGIUM.

Brussels, 487 m. (1½ kw.). 17.00, orch. (Tues., Thurs., Sat. only), news; 20.00, lec., con., news. Relay: Antwerp, 265 m. (100 w.).

CZECHO-SLOVAKIA.

Prague, 372 m.(5 kw.). Con., 20.00-23.00, daily.

Brunn (OKB), 521 m. (2.4 kw.). 10.00, con., news (Sun.); 19.00, lec., con. or dance (daily).

DENMARK.

Copenhagen (Radioraadet), 347.5 m. (2 kw.). Sundays: 15.30, lec.; 17.30, children; 20.00, play; 21.15, news, con.; 21.15, news, Esperanto (Mon.), silent night. Weekdays: 20.00, lec., con., news, con.; 21.30, dance (Sat.).

Ryvang, 1,150 m. (1 kw.). Sundays: 09.00, sacred service.

Odense, 810 m. Relays Copenhagen.

Sorö, 1,150 m. (1½ kw.). Relays Copenhagen.

FINLAND.

Helsingfors (Skyddskar), 504 m. (500 w.).

Helsingfors, 440 m. **Con.**, 18.00 (Tues., Thurs., Sat., Sun.).

***Tamafors**, 368 m.

***Jyvaskyla**, 561 m. (200 w.).

***Uleaborg**, 233 m. (200 w.).

* Relay Helsingfors.

GRAND DUCHY OF LUXEMBURG.

Radio Luxemburg (LOAA), 1,200 m. Con.: 14.00 (Sun.), 21.00 (Thurs.).

FRANCE.

Eiffel Tower, 2,650 m. (5 kw.). 06.40, weather (exc. Sun.); 07.15, 08.00, physical exercises; 11.00, markets (exc. Sun. and Mon.); 11.20, time sig., weather; 15.00, 16.45, Stock Ex. (exc. Sun. and Mon.); 18.00, talk, con., news; 19.00 and 23.10, weather; 21.00, con. (daily). Relays PTT, Paris: 07.15, 08.00 (daily).

Radio-Paris (CFR), 1,750 m. (about 3 kw.). Sundays: 12.45, con., news; 16.30, Stock Ex., con.; 20.15, news, con. or dance. Weekdays: 10.40, news; 12.30, con., markets, weather, news; 16.30, markets, con.; 20.15, news, con. or dance.

L'Ecole Sup. des Postes et Télégraphes (PTT), Paris, 458 m. (800 w.). 07.15, 08.00, physical exercises; 14.00 or 15.00, studio con. or otuside relay; 20.30, lec. (almost daily); 21.00, con. (daily).

Le Petit Parisien, 333 m. (1 kw.). 21.15, con. (Tues., Thurs., Sat., Sun.).

Radio L.L. (Paris), 350 m. (250 w.). Con. (Mon., Wed., Thurs.), 20.30.

Radio-Toulouse, 430 m. (2 kw.). 12.30, con., time sig. (daily); 17.30, news (exc. Sun.); 20.45, con.; 21.25, dance (daily).

Radio-Lyon, 280 m. (2 kw.). 20.20, con. (daily). Temporarily closed.

Strassburg, 205 m. (120 w.). 21.15, con. (Tues., Thurs.).

Radio Agen, 318 m. (250 w.). 12.40, weather, Stock Ex.; 20.00, weather, Stock Ex.; 20.30, con. (Tues., Fri.).

***Lyon-la-Doua**, 486 m. Own con., 20.00 (Mon., Wed., Sat.).

***Marseilles**, 351 m. (500 w.).

***Toulouse**, 280 m. (2 kw.).

***Bordeaux**, 411 m.

* Relays of PTT Paris.

Montpelier, 220 m. (1 kw.).

Angers (Radio Anjou), 300 m. (500 w.). Daily: 20.30, news, lec., con.

Bordeaux (Radio Sud-Ouest), 330 m. Con., 22.00 (Mon., Fri.).

Mont de Marsan, 390 m. (300 w.). Con. (weekdays only), 20.30.

GERMANY.

Berlin, on both 504 and 571.5 m. (4 kw.). 06.30, con. (Sun.); 09.00, sacred con. (Sun.); 11.00, con. and tests; 12.55, time sig., news, weather; 15.00, educ. hour (Sun.), markets, time sig.; 17.30, orch.; 20.30, con., weather, news, time sig., dance music until 24.00 (Sat., Sun., Thurs). Relayed on 1,300 m. by Königswusterhausen (1,300 m.) and Stettin (241 m.).

Königswusterhausen (LP), 1,300 m. (8 kw.). 11.30-12.50, relays Berlin (Sun.); 15.00, lec. (daily); 18.30, relay of Berlin (Vox Haus) con. (daily). 2,525 m. (5 kw.), Wolff's Buro Press Service: 06.45-20.10. 2,880 m., Telegraphen Union: 08.30-19.45, news. 4,000 m. (10 kw.), 07.00-21.00, news.

Breslau, 417 m. (4 kw.). 12.00, con. (daily), Divine service (Sun.); 12.55, time sig. (Sun.), weather, Stock Ex., news; 16.00, children (Sun.); 17.00, con.; 19.00, lec.; 20.30, con., weather, time sig., news, dance (relays Berlin). Relay: Gleiwitz, 251 m.

Frankfort-on-Main, 470 m. (1½ kw.). 08.00, sacred con. (Sun.); 11.55, time sig., news; 12.55, Nauen time sig.; 16.00, con. (Sun.); 16.30, con.; 18.00, markets, lec.; 20.00, lec., con., weather. Dance: relays Berlin. Relay: Cassel, 273.5 m.

Hamburg, 392 m. (4 kw.). Relayed by Bremen (277 m.), Hanover (297 m.), Kiel (233 m.) Sundays: 07.25, time sig., weather, news, lec.; 09.15, sacred con.; 13.15, con.; 18.00, con.; 19.15, sports, weather, con. or opera, dance. Weekdays: 05.45, time sig., weather; 07.00 and 07.30, news, weather; 12.55, Nauen time sig., news; 14.00, weather, con.; 16.15 and 18.00, con.; 19.00, lec.; 19.55, weather and con.; 22.00, dance (Sun., Thurs., Sat.).

Königsberg, 462 m. (1 kw.). 09.00, sacred con. (Sun.); 12.55, time sig., weather, news; 16.30, con.; 17.00, con. (Sun.); 19.30, lec.; 20.00, con. or opera, weather, news, dance (irr.).

Leipzig, 452 m. (700 w.). Relayed by Dresden (294 m.). 08.30, sacred con. (Sun.); 11.00, educ. hour (Sun.); 12.00, con. (daily); 12.55, Nauen time sig., news; 16.30, con., children (Wed.); 20.15, con. or opera, weather, news, cabaret or dance (not daily).

Munich, 485 m. (3 kw.). Relayed by Nuremberg (340 m.). 11.30, lec., con. (Sun.); 14.00, time sig., news, weather; 16.00, orch. (Sun.); 16.30, con. (weekdays); 18.30, con. (weekdays); 19.15, lec.; 19.30, con. (Sun.).

Munster, 410 m. (1 kw.). Relayed by Elberfeld (259 m.), Dortmund (283 m.). 11.45, radio talk, Divine service; 12.00, news (Sun.); 12.30, news (weekdays); 12.55, Nauen time sig.; 15.30, news, time sig.; 16.00, con.; 17.00, children (Sat.); 19.40, news, weather, time sig., lec., con.

Norddeich (KAV), 1,800 m. 24.00 and 04.00, weather and news.

Stuttgart, 446 m. (1½ kw.). 11.30, con. (Sun.); 16.30, con. (weekdays); 17.00, con. (Sun.); 18.30, time sig., news, lec., con. (daily); 21.15, time sig., late con. or cabaret.

HOLLAND.

Amsterdam (PCFF), 2,125 m. (1 kw.). Daily: 06.35-15.30 (exc. Mon. and Sat., when 12.30-13.30), news, Stock Ex.

Hilversum (HDO), 1,060 m. (5 kw.). 09.00, sacred service (Sun.); 19.10, con.; 21.00, news, etc. Testing on 25 kw.

HUNGARY.

Buda-Pesth (Csepel), 560 m. (2 kw.). 09.00, news; 12.00 and 15.00, weather, news; 17.00, dance music; 20.00, con. or opera, dance.

Kosice, 2,020 m. (2½ kw.). 19.00, con.

ICELAND.

Reykjavik, 327 m. (700 w.). Tests: 22.30, 24.30.

ITALY.

Rome (IRO), 425 m. (3 kw.). 10.30, sacred con.; 13.15, official communique; 17.00, children; 17.30, relay of orch. from Hotel di Russia; 17.55, news, Stock Ex., jazz band; 20.30, news, weather, con.; 22.15, late news.

Milan, 320 m. (2 kw.). 20.00-01.00, con., jazz band.

JUGO-SLAVIA.

Belgrade (Rakovitza) (HFF), 1,650 m. (2 kw.). 17.00, news (daily), con. (Tues., Thurs., Sat.).

Agram (Zagreb), 350 m. (500 w.).

LETTLAND.

Riga, 475 m. (2 kw.). Con. daily, 21.00-22.00.

NORWAY.

Oslo, 382 m. (1.2 kw.). 11.00, Divine service (Sun.), Stock Ex. (weekdays); 13.15, markets; 19.15, news, time, lec., con.; 22.00, time, weather, news, dance relayed from Hotel Bristol, Oslo (not daily).

Bergen, 358 m. (1½ kw.). 19.30, news, con., etc.

POLAND.

Warsaw, 480 m. (6 kw.). Daily: con., 11.00-13.00; 15.00-23.00, daily.

RUSSIA.

Moscow (RDW), 1,450 m. (12 kw.). Weekdays: 12.30 and 17.55, news and con.; 23.00, chimes from Kremlin.

(Popoff Station), 1,010 m. (2 kw.). 10.00, 11.00, lec.; 13.00, 19.00, con. (Tues., Thurs., Fri.).

Radio Peredacha, 410 m. (6 kw.).

Trades Union Council Station, 450 m. (2 kw.). 18.00, con. (Mon., Wed.).

Leningrad, 940 m. (2 kw.). Weekdays: 16.00.

Nijni Novgorod, 1,400 m. (1.2 kw.). 21.30, con.

SPAIN.

Madrid (EAJ6), 392 m. (1½ kw.). Daily: con. (times vary daily). Closes at 24.00 on Sun., Wed., Sat.

(*Concluded on page* 882)

"BROADCAST TELEPHONY" *(cont. from page 880)*

Madrid (EAJ7), 373 m. (4½ kw.). 17.30-24.00, con. (almost daily).

Madrid (EAJ4), 340 m. (3 kw.). 16.00, con.

Barcelona (EAJ1), 324 m. (3 kw.). 17.00-21.00, news, lec., con. (Sun.); 18.00-23.00 (daily).

Barcelona (Radio Catalana) (EAJ13), 462 m. (3 kw.). 19.00-23.00, con., weather, news.

Bilbao (EAJ9), 415 m. (1 kw.). 19.00, news, weather, con. Close down 22.00.

Bilbao (Radio Vizcaya) (EAJ11), 418 m. (2 kw.). 22.00-24.00, con. (daily).

Cadiz (EAJ3), 360 m. (550 w.). 19.00-21.00, con., news. Tests daily (exc. Sun.), 24.00.

Cartagena (EAJ15), 335 m. 19.00-22.00, con. (daily).

Seville (EAJ5), 357 m. (1½ w.). 21.00, con., news, weather. Close down 23.00.

Seville (EAJ17), 300 m. 19.00-22.00, con. (daily).

San Sebastian (EAJ8), 346 m. (500 w.). 17.00-19.00, 21.00-23.00 (daily).

Salamanca (EAJ22), 405 m. (1 kw.). 17.00 and 21.00, con. (daily).

Saragossa, about 325 m. Testing.

SWEDEN.

Stockholm (SASA), 430 m. (1½ kw.). 11.00, sacred service (Sun.); 12.30, weather; 14.00, con. (Sun.); 17.00, children (Sun.); 18.00, sacred service; 19.00, lec.; 21.15, news, con., weather. Dance (Wed., Sat.).

Relays.—Boden (SASE), 1,200 m.; Eskilstuna, 250 m.; Falun (SMZK), 370 m.; Gothenburg (SASB), 288 m.; Gefle, 208 m.; Helsingborg, 235 m.; Joenkoeping (SMZD), 199 m.; Kalmar, 253 m.; Karlsborg (SAJ), 1,350 m.; Karlscrona (SMSM), 196 m.; Kristinehamm (SMTY), 292 m.; Karlstadt (SMXG), 221 m.; Linkoeping, 467 m.; Malmo (SASC), 270 m.; Norrkoeping (SMVV), 260 m.; Orebro, 237 m.; Ostersund, 720 m.; Säffle (SMTS), 245 m.; Sundsvall (SASD), 550 m.; Trollhattan (SMXQ), 322 m.; Umea, 215 m.; Varborg, 385 m.

SWITZERLAND.

Lausanne (HB2), 850 m. (1½ kw.) (temp.). 20.00, lec., con. (daily).

Zurich (Hongg), 515 m. (temp.) (500 w.). 11.00, con. (Sun.); 12.00, weather; 12.55, Nauen time sig., weather, news, Stock Ex.; 13.30, piano solo; 17.00, con. (exc. Sun.); 18.15, children, women; 19.00, news, weather; 20.15, lec., con., dance (Fri.).

Geneva (HB1), 760 m. (2 kw.). 20.15, con. (daily).

Berne, 435 m. 10.30, organ music (exc. Sat.); 16.00, 20.30, con.

Basle. 1000 m. (1½ k.w.), con. daily 20.30.

Elektrite Crystals.—Philip Barnard and Co., of 9 and 10, Savoy Street, Strand, W.C.2, have supplied us with samples of their Elektrite crystals which were picked from their stock at random. We have completed tests on these samples with the following results. Sensitivity over the surface of the crystal is good, six consecutive settings of the catwhisker giving a high and fairly constant rectified current from 2 L O's carrier wave. The response to very weak signals is excellent, and the resistance of the crystal varies between 3,000 and 20,000 ohms.

The Liverpool Radio Players will be the name of the 6 L V station Repertory Players in future. The change has been made because many people have been under the impression that the company was associated with a local theatre.

TRADE NOTES

THE airship *Norge*, in which Amundsen recently flew over the North Pole, was equipped for wireless purposes with Exide accumulators. The Byrd and Wilkins expedition also used Exide batteries.

Constructors will be interested to hear that all C.A.V. wireless apparatus is now obtainable from the branch of Rotax, Ltd., at 7, Temple Street, Bristol.

We have received a revised copy of catalogue No. 364F, published by the Marconiphone Co., Ltd., of 210-212, Tottenham Court Rd., W.1. The full range of Marconiphone and Sterling receivers, accessories and components is described.

The Blackadda Radio Co., Ltd., of 48, Sadler Gate, Derby, have issued a most interesting circuit book containing over fifty circuits that may be used with the Blackadda radio-building system.

J.B. Condensers.—In the test report of these condensers, which appeared on p. 813 of No. 209, the gearing ratio was stated to be 30 to 1. This should read 60 to 1. Actually, for thirty complete revolutions of the vernier control knob the moving vanes are turned through 180 degrees.

On May 1 the number of receiving licences current in this country was 2,012,000.

MOUNTING VARIABLE CONDENSERS

SOME of the variable condensers made at the present time are rather heavy owing to the use of brass instead of aluminium vanes. Brass is employed because it enables the vanes of each set, the fixed and the moving, to be bonded together with solder so that perfect electrical connection results. Owing to their weight it is not advisable to mount these condensers upon a vertical panel simply by one-hole fixing, for when this is done the strain upon the ebonite is considerable. The best way is to support the condensers by means of wooden blocks of suitable height upon the baseboard, care being, of course, taken that the wood does not come into contact with any of the metal parts. When this is done all strain is taken off the panel and smooth working is ensured. W.

CHIEF EVENTS OF THE WEEK

SUNDAY, JUNE 27th

London	The Royal Parks Band, relayed from Hyde Park Bandstand
Aberdeen	Orchestral Concert.
Manchester	Master Instrumentalists.
Newcastle	Light Orchestral Programme.
Swansea	Aberystwyth Musical Festival.

MONDAY

Daventry	Special Continental Programme.
Aberdeen	Operatic Excerpts.
Bournemouth	*Remnant Acre.*
Belfast	Orchestral Extracts.
Glasgow	Light Orchestral Concert.
Manchester	"Light and Shade."

TUESDAY

London	*The Test.*
Aberdeen	Irish Programme.
Birmingham	Welsh Programme.
Bournemouth	Light Symphony Concert.
Belfast	"Old Memories."
Cardiff	"Devon, Glorious Devon."
Glasgow	Variety Programme.

WEDNESDAY

London	Robert Carr's Georgian Concert Party.
Birmingham	Folk Tunes and Songs.
Belfast	Orchestral Concert.
Cardiff	A Pastoral Programme.
Edinburgh	Songs and Entertainment.
Hull	An Old-Fashioned Night.
Liverpool	The Band of the Liverpool City Police.
Newcastle	Mainly Musical Comedy.
Sheffield	Smoking Concert.

THURSDAY

London	Canadian Programme.
Birmingham	Light Classics.
Glasgow	Dominion Day Programme.

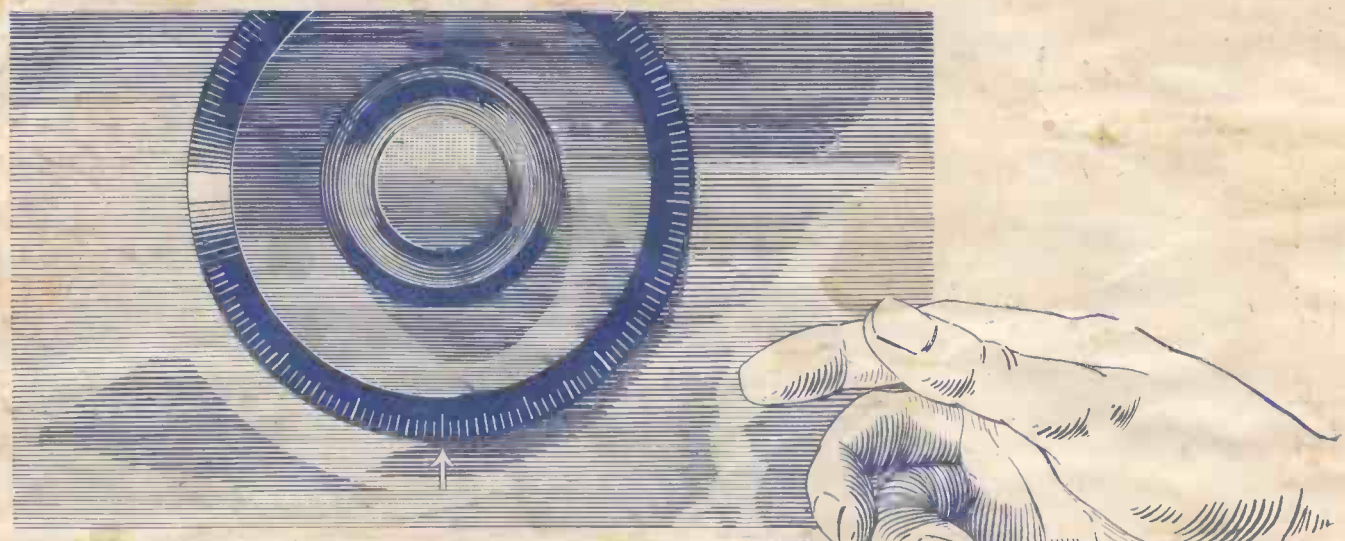
FRIDAY

London	A Broadcast from Brighton.
Aberdeen	Ballad Concert.
Birmingham	Shakespearean Programme.
Bournemouth	The Municipal Military Band.
Cardiff	A Welsh Programme.
Manchester	Songs and Band Selections.
Newcastle	*The Proposal.*

SATURDAY

London	Sir Harry Lauder.
Aberdeen	Scottish Programme.
Belfast	Solos and Duets.
Glasgow	Popular Concert.

A Free Gift.—Sylvex Ltd. of 41 High Holborn, W.C.1, have adopted a novel means of popularising the well-known Sylvex crystals. Each purchaser of the 2s. size crystal or two 1s. size crystals will receive a self-filling fountain pen with gold-plated nib. Sylvex crystals, which can be recommended as being highly sensitive, are obtainable from most wireless dealers.



CHOOSE!

Take your choice of station from the multitude of calls that whisper in your 'phones. Then, just a turn to the dial of the R.I. Retroactive Tuner, **and you have it,** picked out easily and cleanly in a few seconds. No coils to plug in, just one instrument to cover the whole range of wave-lengths from 175-4,000 metres.

The coil is wound with a single layer of wire, a method which has been proved by eminent technicians to be more efficient than multi-layer winding.

In addition the **R.I. Retroactive Tuner** possesses the following advantages :

(1) High frequency losses are reduced to a minimum, by means of the special dead-end switch, which short-circuits the adjacent turns and provides a magnetic screen.

(2) Efficient aerial reaction is provided over the entire range of wave-lengths covered by the inductance, a very important factor when it is recognised how difficult it is to obtain the best reaction value over a wide number of wave-lengths.

(3) Lastly, the **R.I. Retroactive Tuner** costs less than a set of plug-in coils with coil holder to cover a similar range.

Concise explanatory diagrams of circuits supplied with each instrument.

PRICE, 39/6

Write for the R.I. Blue and Gold Catalogue free on application.

BRITISH RI

THE MARK OF BETTER RADIO

RI LTD

Advt. R.I., Ltd., 12, Hyde St., New Oxford St., London, W.C.1.

P.C.33.

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