# The Wireless Constructor

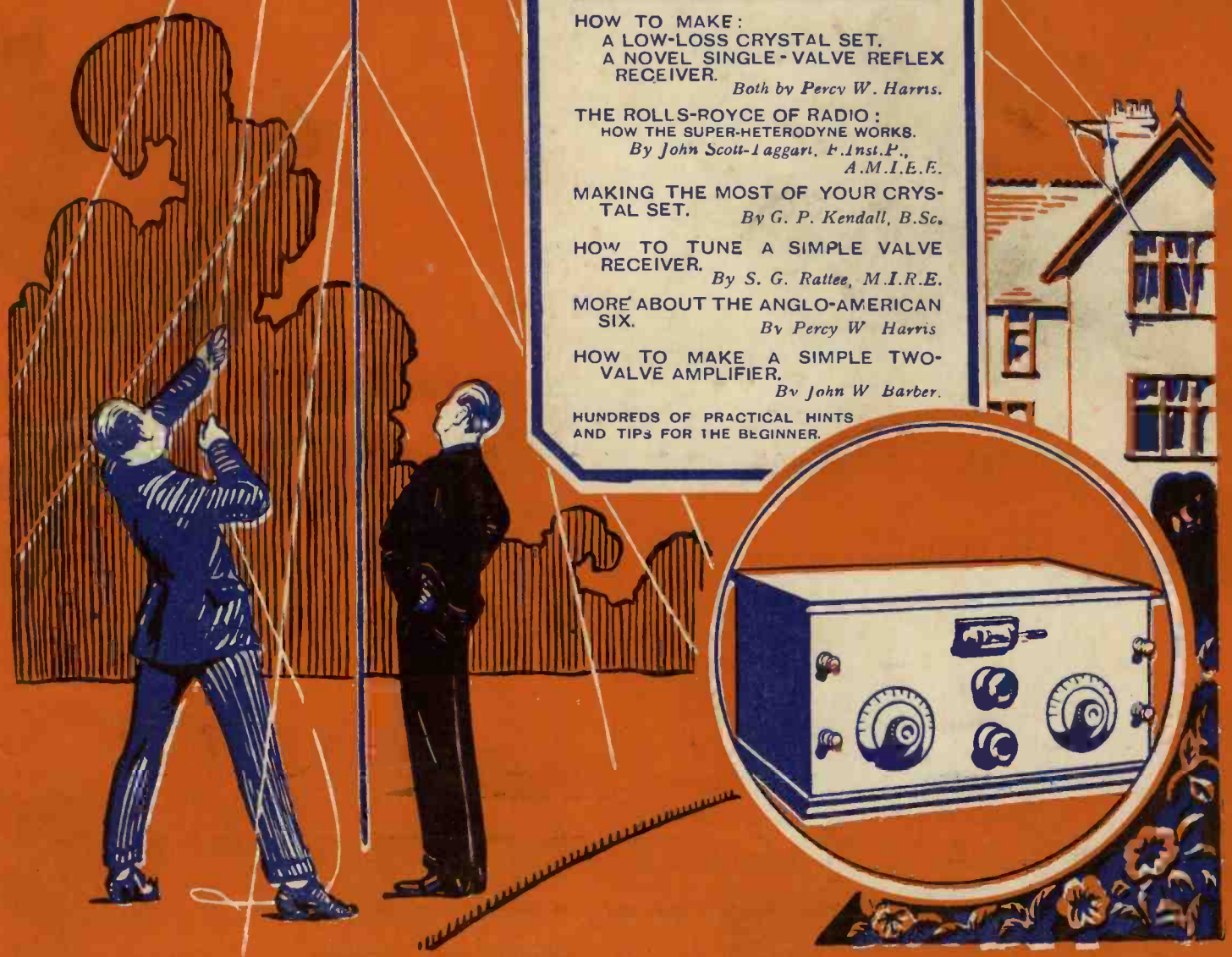
6D MONTHLY

EDITED BY
PERCY W. HARRIS

## CONTENTS.

Vol. 1. No. 4. FEBRUARY, 1925.





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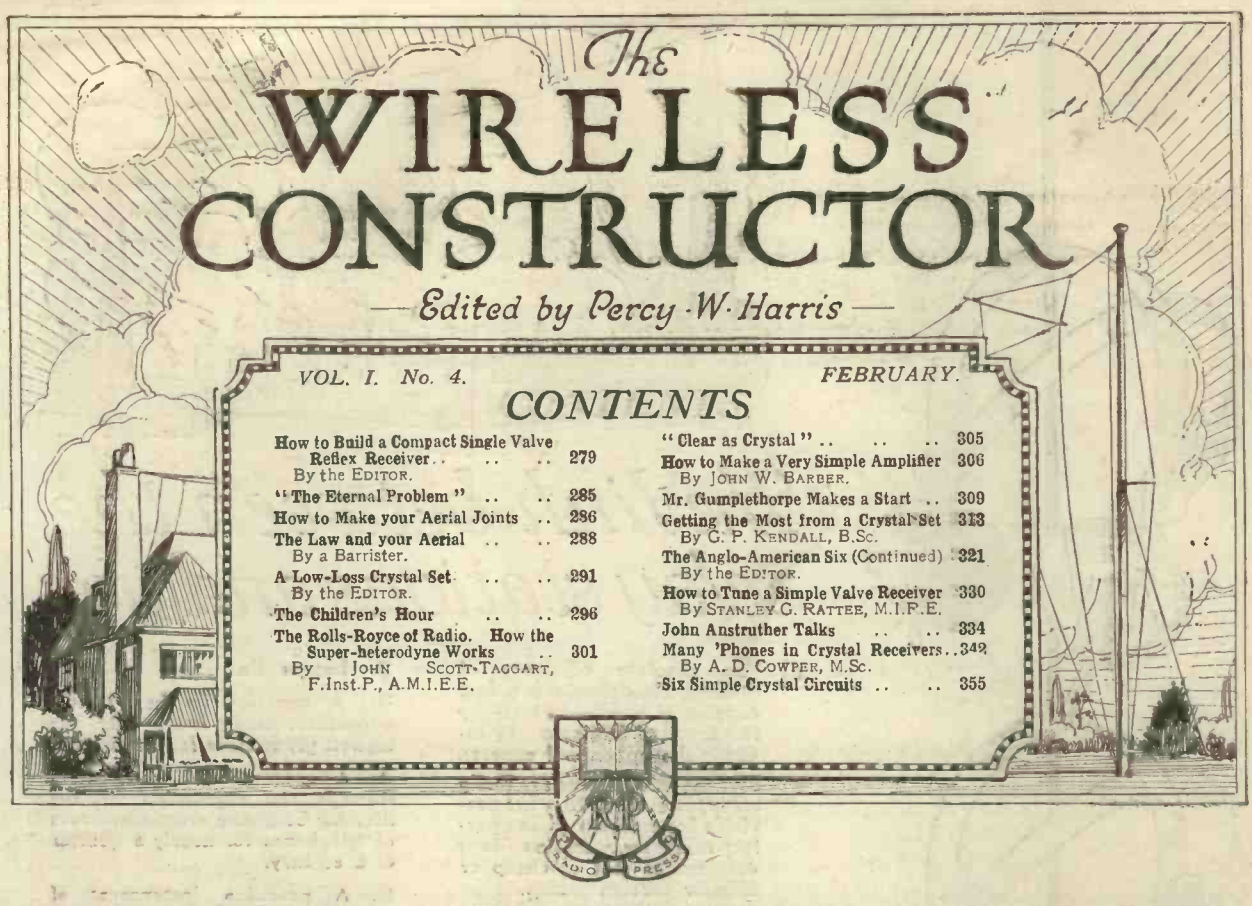

# The WIRELESS CONSTRUCTOR

—Edited by Percy W. Harris—

VOL. I. No. 4. FEBRUARY.

## CONTENTS

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# The WIRELESS CONSTRUCTOR

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Vol. 1. FEBRUARY, 1925. No. 4.

## How to Build a Compact Single Valve Reflex Receiver

*By the EDITOR*

*For the man who wants to get the utmost from a single valve, a simple reflex receiver is undoubtedly the best. In this instrument, which economises valve current by using a crystal as a detector, the valve is made to act both as a high-frequency and a low-frequency magnifier. Up to four or five miles from a broadcasting station, with a reasonable outdoor aerial, the set will operate a small loud speaker—in favourable conditions, at even greater distances than this. Up to eight or ten miles from a broadcasting station, splendid signals in two or three pairs of headphones may be obtained when using only an indoor aerial. Notice that both coils and valves are concealed within the cabinet, out of harm's way.*

LAST month we showed you how to build the "Twin Valve," a two-valve reflex receiver, in which the detector was of the valve type. The instrument, which by this time will be giving satisfaction in very many homes, was designed to make efficient use of a pair of valves. There are many people, however, who prefer to get the most out of a single valve, and who, having no facilities for charging accumulators, want to build an instrument to run with a single valve from dry cells. Undoubtedly the single-valve reflex using a crystal as a detector, is just the instrument for such people, and I have designed the present receiver with their needs in mind.

The valve and tuning coils are concealed within the cabinet. All adjustments are made from the outside.

Perhaps a word or two on reflex receivers will be of assistance to new readers. A Reflex receiver is one in which one or more of the valves serves a double purpose, acting first of all as a high-frequency amplifier to magnify the feeble currents before detection, and, secondly after detection, as a low-frequency magnifier, to give more volume. This means that the current is led through the valve twice, first of all as a high-frequency current set up in the aerial circuit by the oncoming waves, and, secondly, as an audio frequency current that will operate our telephone headpiece or loud speaker. In order that such double action may be obtained it is necessary that there should be two separate circuits connected to the valve, one which will pass the high-frequency current, but not the low-frequency and the other which will allow the low frequency to pass while stopping the high-frequency oscillation.

### The Circuit in Pictorial Form

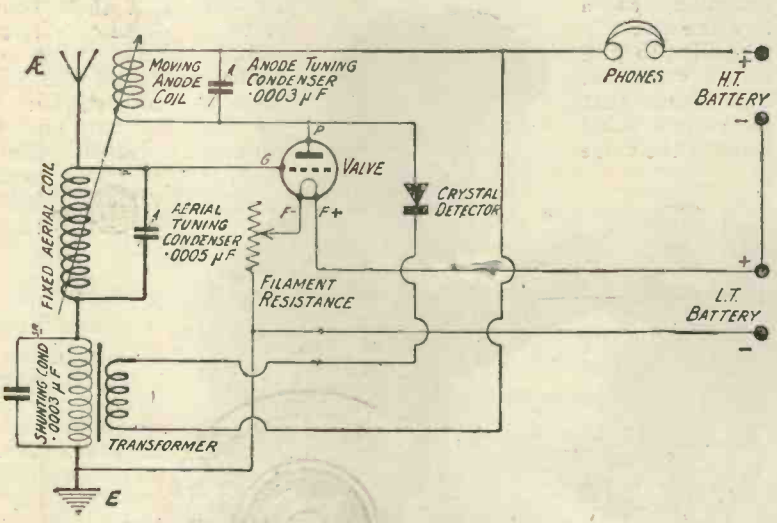
On page 280 we have the circuit drawn out in simple theoretical fashion. It can, in fact, be assembled in several ways if you have the components and set them out on a table. I may say in passing that the circuit used is by no means novel—in fact, its virtue lies in its trustworthiness and its well-proved reliability. You will see that

the aerial is connected to a tuned circuit consisting of an inductance coil and a variable condenser, and if this circuit is in tune with the oncoming waves then oscillations will be built up in it. The oscillations will set up at the terminals of the condenser rapidly varying electrical pressures, for, as the oscillations occur, the electrical pressure across the terminals condenser will vary between zero and maximum in accordance with them.

### How it Works

You will notice that one terminal (the upper) of the variable condenser is connected to the grid of a valve. The lower terminal is connected to one side of a low-frequency intervalve transformer, across which is connected a fixed condenser. Now high-frequency current cannot pass through the windings of a low-frequency transformer, but will pass with great ease through the fixed condenser, which offers very little impedance to them. We thus see that the lower side of the variable condenser, across which the electrical pressure has been set up, is connected through the condenser to the filament of the valve, and in this fashion between the grid and filament of the valve, we shall apply the varying electrical pressures across our tuning condenser. These varying pressures will bring about corresponding variations in the plate current of the valve—that is, current which flows from the high-tension battery across the vacuous space between the filament of the valve and the plate. Connected in this plate circuit is another tuned circuit (see fig.) which is adjusted in resonance with the first tuned circuit (aerial). Owing to the magnifying properties of the valve similar variations of pressure will be set up across the anode condenser but of greater intensity. Across this condenser now we connect a crystal detector which, as we know, will allow current to pass in one direction, but not in the other. Thus, we rectify the impulses in the tuned anode circuit and feed the current so rectified back to the primary winding of the intervalve transformer, the secondary of which, as we have seen, is connected to the aerial circuit. Now, if there were high frequency current in this secondary circuit they would pass through the fixed condenser, and we might say for simplicity that the windings of the transformer would be short-circuited by this condenser. As, however, the impulses set up in the secondary winding are of low frequency, they cannot pass through the condenser (which we can therefore ignore for the moment). The differences of pressure in the secondary are, however, applied through the inductance or coil to the grid of the valve and to the filament by the same path as were applied the high-frequency impulses. Thus we have both high-frequency and low-frequency differences of pressure set up across the grid of the valve. The low frequency pulsations in the plate circuit of the valve pass with ease through the telephones, which have hitherto hindered the passage of the high frequency current.

Ready for work. The knob immediately below the crystal detector controls the filament resistance. Reaction is varied by the lower knob.




The theoretical diagram, of interest to the more advanced reader. The circuit used is ST74.

### Terminals

The rest of the arrangement is of course, quite simple. We have terminals, for the high-tension battery, for the low-tension battery or accumulator, for aerial and earth, and for telephones. The set is actually made up in a polished mahogany cabinet, all components being mounted on a polished ebonite panel; the tuning coils are of the plug-in variety and are coupled together so as to give the benefit of reaction. In most receivers the moving coil holder is placed externally and rarely adds to the beauty of the instrument. Similarly it is quite common for the valves to project from the panel. In this

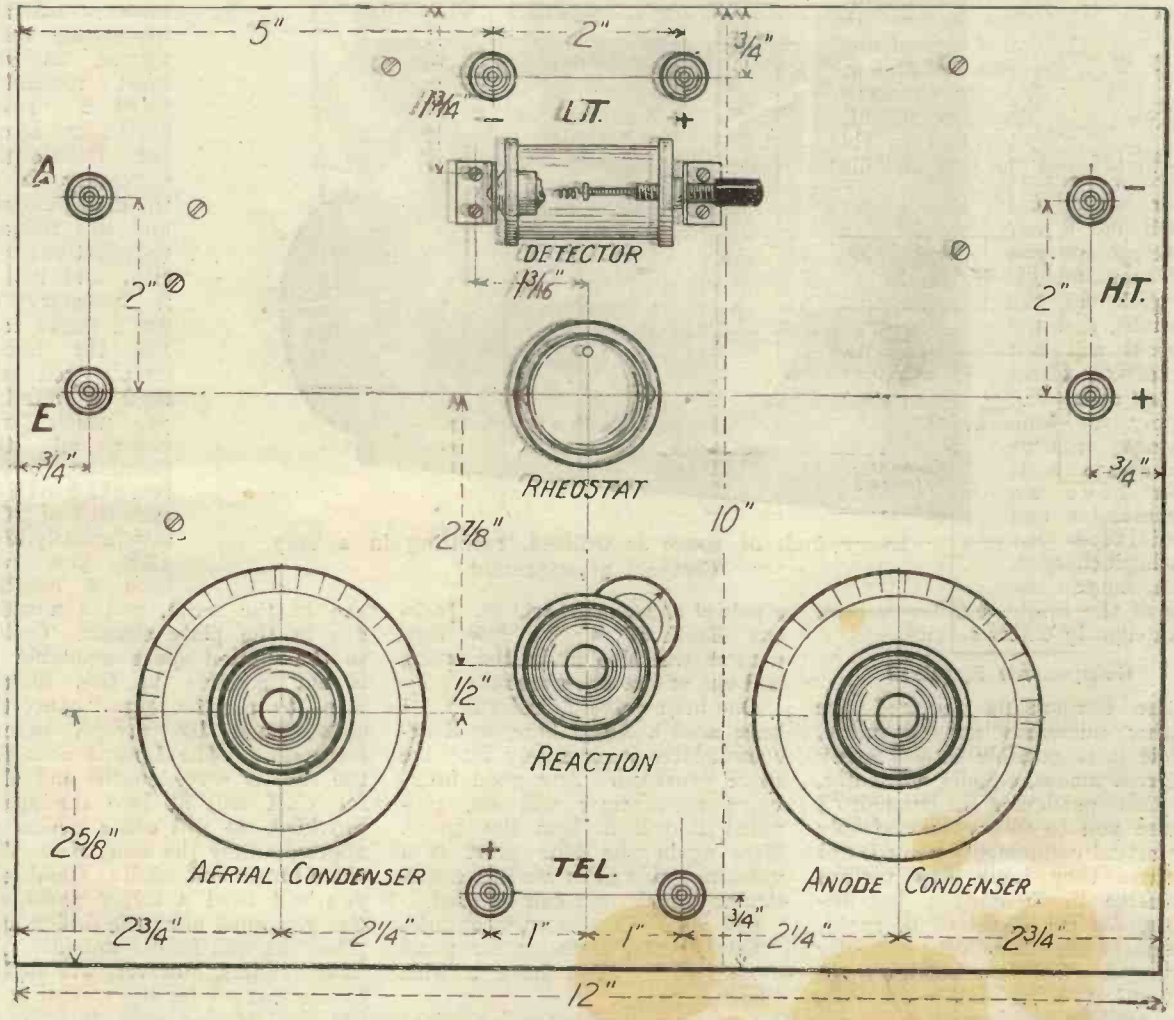
instrument I have used a special form of coil holder, which is very simply mounted on the panel and allows the coils to be placed inside the instrument and yet to be adjusted from the outside. Similarly an anti-vibration valve socket is mounted on the inner side of the panel and keeps the valve out of harm's way. The crystal detector which needs to be adjusted occasionally is outside the panel, as are the two dials of the tuning condensers and the knob of the filament resistance.

### Capabilities

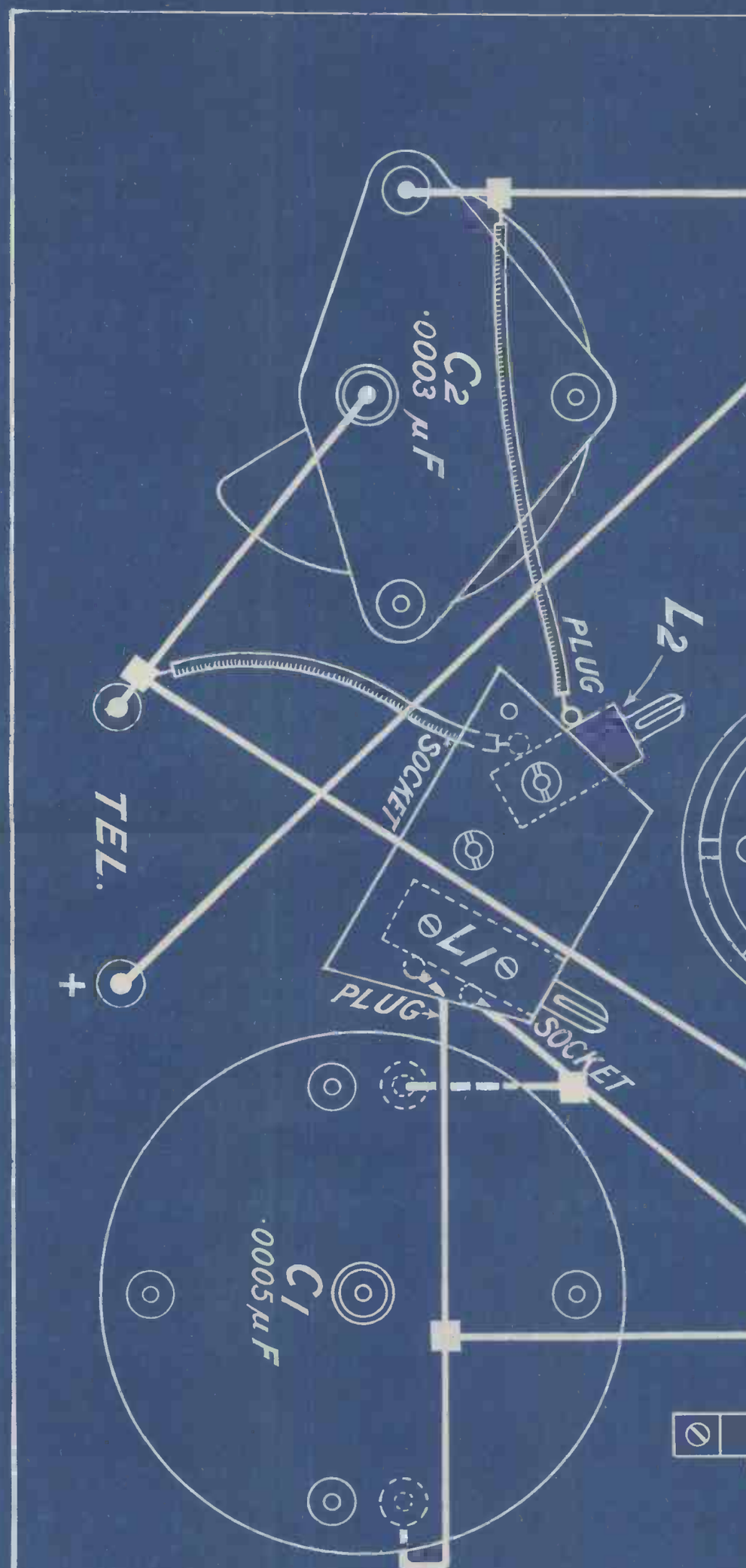
Before we talk about building the instrument, let us see what it will do and what it will not do. I am sure many readers will at once ask the question "Will it bring in all the broadcasting stations?" To this only one answer can truthfully be given. In many cases it will *not*. In good conditions, however, it will bring them in well, for I have built receivers using a similar circuit before, and they have been copied in hundreds by readers of *Modern Wireless* and *Wireless Weekly*. Of the many reports received quite a number have referred to the easy reception of all the broadcasting stations. It would, however, be futile for me to state that the average reader in average conditions stands a good chance of getting them all at first try. With a reasonable outdoor aerial, and when he gains a little skill in the handling of the instrument (it is not difficult to handle really), he may be sure of hearing two or three with ease and at times all.

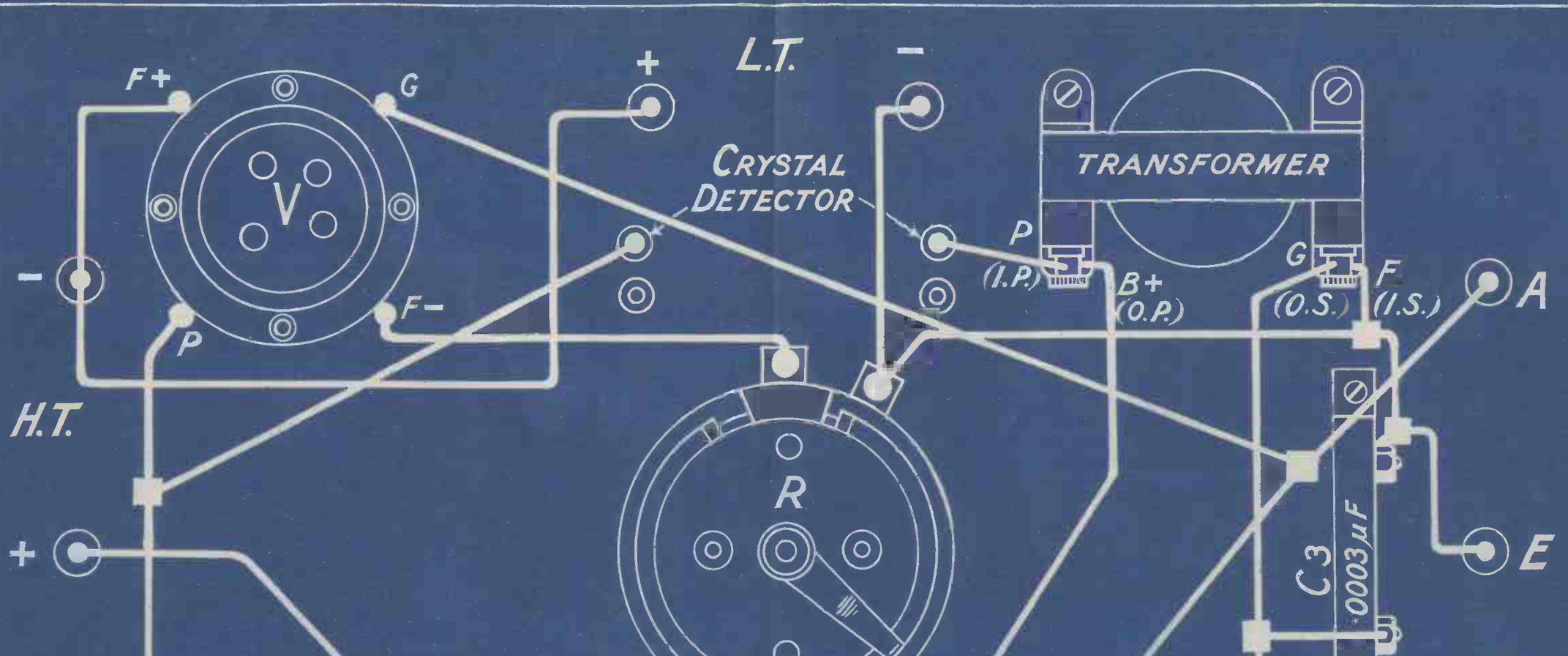
### Conditions Vary

You may wonder why I labour this point, but long experience in designing sets for home constructors has shown me that it is futile to put forward results obtained in highly favourable conditions as if they were regularly obtainable everywhere. What the set will do I can say with certainty. With an average outdoor aerial and within three or four miles of a broadcasting station it really will operate a small loud speaker with sufficient strength to give comfortable reception in a small room. On my own outside aerial at Wimbledon seven miles from 2LO, the strength is still sufficient for loud speaker reception, although personally I prefer signals a little louder than the set will give. On quite a small indoor aerial at the same distance, the set will operate half-a-dozen pairs of telephones perfectly and with quite as much strength as any but a deaf person will require. If, therefore, I say that up to five miles it will operate three pairs of telephones at comfortable strength on a small indoor aerial, I know




Half-size drilling diagram and terminal markings of the front of panel. The small disc above the reaction knob is the indicator of the coil holder. The arrow shows the direction of the moving coil at the moment.


C2
.0003 μF
L2
PLUG
SOCKET
TEL.
+
L1
PLUG
SOCKET
C1
.0005 μF




"DETECTOR" SINGLE VALVE REFLEX SET.

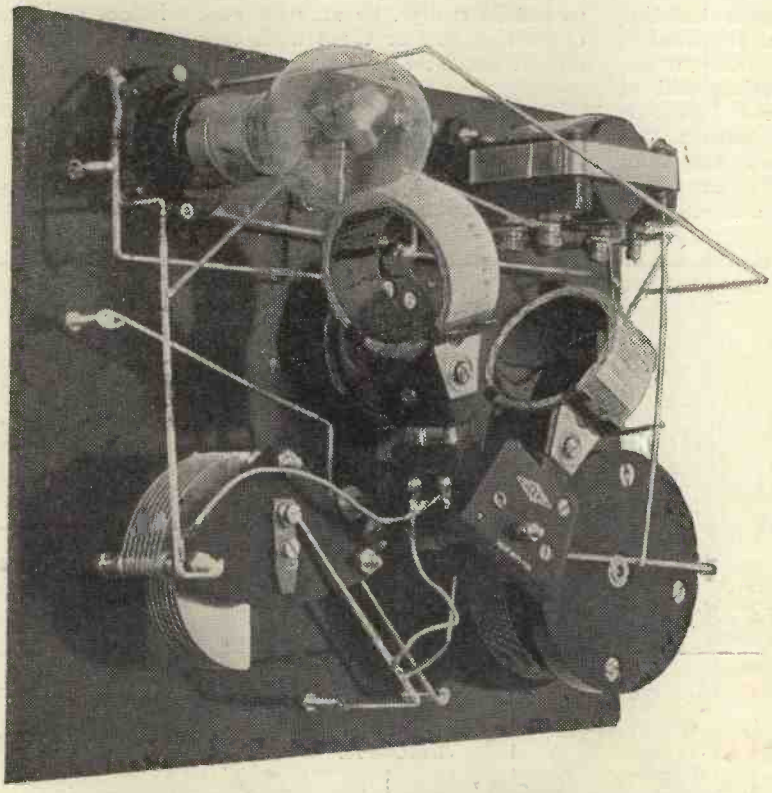
BLUE PRINT No. 1007B PRICE 1/6

, W.C.2.

that this will be well within its capabilities. This will also make allowances for screening and other inefficiencies, absent in my own case.

### Valves

All the ordinary valves work quite well in this set and excellent results were obtained with the new ·06 ampere dull emitters which will run satisfactorily from two or three dry cells. In order that the reader may experiment for himself I have fitted a filament rheostat for either bright or dull emitters. You can for example, put a ·06 ampere valve of any of the well-known makes into the socket and connect up three bell-ringing dry cells in series (that is, with the positive of one connected to the negative of the next.) If now you connect up a sixty or seventy-volt high-tension battery to the H.T. terminals, adjust the crystal detector, connect your aerial and earth and a pair of telephones you will soon find how to pick up the stations, and the current will not be more than these cells can supply for long periods without exhaustion. If you have an accumulator and facilities for getting it charged, then you can use one of the bright emitter valves, with slightly better results.



Every inch of space is utilised, resulting in a very compact arrangement.

### Components Required

The components required are neither numerous nor expensive. While it is possible to use many different makes, equally efficiently, in this particular instrument I advise you to follow very closely the actual components named, not because they have any virtues exclusive to themselves, but because, for consideration of space, the parts have been very carefully arranged. Different makes of components being of different sizes, they might not fit in with the plans. You can soon see, however, if you have other components, whether they will fit into the space by consulting the free blue print which is provided with each copy of this issue. We need, then :—

One polished mahogany cabinet, as shown.

One ebonite panel 12×10 in. (use one of the guaranteed ebonites here. You will find several makes advertised in this journal).

Eight terminals.

Two variable condensers, square law pattern, one of ·0005 mfd. for the aerial circuit and one of ·0003 mfd. for the anode circuit. I have used one of Peto Scott's and one of Bowyer Lowe's here; a pair of either make will fit. Jackson Brothers' square law condensers will also fit in the space, and one or two other makes.

One inter-valve Transformer. I have used a Royal here, as it accommodates itself nicely into the space provided. Any good inter-valve transformer will do, provided it will fit into the space. Here again the blue print is a valuable guide as to whether a particular transformer can be used.

One Fixed Condenser, ·0003 mfd.

One Crystal Detector for panel mounting. (You have a wide choice here.)

One dual Resistance for bright or dull emitters. (That shown is a Burndept. The McMichael dual pattern will also fit here, as will the "Polar" type, using an interchangeable bobbin). If you intend to keep to bright emitters, there is no point in buying a dual purpose rheostat.

One two-coil holder for back of panel mounting. The particular pattern used here is Peto-Scott's. If you use any other make be sure it will fit into the space provided, which you will see is not very great.

One Valve Socket for panel mounting. I have used a Burndept Antiphonic as it eliminates the microphonic noises inseparable from some types of dull emitters.

Suitable coils. For the aerial circuit you will need a number 50 for the lower broadcast wave-lengths and a 75 for the upper. Do not think I have made a mistake in giving these figures, as you must remember that a ·0003 condenser across the transformer secondary is in the aerial circuit, and this reduces the effective capacity, and makes it necessary to use a larger coil. For the anode circuit you will need a number 75, which will cover all the broadcast wave-lengths other than that of 5XX satisfactorily. For 5XX you will need a number 200 in the aerial, and a number 250 in the plate circuit. Owing to the limited space available it is not possible in this instrument to use the large "concert" coils made by several manufacturers. The Igranic coils for the shorter wave-lengths and also for 5XX will fit into the space provided, as will other makes of approximately the same size. To use a larger coil, such as Gambrell, you will need a larger panel, or else you must alter the design and place the coil holder outside. As most readers, however, will desire to use this set for the reception of the local station only, it is quite a simple matter to place two of the smaller coils into the holder and leave them there permanently.

The experimenter can, of course, change them when he so desires.

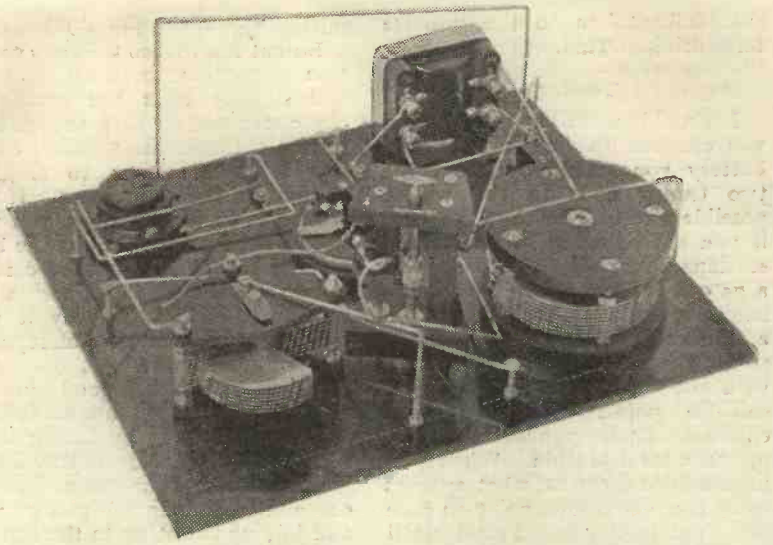
### Condensers

The constructional work will give you little difficulty. The Peto-Scott, Jackson Brothers, and one or two other makes of variable condensers are made for "one-hole-mounting," and the particular two-coil holder shown is also a "one-hole-mounting" proposition. Condensers which are not of the one-hole-mounting type are usually now provided with paper templates to facilitate drilling the holes.

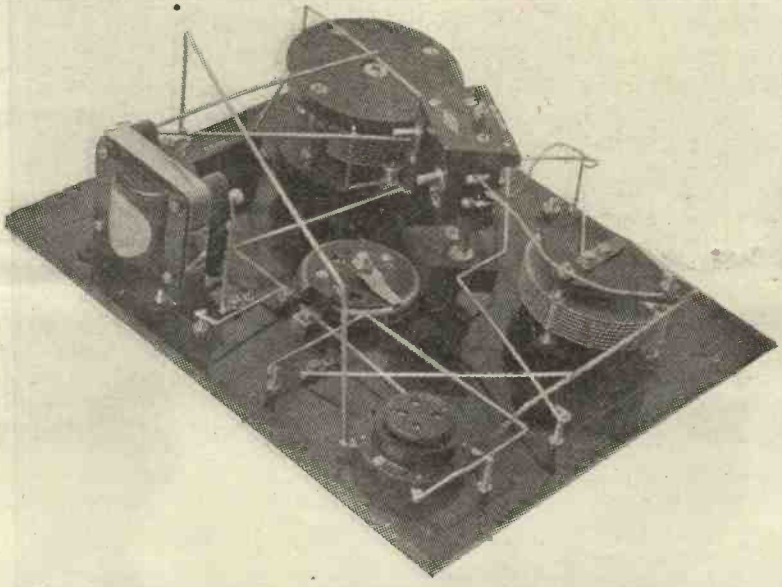
All necessary dimensions are given in the drawings, and a full size blue print shows you how to wire up. Notice that in the blue print two kinds of markings are given for the inter-valve transformer. The Royal transformer is not marked with IP, OP, IS, OS, as are most makes, but has the letters G (grid), P (plate) (positive high-tension battery), and F (filament). For the benefit of those who are using transformers marked with the conventional IP, OP, OS, IS letters, I give the equivalent of these letters as shown.

### Coil Connections

Another point to mention is that it is essential to connect your wires to the correct terminals of the coil holder. You will see from the blueprint that one wire is marked to go to the pin and the other to the socket on each coil socket. Unless you join them up in this way you will run the risk of having your reaction connected the wrong way round. Similarly, be careful to join your wires as shown to the moving and fixed plates of the condenser. This will enable you to make a receiver which will be comparatively, if not entirely, free from hand capacity effects. When actually wiring up it is advisable to place in the coil socket the largest coils you intend to use and to move them about from time to time while you are wiring, to make sure that the coils do not foul any of the wires which cross over. The photographs accompanying the article will help you to place the wiring correctly. You will see from the blue print that where wires cross over and are not joined no special indication is given. Where, however, a soldered connection is made between one wire and another, or a join of any kind, a small square is indicated. This method has been adopted recently in our publications in preference to the older method of showing a loop cross-over, which, whilst it makes it clear that wires are not joined, quite needlessly complicates the drawing.



This photograph and the picture below will help the constructor to wire up the set efficiently.



The wiring around the coil holder must be carefully carried out to avoid fouling the coils.

### Operation

When you have finished wiring up, turn your filament resistance to the off position, place the panel in its case, and connect aerial and earth to the terminals shown. Now take the positive and negative leads of your low-tension battery (whether this is a dry cell or an accumulator) and join to the correct terminals. Place now the valve in the socket and turn the filament resistance on slowly. If all is well with the filament connections, the valve should light up. For dull emitters, of course, you will need to turn the resistance only just on. If, however, you are using a bright emitter, it will be necessary to turn the knob some way round until you come on to the second segment of the resistance. If the valve lights properly and is properly controlled by varying the resistance knob, place it to the off position again and join up the high-tension battery correctly. If it is a plug-in unit, before actually joining up make sure that you know the correct voltage to use for the valve. You will find this on the makers' instructions provided with each valve. A pair of telephones should now be connected to the lowest terminals, and if the phones are marked on one lead with a small cross, this

should be taken to the positive terminal indicated.

### Testing

I should mention that before you connect up your high-tension battery you should open out the two tuning coils to the widest possible extent. With a 50 coil, if you are listening to one of the stations below 400 metres or with a 75 coil for one above that wavelength in the aerial socket and with a number 75 in the moving socket, place the catwhisker in contact with the crystal at what seems a suitable point. Varying both condenser knobs, you will soon pick up your local station. When you have settled down on what appears to be the best tuning point on each dial, readjust your crystal until you get loudest signals. Now move the coupling knob of the coil-holder very carefully and notice if there is any increase in signal strength. By varying this knob you will come to a point where the set certainly gives distorted signals with a rushing noise in the phones. Immediately open up the coils again, for when this state is reached you will be oscillating and causing interference with your neighbours.

### Watch the Coupling

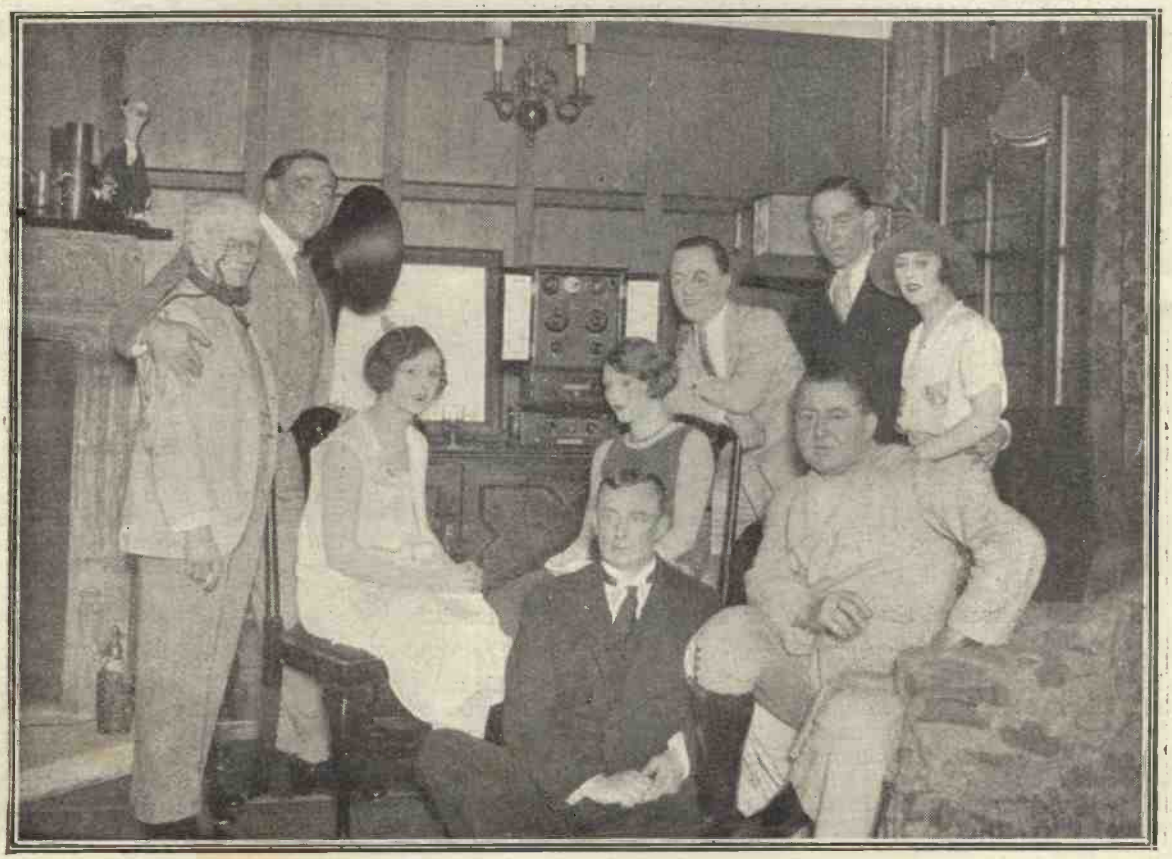
Do not forget also that any variation of coupling between the coils will slightly alter the tuning of the condenser, so that to get best results through the reaction coupling it is necessary to slightly re-tune on the condensers. If the station is some way away, you will need a little practice to get the best results, but in all cases be careful not to use the set in an oscillating condition, for in this way it will cause disturbance and annoyance to your neighbours.

If you have not a good outdoor aerial you may rig up an indoor aerial quite simply by taking some bell wire and placing it round the picture rail of your room, leaving one end free along the picture rail and joining the other to the instrument at the aerial terminal. The earth connection will, of course, be used as with an outdoor aerial. The wire round the room may run on three or even four sides, and will require no other insulation than is provided by the cotton covering.

I think you will like this instrument. Admittedly the occasional adjustment of the crystal is a little more bothersome than the adjustment of a valve, but, on the other hand, the use of the crystal saves one valve and its corresponding low-tension supply. For this reason single-valve reflex receivers using crystal detectors are extremely popular and are likely to remain so.

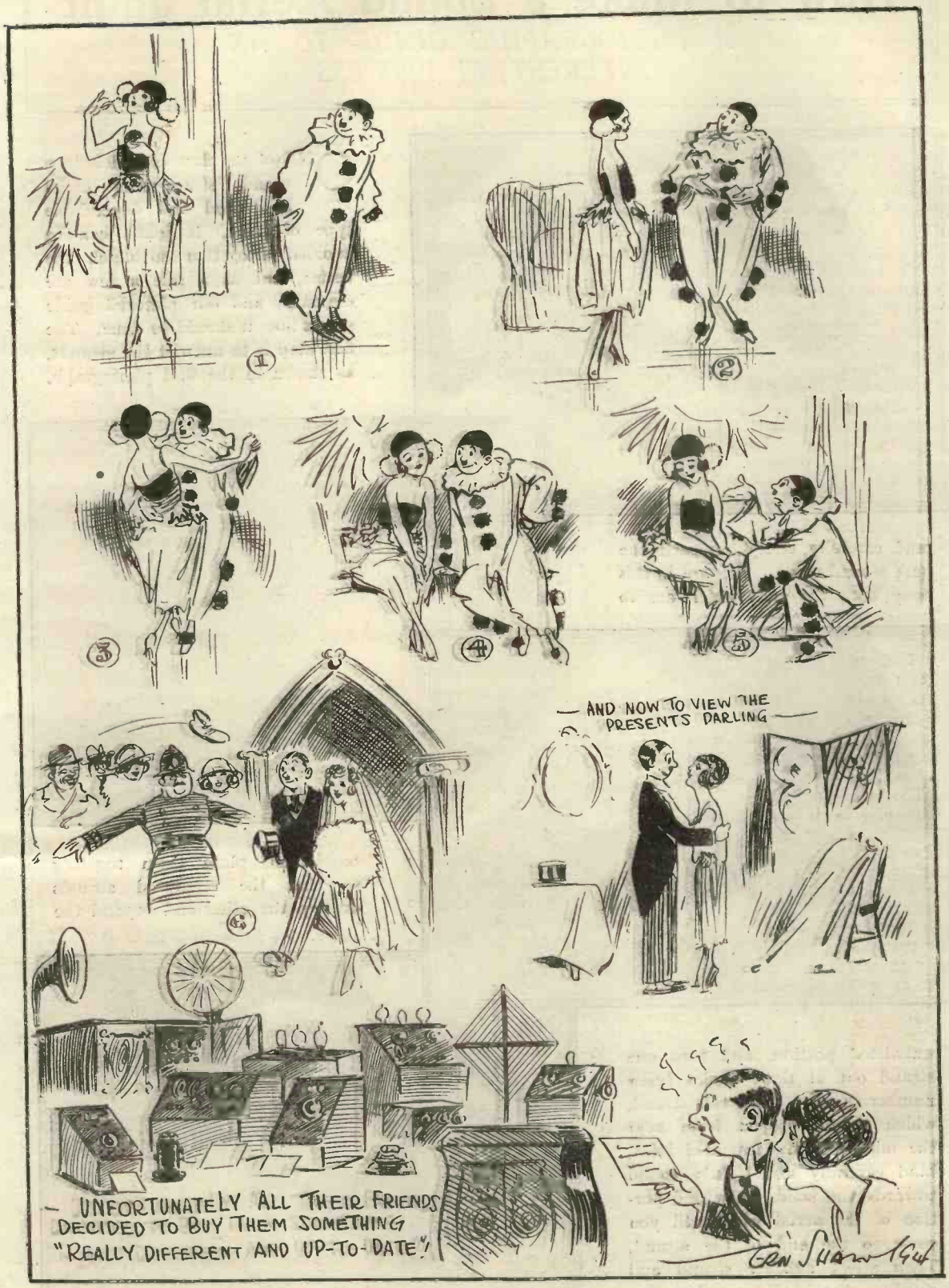
Those readers who successfully build this instrument are invited to communicate with the writer giving their results, so that typical cases may be published for the benefit of other readers. Where possible, a personal acknowledgment of letters will be sent.





Leslie Henson and other "stars," at the Winter Garden Theatre, listening to the broadcasting of "Patricia" from His Majesty's Theatre.

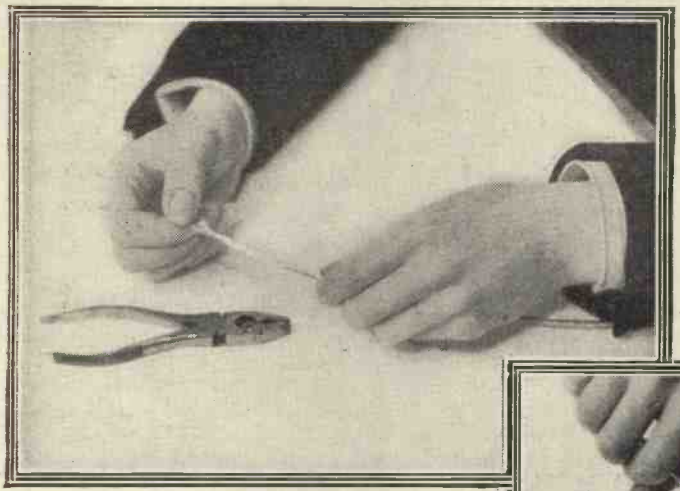
# THE ETERNAL PROBLEM



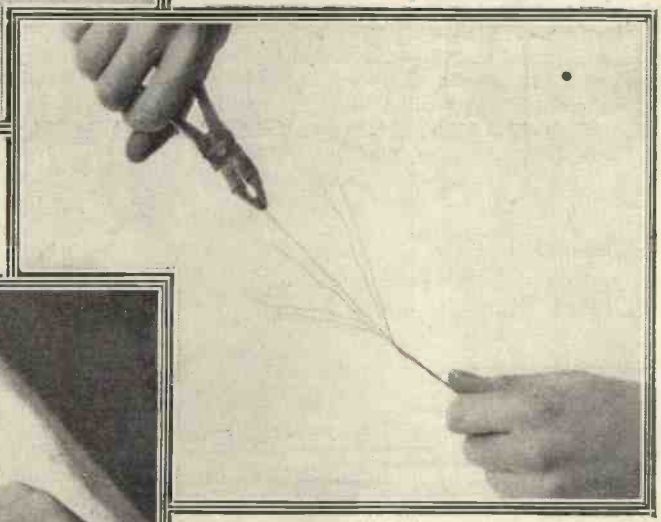

And how their relatives solved it!

# How to Make a Sound Aerial Joint

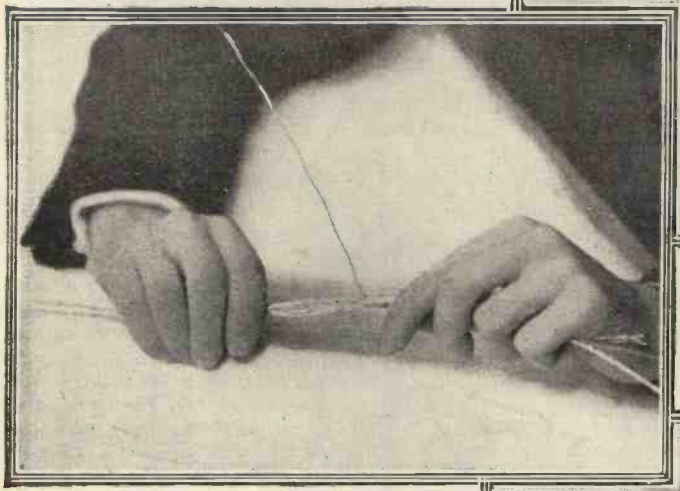
## *A PHOTOGRAPHIC GUIDE TO AN INTERESTING PROCESS*



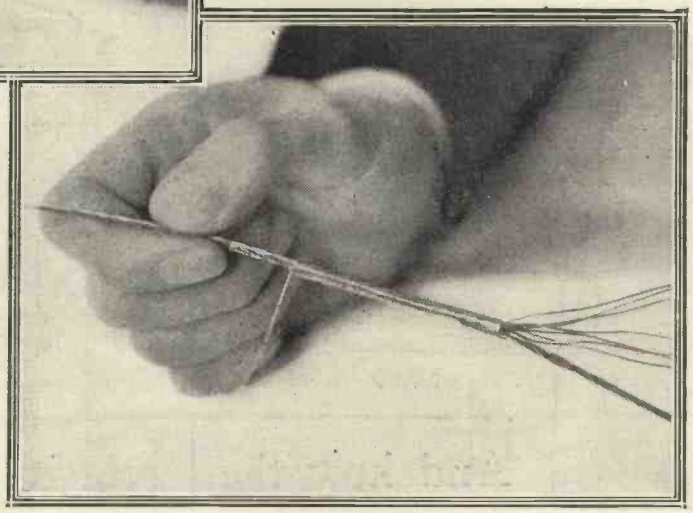
ONE of the first essentials in a sound, storm-proof aerial is a good and dependable type of joint. If joints can be avoided altogether so much the better, but as a rule a few are essential, and our pictorial guide shows how it should be done. The first step is to untwist the strands, as shown in the first photograph,



and carefully straighten each one (see second view). Prepare in this way both the ends which are to



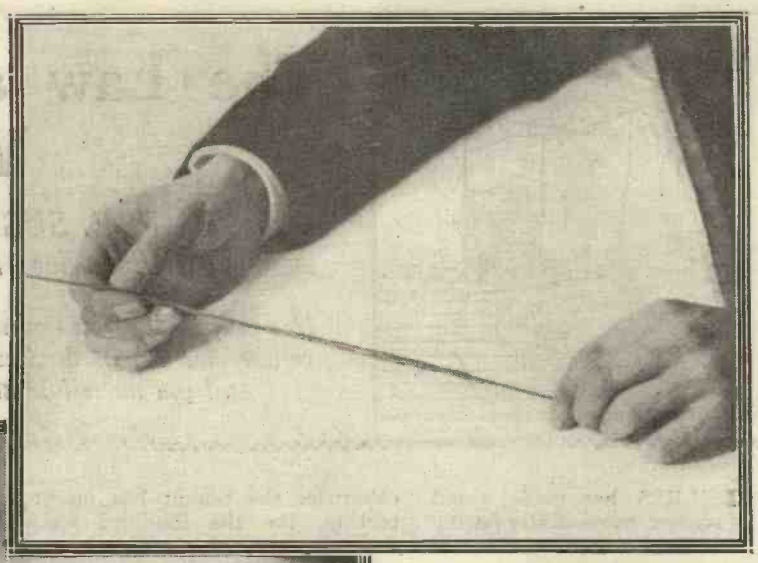
be joined, place them together so that the separated strands overlap the other end beyond the

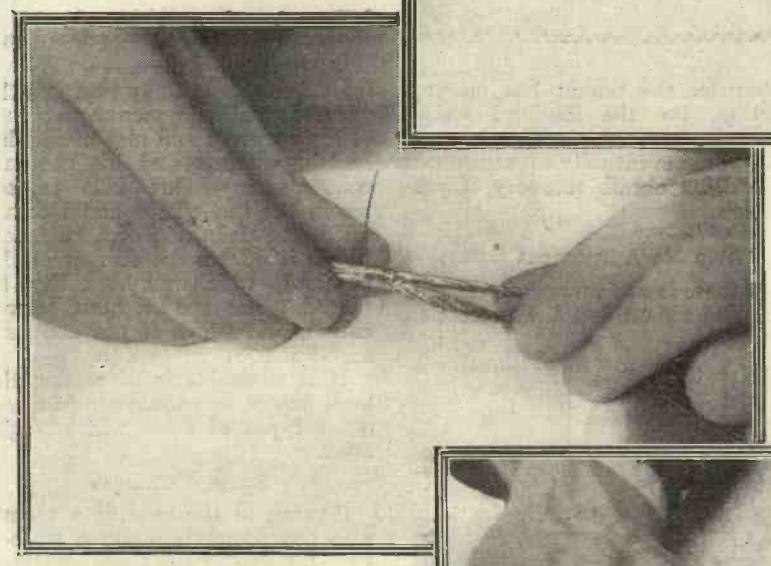


untwisted portion, and turn one strand out at right angles (view number three). With this strand, which should project from near the middle of the intended joint, bind carefully and tightly round towards the solid, untwisted portion of the aerial wire until you come to the end of the strand. Then select another strand and continue the binding, and so on, until all the strands are used up. Then start again at the middle

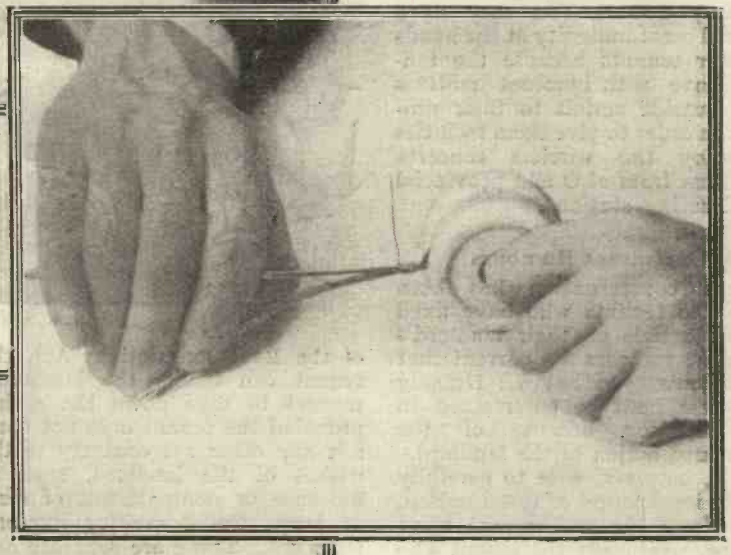
and work the other way until the other set of free strands is used. The result will be to cover the whole joint with close binding, which will taper down to the normal thickness of the aerial wire at either end. View number five shows the finished joint.

The same method may be applied when attaching an insulator to the end of an aerial,

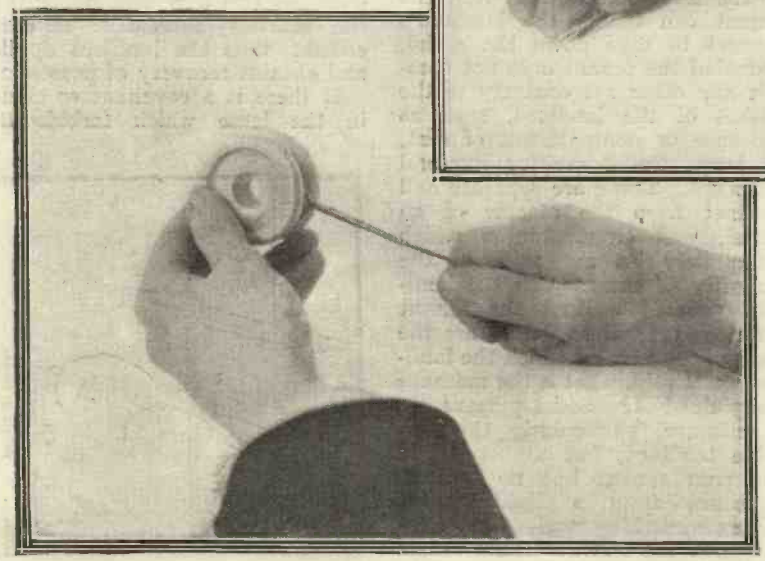




this process being shown in the last two photographs. The strands are untwisted and straightened carefully with pliers as before, and then passed round the groove of the insulator. Binding is then



commenced with one strand, close up against the insulator, as shown in the last photograph but one, and when this strand has been used up the next is used to continue the binding, and so on



until all have been used and the joint is complete.

This method of making a sound join or loop is applicable to other types of stranded wire, and may be used, for instance, with the stranded galvanised wire often used for the stay-wires of an aerial mast.

# The Law and Your Aerial

*By F. E. SUGDEN, A.C.I.S., F.R.Econ.Soc., Barrister-at-Law*

*Has your landlord been questioning your right to erect an aerial? Do you wonder how you stand? This article will tell you the real position in simple language.*

WIRELESS has made rapid strides, particularly during the last twelve months. Its unbounded popularity is recognised by most people, and consequently there are very few persons who do not possess either a valve or a crystal set. It is unfortunately those few persons who do or will not participate in its pleasures that are a source of annoyance to wireless enthusiasts and listeners-in generally, and to whom particular attention should be specially directed. This minority, who are property owners, feel they have suffered great indignity at the hands of their tenants because the tenants have with innocent motives fixed outside aerials to their property in order to give them facilities to enjoy the wireless concerts broadcast from 2L.O and provincial broadcasting stations.

### Unpleasant Rumours

Some consternation has been caused to tenants who have fixed outside aerials on their landlord's property; rumours are current that such is contrary to the law. Happily little fear need be entertained in this direction because of the threatened action of the landlord.

It is, however, wise to carefully sift the legal aspect of the situation, apart from the sentimental point of view. Naturally the tenant who has fixed an aerial on the top of the house where he resides, without first obtaining the consent of the landlord, asks himself the question, What can the landlord do? In such circumstances and in most cases he can do nothing whatsoever. Probable instances are dealt with seriatim.

If there is no tenancy agreement, and the house is outside the scope of the Rent (Restriction) Act, the landlord can obviously request the tenant to take down the aerial because it displeases him, otherwise the tenant has no protection, for the landlord would normally give him notice to quit, and would eventually without much opposition obtain recovery of possession.

### When No Agreement Exists

If there is no tenancy agreement, and the tenant has the protection

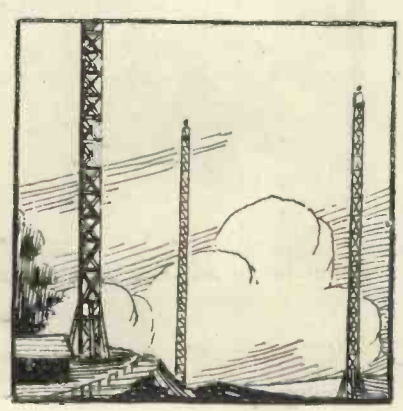
of the Rent Restrictions Act, the tenant can ignore the landlord's request to take down the aerial, provided the tenant does not commit any other act contrary to the wishes of the landlord, such as nuisance or non-payment of rent, or keeps the house for immoral purposes. These are separate and distinct from the placing of an aerial, and circumstances which fortunately do not arise in the majority of cases. Can the landlord proceed against the tenant for nuisance? if so, what are the facts of the case on which the landlord must rely, what is the nuisance complained of? Some persons are a nuisance, particularly the irritable landlord, but unfortunately the poor tenant has no redress. Nuisance from a legal aspect means something noxious or offensive, any act which without actual interference materially prevents the use and quiet enjoyment by another of his property and also affects his health, comfort and his personal convenience. One fails to see where the inoffensive aerial comes under the definition of a nuisance, unless it affects the temper of the landlord, which might easily be roused under the slightest provocation, and which is not countenanced at law.

It is advisable in discussing the legal aspect to endeavour to cover other types of cases which might arise.

### Special Clauses

Coming to the case of a tenant who has premises under a lease—*e.g.*, for one, two, three or more years—which in all cases contains covenants or clauses of what the tenant must and must not do, naturally violation of one of these clauses under most circumstances results in either the landlord claiming damages or the tenant's forfeiture of tenancy of the premises, or even the landlord claiming damages and also demanding that the tenancy agreement be cancelled; thus the landlord applies and obtains recovery of possession.

If there is a covenant or clause in the lease which forbids the



erection of an aerial by the tenant without the consent of the landlord, which is usually to be stipulated in writing, then in such a case there is no defence if the tenant contravenes such a clause. Fortunately this clause does not appear in most leases at the present time, because of the modern growth of wireless.

### Can the Landlord Claim?

If this prohibition clause does not exist the tenant is quite safe, because on what grounds can the offended landlord proceed? The landlord must establish his claim in the Courts under any circumstances. Let one presume he sues under the head of legal waste—*i.e.*, any spoil or destruction in houses, gardens, trees, etc., where is the spoil or destruction of a house, gardens, trees, etc., by the erection of an outside aerial? It is the custom for the tenant when he gives up possession to take down his aerial and leave the outside of the property in as good a condition, allowing for climatic conditions, as the property was originally before his aerial was erected. The tenant after removal of his aerial could always make good at a cost of a few shillings any plaster or mortar, etc., if any injured or displaced as a consequence of the extraction of the bolts, etc., when dismantling the aerial.

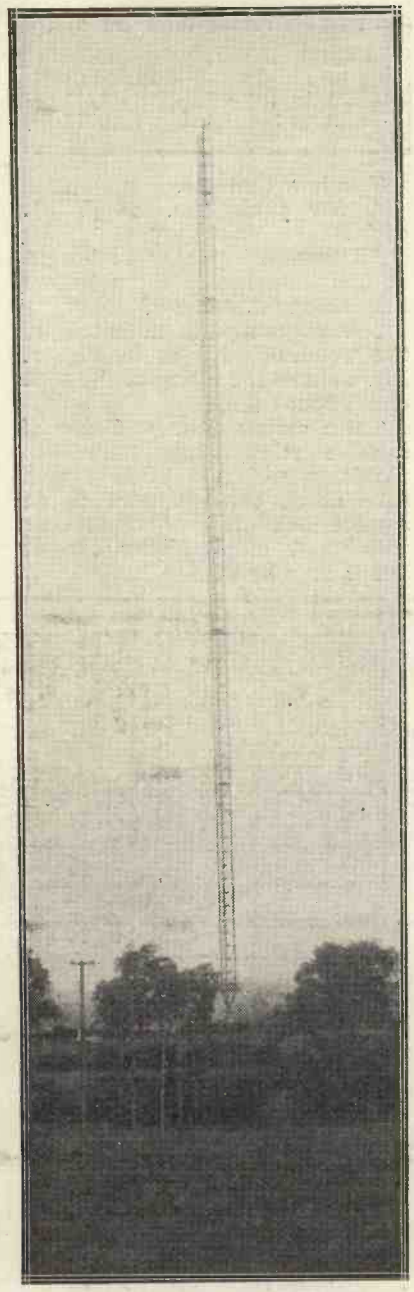
### No Danger to Property

Suppose the landlord feels he has a right of action for damages on the ground of the tenant failing to perform outside repairs, has tenant failed in this respect simply because he has honoured the landlord by ornamenting his property with an inoffensive outside aerial?

Can the owner of an aerial be proceeded against because of an alleged danger during storm? Attempts might be made to prevent the continuous use of an aerial on this ground; but they would, however, fail. If such actions succeeded an impossible position would arise. Take the case of a tenant having a telephone fixed to his house; an old-fashioned landlord might object on the ground of being a danger during a storm, because it attracts the lightning. Similarly, a tenant could not have a fire in his house because there might be an accident which might cause the house to be burnt to the ground. "Might" against the turbulent landlord is a good weapon of defence in the hands of the harmless wireless enthusiast.

### The Indoor Aerial

No mention has so far been made as regards the indoor aerial. One has one's own case in mind, where the aerial is fixed in the attic at the top of the house, and the lead-in



Landlords would have good reason to worry if you put up an aerial mast like this one at Rugby!

cable is contained in the air space in the wall protruding through the skirting board in the diningroom, and thence on to the receiving set. However, from the landlord's point of view, "what the eye does not see the heart does not grieve," and as the landlord can only inspect the premises with the consent of the tenant, otherwise the landlord commits trespass, the question of the landlord's right in this respect cannot arise. In any event, what is the legal waste complained of which might amount to damages if any? The tenant might desire to add insult to the alleged injury by offering "the widow's mite" in full satisfaction of the claim as measure of damages to which the landlord might be entitled.

There is no risk of successful proceedings being taken against a tenant for fixing an aerial unless it is specially forbidden by a special clause in a tenancy agreement, which does not in most cases exist. Care should be taken that the aerial is securely fixed in order to prevent injury being caused to pedestrians who perchance pass one's home and suffer as a consequence of the collapse of the aerial structure.

### Aerials Across Roads

In reference to aerials over public roads, the Public Authorities, including County Boroughs, Borough Councils and Urban District Councils, have the right to forbid an aerial being erected over a public road without its consent, which is sometimes granted on payment of the nominal fee of 10s., as in the case of Bradford Council.

If an aerial is erected over a private road, the consent of the owner must first be obtained, in a similar manner as in the case of consent over a public road.

If an aerial is erected over a new street—*i.e.*, a road which has not been taken over by the Local Authority, either because it has not been paved or streetage has not been paid by the owners of the houses facing the road—the consent of the owners of these houses whose frontage faces the road, and whose right extends to the middle of the new road in front of his property on such a road, must first be obtained.

The owner of roads cannot sue for alleged nuisance of an aerial until such nuisance has been committed—*e.g.*, the aerial falls down and does some damage.

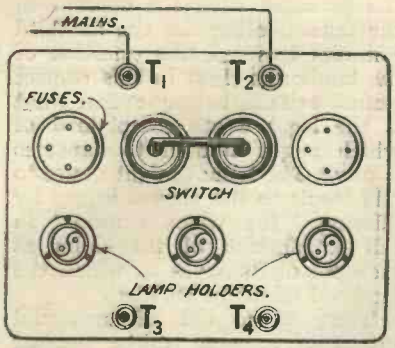



Fig. 1.—Showing the lay-out of the charging board.

# An Easily Made Charging Board

*This article will be of value to those who have direct current electric light mains*

THOSE who have direct current laid on in their homes may charge their accumulators fairly cheaply with the apparatus described here.

The requirements to make the charger are as follows:

One wooden board 18 in. by 12 in.

Three bayonet cap lamp holders, batten type.

One double-pole switch (linked).

Four ebonite bushes.

Four terminals.

Two bow contacts.

A few yards No. 18 V.I.R. cable.

All these things may be bought at any electrician's for not more than about ten shillings.

The apparatus is mounted on the wooden board as in Fig. 1. Fig. 2 shows the wiring at the back of the board.

Three carbon filament lamps of suitable voltage are inserted in the lamp sockets. These should take about three-quarters of an ampere each. If your accumulator will stand more, higher current lamps may be used.

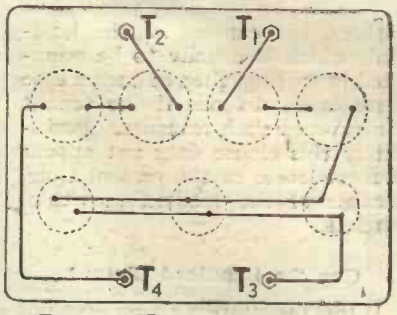



Fig. 2.—The necessary connections, which are behind the board.

The terminals $T_1$ and $T_2$ are connected to the mains, and the two terminals $T_3$ and $T_4$ have lengths of cable attached to them. These are tested for polarity with pole-finding paper, and attached to the accumulator.

The lamps are placed in the sockets according to the amperes required to pass through the accumulator. For instance, only one lamp should be used if the charging rate is one ampere. It is better to work under than over the stated charging rate.

## *Slider or Coil and Condenser for 5XX?*

NOW that the high-power broadcasting station has come to stay, more and more enthusiasts will desire to convert their set to receive the long wavelength transmissions, and as many forms of loading coils are available, the constructor may be in doubt as to which is the most efficient method of loading.

Continental stations have been working on the longer waves for a considerable period, but as additional coils are necessary to receive these transmissions satisfactorily, a number of broadcasting listeners have not been attracted by these transmissions, and have not, therefore the necessary long-wave apparatus.

Pre-broadcasting enthusiasts will probably have long-wave inductances and sliders at hand that may be pressed into service, while more modern converts to radio will argue the merits of the efficient plug-in coil and condenser.

This latter method is certainly the more expensive, but has many advantages over the primitive coil and slider.

Dead-end effects and poor contacts are the *bête noir* of the amateur in connection with the latter, while capacity effects and the problem of higher initial outlay confront the user of plug-in coils.

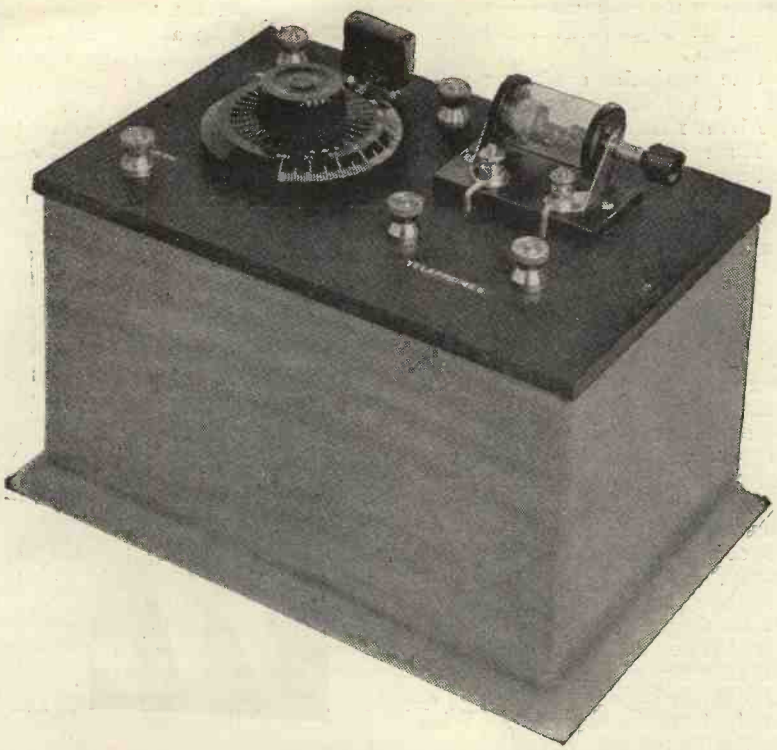
A recent outing of the Wireless and Experimental Association of Peckham. Mr. Knight (chairman) is transmitting.

The slider is always the weak point in the old-fashioned tuning inductance, since it is practically impossible to prevent contact being made simultaneously with several adjacent turns, and this is not conducive to efficiency.

The turns themselves must be kept scrupulously clean, for dirty contacts in the aerial circuit cause broad tuning and loss of signal strength. At the same time, the sliding inductance will give very efficient working if carefully handled, since the aerial may be tuned with maximum inductance and minimum capacity.

The plug-in coil does not possess such defects, and provided that the plug pins are kept clean, there is no possibility of bad contacts from oxidation in moist air.

It should be remembered that the dimensions and shape of the average plug-in coil are theoretically correct for maximum inductance, and herein probably lies the reason of successful results obtained with plug-in coils.



This "Low-Loss" Crystal Set measures nine by five and three-quarter inches and is five and a half inches deep.

# A "Low-Loss" Crystal Set

*By the EDITOR*

*This set is at least twice as efficient as many commercial sets now sold, and for strength of signals received is probably surpassed by none. Although switches have been completely eliminated, it is possible, in a few moments, to change the set for very high selectivity with very little loss of signal strength. This is very helpful when the receiving station is likely to be interfered with by signals from ship and coast Morse stations.*

A FEW months ago, in *Modern Wireless*, I published a design of a crystal set, which many readers have said gives far stronger signals than any other crystal set they have tried. There are two chief reasons for the efficiency of this set—firstly, a special form of low loss coil was used, and, secondly, a special circuit arrangement. In the set about to be described I have incorporated the main features of the previous set, and have slightly modified and improved the coil. Furthermore great simplicity has been obtained by choosing as a permanent circuit that which experience shows is likely to give the best results under average conditions.

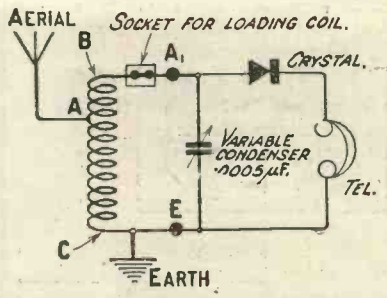



Fig. 1.—The theoretical circuit as generally recommended.

It is only recently that wireless experimenters have discovered that the minute currents picked up by the receiving aerial are quite appreciably reduced in strength unless we use a special form of "low-loss" coil. Coils with very fine wire, coils heavily impregnated with paraffin wax or shellac, coils which are wound on a tube of inferior material, and coils wound anyhow in several layers are all bad when we want to get the utmost efficiency from our set. Thick wire coils wound in such a way that they have a small self-capacity, and a minimum of solid material in the electric field set up, not only conserve the energy which we can ill afford to lose, but also sharpen up the tuning. If now we use a good coil and avoid unnecessary losses by using a satisfactory variable condenser, we have gone a long way towards making a set which approaches our ideal.

The coil used in the present set is wound on an X-shaped former in three slots, these slots being 2 in. deep, and separated from one another by an inch. In passing I might mention the separation between the three sections of the coil is larger in this set than in the previously-mentioned instrument, with, I think, improved results. Two-thirds of the coil is included in the aerial circuit, and the whole of it in the circuit to which the crystal detector is connected. There are, as you will see from examination of the photograph and drawings, three terminals on the aerial and earth side of the instrument. Between the two upper terminals is fitted a socket for a plug-in coil, so that when necessary we can plug-in a loading coil for Chelmsford. This socket is normally shorted by the plug shown. To receive Chelmsford it is only necessary to remove the short-circuiting plug from the socket, plug in a No. 150 coil of any well-known make, and connect the aerial to the terminal A1, leaving A free. Normally, the aerial is connected to A, which, as the circuit diagram shows, places two-thirds only of the coil in the aerial circuit.

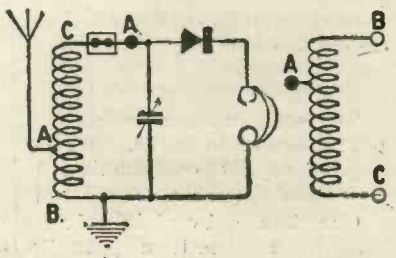



Fig. 2.—An alternative arrangement. On the right is shown the coil with its three connections. For the fig. 2 circuit B is connected to earth and C to the socket.

One advantage of having two-thirds in the aerial circuit and all of the coil in the closed or "secondary" circuit (as it may be termed) is that with a given size of variable condenser we cover a wider range of wave-lengths than would otherwise be the case. The tuning is also

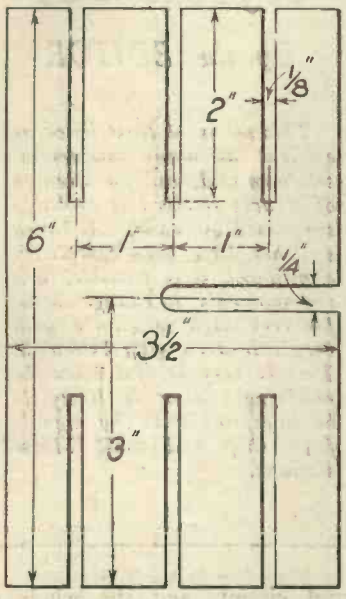



Fig. 3.—Two pieces of wood or ebonite are cut like this, and joined together egg-box fashion.

sharper. The crystal detector used is of good pattern recently placed on the market by The General Electric Co. It has a ball and socket adjustment for the cat-whisker, and in addition a micrometer setting, which enables one to exert just the right degree of pressure to get the best results. A detector of very similar design is made by Burndept, Ltd.

### Components Required

The set is neither difficult nor expensive to make. We require for its construction the following parts:

One box 9 by 5¾ in. It must be not less than 4½ in. deep internally.

One ebonite panel, 9 by 5¾ by ¼ in. (Be sure to use guaranteed leakage-free ebonite.)

Two ebonite or fretwood strips, measuring 6 by 3½ in.

Five terminals.

One panel-mounting socket for plug-in coil.

One short-circuiting plug for same.

One crystal detector. (That shown is G.E.C. micrometer. Any good make of crystal detector may be used here, provided its adjustment is sufficiently accurate.)

One variable condenser .0005 μF. (That shown is a "Kelford.")

About 1 lb. of No. 16 d.c.c. wire.

Three short lengths of flexible india rubber covered wire.

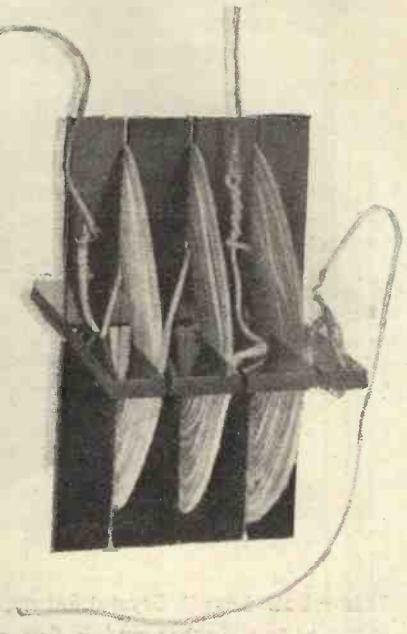
Two 2 ft. lengths of No. 16 gauge square-section tinned copper wire.

### Constructional Details

The first step is to cut the ebonite or wood strips as shown in Fig. 3. The coil slots are ⅛ in. wide by 2 in. deep. The slots cut transversely for enabling the two pieces of ebonite to be put together "egg-box fashion," are ¼ in. wide and 1¾ in. deep. Two pairs of holes for securing the two ends of the coil are drilled in suitable places at each side of one of the pieces (see photograph).

As soon as the pieces have been cut to shape, put them together, thread one end of your coil of No. 16 d.c.c. wire through the two holes at the beginning and wind on twenty turns in each slot. When you arrive at the twentieth turn of the first slot, take your wire across to the bottom of the second slot, wind till the second twenty turns are finished, twist a loop in the wire and then carry on in the third slot until the whole sixty turns have been wound. The end of the coil is now threaded through the remaining two holes to prevent slipping.

The next step is to bare the ends of the wire and to scrape the cotton covering from the loop which has been twisted up at the end of the second section. Tin the exposed portions and solder to each of them lengths of wire about 6 or 8 in. long, using for the purpose the flexible india rubber covered wire



A photograph of the completed coil.

already mentioned. It will now be seen that the coil will just stand within one end of the box destined for it.

Now drill the holes in the panel in the position as shown. If you use a different make of variable

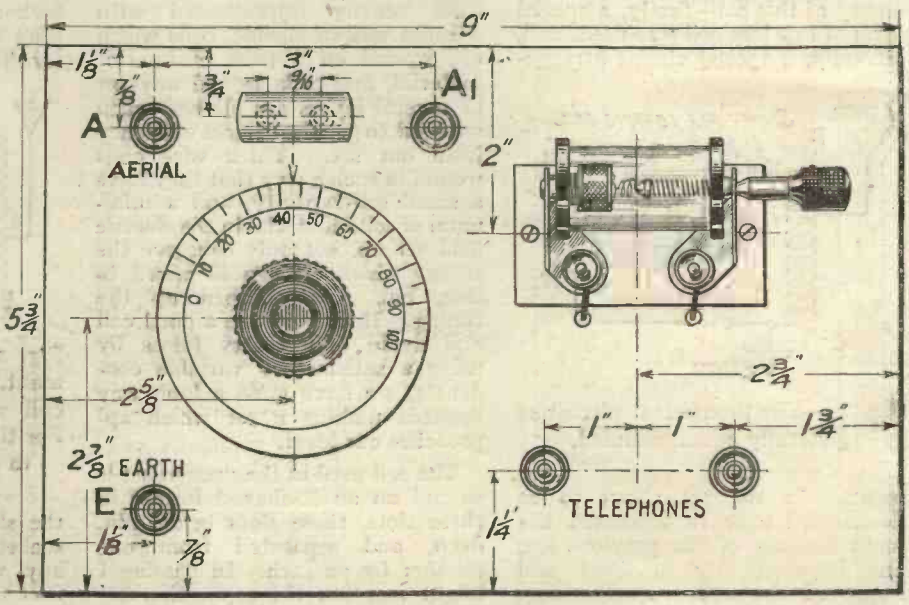



Fig. 4.—Drilling diagram and panel markings. The terminal A1 is used for the aerial connection when Chelmsford is being received. For this station the short-circuiting plug between A and A1 is withdrawn, and a No. 150 coil plugged in.

condenser (and there are a number of good makes on the market) the securing holes may be in different positions. The same remark applies to the crystal detector. Examine the photographs and wiring diagrams carefully, and you will see that three flexible leads from the coil come to three points on the panel. The flexible wires are secured to these points by nuts, and not by soldering, so that before you solder any wires on to these particular terminals run on a couple of nuts first of all. You can then solder the wires which go to these terminals without interfering with the subsequent connection of the flexible leads to the nuts. Keep all leads as short as possible and fairly close against the panel. Projecting wires might interfere with the coil, which must occupy nearly one-half of the box.

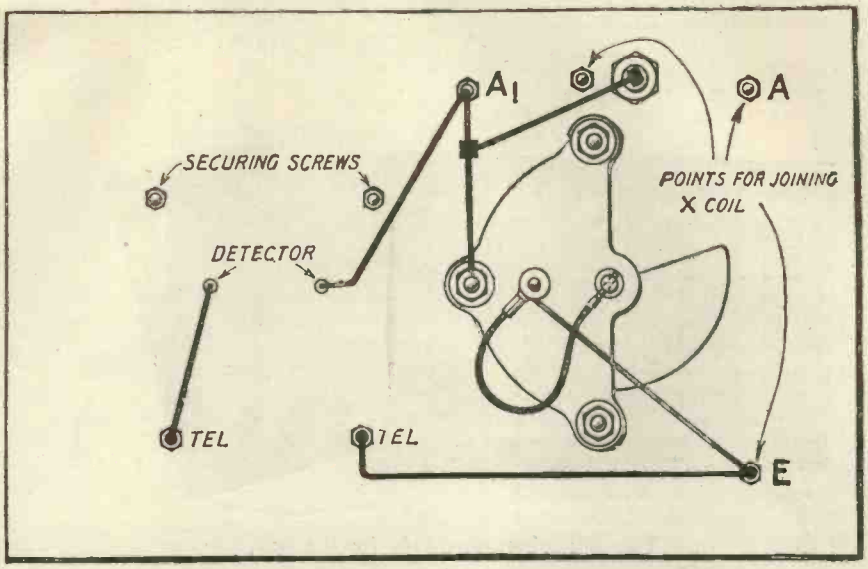
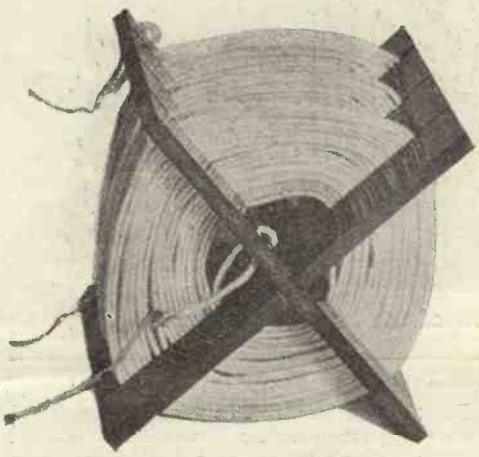



Fig. 5.—The wiring is very simple. Notice that the coil is secured by nuts to the three points indicated.

When you have soldered up all connections on the panel, take the three flexible leads indicated. and fasten their ends underneath the nuts shown. For normal use join as shown in Fig. 1. When additional selectivity is required, or if you find the set on your aerial will not tune quite low enough, use the connections shown in Fig. 2. Unless you have considerable interference from other stations, I would recommend the first arrangement, as giving slightly louder signals. As soon as you have connected the flexible leads, place the coil in one end of the box and adjust the panel in place, holding it down to the box by a couple of wood screws passing through clearance holes in the ebonite. As soon as you have done this you can apply the Radio Press panel transfers for the aerial and earth terminals, and the telephones.



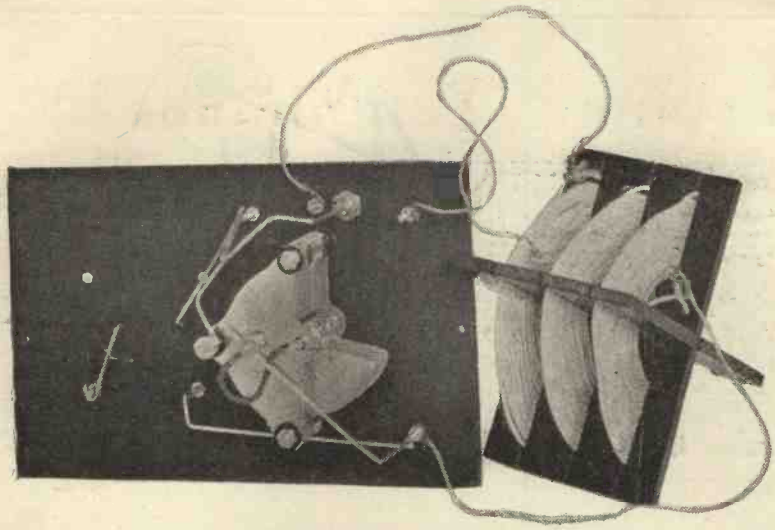
Another view of the finished coil. It is wound with No. 16 double cotton-covered wire.

### Operation of the Set

Place the cat whisker in contact with the crystal, connect aerial to A and earth to E, and, with the shorting plug in place, turn the knob of the variable condenser until you hear signals from the local broadcasting station. As you cannot possibly radiate with this receiver, there is no harm in swinging the condenser backwards and forwards, as this method will be found useful in finding which point gives the best signal strength. Keep the condenser on this point and re-adjust the crystal detector to get the loudest possible signals. Now make a final adjustment of tuning on the tuning condenser, and you will be ready to enjoy the programmes.

To receive Chelmsford, 5XX, withdraw the short-circuiting plug, insert a No. 150 coil and connect the aerial to $A_1$. You will now find that Chelmsford will tune in about half-way round the scale of the variable condenser. If a broadcasting station should not be working when you have finished the set you can test it on ship signals on 600 metres, which will be bound to come in quite well on the upper end of the scale, using the coil in the box.

Ready for joining the coil.

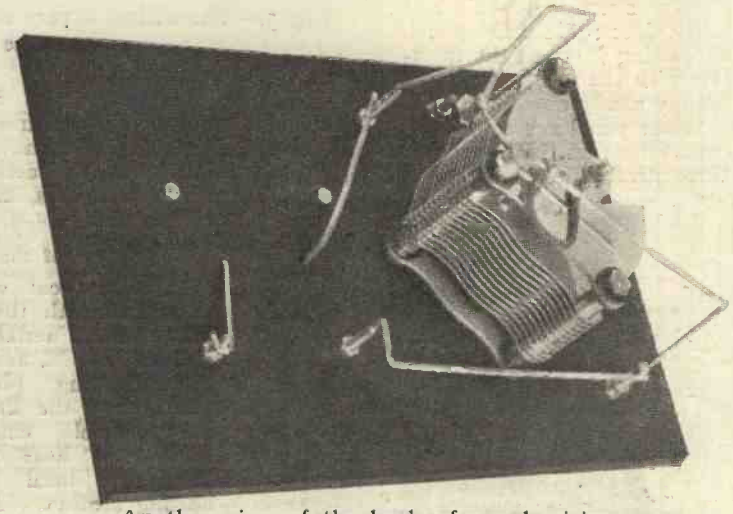


The coil joined up ready for the box.



### Wave-length Range

On an average aerial connected to A and earth to E terminals, and with the socket short-circuited by a plug, the set will be found to tune from 340 metres to 600. With the connections made from the coil to the set, as shown in Fig. 2 (highest selectivity position) the wave-length range will be from about 240 to 500 metres. With a very small indoor aerial it may be found slightly advantageous to move the aerial wire from A and place it on $A_1$, keeping the short-circuiting plug in position meanwhile. In any case, this experiment should be tried to see whether it gives better results. An advantage of this set is that it is so easy to remove the low-loss coil for experiments in other circuits you may have.



Another view of the back of panel wiring.

## *What a Reader Heard with "A Simply Made Single-Valve Receiver"*

SIR,—I hope I am not intruding on your valuable space by writing this letter to your journal. I feel I owe you this letter.

Last week-end I rigged up that little cabinet one-valve set you described in last month's (December) WIRELESS CONSTRUCTOR, with the sole object of working Swansea Relay Station. However, last Sunday night II received all the B.B.C. stations except Birmingham (including Chelmsford). Bournemouth, Cardiff and Chelmsford were enjoyably loud in 'phones. Radiola comes in well, also Petit Parisien and Hamburg.

Candidly, I did not expect more than Cardiff on it, but to-day I had the surprise of my life. I had been informed that Swansea would be testing at midnight last night (December 11th), and so I sat up for it.

Result—No Swansea; it was all a rumour! But I had WBZ (W B Zee)—and all on one valve at excellent strength! From them I had a piano concert with orchestral accompaniment, a financial talk, farmers' talk, and a stage talk. The announcer announced 7.36 p.m. Eastern standard time, and it was about 12.45 a.m. by my clock; of course, it was December 11th in U.S.A. then. There were no atmospherics or Morse, but much fading. I think this speaks well for the wonderful stuff you turn out in your very valuable journals. As I mentioned in a previous letter, this is the eighth of your sets I have built—and the most startling one, I can assure you.

Best of luck and prosperity to your papers.—Yours faithfully,

Swansea. E. E. EVANS

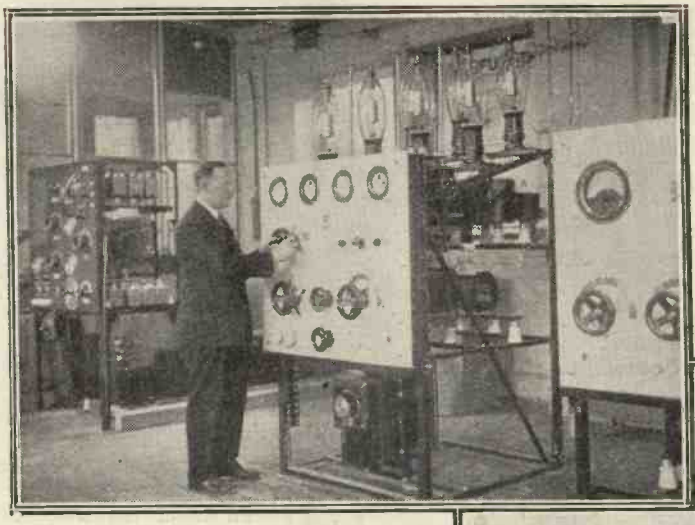
*December 12th, 1924.*

## *The Twin-Valve Receiver*

In the article describing the Twin-Valve receiver in our last issue, we omitted to state that the cabinet was built by Mr. W. H. Agar.

# Low Resistance Telephones

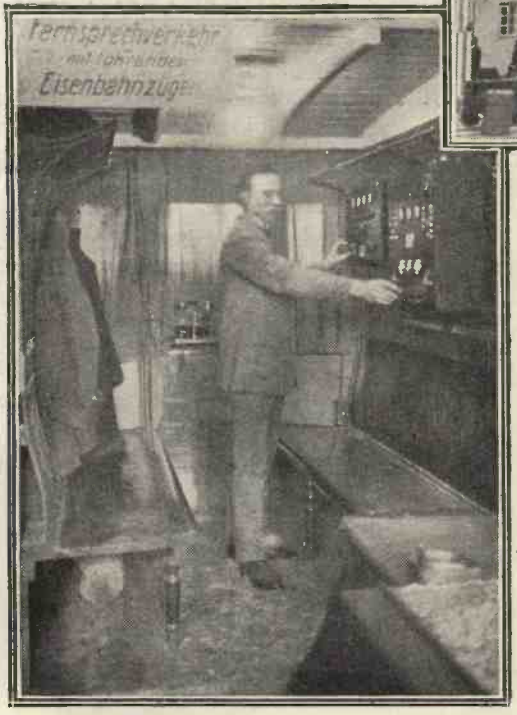
## *SOME INTERESTING FACTS*



BOTH single earpieces and complete sets of headphones of low resistance are now obtainable very cheaply indeed from dealers in Army surplus goods. As a rule each earpiece is wound to a resistance of 60 ohms, so that the total for the headset is 120 ohms. One reason probably why these goods are so cheap is that most people think that they are of little or no use unless a telephone transformer is employed. As a matter of fact, for short distance reception, low resistance phones answer very well indeed in the crystal set. It is only when the range becomes long that any great advantage can be found in using the high resistance type of telephones.

Above: The transmitting station at the first German Wireless Exhibition.

On the right: The exterior of the Exhibition Buildings decorated for the opening day.



At the first German Exhibition: An exhibit showing wireless apparatus for use on a moving train.

Many people, as a matter of fact, make the mistake of using telephones with far too high a resistance in connection with crystals. There is a prevalent idea that if a 2,000 ohm headset gives good results, you will get better reception still with 4,000 ohm phones and still better with 8,000, the idea being that the higher the resistance the greater must be the sensitiveness. Experiments made by the writer have shown that with most of the commonly-used crystals a resistance of 1,000 ohms in the telephones is ample, and that it is usually a drawback to use more than 1,500. Should you possess a pair of very high resistance telephones you can quite easily lower their resistance by wiring the two receivers in parallel instead of in series. This has the effect of reducing the total resistance in circuit to a quarter of what it originally was.

R. W. H.

Uncle Humpty-Dumpty (London).

# The Children's Hour

By "CARRIER WAVE"

Auntie Gladys (Birmingham).

"THE Children's Hour." Magic words are these to the older generation, for they conjure up sentimental visions of a twilit room, a blazing fire, before which the mother sits telling fairy stories to a bevy of youngsters on the hearth-rug—"Once upon a time."

Yes, indeed, never were words more prophetic, for those times are gone beyond recall. The "Children's Hour" of to-day takes place round a network of wires, headphones and valves, and what is more amazing, in silence.

The youngsters of this generation if not broadcasting themselves, as did the happy little crowd at 2LO recently, show a lively interest in battery current, and demand new headphones, valves or crystals as Christmas presents. Not only have they an official "Corner" in broadcasting, but a special staff of artists to watch over it throughout the country.

It is, of course, to 2LO that the largest family of nephews and nieces is attached, and the oldest "uncle" in point of experience is "Uncle Arthur." This has made Mr. Burrows one of the most sought-after officials of the B.B.C. Commencing his career as a journalist, time brought him to Marconi House as Publicity Manager to the Marconi Company, and when the B.B.C. came into existence, Mr. Burrows, who has a perfect genius for organisation, became Director of Programmes.

Uncle Rex (Mr. R. F. Palmer), of the London Station.

### Uncle Arthur's Task

No easy task is this, for not only has he the actual programmes to arrange—and the magnitude of this alone everybody will admit—but he has all the questions of copyright to deal with, as well as the engaging of the artists and seeing also that their songs do not infringe the by-laws. We should imagine that Mr. Burrows' pet nightmare is the Society which prevents us hearing all his favourite works. It is not surprising, therefore, that the pleasantest of avuncular voices is too often missing.

Co-equal in favour is "Uncle Rex," known to the world as Mr. R. F. Palmer and the London Station Director. He has been associated with 2LO from its very inception, and takes his work very seriously. But one of the greatest treats, whether in the "Children's Hour" or in the ordinary programme, is to get a song from him, for it is no exaggeration to say that he possesses one of the finest voices in the country, as witness his recent songs at the "Birthday" party. Even when only one of the "Annoyancers," as a dear old lady terms them, it is Uncle Rex who informs us in the best microphone voice in the building.

"Uncle Caractacus" would be in danger of being badly spoiled if he could be seen as well as heard,

Uncle Leslie (Mr. Leslie Page), until recently at Bournemouth.

Uncle Jeff, of London.

*A chat on the Aunties and Uncles whose daily talks and messages are such a feature of British broadcasting*

Auntie Elsie (Birmingham).

Uncle Joe (Birmingham).

for he is still in his twenties, and knows just what youth wants. It is just as well that he does not threaten to leave his English at home, for he could conduct that "Corner" in all the Continental languages if he liked.

Of the "Aunties," first, of course, is "Aunt Sophie," the name by which a very brilliant pianist, Miss Cecil Dixon, is known. Miss Dixon hails from the Fiji Islands, but early came to England to study as a classical pianist, and her recitals at Æolian Hall testify to her success. Studying under a teacher who has made a world-wide reputation for his own particular methods, Tobias Matthay, Miss Dixon has become one of his best-known exponents, and she herself is a professor at the Royal College of Music.

Another clever pianist is "Auntie Hilda (Miss Dederich), whose "Music Pictures," given every fortnight, to the stories told by "Uncle Humpty Dumpty" have become a recognised feature.

This latter "Uncle" has lately come to us from Manchester, and as Mr. K. A. Wright is also Assistant Director to Mr. Palmer.

Uncle Caractacus (Capt. C. A. Lewis) of 2LO.

### The Musical Side

Of the other "Uncles," we have almost best of all, "Uncle Jeff." As Musical Director and arranger of all the operas, Mr. Stanton Jefferies has done fine work. Few people realise that he is also one of the finest organists in the country, and was formerly organist at Windsor Chapel. His performance at the National Institute was a triumph of organ playing and knowledge of wireless needs.

Other uncles of 2LO are "Uncle Jack Frost," who, as Captain Jack Frost, has a great deal of technical work to do, and "Uncle Pollard Crowther," who knows more about Japan than is to be found in a dozen books.

### Bournemouth

The Hampshire district is very fortunate in 6BM's uncles, for they are led off by the Station Director himself, Mr. Bertram Fryer, who is known to his young broadcasting "relatives" as "Uncle Jack," and the children's as well as the Scholars' Hour, which he inaugurated, are sources of joy to him. From one school alone, 280 boys out of 370 possess receiving sets, and their letters often contain valuable suggestions.

### Energetic Uncle Jack

Mr. Fryer's energy is boundless, and his experience gained in a successful theatrical career makes him the ideal director for any station. It was at Newcastle that he first proved his supreme value, coming to the B.B.C. direct from the Apollo Theatre in London where he was playing in "Hawley's of the High Street." As actor, producer, manager, Mr. Fryer's reputation is known not only throughout the kingdom, but in South Africa as well. At Newcastle he produced the first operas, and with none but local talent. At Bournemouth he has made, with the

Uncle Will (Aberdeen).

Uncle Jack (Bournemouth).

assistance of another clever conductor, Captain Featherstone, one of the best stations on the line. He has had capable assistance also from "Uncle Rob" (Captain Keene) and "Uncle Leslie" (Mr. Leslie Page), but recently transferred to another station.

### Birmingham

The mascot of 5IT is "Snookey," and, "Tune in 'Snookey,' daddy, please do," I am told when I venture near my own set in the magic hour. I should not be surprised if a good many of us "tune in to 'Snookey,'" for, though we are not personally interested in the quaint little creature's adventures, we like to hear the clear accents of "Auntie Phyll" who relates them. Miss Richardson makes a strong point of elocution, and has a mobile voice that allows her to keep half a dozen characters living at the same time. She is known to a very wide circle of nephews and nieces.

This station, however, possesses a whole army of uncles and aunts. First, there is "Uncle Joe," more respectfully known as Mr. Joseph Lewis and the Musical Director of 5IT. But he is affectionately known to thousands as "Young Joe," to distinguish him from his father, a famous conductor in the Midlands, and Mr. Lewis himself relates an occasion when he was rightfully termed "Poor Old Joe." This happened in Walsall many years ago, when Mr. Lewis was to conduct a choir formed from the newspaper boys in the district. The conductor's stand was a brave affair as regards bunting, but unfortunately was composed of ginger-beer cases. Conducting with his usual energy, Mr. Lewis says, "I leapt, for one item, positively leapt in my place, only to feel the stand give way, and from which I was extricated with difficulty. All might yet have been well, had not the announcer given forth the next item, which was a song, 'Poor Old Joe.' This put the finishing touch, and it took some five minutes before the laughter subsided sufficiently to 'carry on.'"

Auntie Sophie (Miss Cecil Dixon) at London.

### Uncle Joe as Conductor

But Mr. Lewis's fame as a conductor is not only confined to his own district. As conductor of the Wolverhampton Musical Society, comprising some three hundred members, Mr. Lewis brought the choir up to London, with a big concert at Queen's Hall, and gained tremendous success. That his work is appreciated is proved by the tributes paid him by Sir Edward Elgar and Granville Bantock, and at the Birmingham Broadcasting Station his name stands for everything true in art. An additional proof are his "Radio Fantasies."

Next is "Auntie Phyll" again, and then "Uncle Edgar," no less than Mr. Percy Edgar, the Station Director.

Mr. Edgar is the son of a well-known Stafford journalist, but, making a stage appearance at the age of four, evidently this debut determined his present career, for we find Mr. Edgar in later years devoting himself sternly to the theatrical art, and specialising in Dickens's characters. When the B.B.C. came into being, chance led the powers that be to choose Percy Edgar, and a better choice it would be impossible to make.

Mr. Cecil Pearson, who was known as "Uncle Pip," has now been appointed Director of the Liverpool Station, but his place has been taken by "Uncle Felix," who is next in favour and really known as Mr. A. Pelham. Mr. Harold Casey is best known as "Uncle

Auntie Phyll and Snookey at Newcastle.

This picture shows a group of the Birmingham Aunties and Uncles.

Uncle Jack Frost of London.

Pat" in the Children's Hour, but as a vocalist in his own proper person he is hard to beat, and has had a successful musical career.

**Another Uncle Jack**

Birmingham also has its "Uncle Jack" in the person of Mr. Jack Cooper.

The Aunties are a very important part of 5IT's staff. First there is "Auntie Gladys" (Miss Colbourne), who also takes charge of the Ladies' Corner. Equally popular is "Auntie Elsie" who, as Miss Wilson, is a known pianist and singer and accompanies her own songs in the Children's Hour. She admits to one weakness, a passion for fancy work, though this is an item especially for her nieces to note. Also we have "Auntie Kitty" (Miss Usherwood), and "Auntie Dorothy" (Miss D. Barcroft).

**Aberdeen**

The chief uncle here now is "Uncle Will," who, as Mr. W. D. Simpson, is Assistant to the Station Director, and one of the oldest members of the B.B.C., having joined the company in January, 1923, taking up his duties in Aberdeen on the opening of that Station, and coming from Newcastle.

This Station has been exceptionally fortunate, for it has also had "Uncle Ronnie," no less than Mr. R. E. Jeffrey, the first Station Director of 2 BD, and who left recently amidst much wailing and gnashing of teeth to become the Director of Plays at 2 LO. Then there is "Auntie Chris" who, as Miss Christine Crowe, has a wonderful gift for writing sketches in the Doric. She was the first auntie of 2 BD. Another auntie whose "visits" are always eagerly welcomed is "Auntie Nancy," for she plays haunting violin solos, and is no less than Miss Nancy Lee, the Musical Director of the Station. "Uncle Harry," or Mr. McKee, also had charge of the lectures, and he works, too, in a dual role.

One and all have had wide experience in music and in art, and give of their best to the Hour in which they, too, can forget the sterner duties of life and pretend that they have put the clock back and they are once more children, and comrades to the vast unseen family of nieces and nephews.

**Next Month:**
**A Chat about the Musical Directors of the B.B.C.**

Auntie Sophie and some of the Uncles at 2LO. Uncle Arthur is seated on the piano (second from right).

Miss Thelma Hughes, aged six, who recently recited during the Children's Hour from 2LO.

Uncle Rob (Bournemouth).

## *Some Radio Press Sets*

**THE ST 100**

SIR: I am writing to say how pleased I am to have constructed a "ST 100" set. Although I have never seen the inside or wiring of any other valve set, I was able through your wonderful and simple instructions in "Radio Press Envelope No. 1" to build this set, which works splendidly. If anyone had told me three months ago that I could build a set like it, I would not have believed it, because I have no knowledge of wireless or radio affairs whatever; but it is made, and it works, and I am proud of it, and great credit is due to you.

Thanking you and wishing you every success.

Yours faithfully,

Lewisham, S.E. J. VIDLER.

**THE ALL-CONCERT RECEIVER**

SIR: A couple of months ago I put together an "All-Concert Receiver," as instructed in your "Twelve Tested Wireless Sets" and I have every reason to be pleased with the set.

Though 1,400 miles from Radio Iberica, I can pick him up every night. On more than one occasion this station has been almost as strong as Bournemouth, which is our strongest station with the small coils (35, 50 and 75). With the Chelmsford coils my set is much better than any set in this district, including two 4-valve sets which cost their owners over £50 each, the volume and tone being all that one can desire.

Yours faithfully,

Lerwick. G. T. KAY.

# What Our Readers Can Do

*Some Interesting Experiences with Radio Press Sets*

**THE SEVEN-CIRCUIT CRYSTAL SET.**

SIR: I wrote you some time ago regarding the Crystal Set in THE CONSTRUCTOR for December. I then said I would give you my experiences with it. There is no doubt it is the most efficient crystal receiver I have ever built, and I have made a good many. I am 15 miles from 5SC (Glasgow), my aerial is 60 ft. between insulators and 35 ft. high. From insulators to set the lead-in is 40 ft. My earth is 5 ft. from set to ground contact (copper plate). I get very good telephone strength on practically all the circuits, but on two of them I get quite exceptional volume and clarity. These are (1) aerial in extreme right socket and earth and condenser in second from left; (2) aerial as in (1) and condenser as in (1), but earth in extreme left socket. Connected to wiring for smoking room and kitchen, 40 yds. from terminal to terminal, with two telephones and loud speaker in circuit at same time, speech can be followed quite clearly from loud speaker 6 ft. away. I hardly think that can be beaten by any crystal set, except when there is freak reception. Here is an example of freak reception. With the Four valve Family receiver working on first-mentioned aerial fixed immediately above a 25 ft. twin indoor aerial fixed beneath rafters and leading to a bedroom, I can get with any crystal set attached to the indoor aerial, whatever I am for the moment getting through on the four-valve receiver, which is almost everything in Europe and often the U.S.A. To be in the fashion I should have claimed that I have U.S.A. on a crystal set, which is literally true!

Yours faithfully,
A. J. WRIGHT.

Motherwell.

SIR: I am pleased to inform you that I have made the "7-Circuit Crystal Set as described in THE WIRELESS CONSTRUCTOR, Vol. I., No. 2. I get good results on two pairs of Brandes' headphones, being able to distinguish clearly every word spoken from Manchester Station, or relayed from London, via Liverpool. Orchestral music from either station is quite loud. This is not bad considering I am 22 miles from Manchester and 32 miles from Liverpool. I should like to say that this is my first venture in wireless in fact, a week ago I shouldn't have known a valve from a crystal, until I bought your book. My aerial is of the double wire type, 30 ft. between insulators and 30 ft. high. The cost of making set was 17s. (exclusive of headphones and aerial).

I think your book THE WIRELESS CONSTRUCTOR is *the* thing for a beginner.—Yours faithfully,

WM. J. CLARKSON.

Chorley, Lancashire.

SIR: I feel that I must drop you a few lines regarding the "Seven-circuit" Crystal Set, details of which are to be found in the December issue of THE WIRELESS CONSTRUCTOR

Both I and my friends are astounded at the strength of signals we now receive; to say the least, the set is wonderful.

I have a 25-ft. pole and 75 ft. of Electron aerial, with 25 ft. leading in direct to set, 8 yds. earth wire soldered to water tap; I live about 1½ miles from our Relay Station, as the crow flies, and am also situated at a high point on the outside of the town.

My friends are rather disappointed with their own sets since hearing mine, and wish that your article had been published a little earlier.

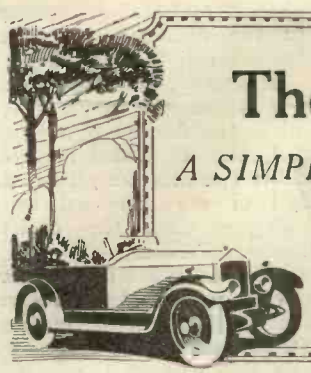
I feel greatly indebted to you for presenting such a remarkably good set, and in return I promise to do my utmost to increase your already large circulation of THE WIRELESS CONSTRUCTOR.

Thanking you again for such splendid help,

Yours very gratefully,
A. FREEMAN.

Nottingham.

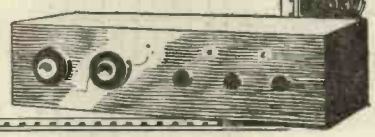
John Henry, the famous comedian, is here seen with his wife Blossom, and Egbert.



# The Rolls-Royce of Radio

## A SIMPLE ACCOUNT OF THE SUPER-HETERODYNE RECEIVER

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.



AMERICAN experimenters have called the supersonic-heterodyne receiver the Rolls-Royce of radio. This catch phrase is undoubtedly an accurate description of what many experimenters regard as the most difficult wireless receiver to make.

It is nothing of the sort. On the other hand, I am not sure that it is not one of the simplest multi-valve sets to construct, and most certainly to operate.

I would almost go so far as to say that the broadcast receiver de luxe of the future will work on this principle, and that different broadcasting stations will be received by the simple turning of one handle.

The words "supersonic-heterodyne," or "super-heterodyne" (an abbreviation), are inclined to terrify the beginner. The principle of the receiver, however, is not nearly as difficult to understand as many people imagine, and I propose to explain, in as few words as possible, the action of this extremely useful system of wireless reception which is practically unknown in this country. A very full and detailed account is at present being given in a series of articles which I am publishing in *Wireless Weekly*, full constructional details of super-heterodyne sets being given.

The advantages of a supersonic-heterodyne are:

1. Very long ranges may be accomplished.

2. Frame aerials may be used with great success.

3. Great selectivity is obtainable.

The sensitiveness of the supersonic heterodyne is its great feature. It is possible on a frame aerial only 2 ft. in diameter to receive, under good conditions, American broadcasting stations on a loud-speaker in this country. I am afraid I am one of those very sceptical people who do not believe in obtaining long-distance results with the ordinary receiver. I have probably worked and handled more different types of receiving sets than anyone else in this country. I have experimented with literally hundreds of circuits, and only selections from these have been published, because it is not every circuit which looks well on paper which may be handed out to hundreds of thousands of readers for constructional purposes. In spite of this, I still have an uncomfortable feeling when long range instruments are mentioned. I quite admit that with skilled handling ordinary apparatus is frequently capable of long range reception, but more usually than not, even when this reception is accomplished, there is so much interference that the signals are barely worth receiving.

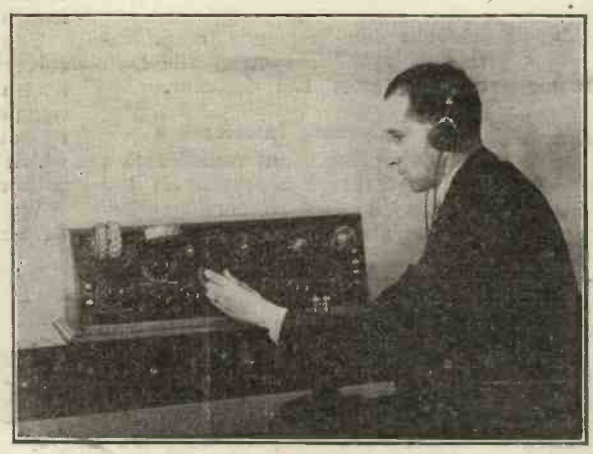


Fig. 1.—A five-valve super-heterodyne designed by the author.

### The T.A.T. System

The T.A.T. system of high-frequency amplification which I have developed and described in the last three issues of *Modern Wireless*, goes a long way to the solution of the high-frequency amplification problem, but in spite of this I strongly believe that the supersonic-heterodyne type of receiver will ultimately be the one to be used for long-distance reception.

The only disadvantage, and to many it will be an insuperable disadvantage, of the supersonic heterodyne type of receiver, is that a large number of valves is used.

Fig. 1 in this article shows a five-valve receiver which I have designed, and although it is theoretically possible to obtain supersonic heterodyne effects with a single-valve receiver, yet the best results are unquestionably obtainable with from 5 to 10 valves.

Now to study the action of this fascinating type of receiver. Why is it that the ordinary receiver is limited in its range? Why, in fact, will one receiver not receive long-distance signals while another, using more valves, will receive a much longer range? It is not merely a question of the number of valves used, but the way in which they are used. I have known many a single-valve set give much better results on distance work than a three-valve set.

The whole trouble, really, is in the detector. Although we have improved wireless apparatus in innumerable directions, the modern detector is little better than it was 20 years ago. This is a rather startling statement, but a real technical investigation into the matter will show that it is true. We have done wonders in the way of developing high and low-frequency amplification, but we have done practically nothing to develop an efficient rectifier. The trouble is that a rectifier, or detector, whose purpose is to change the high-frequency currents which come into the aerial system into low-frequency currents capable of operating telephones, for example, will not work unless the high-frequency

currents are sufficiently strong. A child may try and open a door, but unless its wrist is strong enough to turn the handle the door will not open: unless the incoming high-frequency wireless currents are strong enough, they will not work a detector, even though the currents may be there.

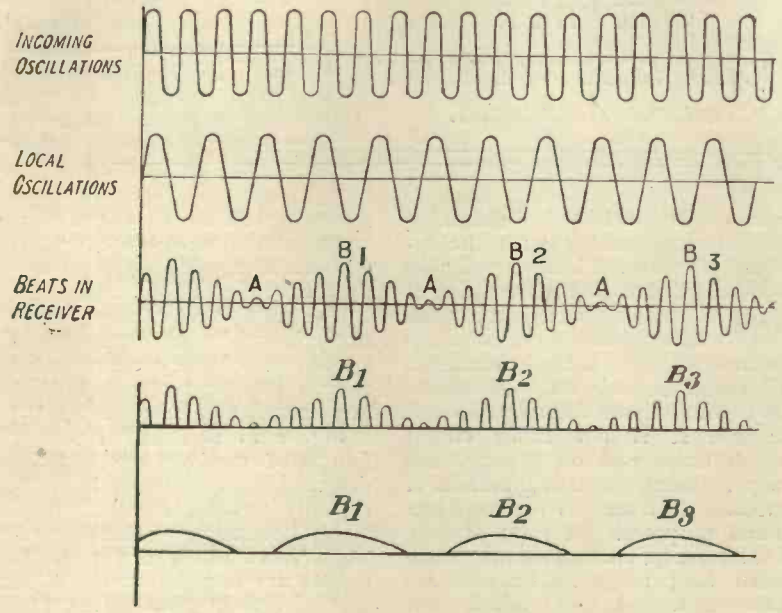



Fig. 2.—How the sets of oscillation combine.

### After the Detector

As a matter of fact, the signals given out by a detector, say a crystal detector, depend upon the strength of the high-frequency currents which are produced in the aerial circuit by the incoming waves. If the currents in the aerial circuit are too weak, they will not work the crystal detector and no signals will be heard in the telephones. Under these conditions it is practically useless adding more valves to amplify the low-frequency signals, because they are simply not there to amplify. In such circumstances we can do either of two things: we can use an improved detector or improve an existing detector artificially, or we can amplify the incoming high-frequency currents until they are sufficient to work the detector properly. This latter step is what is usually done. It may be taken as a rule that the signal strength output of the detector, whether a crystal or a valve, is proportional to the square of the amplitude of the incoming currents. To speak very roughly, if we double the strength of the incoming currents we will get four times the signal strength in the phones.

The obvious thing to do is to increase the high-frequency currents as much as possible, and this can be done by using a better aerial or by using one or more stages of high-frequency amplification, *i.e.*, amplification before the detector, whereas low-frequency amplification is amplification of the L.F. currents after the detector.

### Eliminating Interference

Another important consideration in long-distance reception is the elimination of interference by other stations, atmospherics and all sorts of extra noises which almost invariably come in when more and more valves are used.

A signal may be there all right, but it will not be any use if there is a background of noise and interference. A tin whistle in the middle of the night will sound much clearer than a factory hooter, if the hooter is working when half-a-dozen other hooters are also busy. There are all sorts of peculiar noises set up in a multi-valve set, quite apart from interference due to atmospherics and other stations, and in the ordinary way L.F. amplification will increase them.

The supersonic-heterodyne receiver possesses the great merit that, while the desired signals are amplified, the incidental and objectionable currents are either not amplified or are increased to a lesser degree than the desired signal.

An added advantage is that since the supersonic heterodyne receiver works so well with a loop, considerable interference may be eliminated by being able to turn the loop in different directions, and so taking advantage of its directive properties.

### What the Super-heterodyne Does

The supersonic-heterodyne receiver does two things. It provides an improved detector, or rather a detector which is artificially improved, and it also enables several stages of easily controlled amplification to be obtained.

In the ordinary way it is very difficult to amplify high-frequency currents by several stages of amplification because the valves are so liable to oscillate. This is particularly the case where the signals to be received are of short wavelength, *e.g.*, 500 metres and below.

The supersonic-heterodyne receiver changes the short wavelength signals into long wave signals which may then be amplified by several stages of amplification, which can be easily controlled without the valves oscillating.

We change the incoming high-frequency currents into currents

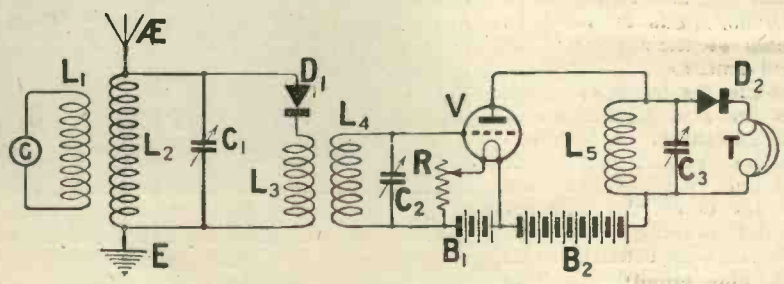



Fig. 3.—A very simple supersonic-heterodyne receiver.

of lower frequency which are not audible, but correspond to long wave-lengths, *e.g.*, 6,000 metres, by combining with the incoming currents locally generated continuous oscillations, *i.e.*, oscillations which resemble the oscillations produced by the carrier wave of a broadcasting station.

### The Local Oscillator

These local oscillations are generated by an oscillating valve in the receiver, which valve, in

many cases, does nothing else but provide the local oscillations. These are then fed into the receiving circuit, *e.g.*, the aerial circuit, and the oscillations which are given a wave-length slightly different from the wave-length of the incoming signals produce what are known as beats with the latter. When two organ notes are sounded, it is frequently possible to distinguish

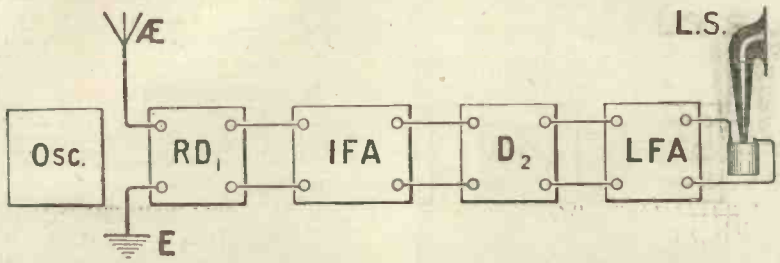



Fig. 4.—The different elements in one type of super-heterodyne receiver.

a third note which is produced by the interaction of the other two; in the same way, if two sets of wireless oscillations of slightly differing frequency corresponding to slightly different wave-lengths are mixed up together, a third frequency is obtainable in the form of beats. These beats are increases in the resulting currents which occur at regular intervals.

### A Simple Explanation

In Fig. 2 it will be seen that the top line shows the incoming signals, while the second line shows locally generated currents. It is assumed, for this explanation, that the incoming signals are of continuous wave form, although telephony signals, of course, will not be of the same evenness, but will increase and decrease in amplitude. Nevertheless, for the sake of this explanation, it is best to consider that we are simply receiving, say, the carrier wave of a broadcasting station. By mixing with this carrier wave the local oscillations shown in the second line of Fig. 2, we get a resulting current in the receiving circuit, which looks like line 3, and it will be seen that humps marked B1, B2 and B3 are produced, these humps being called beats. If now we rectify the currents shown in the third line by means of a crystal, or more usually a valve, we will obtain, in the output circuit of that valve, rectified currents—*i.e.*, currents which flow in a given direction, as distinct from currents which alternate in their direction. This is necessarily a rather rough explanation, but line 4 will show what happens.

In this figure it will be seen that little pulses of high-frequency currents are obtained which mount up to their maximum value at the points B1, B2 and B3.

In each of the little humps, B1, B2 and B3, which are known as beats, the average effect only is utilised, so that what we get is shown in the fifth line where each of the little high-frequency pulses in each of the bumps, or beats, are added together to produce one single pulse of current. The number of these beats, B1, B2 and B3, will be equal to the difference in frequency between the currents in the first and second lines.

The frequency of these beat currents will depend upon the difference in frequency between the incoming signals and those locally generated, and they may be adjusted to any value by adjusting the frequency of the local oscillator.

### The Beat Frequency

The beats may be made to have a frequency of almost any value up to, for example, 50,000. If the beats have a frequency of, say, 1,000, a very clear note will be produced which could be heard in telephone receivers connected to the output side of the detector. If, on the other hand, the frequencies are above about 10,000, telephone receivers would not take any notice of them, and nothing would be heard. A beat frequency above 10,000 would be said to be supersonic—*i.e.*, above the audible limit. Beginners should understand that the human ear cannot detect sounds above a certain frequency, the upper limit being usually in the neighbourhood of about 10,000.

If the beats are at the rate of about 50,000 per second, the currents will resemble those produced by waves having a wave-length of 6,000 metres, and the outward currents from the detector may be applied to a high-frequency amplifying system tuned, or arranged to work, on a wave-length of about 6,000 metres. After several stages of this long wave, or intermediate frequency amplification, the currents are once more detected, and, if telephony is being received, signals will be heard in the output circuit of the second detector.

### A Simple Set

Fig. 3 shows a very simple supersonic heterodyne receiver, in which it will be seen that the ordinary receiving circuit L2 C1 is employed, a crystal detector D1 being used. The output of the crystal detector D1 is a long wave high-frequency transformer L3 L4, the secondary L4 of which is shunted by a variable condenser C2, which tunes the secondary to a wave-length corresponding to 6,000 metres. The valve V is a high-frequency amplifier, the tuned anode circuit L5 C3 being also tuned to 6,000 metres. Across this circuit we have a crystal detector D2 and telephones T. In this circuit, we also have an oscillating valve marked G, which generates local continuous wave currents, which pass through the inductance L1, and are induced into

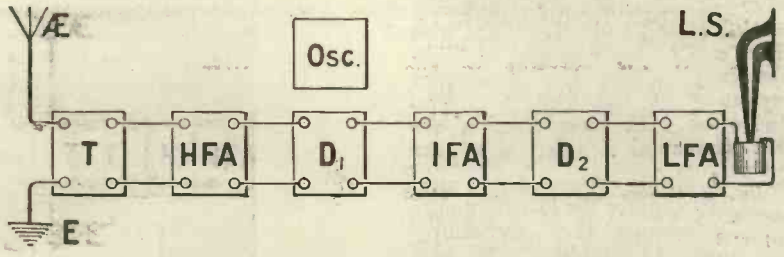
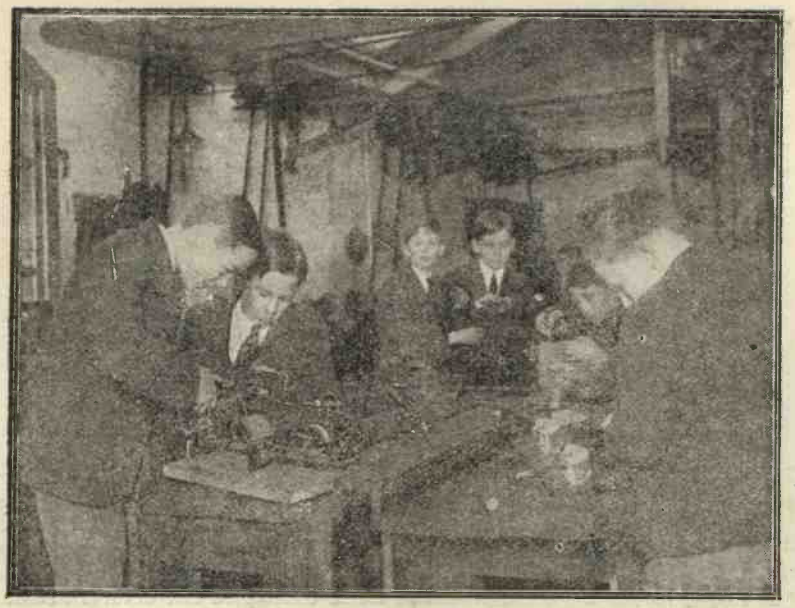



Fig. 5.—Another arrangement of units.

the circuit L2 C1; the local oscillations have a frequency slightly different to that of the incoming currents, so that beats are produced in the circuit L2 C1. These beats are rectified by the crystal detector D1, and the beat frequency, which is adjusted to correspond to 50,000, sets up oscillations in the circuit L4 C2, corresponding to a wave-length of 6,000 metres. These 6,000 metre signals are now amplified by the valve V, which is usually called the intermediate frequency amplifier, and the amplified long wave



Schoolboys are now officially encouraged to make their own receivers. The boys at Harrow.

signals in $L_5$ $C_3$ are rectified by the crystal detector D2, and operate the telephones T. It is possible, of course, to add one or more stages of low-frequency amplification at the end of this system.

### An Improved Result

The effect in this circuit of the oscillator is to improve the rectifying action of the detector, and also to produce long wave signals which may be readily amplified. In most cases there are three stages of long wave or intermediate frequency amplification, and there are also often one or more stages of high-frequency amplification at the very beginning of the system. Two stages of L.F. amplification are also often used at the end of the system.

Fig. 4 shows the different elements in one type of supersonic heterodyne receiver. In this case the oscillator is shown in a separate box on the left while the receiving circuit and the detector are shown in the box R D1. The output of the detector is now fed into the intermediate frequency amplifier I.F.A., and the output from this is applied to a detector D2 in another box. The output of the detector D2 now goes to the low-frequency amplifier L.F.A., the output of which is taken to the loud-speaker L.S.

In Fig. 5 I have shown different units, the first being a tuner T, the second an ordinary high-frequency amplifier H.F.A., the third a detector D1, which will usually be a valve, an oscillator OSC, placed in proximity to the detector valve so as to induce oscillations into its grid circuit, an intermediate frequency amplifier I.F.A., a second detector valve D2, and a low-frequency amplifier L.F.A.

The master explains a technical point.

In case some readers do not understand what is meant by heterodyne, let me say at once that it is a name given to methods of receiving in which currents of different frequencies are combined so as to produce beats. The word has been in use for many years in connection with the method of receiving continuous waves, which ordinarily, without the production of beats, would not influence an ordinary detector.

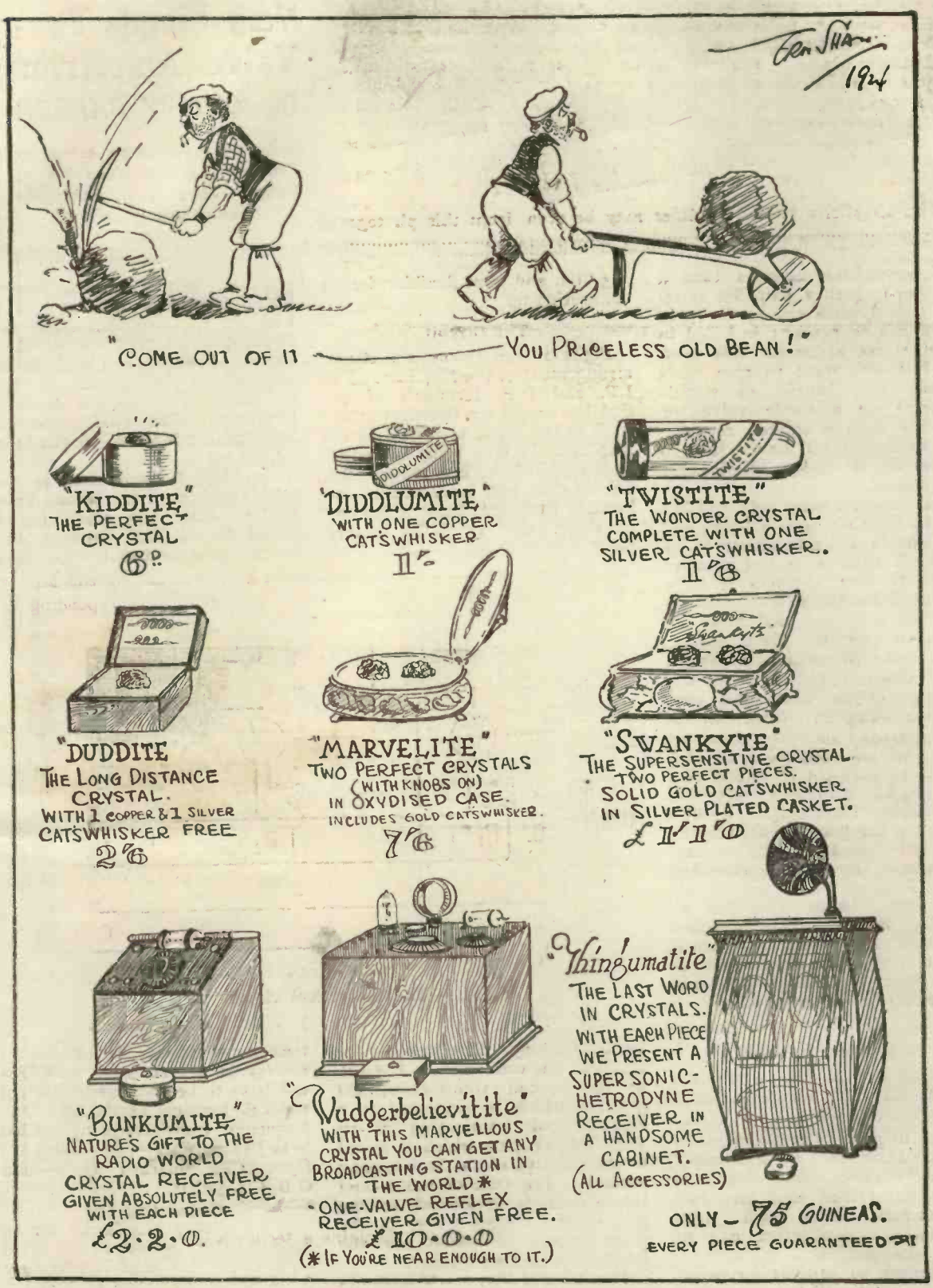
### Further Help

There are obviously very many points which cannot be dealt with in a simple article of this kind, and those who desire more should consult the issues of *Wireless Weekly* in which the articles are appearing.

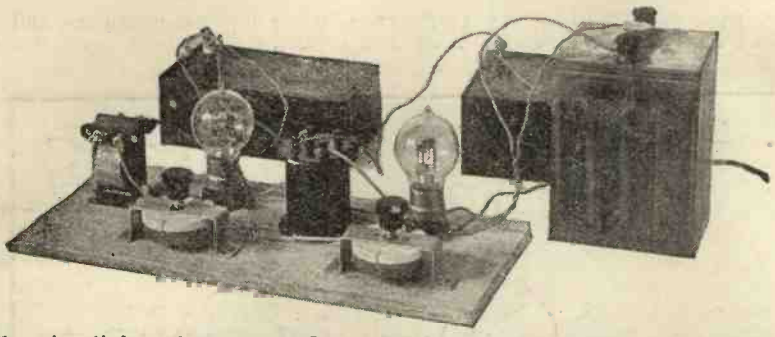
The supersonic-heterodyne receiver is undoubtedly due to come into its own in this country, and I hope to do a good deal myself towards popularising what is undoubtedly the most fascinating of all broadcast receivers.

Perhaps the shortest way of explaining the supersonic-heterodyne is to say that by means of locally produced oscillations it is possible, by combining them with incoming oscillations to produce beats which are adjusted, approximately, to a frequency of the order of 50,000, these beats being then rectified and producing currents of 50,000 frequency corresponding to 6,000 metres, which are then amplified by an ordinary high-frequency amplifier and detected by a final detector valve.

# CLEAR AS CRYSTAL!




Our cartoonist has a dream after his Christmas shopping.



The simplicity of the amplifier may be seen from this photograph.

# How to Make a Very Simple Two-Valve Amplifier

*By JOHN W. BARBER*

*Often the experimenter wishes to "run-up" an amplifier in a hurry. Here is a thoroughly efficient way of doing it*

IT sometimes happens that a low-frequency amplifier is required when one made up in a cabinet or perhaps included in a set is not at hand. One may, for instance, want to give one's friends the benefit of signals received on a single valve, or possibly even a crystal, receiver, and there may not be the time to make up a really nice-looking instrument.

An amplifier can very quickly be put together upon a board and will enable a loud-speaker to be operated from a crystal receiver upon the local station. It must be realised that a low-frequency amplifier will not materially increase the range of a given receiver, as it is only the signals which are there that are magnified to any degree. Signals from the local station, however, which are of good strength on the crystal set alone, will be magnified to such an extent that the operation of a loud-speaker is quite a practicable suggestion. The amplifier, as illustrated in the photograph, may be used either as a one or two-stage instrument, as will be described later.

Be sure, before you add an amplifier to your crystal set, that the set itself is giving every satisfaction and that signals are as loud upon the set as they can reasonably be expected to be.

### Components Necessary

The parts that will be required to construct this simple amplifier are as follows:—

2 low-frequency transformers In this case I have used a "Max-amp" and a "Super-Success," but it is to be understood that any two transformers which will work reasonably well together can be used.

2 filament resistances for board mounting (Metro-Vick).

2 valve sockets (Bretwood).

5 Clix, and some flexible wire for connecting up.

### The Circuit

Fig 1 is the theoretical circuit arrangement of the amplifier. The I.P. and O.P. terminals of the first low-frequency transformer are used as the input terminals to the amplifier, the O.S. being connected to the grid of the first valve. The I.S. of the two transformers are brought to flexible leads which end in either Clix or H.T. battery plugs for connecting to a grid-biasing battery. The plate of the first valve is connected to the I.P. of the second transformer, the O.P. of which is connected to a flexible lead terminating in an H.T. battery plug which is joined to the positive of the high-tension battery. The O.S. of the second transformer is connected to the grid of the second valve, in the plate circuit of which are the telephones, or loud-speaker.

Now look at Fig. 2. This shows the parts mounted upon the board with the wires connected in position. It will be quite easy to follow from this drawing how to wire up the amplifier. The two filament resistances are wired as shown. Connection is made to the accumulator by means of two flexible leads which end in spade terminals. The cord from the loud-speaker is joined in circuit as follows:—

One tag is connected to the plate terminal of the second valve holder, while the other tag is joined to an H.T. battery plug which is connected to the high-tension battery. If an extra battery is not at hand, grid bias will have to be dispensed with and the I.S. terminal of the two low-frequency transformers will have to be joined to L.T.— by joining the three Clix marked G.B.— and G.B.+ together.

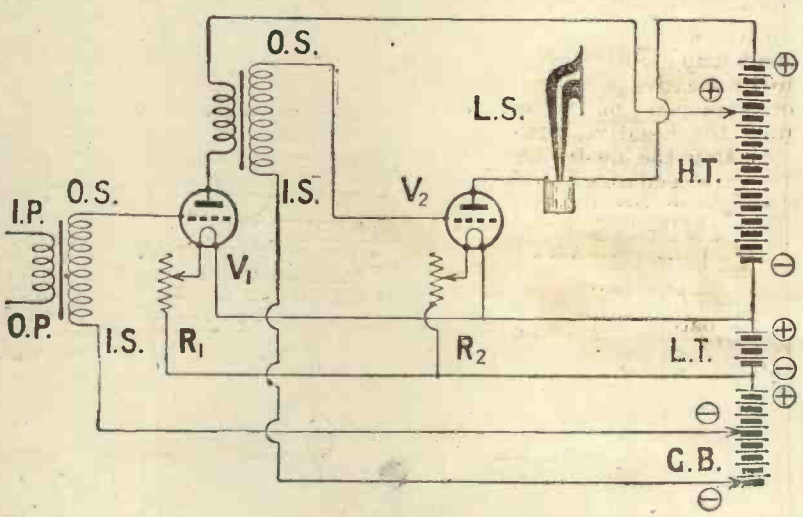
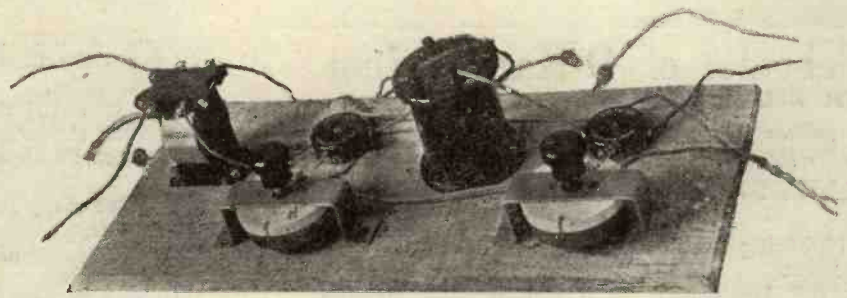



Fig. 1.—The theoretical circuit diagram.

### Connecting Up

It is a very simple matter to connect this amplifier up to a crystal set. All that is necessary is to take a wire from each of the telephone terminals of the crystal set and join them to I.P. and O.P.

of the first low-frequency transformer, respectively. A wire may be taken from the negative L.T. terminal to earth. The lead from the loud-speaker which ends in an H.T. battery plug is put into the positive socket of the high-tension battery. The lead from the O.P. of the first low-frequency transformer, which also ends in a similar plug, is put into a socket of the H.T. battery corresponding to a slightly lower voltage. The two leads from the filament resistances are joined to the accumulator, and the negative terminal of the high-tension battery is joined by a piece of wire to the positive terminal of the accumulator. For grid biasing a suitable battery may be made of two flash-lamp cells joined in series, that is, with the long strip of one joined to the short strip of the next. The remaining short strip (positive) is then joined to the negative of the accumulator, or to any point on the wire coming from the negative, while the two leads from the low-frequency transformer secondaries may be joined, the first to the junction between the two batteries and the second to the remaining long strip.



A near view of the amplifier showing how the parts are mounted on the board.

### How to Work the Set

If a battery with tappings, that is, of similar type to a high-tension battery, is available, its positive terminal should be connected to the negative of the accumulator. The two flexible leads from the I.S. of the transformers are joined to points on the battery corresponding, roughly, to 3 and 6 volts respectively.

With the set joined up as indicated, turn the filament resistances from the off position slowly and note that the valves light up. As the filament resistances are turned, signals should come through, weakly at first and gradually increasing in volume, provided that the set is tuned to the wavelength of the local station and that the latter is working. Do not turn the filament resistances any further than is necessary to get good loud signals, as no advantage is gained by burning the valves too brightly, and their life may thereby be shortened. The value of the high-tension battery voltage will depend upon the type of valve used, and the value of grid bias will, in turn, depend upon the high-tension voltage. As a general rule, however, about 80 volts may be applied to the first valve, via the O.P. of the first transformer, and about 100 may be used upon the second plate, and in this case about 3 volts will be required upon the grid of the first valve, while 6 or 8 may be necessary upon the grid of the second valve.

### Connecting to a Valve Receiver

If it is desired to connect the amplifier to a valve receiver, all that is necessary is to connect the telephone terminals of the valve receiver to the I.P. and O.P. of the first transformer in the amplifier. This may be done in the following manner:—

Ascertain from the valve set which telephone terminal goes to the anode of the valve and which goes to H.T.+. Then connect the amplifier so that the I.P. of the transformer is connected to the telephone terminal which is connected to the plate of the valve in the valve receiver, whilst the O.P. goes to that terminal which is connected to the positive of the high-tension battery. The battery connections of the valve receiver will remain as previously. Upon tuning the valve set, signals will be heard in the loud-speaker at considerably increased strength.

### Use as a Single Stage Amplifier

To use the amplifier as a single stage only, all that is necessary is

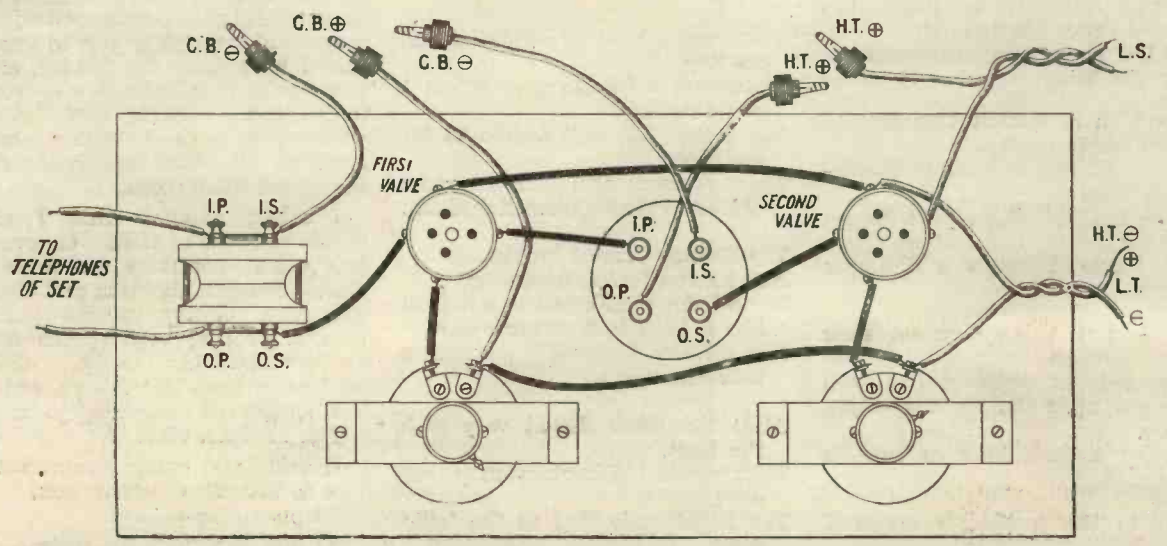



Fig. 2.—This drawing shows the relative position of the components, and how they are joined up.

to take the leads which go to the I.P. and O.P. of the first transformer and to join them to the corresponding terminals of the second. The wires going to the second transformer primary winding are temporarily disconnected. The second valve only is in use now, and consequently the only positive tapping on the H.T. battery will be that which is joined to the loud-speaker.

It will be noticed that no fixed condensers are included in this amplifier, the reason being that in all probability there will be such a condenser across the telephone terminals of the set to which the amplifier is to be connected. If no condenser is provided in this position, however, a ·001 or ·002 $\mu$F condenser should be joined across the primary terminals (I.P. and O.P.) of the first low-frequency transformer.

A condenser may sometimes improve reception if connected across the loud-speaker terminals, and one having a capacity of around ·002 $\mu$F may be tried. The best value of condenser in this position will vary with the make of loud-speaker and the best results will only be obtained after trial. Crackling noises due to a partially run-down high-tension battery may be reduced by shunting the battery with a 2 $\mu$F fixed condenser, that is, the condenser is joined across the positive and negative terminals of the high-tension battery.

The amplifier as described is, however, exceedingly simple and may be put together by even a novice in a few minutes. The results will well repay the very short time in constructing it.

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## "The R'ebonite of O-Mar Conium"

(WITH ALL APOLOGIES TO THE POET)

*It was not written "In a Persian Garden," owing to the Weather Report "Further Outlook Unsettled"*

AWAKE, for Lightning in the Dead of Night
Has struck the Aerial and put the Valves to Flight.
And Lo! the Crystal of the East has caught
The Wife's dread ire in a Fall of Light.

Dreaming when yet Dawn's glow was in the sky,
I heard a Voice within the Bedroom say,
"Awake, my Love, and get fresh Valves to-day,
Lest John Henry's 'barrow' comes awry."

Come, switch all on, and in the Filament's dull glow
The Winter programmes o'er the Aether bring.
Through intervals the B.B.C. has but a little time to stay,
And Lo! the programmes soon are on the Wing.

Here with a wireless Set beneath the bough,
A Valve or two, a Book of hints—and Thou
Beside me, list'ning to the Microphone,
And Home becomes a Paradise enow.

The dearest Valve men set their Hearts upon
Burns out—or oscillates and anon
Like gas upon the Meter's empty face,
Lighting a little hour or two—is gone.

Then to the oscillating aether I cried,
Asking what Valve had power to long abide
Beside her listeners, stumbling in the dark,
And "loud atmospherics" the Aether replied.

One Moment with the Announcer's Waste of Time,
"Two Minutes, please," in the Well of Time to bear.
The stars are setting and the Closing Down,
Commences Atmospherics. O! make haste.

Ah! my Beloved, fill the Battr'y that clears
To-day of past mistakes and Future fears,
To-morrow, why to-morrow, I may be myself with yesterday's
Seven Thousand Valves—gone west.

There was a Door to which I found no Key,
There was a Studio past which I could not see.
Too many "talks" awhile to Me and Thee
There seemed, and then no more of Me and Thee. (We switched off).

The Moving Crystal breaks,
And having broke, moves on,
Nor all the nimbleness or wit shall lure it back to that same spot,
Nor all thy "words" produce a note through it.

Alas! that Time should vary with the Beat,
That musical Directors may not meet,
The Nightingale that to the 'cello sang,
Ah! whither, whither Flown, who knows—or Cares.

Ah! Love, couldst Thou and I with B.B.C.'s conspire
To grasp the Listeners' Scheme of Pros. entire,
Would we not shatter them to bits,
And then re-frame them nearer to the Heart's Desire.

Ah! Valve of my Delight that knows no wane,
The microphone of 2LO is working once again.
How oft Hereafter working shall it wait
In this same Valve Set after me—in vain.

L. B.

---

## A "Wireless Constructor" Set in Belfast

SIR,—Re the "Simply made Single Valve Receiver," described by you in the December number of THE WIRELESS CONSTRUCTOR, it may be of interest to you to know that I have made up this set, and the results obtainable are exceedingly good. There is sufficient volume to work a loud-speaker, enabling all items to be clearly heard in a small room.

I might mention that I am within one mile of 2BE. On evenings when conditions are favourable, I can get Aberdeen and Glasgow very clearly on the headphones, hearing both speech and music remarkably clearly. Coils used are a Burndept No. 75, and a home-made coil containing 50 turns of No. 22 d.c.c. wire.

Wishing you every success with THE WIRELESS CONSTRUCTOR,

I remain,
Yours truly,
R. FARTHING.

Belfast.

# Mr. Gumplethorpe Makes a Start

*By "BROADCATCHER"*

*Mr. Gumplethorpe didn't like wireless, in fact he blamed it for all the nasty things that happen in the world, but his son Horace converted him. Read how it was done!*

WHEN I tell you that but a few short weeks ago Mr. Edward Gumplethorpe did not know an ampere from a wave trap, you will realise at once that he was nothing of a wireless enthusiast. In point of actual fact he was quite the reverse. He looked upon wireless with a kind of superstitious awe, regarding it as an invention of the evil one responsible for almost everything unpleasant that occurred. If the weather were too hot Mr. Gumplethorpe promptly explained to all his friends and neighbours that nothing else could be expected with all these waves whizzing about. Similarly, if rain fell to excess, if snow arrived out of due season, or if untimely hail ruined his gooseberries,, Mr. Gumplethorpe was quite convinced

Eyes streaming with tears, and cheeks bulging with toffee. . .

that wireless was entirely responsible. He went further than this. According to him men's minds became warped and distorted owing to their continual immersion in ether waves, with the result that strikes, wars, rumours of wars, political disturbances, and horrible crimes were of constant occurrence.

### The Terrible Influence of Wireless!

I am quite sure that in his heart of hearts he was convinced that the twopence-farthing added at the end of the last half-year to the rates of his native town was entirely due to the terrible influence upon everything of wireless in general and broadcasting in particular. He would tell you tales of how he had seen little birds fold up their wings and fall dead as wireless waves caught them in the neck; he would prove to his own satisfaction, if not to yours, that listening-in caused deafness, spinal curvature, gout and flat foot; he would show that the outbreak of the recent smallpox epidemic was coincident with the increase in broadcasting Anyway, Mr. Gumplethorpe was about the most prejudiced, case-hardened and bigoted anti-radioist that you could find if you were to spend a month of Sundays in your search.

### A Loud Voice

He had instilled his own high principles into his family with great success, for since he possessed a loud voice and a masterful manner, none of them dared say a word to oppose him. This was as you will see, a very sad case. All around Acacia Villa, the very pleasant little abode of the Gumplethorpe family, grew a forest of aerials. Every garden save theirs, every house but Acacia Villa, displayed proudly these modern aids to the natural beauty of the landscape. Alone amongst all of them the garden of Acacia Villa was given up entirely to cabbages and flowers, whilst his chimney pots serve no more useful purposes than to provide a way out for the smoke, and in summer a convenient nesting-place for the starlings. Perfect peace would, I think, have reigned at Acacia Villa — Edward Gumplethorpe would have seen to that—and the house might have remained for ever destitute of an aerial if it had not been that the son and heir of the family, young Horace, was packed off in September last, his eyes streaming with tears and his cheeks bulging with toffee drops, to a preparatory school.

### A Strange Tongue

The establishment which he adorns has the pleasant custom of releasing its young gentlemen for a few days' holiday at half term, and thus it happened that young Horace came home, this time with dry eyes, though his cheeks were still bulging. Hardly had he entered the house when he began to speak in what appeared to his father to be a strange tongue, babbling excitedly of 2LO, and oscillations, and kilowatts, and inductances, and detectors, and all sorts of things of that kind. Mr. Gumplethorpe patted the lad on the head and complimented him upon the good progress that he was making with his Greek. And then the bolt fell, the bomb burst, the broadside was delivered into the shivering timbers of our hero. The lad explained to his horror-stricken sire that he was not talking Greek or any such rot as that, but that he was speaking of wireless. "Wireless," shouted Mr.

"Wireless," shouted Mr. Gumplethorpe.

Gumplethorpe, "wireless. I won't have the subject mentioned in my house. Go to your room at once, sir, and never let me hear you talk in that way again." Horace went to his room a little crestfallen and was joined very shortly afterwards by his younger brother, Benjamin.

### A Partner in Crime

As a punishment Mr. Gumplethorpe had decided that Horace should have no tea. Ben, however, whose lips had not been sullied by talking about the forbidden subject, was not included in the programme. When he failed to appear for his usual hearty meal his fond parent saw at once that something terrible must have happened. In the ordinary course

of events it would be easier to keep a duck from water than young Ben from anything that looked like a tea-table. Mr. Gumplethorpe went upstairs to investigate. Ben was not in his room. He went to Horace s room and turned the handle. The door did not open, being locked on the inside. With loud raps and still louder shouts Mr. Gumplethorpe demanded instant admission.

### More Trouble

There was a kind of scuffling noise inside the room. Drawers were opened and shut, cupboard doors banged, whilst excited whispers were distinctly audible. At the end of about a minute the door was opened by a very red-faced Ben, who asked instantly if his father wanted to come in. Mr. Gumplethorpe strode into the room. There was a rather guilty look upon the faces of both the youngsters, but what attracted his attention still more was a

" . . . And what is that, sir?"

length of wire protruding from Horace's coat-pocket. "And what is that, sir?" he asked. "Oh, just a bit of wire, dad." A rapid examination of other pockets disclosed the presence of lots more bits of wire, and yards and yards of it were extracted from those of young Ben. When I say that Mr. Gumplethorpe opened his mouth and let himself go you will understand his small sons had a pretty rotten time of it. At the end of a lengthy lecture, in which he pointed out emphatically that a continuance of their present conduct would infallibly bring them to the gutter, he sentenced both to further detention and departed, locking the door this time upon the outside.

### Fixing Up the Set

No sooner had the sound of his footsteps died away than Ben, wiping the tears from his eyes, said softly, "We are all right now; he won't be back for hours and hours." Then from drawers and cupboards came telephones, condensers, inductances, a detector, and yards and yards more wire. After a number of abortive attempts they got the outfit rigged up and, with the help of a wire slung across the room as an aerial and with an earth made in the most bare-faced way to a gas-pipe, they managed to pick up 2LO, only about five miles distant.

### Recognisable Sounds

I am not going to say that their reception was perfect or that signal strength was all that it might have been. Still, they did manage to hear the words every now and then, and music was distinctly recognisable as a tuneful noise. After a long period of listening-in their heads began to nod, they could hardly keep their eyes open, and before long both were sound asleep upon the bed. It was very shortly after this that Mr. Gumplethorpe thought that the time had come to visit the culprits once more to see if they were in a better frame of mind.

### He Listens!

Opening the door quite softly he stepped in and smiled as he saw the two sleeping figures. Then his eyes travelled round the room, and on the table by the window he saw the unholy contraption that they had rigged up. He knew, as I have said, nothing whatever about wireless, but he did know a telephone when he saw one, and there on the table was unmistakably a pair of receivers. Making quite sure that both boys were asleep, he moved softly across and picked up the 'phones. He fitted them rather clumsily over his head just, as he told himself, to see how evil the thing was in order that he might be able to rub it in better when he spoke to the boys the next morning.

About an hour later Ben nudged Horace very softly in the ribs, whispering in his ear, "Don't make a sound, you silly ass." There at the table, in full view of both his sons, sat Edward Gumplethorpe with the 'phones upon his head and a seraphic smile upon his face. He was leaning back in his chair, whilst his right foot beat time softly to the strains of the Savoy Havana Band. The boys were to all appearances sound asleep, though a careful observer might have noticed that each of them opened an eye from time to time and gently nudged the other.

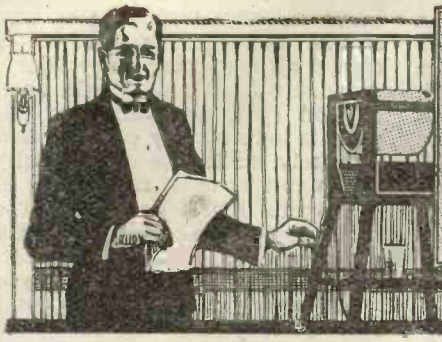
### The Complete Conversion

This is the true story of how Edward Gumplethorpe received his first introduction to wireless. The whole tale was told to me amidst chuckles of joy by Horace and Benjamin as they sat in my wireless den. They have hopes that before very long the reproach of being the only un-aerialled house in the district will be removed from Acacia Villa, and they have urged me to go round and see their father. They feel quite sure that if I lead gently up to the

Beating time to the Savoy Havana Band.

topic of wireless I shall find that he has been pretty badly bitten. I think so, too, and later on I hope to be able to report that Edward Gumplethorpe has joined the ranks of the great band. If he is not arguing about the respective merits of reflex and straight circuits by that time, I am quite willing to eat my hat, and you, reader, may come and see me do it.

*(More about Mr. Gumplethorpe shortly.)*



# Getting the Most from Your Crystal Set

*By G. P. KENDALL, B.Sc., Staff Editor*

*An article which should be read by every new-comer to the art*

THERE would seem to be a very general impression that a crystal set is just a crystal set, capable of giving results of a certain standard and no more, and able to give those results regardless of the way it is treated and of the efficiency or otherwise of its details. Actually, however, crystal sets respond remarkably to different treatment, and it must not be forgotten that there are many experimenters who are able under favourable conditions to receive quite a number of the B.B.C. stations without the use of valves or any other amplifying device. Such results, of course, are only possible where a really efficient receiver is used, and where due attention is paid to all those small details which in the aggregate make so great a difference to the performance of the set, however simple it may be. I propose in this contribution to give some notes upon these details, and show how real efficiency can be obtained with a very small expenditure of trouble, provided that the set itself is reasonably well designed.

### The Crystal

Good results are obviously impossible with a poor specimen of crystal, and it is well to confine oneself to one of the well-known varieties, and even then to obtain several pieces and carefully try them to make certain that one has a sufficiently good specimen to make it worth while to devote one's attention to the other details of the receiver. We may not all think it worth while to attempt to receive distant broadcasting stations with only a crystal set, but it is well worth while to seek efficiency even where only the loudest and clearest possible signals are desired from the local station.

Many crystal users unfortunately never prosper in their search for a really good specimen, for the simple reason that they have never learned how delicate a thing a piece of crystal really is, and do not treat it with sufficient care to give it a chance to show its real quality. In the first place, it must be realised that dust and grease are fatal to good results, and the greatest of care must be taken to preserve the crystal surface from them. Dust is fairly easily excluded by keeping crystals carefully shut up in boxes until required, and using a glass or paper cover on the detector itself. Many excellent types of crystal detector are now available, of course, upon which a glass cover is provided as a standard. Grease, however, presents a more difficult problem, for the simple reason that one's fingers, however clean they may appear to be, nevertheless carry a microscopic film of moisture and grease at almost all times, and a crystal which has once been handled is almost certain to have suffered. It should therefore be made a rule always to handle crystals by means of a pair of tweezers, and never to touch them with the fingers. This may seem a tiresome procedure to those who are accustomed to carry their spare crystals in their trousers pocket, but only in this way can one make sure of preserving the crystal from contaminating influences.


A tiny crystal set, one of the signs of Continental interest in Radio.

### Exposure to Air

Mere exposure to the air is also capable of injuring certain types of crystal, and it is therefore customary to supply the better types enclosed in an airtight box, usually with cotton wool packing. This furnishes another argument in favour of the totally enclosed crystal detector, and it should be borne in mind as an explanation of the weakening of signal strength which may take place when a crystal has been in use for some months. When this happens it is often possible to rejuvenate the crystal by breaking it open to expose a fresh surface, provided that the specimen is large enough for such treatment. Various remedies have been proposed from time to time for this failing, such as careful heating, washing in various chemicals, and so forth; but when it is remembered that a specimen of crystal may only cost from a few pence to perhaps 1s. 6d. it hardly seems worth while to take so much trouble.

### Mounting the Crystal

It is undoubtedly in the fixing of the crystal in the cup that many experimenters go wrong; but the blame should perhaps attach rather to the manufacturers of the commoner types of crystal detector. To provide the crystal cup with three screws for gripping the crystal is a direct incitement to the user to employ that very unsatisfactory method of mounting. To mount the crystal in this way is to sacrifice a certain degree of efficiency with considerable certainty, although the difference may not be noticed where signals are normally strong. Such refinements as we are now dealing with are of most importance, of course, at such a distance from the broadcasting station that signals are not very strong. The best method from the point of view of efficiency for crystal mounting remains that which employs the metallic alloy known as Wood's metal, although many experimenters are loath to employ this method on account of what they consider its troublesome nature. Nevertheless, so long as a good class of Wood's metal is employed it is really a quite easy matter, all that is

necessary being to place a small piece of the metal in the crystal socket, to heat this very gently over a small gas flame until the alloy just melts, to remove any scum from the surface of the melted metal by means of a match stick, and then to drop the crystal into the cup and allow the whole to cool.

### Wood's Metal

The important property of Wood's metal is its low melting point, so that the crystal can be immersed in the molten metal without injury from heat, and it must on no account be thought that ordinary solder can be employed as a substitute. It is further necessary to specify that a good quality of Wood's metal be employed, since there is quite a considerable amount of this material upon the market which has an unduly high melting point, which involves a certain risk of injury to the more delicate types of crystal. On no account should the cup be overheated during the mounting process.

If the experimenter retains a strong objection to the Wood's metal method, a compromise can be achieved by first gripping the crystal securely between the screws of the cup, and then packing all round it very tightly with tinfoil. I do not advise this method, since it seems to me that the Wood's metal method should be adopted as a standard, but good results can certainly be obtained by the use of tinfoil.

### The Catwhisker

Although almost any metal point pressing upon a crystal will produce results of a sort, it is useless to expect the best unless a really good and suitable catwhisker is employed. In the first place, it will be found that if a suitable metal is employed much better and more permanent results are obtainable, and gold, silver or one of the special alloys sold under various fancy names is preferable. Metals such as copper and brass will give quite good results so long as they are perfectly clean and free from tarnish, but they are really more trouble than they are worth, since one must be perpetually brightening the point by means of glass-paper or cutting off a short length to expose a fresh surface. The other metals mentioned are more or less non-tarnishing, and therefore need no attention. The main secondary requirement in a catwhisker is that it should be light and springy, and hence it follows that only a very slender wire should be employed. Some of the catwhiskers that one sees novices attempting to adjust are far too thick and stiff, and always remind me of a watchmaker attempting to operate upon a watch with a poker. Remember always that the majority of the modern types of galena crystal, that is to say all of that class which are given fancy names mostly ending with "ite," require an exceedingly light pressure, and it is practically impossible to obtain such a pressure if the catwhisker is at all stiff.

### Adjusting the Detector

"To adjust a crystal detector," say the text-books, "lower the point of the catwhisker gently upon the surface of the crystal, trying different points until a sensitive one is found." What could be simpler? As a matter of fact, it is just here that skill and practice are called for in operating that otherwise simple thing, a crystal set. It is *not* a simple matter to lower the point of the catwhisker lightly upon the crystal, trying different points, until the desired sensitive one is found, since there are a variety of ways of doing this, and the right one requires a certain amount of delicacy of touch, and also a knowledge of the correct method.

### Don't Scratch!

One must, above all things, avoid scratching the point of the cat whisker across the surface of the crystal, since in this way the sensitive points are destroyed. The object should be to lower the point straight down upon the surface, and if this point does not prove to be sensitive, lift it again, move it transversely, and again lower it. One may in this way sample the whole surface of a crystal without doing it any injury, and one will ultimately light upon a good spot, provided that the point is lowered very carefully and delicately, so that when it finally comes to rest upon the surface of the crystal it will do so with the lightest possible pressure. With a really good crystal, no doubt, this searching process is almost unnecessary, because the crystal may quite possibly be uniformly sensitive all over, so that all that is required is a little practice and care in the operation of lowering the catwhisker point in such a manner that it shall only rest very lightly upon the surface. The ease or otherwise of this operation depends very largely upon the type of the crystal detector, and there are a number of excellent varieties now upon the market in which it is made as easy as possible by the provision of some form of screw adjustment or other slow motion for advancing either the catwhisker point or the crystal cup itself, so that the degree of pressure when contact is made can be adjusted to a nicety. The use of such types of detector is strongly to be advised, since they eliminate a good deal of the need for skill. All that is needed in their case is the knowledge that a light pressure alone is required.

Let me again emphasise the fact that it is the *rubbing* of the catwhisker point across the surface of the crystal which must be

(*Continued on p.* 317.)

Bedtime stories.

(*Continued from p.* 314.)

avoided above all things when adjusting the detector. Take pains never to earn the title of "crystal scratcher," sometimes opprobriously applied to users of crystal sets.

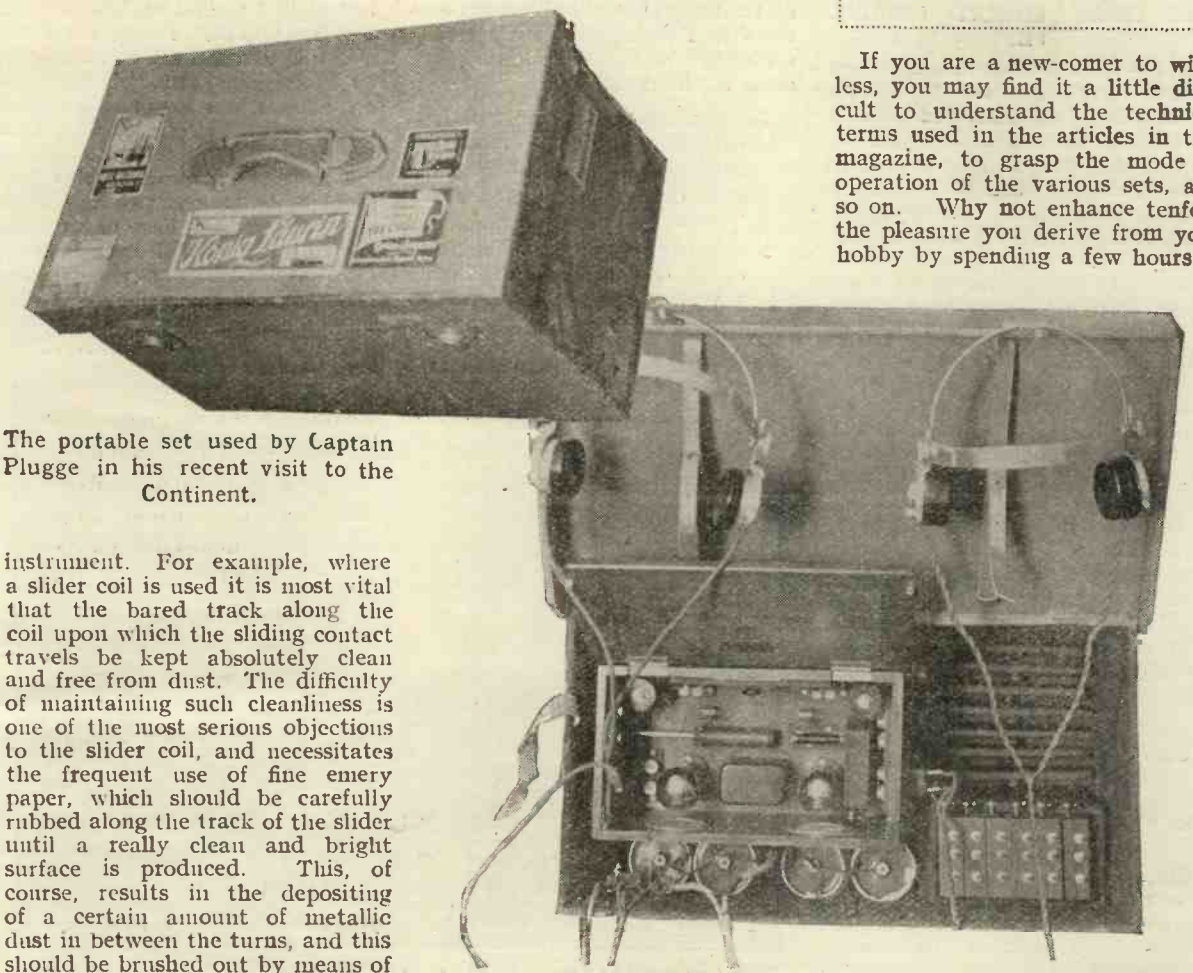
### General Maintenance

There are a number of other little points about the receiver which must be given their due share of attention to obtain the best results, and one of the most important of these is the keeping clean of the various rubbing contacts which may be included in the instrument. For example, where a slider coil is used it is most vital that the bared track along the coil upon which the sliding contact travels be kept absolutely clean and free from dust. The difficulty of maintaining such cleanliness is one of the most serious objections to the slider coil, and necessitates the frequent use of fine emery paper, which should be carefully rubbed along the track of the slider until a really clean and bright surface is produced. This, of course, results in the depositing of a certain amount of metallic dust in between the turns, and this should be brushed out by means of a stiff brush, a toothbrush being suggested.

### The Slider

The contact point of the slider should be treated in a similar manner, and when both have been reduced to a thoroughly clean and bright condition, a trace of vaseline should be rubbed over both surfaces, which serves to preserve the parts from further corrosion, and imparts a smooth movement to the slider. It might be thought that the use of an insulating material in this way would impair the electrical contact, but this is actually not the case, and this expedient is one which is commonly adopted in electrical laboratories. The film of grease appears to protect the metallic surface from corrosion, but the contact point is able to pierce through it to the metal beneath, and a perfect electrical contact is still possible.

Similar treatment should be given to the slider bar, and the path of the slider which bears upon it, and also to all other points of sliding contact in the set, such as switch studs and switch arms. All terminals under which wires are secured should also be cleaned whenever they appear to be at all dull and tarnished upon the surfaces at which contact should take place, and wherever else contact is made between two metallic surfaces which are merely pressed together. The only other point of importance in the maintenance of the set would appear to be the matter of preserving the instrument from dust and damp. A combination of these two is capable of causing very serious leaks upon ebonite panels, in coils, variable condensers, and so forth, and if there is any reason to suspect that the situation of the set is a damp one, the instrument should be periodically gently dried in front of the fire. It should be protected from dust by means of a cover if possible, and the panel should be dusted over occasionally with a soft brush, such as a shaving brush.

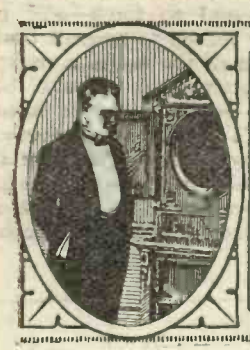


The portable set used by Captain Plugge in his recent visit to the Continent.

The trip was fully described in our last month's issue.

## *Are You a Beginner?*

If you are a new-comer to wireless, you may find it a little difficult to understand the technical terms used in the articles in this magazine, to grasp the mode of operation of the various sets, and so on. Why not enhance tenfold the pleasure you derive from your hobby by spending a few hours in obtaining a working knowledge of its elementary principles? Two most interestingly-written little books ("Wireless for All" and "Simplified Wireless") have been specially prepared by Radio Press, Ltd., to facilitate your progress. They are written by John Scott-Taggart, F.Inst.P., A.M.I.E.E., and they should be read in the order given. Their respective prices are 9d. and 1s., and they can be obtained from any bookseller.



# Our Readers' Views

*Some Interesting Correspondence*

### THE SEVEN CIRCUIT CRYSTAL SET

SIR,—I am pleased to inform you that I have made the "7-Circuit Crystal Set" as described in THE WIRELESS CONSTRUCTOR, Vol. I., No. 2. I get good results on two pairs of Brandes' headphones, being able to distinguish clearly every word spoken from Manchester Station, or relayed from London, via Liverpool. Orchestral music from either station is quite loud. This is not bad considering I am 22 miles from Manchester and 32 miles from Liverpool. I should like to say that this is my first venture in wireless; in fact, a week ago I shouldn't have known a valve from a crystal, until I bought your book. My aerial is of the double-wire type, 30 ft. between insulators and 30 ft. high. The cost of making set was 17s. (exclusive of headphones and aerial).

I think your book THE WIRELESS CONSTRUCTOR is *the* thing for a beginner.

Yours faithfully,
WM. J. CLARKSON.
Chorley, Lancashire.

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### THE "WIRELESS CONSTRUCTOR" NEUTRODYNE SET

SIR,—I have made the Neutrodyne receiver as described in your journal, and I thought you might be interested to know the results obtained.

I did not follow strictly the panel lay-out, as I had a 20 × 10 panel which had been used for the "All Concert," and I used this. However, I carefully spaced my components always with a view to keeping the high-frequency part of the circuit as short as possible. I could not get a Neutrodyne condenser in Hull, so made one from an old vernier condenser. I used one fixed vane and one moving (cutting the moving vane away slightly). All my components are of absolutely the very best. All variable condensers have verniers, and nothing cheap has been put into the set. I took great care with the soldering, and the following are some of the results:—

Local relay station, no aerial or earth, 3 valves: Moderate loud speaker.

Ditto, ditto, 2 valves: Loud 'phone.

Manchester, Bournemouth, Newcastle, 60 ft. aerial (40 ft. high), 3 valves: Good loud speaker.

Ditto, ditto, 2 valves: Loud 'phone.

This apparatus was used at a demonstration of "Seeing by Wireless," given recently.

Glasgow, Aberdeen, London, Birmingham, 3 valves: Always very loud 'phone and sometimes moderate loud speaker.

German, Spanish and French stations, 2 valves: Good 'phone.

Ditto, 3 valves: Loud 'phone.

In addition to the above, I picked up the transmission from the s.s. "Leviathan" when she was testing. She was then 750 miles west of Cherbourg. I have had WBZ, Springfield, twice, and last night I picked up Schenectady, U.S.A. (WGY). Every word was readable, except when interrupted by Morse and atmospherics. At one time it was loud enough to be heard with the 'phones 6 in. from the head.

I have spent upwards of a year trying out different two and three-valve circuits, but have never found one to touch this. I am absolutely delighted with my results, and Mr. Percy Harris will have to put something very tempting forward to induce me to pull this circuit down and try another. I have a three-valve resistance capacity coupled amplifier, which I used preceded by a crystal detector for loud speaker on our local station. My next step will be to adapt it so that I can couple it up to my Neutrodyne and so obtain loud-speaker results from every station without any loss in purity.

Wishing you every success,
Yours faithfully,
E. BULTON,
Hull.

# The "Anglo-American Six"

## *A NEW RECEIVER WITH THREE STAGES OF HIGH-FREQUENCY AMPLIFICATION*

*By PERCY W. HARRIS, Editor*

*In this article further constructional details, practical operating hints and results obtained are given. Last month we dealt with the circuit diagram and the methods adopted in designing the instrument*

*(Continued from p. 213 of the January Issue.)*

I AM writing this article a very few days after the January issue of THE WIRELESS CONSTRUCTOR was first placed on sale, but in these few days I have received plenty of evidence that the "Anglo-American Six" has aroused considerable interest. During the past month I have spent a good deal of time in experimenting with this receiver, and have introduced one or two slight improvements which add to the ease of handling. Before discussing the results, however, we will continue the description of how to build the instrument.

The panel will probably be bought by most readers ready cut to size. The first step is to mark it out to suit the components you have purchased. A full sized blue print of the front of the panel (corresponding with the diagram published on page 211 of the January issue) is obtainable from the Sales Department of The Radio Press, Ltd., price 1s. 6d. post free. This will be of great help to you in laying out the parts to best advantage.

The valve windows will require 1 in. holes cut in the ebonite. These may seem a difficult proposition to many readers, and I would like to point out at once that cutting such holes is a very easy matter if only you have an ordinary inch carpenter's centre bit and a brace. First drill a hole of about ⅛ in. diameter in the centre of the disc which must be cut out. In this hole place the point of the bit and carefully turn the brace when the outer cutting edge of the bit will describe a circle. Cut halfway through the panel, then turn over and cut through from the other side. The centre piece will then drop out, and you will have made a fine, clean-cut hole, over which you can place your window.

Now mount your filament resistances, variable and neutrodyne condensers, together with the jack, variable grid leak and on-and-off switch. The three neutrodyne condensers, as you will notice, are placed symmetrically with regard to the other condensers. A good deal of my time during the last month has been spent in trying different makes of components in this receiver, not because the parts first used were unsatisfactory, but because some makers are very much behindhand in their deliveries, and I know that my readers will not desire to delay the construction of this set very long by having to wait for a certain part. I mentioned in the last issue that the Bowyer-Lowe and "Magnum" neutrodyne condensers work quite as well in this set as the Gambrell. I now find that the Polar "Micrometer" condenser and the Colvern neutrodyne condenser are both satisfactory here. Peto-Scott's also make a suitable condenser. Since last month I have added a slight refinement in placing three Colvern variable condensers in parallel with the neutrodyne condensers. It should be noted that these are ordinary Colvern pattern, and not the Colvern neutrodyne condensers. The object of these three parallel condensers is twofold. I find, for example, that in this particular method of neutrodyning a fair amount of capacity is needed. That given by the ordinary neutrodyne condensers, while sufficient, is not quite enough for convenient handling. I have, therefore, paralleled the three Colverns with the ordinary neutrodyne condensers, which allows me to have the fine adjustment of these latter with an additional advantage in adjustment, which I will explain later.

By lifting the lid the valves and plug-in units are readily accessible.

If you examine the circuit diagram in page 204 of the last issue you will see that no fixed condenser is shown across the primary windings of the inter-valve transformer, although there is one across the resistance in the second stage of audio frequency amplification. Do not think this is an error. In a set in which we use reaction from the detector plate circuit a shunting condenser is necessary. In this case we do not introduce reaction in the plate circuit of the detector valve, and the main object of this condenser immediately vanishes. I have, however, since introduced such a condenser across the jack in such a position that when the telephones are plugged in it is across the telephones. When the plug is withdrawn the condenser lies across the primary of the transformer. The condenser in this case adds slightly to the stability of the set, and is perhaps just as well included. The condenser across the resistance may or may not give improved results; the value is quite small (·0001 mfd.), and it is illustrated in place in my set. I suggest that the reader wires up without it, and tries out his receiver first of all. It can then be added to see whether any improvement arises. In my own receiver it seems helpful.

When all the parts have been mounted up on the ebonite panel, lay this aside and secure the various components to the baseboard. It will be noted that the terminal strip is held against the back of the baseboard by three wood screws. The terminals are 1 in. apart, and the dimensions of the strip can be seen from the illustrations in the previous issue and from the figures given in the list of components.

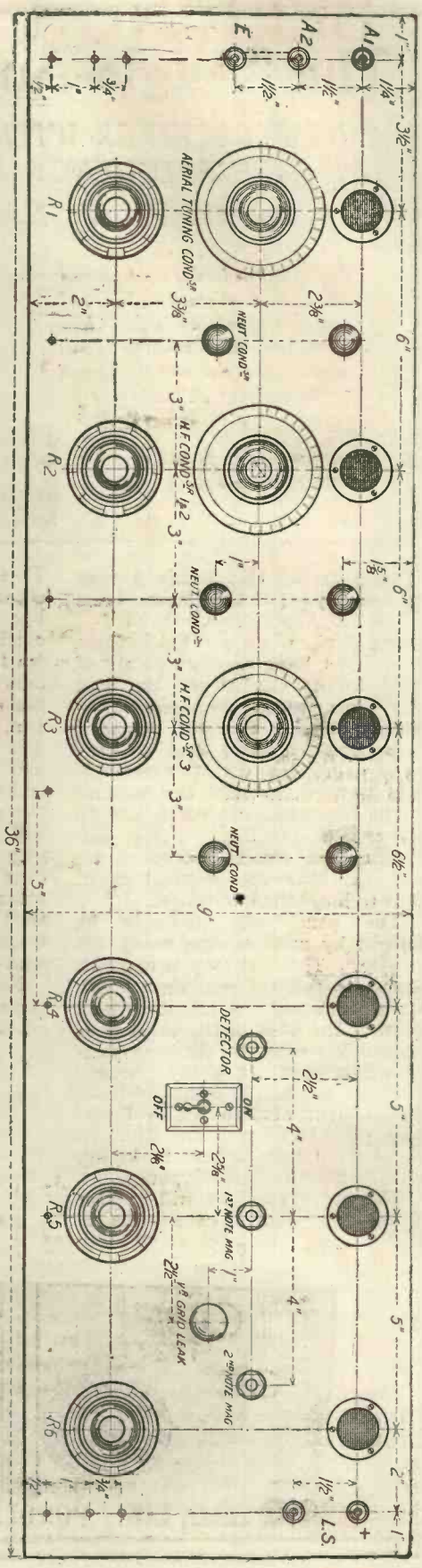
### Wiring-up

For a multi-valve set this instrument is quite simple to wire, and if you follow out the wiring diagram given in this issue (as usual, it is obtainable in blue print form, full size) you will not find the work at all difficult. If you use the Polar micrometer condenser as your neutrodyne condenser, you will not need to have any additional capacity in parallel, but if you use any of the other makes of neutrodyne condenser suggested, I recommend three Colverns in parallel with them. You must use your own judgment which of the two arrangements you adopt. The cost of a neutrodyne condenser of one of the well-known makes plus a Colvern is less than the cost of a Polar micrometer condenser. On the other hand, it is convenient to have both fine and coarse adjustment in one condenser. Either method is fully efficient.

Be very careful to wire up the valve sockets and the transformers sockets exactly as shown. This method will be correct for McMichael, Bowyer-Lowe, Magnum, and Peto-Scott plug-in transformers. I may mention in passing that I have already arranged with these four firms to wind special transformers to which I have given the name "neutrodyne unit." If used in, say, a Transatlantic set, as ordinary plug-in transformers, they will tune from 250 to 550 metres. In the present instrument they will cover the broadcast band adequately.

Another point to notice is that the grid leaks are not across the condensers, but are connected between one clip of the condenser and a separate clip which I have mounted on a small piece of ebonite. All the components I have used are self-insulating, with the exception of this particular clip, but if you use valve sockets which are not made for securing to a wooden base, you

(*Continued on page 325.*)



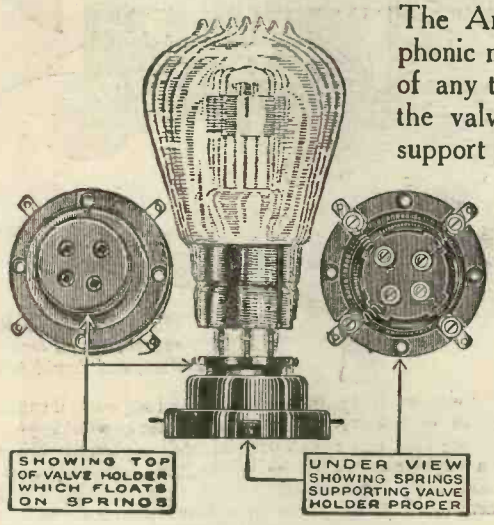

The front of panel diagram repeated from last month's issue, but with the additions of the positions of the vernier knobs above the neutrodyne condensers. Blue print No. C100 6A, price 1/6 post free.

# The Anti-Phonic Valve Holder

## *Reduced in Price—Now 5/-*

THE Anti-Phonic Valve Holder, a novel component on which Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., has commented favourably, has now been reduced in price to **5/-**. The big demand for this Burndept Component has enabled us to make a saving on manufacturing costs, the benefit of which is being passed on to the public.

The Anti-Phonic Valve Holder entirely eliminates microphonic noises in dull-emitter valves and will prolong the life of any type of valve. As shown in the sketch on the left, the valve holder proper is slung on springs, this method of support effectively preventing vibration being conveyed mechanically to the valve. The valve sockets are countersunk, the possibility of short circuits thus being eliminated. Those who construct apparatus will appreciate the advantages of using Anti-Phonic Valve Holders in any type of receiver.




**No. 401. Anti-Phonic Valve Holder, for panel or base mounting, in carton, with screws, 5/-**

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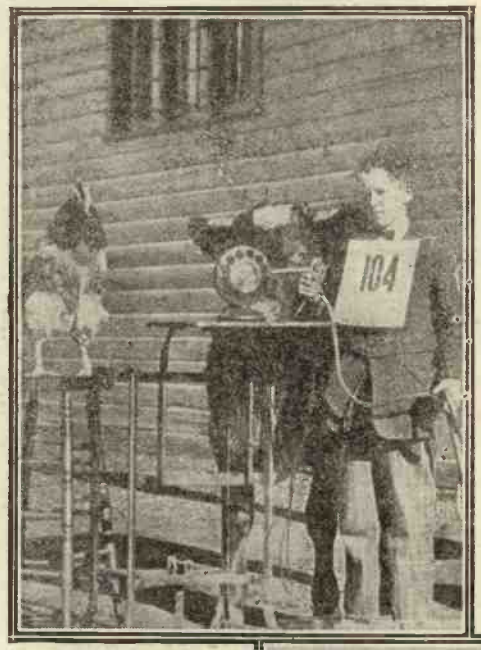
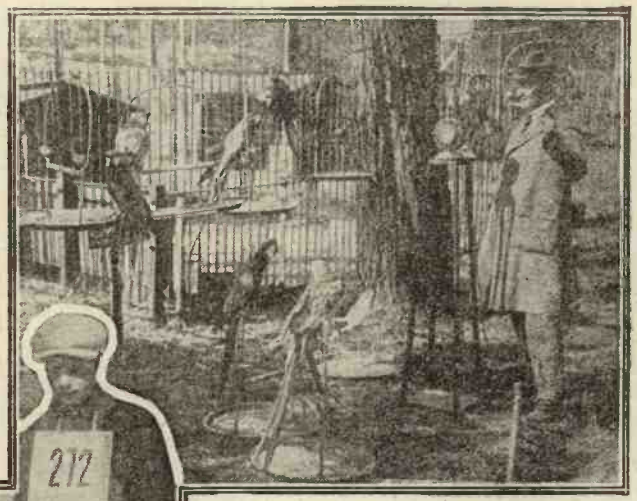
(*Continued from p.* 322.)

should, of course, mount them on adequate insulation, such as a strip of ebonite. In particular, do not change the position of the high-frequency transformers with the idea of saving room. The spacing of the transformers is deliberate, as I mentioned in the last article.

When you have wired up, you should make very careful tests on the instrument. I particularly recommend following the method about to be described, as it will save you time in the long run and obviate damage to valves.




Broadcasting animal sounds and cries from an American Zoo.



The parrots are not affected by microphone fright.


A hearty grunt which was heard for many miles.

First of all set all filament resistances and the on-and-off switch to the off position. Place a valve in the first socket, turn the switch on and carefully turn the knob of the filament resistance to see whether the valve lights up. If it does light satisfactorily, turn the filament resistance to the off position and test the next and subsequent valves in the same way. When you have satisfied yourself that all filaments are properly controlled by their rheostats you can see about testing other points of the set.

### Note on High Tension Batteries

It may have surprised some readers to find that in a multi-valve set such as this that no provision is made for shunting condensers across the H.T. battery. I have come to the conclusion that the average experimenter who is likely to build this set is also likely to have other sets on hand and will probably experiment with still further instruments. As it is most unusual to use more than one set at a time, and as furthermore most experimenters are limited in their supply of H.T. batteries, it seems to me quite superfluous to place shunting condensers in each instrument we use. It is highly important to use adequate shunting condensers across the H.T. battery, but quite unnecessary to provide each instrument with its own set of shunting condensers. I therefore recommend you to connect your Mansbridge condensers (they should have a capacity of not less than 1 mfd. each) across the tappings outside this receiver. You can then use the same shunting condensers when the same H.T. battery is used with other sets. Use one condenser across each H.T. supply.

The second special point is that I do not recommend one high-tension battery for the whole set, unless it is a high-tension accumulator. The reason is that the total H.T. current taken by the plate circuit in this instrument is much greater than the average high-tension dry battery can be reasonably expected to give. I recommend you to use one high-tension battery for the H.F. valves, one for the detector and first note magnifier, and a third for the last note magnifier. If you have them it is still better to use separate H.T. batteries for the H.F. detector and each note magnifier, making four in all. Do not think this is an extravagant idea. Your high-tension batteries will last much longer and give far better service if you take a relatively small load from them.

With regard to the high-tension voltages used, I recommend you to follow the maker's instructions in this matter, as there are considerable variations between the different makes of valves. There is no need to have very high voltages on the high-frequency valves, as the fluctuations here will not be large. The detector voltage, too, should be kept fairly low, say, 40 or 50 for the average general purposes valve. The plate voltages of the L.F. valves should be considerably higher (somewhere in the neighbourhood of 100 volts, when using the ordinary general purposes valve). Personally I use the new dull emitter type of power valve in the note magnifying stages (B. 4, D.E. 5, &c.). They give admirable results, and are quite economical in filament current.

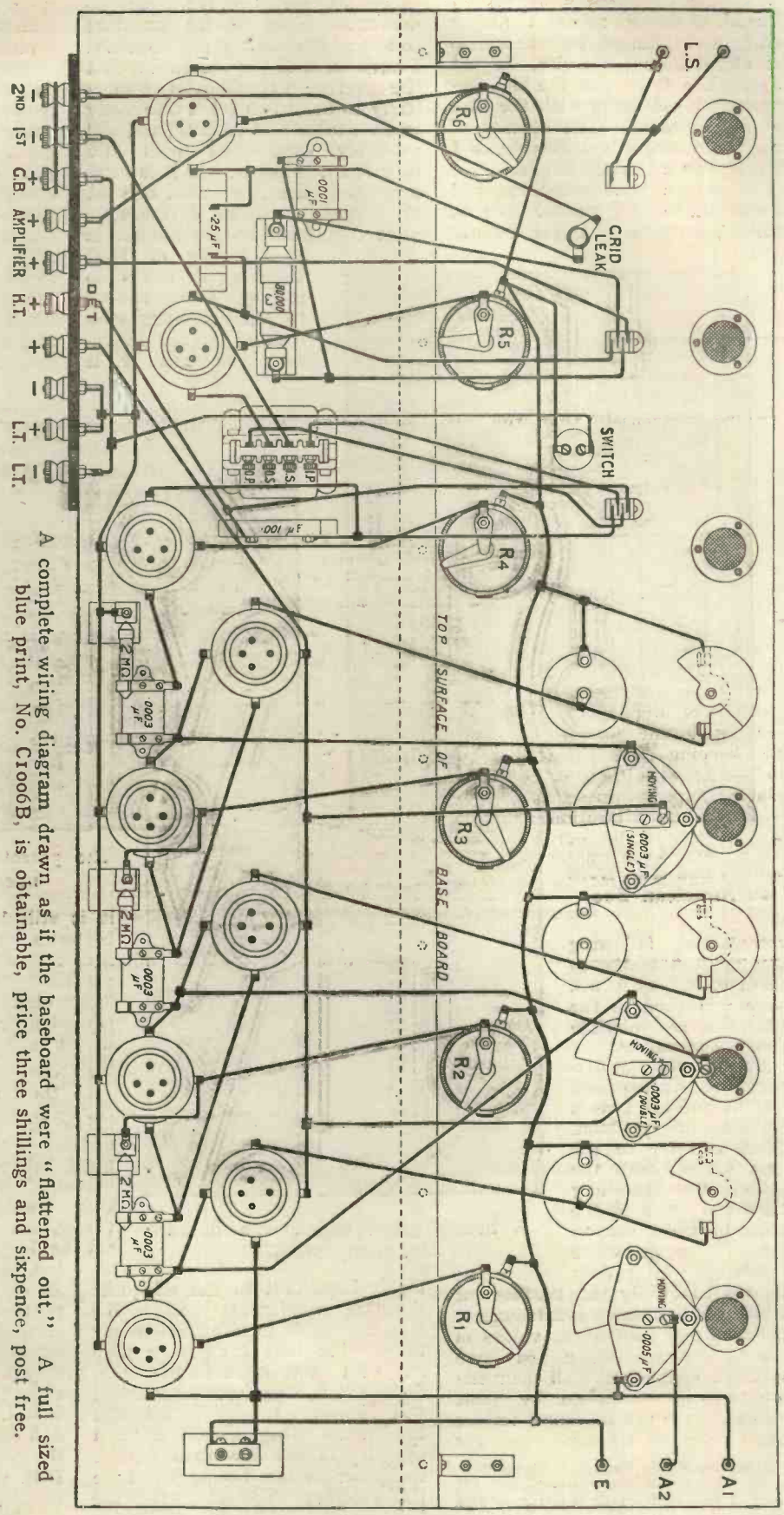
### Valves

I have received WGY (Schenectady) on a loud speaker on this set, using valves of the ·06 type throughout, even in the note magnifying stages, but you will get higher efficiency by using the ·25 ampere type of dull emitter in this set. Best of all, unless you cannot manage to get the necessary "juice," I would recommend bright emitters for the high frequency and detector valves and valves of the B. 4, D.E. 5, &c., type for the note magnifiers.

### Grid Bias

For preliminary tests I suggest that you short circuit the grid bias terminals. When the set is found to be working satisfactorily you can experiment with grid bias according to the valves you are using. Do not expect grid bias will give you greatly increased signals; the object of using such bias is to reduce distortion, if present, and to reduce the plate current required to run the set. In the case of the very dull emitters of the ·06 ampere variety, however, grid bias may improve signal strength appreciably.

Reverting to our preliminary tests, connect a pair of high-resistance telephones to the Elwell plug (these plugs have special forms of spring clips, which grip the tags of the telephones quite securely), and plug into the first jack socket. Light the filaments of the first four valves (do not turn on the last two filaments yet), screw out the neutrodyne condensers as far as they will go (by the way, do not conduct these preliminary tests during broadcasting hours), and plug in a suitable coil for broadcast wave-lengths in the coil socket (25, 35 or 50). You will know the kind of coil to use from your previous experience with other receivers on your own aerial. Plug in three H.F. transformers or neutrodyne units (if you already

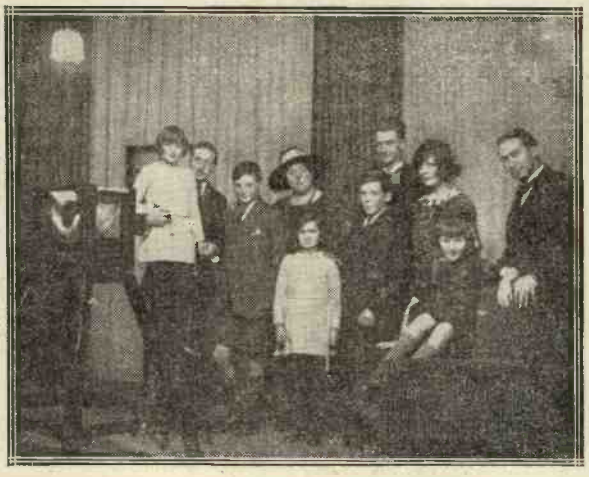



A complete wiring diagram drawn as if the baseboard were "flattened out." A full sized blue print, No. C1006B, is obtainable, price three shillings and sixpence, post free.

have plug-in transformers for the broadcast band, try these first of all), and adjust the three condenser dials until you hear signals of some kind. It may sound difficult to tune on three condensers simultaneously, but you will find that you can do most of the picking up on the first two, the third condenser being used to strengthen these signals. In a moment or two you are sure to pick up some signals, and it is highly probable the set will burst into oscillation immediately. You can judge if this is so by a rushing sound in the telephones and a loud plonking noise when you touch the aerial terminal. Notice, by the way, for parallel working of the aerial tuning condenser, that the two lower terminals on the left-hand side of the panel are short circuited by a piece of wire. Now gradually screw in the neutrodyne condensers (each by about the same amount), and turn your condenser knobs backwards and forwards. You will find a tendency to self-oscillation is reduced, and after a time, by manipulating the three neutrodyne condensers (and if you are using the Colvern by keeping this "all in"—*i.e.*, with the two plates super-imposed) you will find a position where very little self-oscillation takes place. A final adjustment on all three condensers will stabilise the set completely. You will probably find that the critical condenser is the middle one, the next critical the one nearest the aerial terminal, and the least critical of all the one next to the detector valve. I am sorry I cannot give you more detailed instructions on this neutrodyning process. The only way is to spend an evening at it, after broadcasting hours. You will soon find there is a critical position on each, and when you have got the set properly adjusted you will find that a slight turn of any of the three Colvern condensers will cause the set to oscillate. These Colverns thus act as a ready means of introducing reaction into any of the three circuits, and in practice you will greatly appreciate the fine adjustment possible here. With the Polar micrometer condenser a slight twist of the knob will have the same effect.

Do not be disappointed if you do not get first-class results in the first half-hour of trying. After an evening or two in adjusting the set you will find that everything comes delightfully simple and, in fact, you will find it quite possible to pick up three or four broadcasting stations by turning the middle condenser alone, subsequently bringing them in full strength by adjusting the aerial condenser and the second high-frequency condenser. You will most likely be struck by the remarkable purity of the distant stations, for, perhaps for the first time, you will be listening to them without reaction being pushed up to the hilt.

You will now be ready to test the note-magnifying stages. This is easily done. Connect up a suitable high-tension voltage to the terminals shown, light the two filaments and plug into the second jack. There should be a very great increase in signal strength in this transfer and, by plugging into the second note-magnifier (last jack), you will get a tremendous increase in volume. Notice the two terminals on the right-hand side of the panel are connected in parallel with the last jack. This is for the purpose of attaching a loud-speaker. If a loud-speaker is kept permanently connected to the terminals, you will find that it is automatically cut out of circuit when you plug into the detector or first note-magnifying valve. You can listen in on the telephones and make your tuning adjustments in this way. If the valve filaments of the note-magnifiers are lit, the act of withdrawing the plugs from the first jack will automatically place the loud-speaker after the two note-magnifiers. When the note-magnifying valves are working satisfactorily you can make the best adjustment of H.T. voltage and grid bias to suit the valves you use.

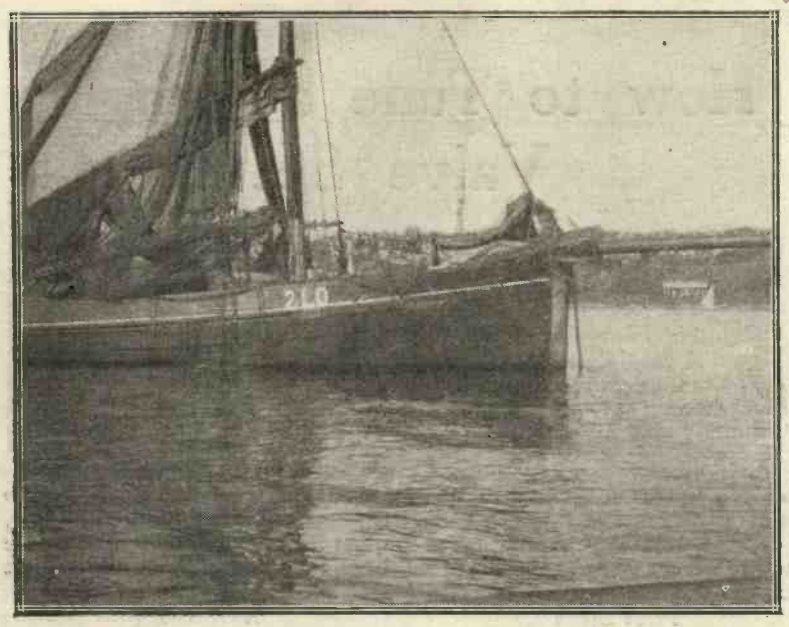


A happy group in the Aberdeen studio.

### Results

Now for the results of this set. The sensitivity is such that I have been able to pick up Madrid in the telephones, using the first four valves only, on a 2-ft. frame aerial. On a small indoor aerial at Wimbledon, Bournemouth comes in at full (almost too great) loud-speaker strength while London is working without any interference from the latter, using all valves, while adequate loud-speaker strength from the same station is received on five valves. (Remember, this is without forcing the set with reaction.) On the outdoor aerial, when 2LO is not working, Madrid comes in on the loud-speaker with such strength that several visitors have mistaken it for 2LO. This, again, is without pressing the set to any great extent. Very much greater volume was obtainable, but, when more reaction was used, a certain amount of distortion was introduced. I mentioned in last month's article that one of the great features of this set is that one can get adequate volume from distant stations without recourse to the last limit of reaction. In this way we can preserve the purity of the transmissions and have always "something in hand."

Another station which has been mistaken for 2LO so far as quality and strength is concerned is Zurich, while all of the Continental stations come in with wonderful volume in the telephones, using only the four valves. The real joy, however, is in the reception of American broadcasting on a favourable evening. Let me say at once that neither this set nor any other (even the most elaborate super-heterodyne) will bring in American broadcasting every evening, but, when conditions are at all favourable, the Anglo-American Six will justify its name to a remarkable degree. Those readers who are used to receiving WGY, KDKA on the longer wave, WHAZ and others will know that loud-speaker strength is generally only obtainable with a considerable amount of distortion due to the pressing of reaction to the last limit. In this receiver, without recourse to reaction, we can get



NOT the new London station, but a trawler with the the same "call-sign."

beautifully pure reproduction, and on the first occasion I tried the set on American broadcasting, a talk on the necessity of early mailing of letters at Christmas time was so clearly received that the speaker might have been in the next room.

### Selectivity

The selectivity of this set is much higher than that of the Transatlantic series of receivers I have previously described. At seven miles from 2LO on a good sized outdoor aerial it is still not sufficiently selective in itself to cut out all traces of London when receiving Bournemouth, Manchester or Cardiff. Madrid and Newcastle, however, are easily separable (a fairly good test), and on stations above Bournemouth wavelength London can be cut clean out without any difficulty. Continental reception is still accompanied by the roar of Morse signals around the 450 metre band, and this I am afraid is inseparable from such reception until ship station apparatus is modernised and stations keep to the wavelengths allotted to them.

### Wavetrap

I have had very remarkable results using a wavetrap with this set, and have found this method of reducing interference and sharpening the tuning much preferable to the loose-coupled method. Next month I hope to describe a companion cabinet to be put alongside the Anglo-American Six with a wavetrap arrangement which can be used to cut out the local station, even when this is very close. With such a wavetrap in circuit it is a very simple matter to substitute one of the other broadcasting stations for your local station when you get tired of the local programme.

I shall be delighted to receive reports from readers on results they obtain from this set, which has given me more pleasure in operating than any I have previously built.

## *AN EFFICIENT RECEIVER FOR FAMILY USE*

The design of a receiver for family use is by no means an easy matter, since it must be thoroughly simple and straightforward in arrangement and mode of operation; yet it must be capable of giving good enough results to satisfy such members of the family as may be possessed of sufficient technical knowledge to be critical. Obviously, it must work a loudspeaker, and be capable of using dull-emitter valves if suitable filament resistances are fitted. Further, it must be sufficiently sensitive to give good results when used with an indifferent aerial.

These stringent requirements are remarkably well fulfilled in the instrument designed by Mr. Percy W. Harris, and named by him the "Four-valve Family Receiver." This set is described in Radio Press Envelope No. 2 (Radio Press, Ltd., price 2s. 9d., post free), with the usual wealth of detailed instructions, working drawings, full size blue prints and photographs.

### What Readers Think of the Set

Many thousands of these sets have been built by home constructors, and the correspondence columns of *Wireless Weekly*, *Modern Wireless* and this journal furnish remarkable testimony to the excellent results which they have obtained.


PROOF POSITIVE !

# How to Tune a Simple Valve Set

*By STANLEY G. RATTEE,*
*Member I.R.E., Staff Editor*

*A helpful article for the man who has recently taken up the hobby*

THOUGH the various forms of tuning would at first appear to be different from each other, they are in effect precisely the same in that their objective is to tune the receiving aerial to the frequency of the desired oscillations emanating from a particular transmitting station. Whether the adjustments are made upon a variometer, slider coil, a plug-in coil and condenser, or a tapped inductance the effect is the same—namely, to add to or reduce the electrical length of the receiving aerial until its frequency is equal to that of the aerial circuit of the desired transmitting station.

### A Popular Circuit

As a guide to what to do and how best to do it we will take a popular circuit of simple design, and proceed to tune it to the long wave station of the B.B.C. on 1,600 metres. The circuit is shown in Fig. 1, which illustrates a typical single-valve reaction circuit; the coil $L_1$ represents the aerial inductance, which in the present case we will make a plug-in coil; $C_1$ is a variable air condenser, usually of 0·0005μF capacity, whilst $L_2$ is another plug-in coil, coupled to $L_1$ to produce a reaction effect. The values of L.T. and H.T. should be those as recommended by the maker of the valve; the values will usually be found within the containing box. Excluding the filament resistance $R_1$, then $L_1$, $L_2$ and $C_1$ are the only three points at which we must make adjustments for the best results, the remaining components being of fixed values. Since the wave-length we wish to receive is 1,600 metres, we must choose a coil which, with a 0·0005 μF condenser in shunt, will best cover that wave-length, and with the average aerial it will be found upon experiment that a No. 150 coil is the most suitable. The next value we must decide upon is the size of the reaction coil $L_2$, and using so large a coil as No. 150 in the aerial circuit we may safely choose a No. 200 coil for reaction.

### First Steps

The set is now ready for tuning, and assuming the aerial, earth, telephones and batteries have been connected, and the valve inserted in its socket, the aerial coil and the reaction coil should be spaced as far apart as they will go before lighting the valve by means of the filament resistance.

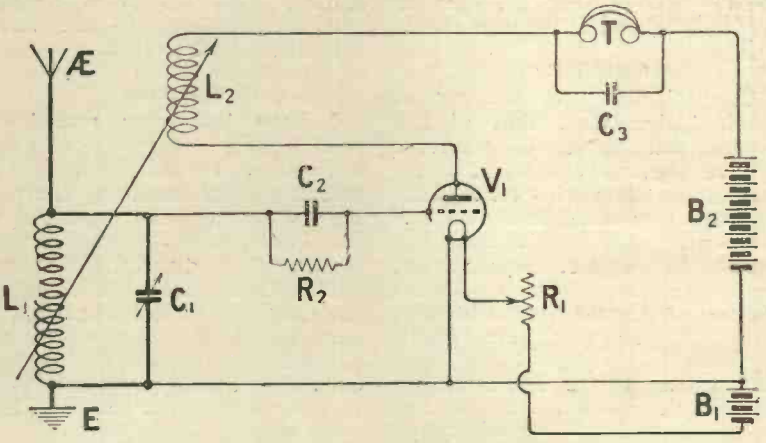



Fig. 1.—A popular single-valve reaction circuit.

With the valve burning at a suitable temperature, the condenser $C_1$ should be set to read at zero upon its scale, and slowly turned towards its 180° mark until the signals of 5XX are heard. Once these signals have been picked up the condenser should be varied even more gently until the best results are obtained, when the reaction coil should be slowly moved nearer to the aerial coil until the signals are made slightly louder. At this point leave the reaction coil alone, and again vary the condenser ever so slightly, when signals will be louder still. Again move the reaction coil nearer to the aerial coil, but *very little nearer*, when further adjustments are made upon the condenser for the loudest results.

### A Warning

Once these adjustments have been made the receiver should not be touched, as any attempt to bring the reaction coil nearer to the aerial coil will probably cause the receiver to oscillate either then and there, or else when further adjustments are made upon the condenser. When these final adjustments have been fulfilled the receiver will be working to the best of its ability, and should be allowed to remain so; any attempt at increasing the value of H.T. or turning up the filament resistance will at once set the receiver in a state of oscillation, and instead of improving our results they will become distorted.

### Weak Signals

In those cases where it is not possible to pick up 5XX with the two coils separated at their greatest distance, the reaction coil may be moved a little nearer, though not

much, and searching again made as before, with the variable condenser. Before moving the condenser, however, touch the aerial terminal with a wet finger, which, should the reaction coil have been moved too near to the aerial coil, will produce a distinct "cluck" in the telephones when the finger is removed, indicating that the receiver is oscillating. In these circumstances the two coils should be separated to a safer distance.

### Shorter Waves

Should the receiver be required to cover the shorter wave-lengths then the operation of tuning is precisely the same, but using different sizes of coils. Apart from the long wave station at Chelmsford, the B.B.C. wave-lengths may be regarded as being between 300 and 400 metres and between 400 and 500 metres. In this way we may be safe in remembering that for the 300-400 metres band a No. 25 or 35 coil should be used as the aerial coil (according to the size of the aerial), and a No. 50 for the reaction coil; for the 400-500 metres band a No. 50 coil should be used for the aerial and No. 75 for reaction.

### Oscillation Tests

In connection with the adjustment of the reaction coil, should this coil be brought too near the aerial coil, a "rushing" noise will be heard in the telephones, when, if a wet finger is applied to the aerial terminal, the set will be found to be oscillating. If we persist in bringing the reaction coil nearer the aerial coil then the receiver will eventually give the too-well-known howl, but it must be understood that the receiver will be oscillating long before the howling condition is reached, a point which far too many listeners seem unfamiliar with.

### Another Popular Circuit

Another popular circuit which many readers will have incorporated in a receiver is that shown in Fig. 2. We have as before the aerial circuit $L_1$, $C_1$, with a reaction coil $L_3$ coupled to $L_1$. The first valve in this case acts as a high-frequency amplifier, meaning that the received oscillations are amplified before being detected by the second valve. It will be seen that in the anode or plate circuit of the first valve we have another coil $L_2$ shunted by a variable condenser $C_2$, which readers will recognise as a tuned anode. As before, the value of $L_1$ will vary with the wave-length desired, as also will the reaction coil; the condenser $C_1$ will in most receivers be of 0·0005$\mu$F capacity. The value of the coil $L_2$ will, in relation to $L_1$ and $L_3$, vary with the wave-length desired, whilst the condenser $C_2$ will in the majority of receivers be one of 0·0003$\mu$F. The tuning of a circuit of this type is a little more difficult than that in Fig. 1 on account of the extra controls and its natural tendency to oscillate. With care and a little patience, however, the operation of such a circuit need present no difficulties to even the beginner in radio.

### Tuning Two Circuits

With the various external connections made, such as telephones, batteries, &c., the two coils $L_1$ and $L_3$ should be separated as much as possible and suitable coils inserted in the coil sockets. For purposes of example we will again choose 5XX as the station we wish to tune and insert therefore coil No. 150 in the aerial socket, coil No. 200 for reaction. As in Fig. 1 we tune the aerial circuit to the frequency of the incoming oscillations and since we are to amplify our received signal before detecting it, it is necessary also to tune the circuit $L_2$ $C_2$ to the frequency of $L_1$ $C_1$, otherwise nothing will be heard. It is during this process of tuning the two circuits $L_1$ $C_1$, and $L_2$ $C_2$, that the receiver shows a tendency to oscillate of its own accord, and extreme care, therefore, is called for.

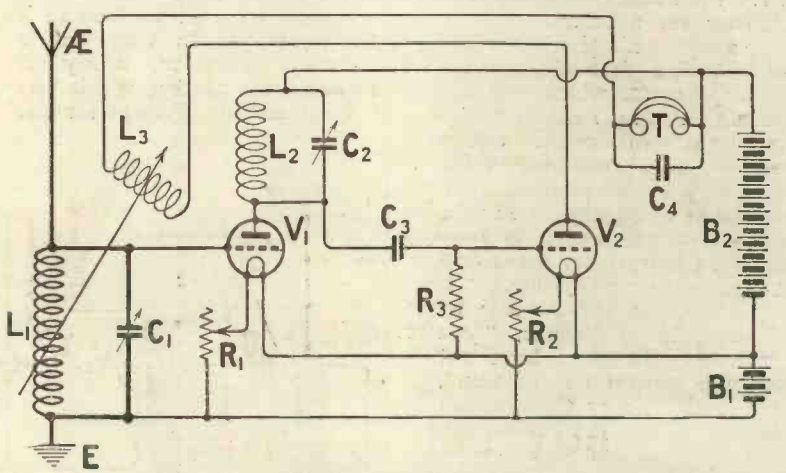



Fig. 2.—Another popular arrangement.

### Coil Values

Using such a circuit as Fig. 2, experiments will show that for the reception of 5XX the best value for the coil $L_2$ will be a No. 200; we have, therefore, No. 150 for $L_1$, No. 200 for $L_2$ and No. 200 for $L_3$. With $L_1$ and $L_3$ at right angles to each other, we now light both the valves, when tuning must be made upon the two condensers $C_1$ and $C_2$ simultaneously, tuning being sharper upon $C_1$ than upon $C_2$. Variation in the reading of these two condensers should be made until the loudest signals are received, and it must be remembered that very rarely will the two readings be the same, meaning, if $C_1$ is at 30° it does not necessarily follow that $C_2$ ought also to be at 30°; on the contrary, in 99 cases out of 100 it will not be.

Having tuned the signals to their loudest by varying $C_1$ and $C_2$ we now bring $L_3$ a little nearer to $L_1$, remembering the precautionary remarks about reaction, and again tune with the two condensers for the best results. Finally we bring $L_3$ nearer to $L_1$ and once more tune with the two condensers, that is, if we can do so without oscillating.

### H.T. and L.T.

So long as we are not oscillating, in which case $L_3$ must be moved a little away from $L_1$, then the receiver should be left alone for that period during which we wish to receive 5XX, as apart from the condensers and coils, any alteration in H.T. voltage or any variation in either of the filament resistance will cause the set to burst immediately into oscillation.

The tuning operation is the same no matter what the wave-length may be, and for the guidance of readers the best coil sizes to use for B.B.C. stations other than Chelmsford are, for those stations with wave-lengths up to 400 metres, No. 25 and 35 for the aerial, No. 50 for reaction with a No. 50 or 75 for the tuned anode. For those B.B.C. stations below Chelmsford and above 400 metres the aerial coil should be a No. 35 or 50, the reaction coil No. 50 and the tuned anode a No. 75 coil.

# John Anstruther Talks

*The second of a series of chats on wireless subjects. The first appeared in our January issue. Each article is complete in itself.*

IT was Painter who put forward the next problem. He explained that he had just made up a set of his own design containing three valves, and that he was not satisfied with the quality of the signals received. At John's request he drew the circuit, which is shown in Fig. 1. John took it and looked at it steadily for a minute or two, puffing away at his pipe the while. Then he took a piece of paper and drew the diagram which you will see in Fig. 2. Fig. 1 shows a very ordinary straightforward circuit consisting of a rectifying valve with two note magnifiers. In Fig. 2 the same circuit is seen with a few alterations, which, as John explained, make a very great deal of difference to its working. "If you put the two circuits side by side," he said to Painter, "you will see that though I have not altered the general run of yours, I have made two or three rather important changes and additions. Let me tell you, first of all, what I should imagine to be the faults which you have to find with your own design.

### Loose Coupling

In the first place, your signal strength is probably not so good as it ought to be. This is because you are using a large aerial tuning condenser in parallel with the inductance. For short waves I suggest putting the aerial tuning condenser in series. Next, I do n t think that you found your set very selective. This is due to two things. In the first place, you are using a single circuit tuner, and, secondly, your A.T.C. has a large maximum capacity. A single circuit tuner is not nearly so selective as that which consists of two circuits loosely coupled to each other. The looser the coupling the more selective the set becomes. By placing $L_1$ and $L_2$ (in fig. 2) far apart you can so arrange matters that your tuning is sharp, which means that you can eliminate unwanted signals better. And then there is the point about the big A.T.C. A very small movement of the knob means a comparatively large change in its capacity. This being so, you may find it difficult to make the very small alterations in capacity required to tune in a weak signal, or to tune out a moderately strong one nearly on the same wave as that which you are trying to get. Except for the very long waves, the variable tuning condenser with a capacity of ·001 $\mu$F is quite out of place in the receiving set. You will find it much better to use a ·0005 $\mu$F for A.T.C. and ·00025 $\mu$F or ·0003 $\mu$F for the closed circuit or circuits."

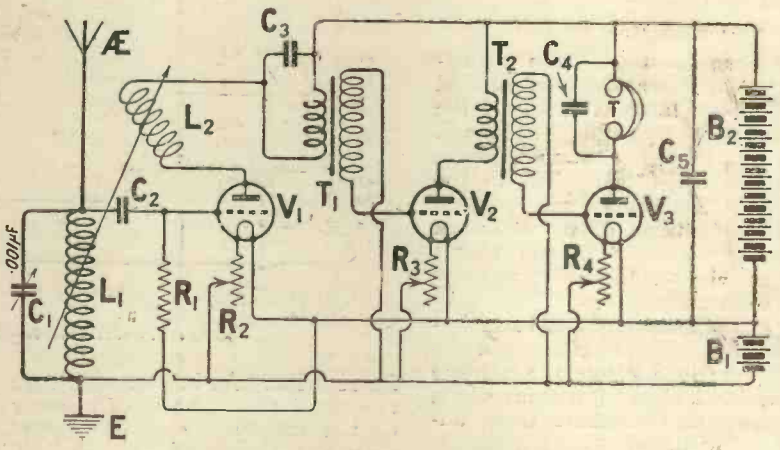



Fig. 1.—The circuit used by Painter.

### Flat Tuning

"You are absolutely right so far," said Painter. "I certainly did find my tuning difficult, and I was wondering in what way I could manage to improve it. But, at the same time, when I do tune in a powerful telephonic transmission I find that I get a good deal of distortion. You know what I mean; there is a certain harshness in music, and speech is inclined to be rather woolly."

"I was just coming to that," replied John, "but, before I do so, tell me if the set is not inclined to be just a little on the noisy side."

"Well, it is certainly not so quiet as I should like it to be," Painter answered, "and, though I have tried several things, I do not seem to be able to get rid of a certain amount of 'mushiness.'"

"How have you placed your two low-frequency transformers?" asked John. "Are they fairly close together, and have you mounted them with their cores parallel to one another?".

Painter looked a little surprised.

"Oh, I have got them pretty far apart," he said, "but the cores certainly are parallel, for I did not think that that mattered very much."

John nodded, and went on to tell us something about transformers. We learnt that when two are used in a set it is almost impossible to prevent some slight interaction taking place between them owing to the magnetic and capacity couplings which exist even

when they are separated by large distances. Interaction, however, can be kept down to something so small that its effects upon reception are not noticeable if certain precautions are taken. The first of these is to keep the transformers well apart and to mount them with their cores at right angles. The second is to earth their cores by taking a wire from them to L.T.— as shown in the diagram.

### Noisiness

"But though stray couplings may be responsible for both distortion and noisiness," he went on, "there are other reasons why Painter is not satisfied with the quality of his reception. If you look at his circuit you will see that he is applying the same high-tension voltage to the plates of all three valves. Now, one of these valves is acting as a rectifier, whilst the other two are note magnifiers. In the rectifying valve we want a good flow of what is called grid current. On another evening we will discuss the way in which the rectifying valve works, but to-night it will be enough to say that we cannot obtain the best results possible if we apply the same H.T. voltage to all valves. You are probably getting reasonably good signals, however, Is that so?"

"Fairly good results," said Painter.

### Not the Best

"I will take your own words, 'fairly good results,'" replied John. "That is just what you do get. You have to find a kind of compromise voltage with them, so that, though all the valves are doing their jobs in some sort of way, none of them is really doing it properly. If you want efficiency you must make the best use of every valve."

"What," queried Morris, "is the effect on plate current of increasing the high-tension voltage?"

"I'll go further into that on another evening when we come to discuss valves in detail," said John, "but, very roughly, the effect is this. Suppose that we apply 30 volts to the plate of a given valve and keep its grid at zero potential; we shall find that, say, half a milliampere of current is passing through the valve. If now we raise the plate voltage to 60, there will be a considerable increase in this current. We shall find also something else. Whereas with a plate voltage of 30 we could stop the flow of current altogether by making the grid 2 or 3 volts negative, with 60 on the plate we can make the grid 3 or 4 volts negative and still have a very respectable amount of current passing. Now, the more negative the grid the more we cut down grid current. If you look at the two note magnifiers in the circuit that I drew you will see that I have placed a small battery so as to make the grid of each rather negative. Thus by raising the plate potential and making the grid negative we keep grid current right down and avoid distortion. You will see that I have provided a separate high-tension tapping for the rectifying valve, which enables us to adjust its plate voltage so that best results are obtained."

The hands of the clock were now pointing to almost midnight, and though we were all burning to ask more questions we felt that it was time for the meeting to break up. Each of us is preparing more problems for John Anstruther to deal with, and I will record next month the answers that he gives to them.

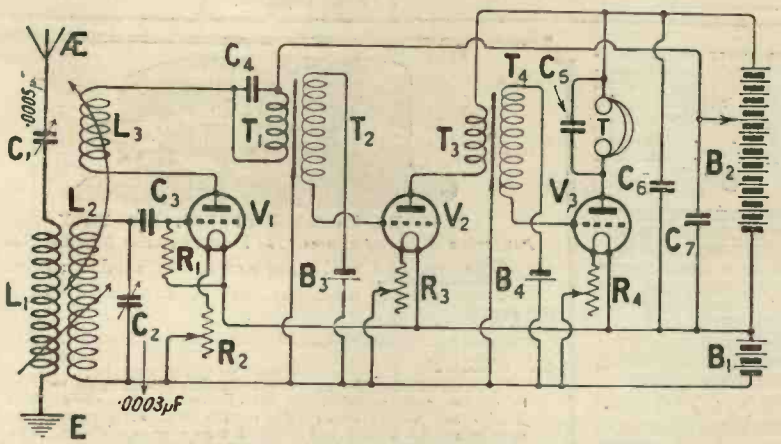



Fig. 2.—How Anstruther improved the circuit.

## Test Report of the "Polar Blok" Anglo-American Six

*By the EDITOR*

THE remarkable flexibility of the "Polar Blok" assembly system is well demonstrated in the make up of the Anglo-American Six, which, by the courtesy of the Radio Communication Company, I have had the opportunity of testing on my own aerial, in conditions with which I am well acquainted. The set when assembled forms a panel (or rather a set of interlocked panels) measuring over all 36 in. by 8 in. For neutralising the Polar Micrometer condensers are used, and as closely as possible the layout follows the original set.

Of course some efficiency has to be sacrificed in any such arrangement as this, as the wiring cannot be disposed quite as in the original. On practical test, however, the loss of efficiency was found to be small, and excellent results, comparable with the original set, were obtained. Madrid, for instance, was clearly audible on four valves, using a 2 ft. frame aerial. With six valves small-room loud-speaker results were obtained. Owing to the very great sharpness of tuning, the tuning in of Madrid in this way was difficult, and required experience not possessed by the beginner.

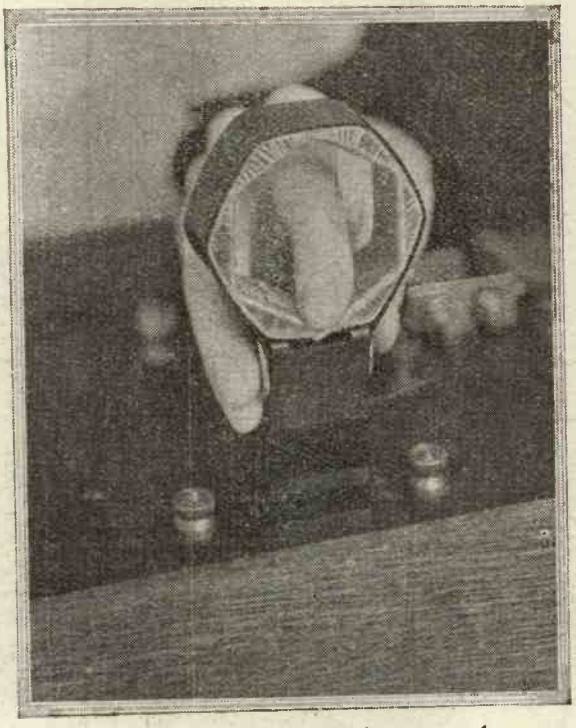
On all the B.B.C. and many Continental stations excellent results were obtained, with perfect control of oscillation by means of the neutralising condensers. The same clarity in long-distance reception which is such a feature of the original set (due to reception without recourse to strong reaction coupling) was in evidence, and the selectivity was also high.

Several different makes of plug-in transformers were used in the tests, of the type originated by McMichael's, and now obtainable from a number of firms. All worked well.

Summarising the report, I can say that while the set is not quite so efficient as the original Anglo-American, it falls little short of it in results, and can be recommended to any reader who prefers the unit method of construction to the completely finished type of receiver, of which the Anglo-American Six is an example.

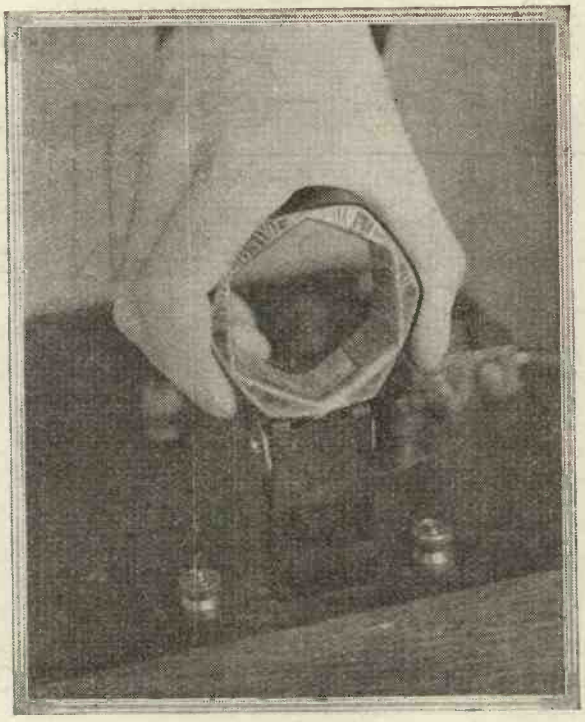
# YOUR PLUG-IN COILS

## *THE RIGHT AND WRONG WAY OF HANDLING THEM*

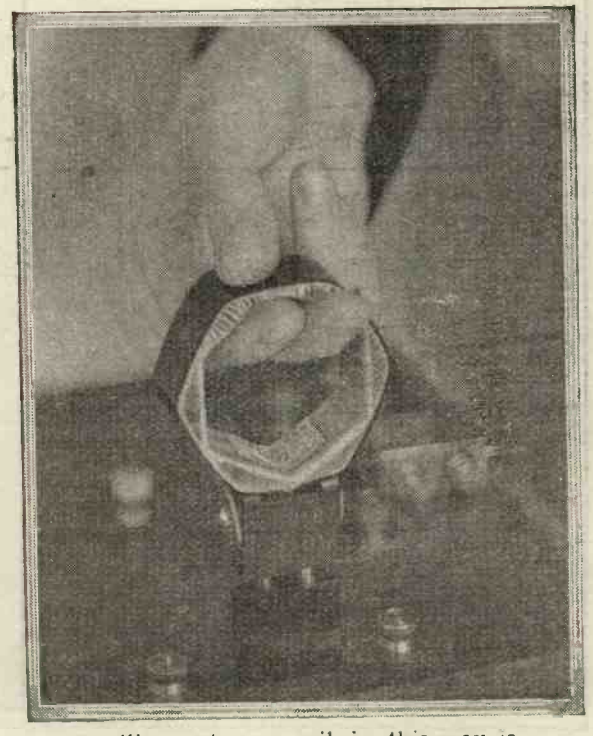


Place the coil in its socket this way, and . . .

pull it out like this.



If you try to insert it in this manner you will spoil the coil, while . . .



pulling out your coil in this way is sure to injure the windings.

# JONES MAKES A NEW CIRCUIT.


He gets good reception—But only just ! ! !

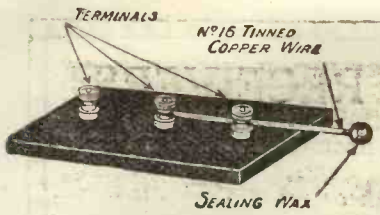



Fig. 1.—The complete switch.

# How to Make a Simple Change-Over Switch

*By STANLEY G. RATTEE, Member I.R.E.*

AMONG the many little things that the constructor will find interest in making himself, is the simple little switch to be described.

The proper name of such a switch as this is a "single-pole change-over switch," and, though its uses are many, two purposes to which it may be put are given herein.

The first figure shows the make-up of the switch, wherein it will be seen that three ordinary terminals are used, mounted upon a small piece of ebonite sheet. The connecting arm, or what would be the "knife" in a commercially made switch, is made from a short length of No. 16 S.W.G. tinned copper wire, one end being turned so as to form a ring and the other end being encased in a ball of sealing-wax to form a handle.

### The Base

The dimensions of the ebonite mounting piece are given in Fig. 2, the ebonite being ¼ in. or ⅛ in. thick, squared up and treated with a rubbing of emery paper to remove the possibility of surface leakage. The three terminals are mounted in the ordinary way and secured by means of nuts and washers. The connecting arm is connected to the centre terminal as shown in the illustration, and by means of slacking off the milled heads of all three terminals the connecting arm may be used to join either the left or right hand with the centre.

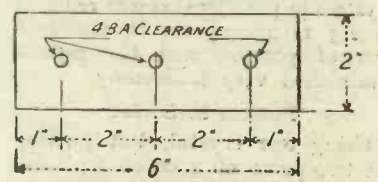



Fig. 2.—Drilling diagram.

An arrangement such as this, though extremely simple, is sufficient to permit the cutting in or out of, say, a low-frequency valve, the connections for such a circuit being given in Fig. 3. It will be seen that with the centre terminal connected to one side the reaction coil is connected direct to the telephones, in which case the first valve only is in a circuit; on the other hand, if the centre terminal is connected to the other side of the switch, the reaction coil is connected to the primary of the transformer, when both valves may be used.

### A Useful Application

Still another purpose to which the switch may be put is that of changing over from telephones to loud-speaker, as shown in Fig. 4. The telephone terminals of the set are connected to the two outside terminals of the switch, as are also one lead of the telephones and one lead of the loud-speaker. The remaining leads of both the telephones and the loud-speaker are connected to the centre terminal of the switch. By means of this arrangement moving the connecting arm from one side to the other automatically changes over from telephone reception to loud-speaker, the connecting arm short-circuiting whichever is not required.

### A Warning

Though this or any other single-pole change-over switch may suggest itself for many more uses than the two given, it is not generally advisable that switches of this type should be incorporated in the high-frequency side of a receiver, as the capacity introduced by such inclusion will in all probability render the set inefficient both as regards sensitivity and tuning; in fact, it may be said that except where great care has been given to the design the best H.F. results are obtained where no switching of any kind is used in that part of the circuit where H.F. currents are being utilised. Another suggestion which may occur to readers is that this little arrangement might serve as an aerial-earth switch, in which case the reader must dismiss the suggestion as being an impracticable one. The purpose of an aerial-earth switch is to conduct heavy charges in the aerial to earth, and in order that this may be done with safety any switch used for the purpose must be capable of carrying very heavy currents, and is consequently considerably larger than the device described. In any case, the safest method is to disconnect both aerial and earth from the set, join the two wires together, and to throw them out of the window clear of the house.

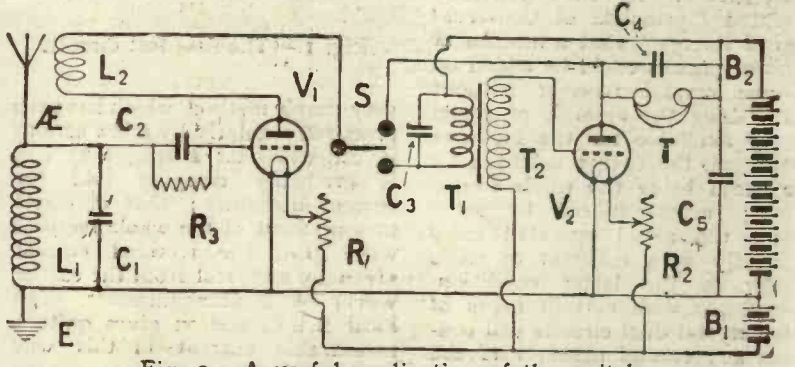



Fig. 3.—A useful application of the switch.

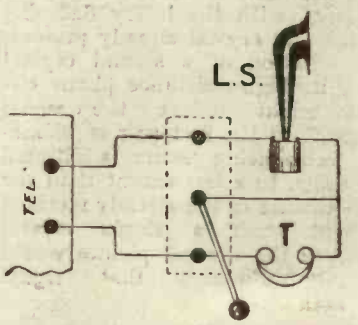



Fig 4.—Telephones or loud speaker.

# MANY 'PHONES IN CRYSTAL RECEIVERS

*Some Interesting Practical Tests and Measurements*

*By A. D. COWPER, M.Sc., Staff Editor*

IT has been suggested that the familiar diminution in signal strength observed when two or more pairs of phones are connected up to a crystal receiver, either in series or in parallel, would be reduced (or even obviated) if, instead of merely putting the different pairs of phones in series with *one* crystal across the tuning inductance (as is usually done), each phone were given its own crystal, and the several crystals were then connected in parallel across the inductance.

### What was Expected

It would appear to be directly contradictory to the generally accepted "principle of Conservation of Energy" that a number of pairs of phones could be added on to one crystal receiver without diminishing the amount of signal energy available for the first one connected, the energy collected by the aerial being the whole source of it; unless indeed by some means the aerial operated more efficiently as a collector of radio energy in the latter condition. Experience with certain types of valve-crystal dual circuits will convince any careful observer of the very heavy damping *one* crystal arranged across an inductance gives; though in this case the addition of a *second* crystal is proportionately less noticeable. It was conceivable that in a crystal receiver, with the heavy damping of the first crystal already present, the addition of a second crystal with its high-resistance phone circuit might reduce the signal strength in the first pair of phones by introducing some additional damping, to a less extent than the partitioning of the already rectified current from a single crystal between the several phones would directly diminish that signal strength.

### Accurate Measurement

In view of the quite hopelessly inaccurate nature of mere casual observation of relative signal strength (such observations being subject to a percentage error running into several hundred per cent. upwards, and fifty per cent., at a moderate estimate, downwards, when there is the slightest delay or distraction of the senses between two observations), the only way to determine this question is naturally by actual *quantitative* measurement. Fortunately we have a

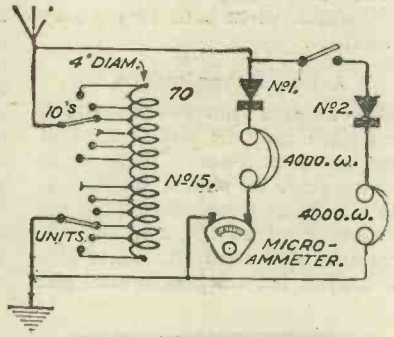



Fig. 1.—The first test circuit.

very simple method, which has been practised regularly by a few serious investigators for a long time and is gradually creeping into the current literature: that of direct measurement of the whole rectified wave (*i.e.*, the rectified current given by a crystal from the carrier wave) by a microammeter. The local B.B.C. station gives quite a measurable current in this way up to at least 35 miles on a very ordinary aerial. By putting the microammeter in series with one pair of phones, it is possible to see by the reading of the instrument precisely how much current is being obtained from the whole carrier wave; and the modulated portion, which gives the audible signals is, of course, a definite fraction of this.

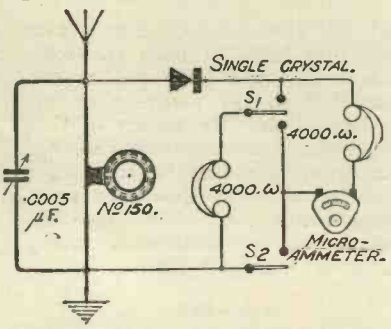



Fig. 2.—Measuring loss of signal strength with second pair of telephones in use. Switches $S_1$ and $S_2$ put second pair in series or parallel.

Arranging a circuit as shown in Fig. 1, the reading of the microammeter was taken, first with one pair of 4000 ohm phones in series with the first crystal, at optimum setting; second with the second crystal and pair of phones in parallel with the first, the second crystal being also given its optimum setting. The receiver was connected to an indifferent test-aerial 35 miles from 2LO, at night. Measurements were also made on 5XX, who was about the same distance away. In each case really efficient tuning arrangements were used; for the short wave a tapped inductance of No. 15 S.W.G. d.c.c. wire was used, which gives by actual measurement the optimum signal strength of all devices compared quantitatively with it.

### Some Figures

With one pair of phones, on 2LO the current through the phones was 1.5 microamperes. With a second pair of 4000 ohm phones and a second crystal, the current was 0.2 microamperes in the first pair, and the signal strength was noticeably much poorer. On lifting the second cat's-whisker, the microammeter needle jumped back to the original reading of 1.5 microamperes.

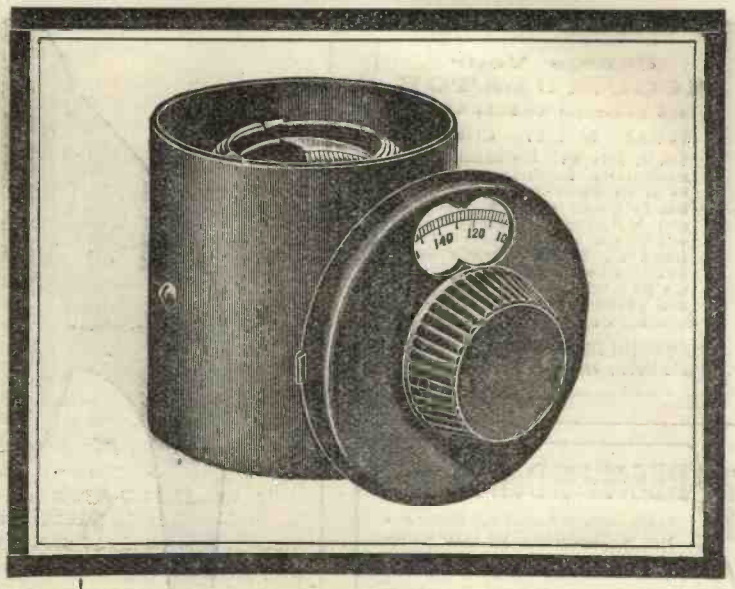
On 5XX the reading with one pair of phones was 5 microamperes; with two pairs of phones and two crystals in parallel this was reduced to 2.5 microamperes in the first pair of phones, and the signals diminished very noticeably.

### Phones in Series

Using one crystal, but putting the two pairs of 4000 ohm phones in series, the current was cut down from 1.5 to 1.25 microamperes on 2LO; with the phones in parallel on the same good crystal from 1.5 to about 1.3 microamperes. In the first case, there was a noticeable diminution in signal strength, but not so much as with two crystals in use; in the second case the drop was quite small, and would easily have passed unnoticed if the attention had been distracted at the moment when the change was made.

(*Continued on p.* 345.)

IGRANIC
Variometer
B & BL Types



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# A *new* Variometer and a *new* Condenser

In these latest Igranic achievements you will find that Igranic craftsmen have eliminated the failings of earlier variometer and condenser designs.

Both have proved their sterling merit in exhaustive and searching experimental work and now we can confidently say (as we do of all Igranic devices) that you will "build a *better* set" if these new Igranic Components form part of your receiver.

**IGRANIC RADIO DEVICES INCLUDE:**
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## Variometers
## B & BL Types

WOUND ON AIR! Therein lies the great feature of this new type Igranic Variometer. The windings are self-supporting without the need for moulded insulation. Self-capacity is low and mutual induction high. Windings are protected by a paxolin tube and one hole fixing is provided for. Type B is for B.B.C. wavelength ranges and Type BL for Chelmsford, Radio-Paris, etc.

Prices:

| | | |
|---|---|---|
| B | 280 to 650 metres | 12/6 |
| BL | 700 to 2,400 ,, | 18/- |

## THE
## IGRANIC-FRESHMAN
## Fixed Condenser

Is designed upon an entirely new principle and so constructed as to render variations in capacity negligible. Will withstand high voltages and is eminently suitable for usual reception purposes and low power transmitting. Dielectric losses almost non-existent.

Prices:

.0001 mfd., .0002 mfd., .0003 mfd. — 2/- each
.0005 mfd., .001 mfd., .002 mfd. — 2/- each
.003 mfd., .005 mfd., .006 mfd. — 2/6 each

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**Works: BEDFORD**

BRANCHES AT BIRMINGHAM, CARDIFF, GLASGOW, LEEDS, MANCHESTER, NEWCASTLE

(Continued from p. 342.)

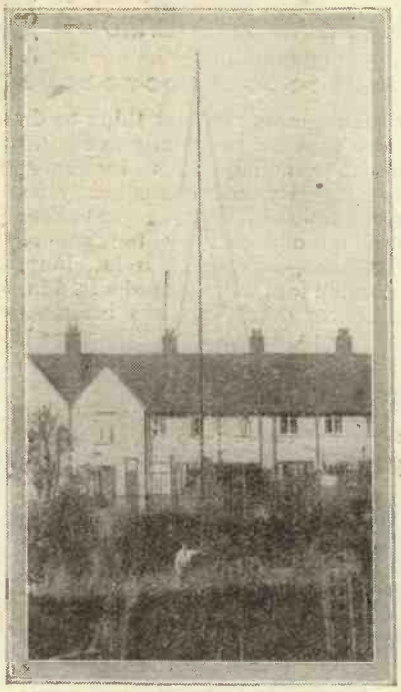
Evidently, when made the subject of quantitative measurement, the effect of a second crystal with the phones arranged in series with it, is to produce far greater loss of signal strength by heavy extra damping than results from multiplying the number of phones connected to a single good crystal.

Measurements of this type can be readily made with any really sensitive laboratory type of reflecting galvanometer. Those in question were made with a table type of needle-indicating microammeter made by Messrs. Pye & Co., of Cambridge, reading single microamperes up to 40 on an open scale.

## THE "ALL-CONCERT" RECEIVER

SIR,—My thanks are due to Radio Press and Mr. Harris for the splendid results I am getting from my three-valve set made by myself according to the instructions of Mr. Harris.

The set was completed last week-end (it is the "All Concert Receiver"). Since then I have had twenty different stations, details of which are below. The set is made as described, with two exceptions, which are:—All parts mounted on one ebonite panel, and I have included a switch for cutting out the note magnifier on loud signals.



An efficient type of amateur aerial.

All coils are home made and wave wound, the loud speaker is an "Amplion," aerial full length single wire and about 30 ft. high.

The stations received are as follows: the first eleven I have had on the loud speaker and the remaining nine at good telephone strength.

6LV, 5NO, 6BM, 2ZY, 5XX, 2LS, 5SC, 2LO, Petit Parisien, Radio Paris, and Konigsberg, on the loud speaker; and:—

6KH, 6FL, 5IT, 5NG, 2EH, Madrid, Voxhaus, Radio Belgique, and School of Posts (PTT) at good telephone strength.

I shall be glad to read at any time of readers' experiences with this circuit. I myself am more than satisfied, as I think it is a fine all-round three-valve set.

Thanking all concerned.

I remain,
Yours truly,
R. H. WHALLEY.

Lancs.

# What You Want to Know

*SOME INTERESTING QUESTIONS ANSWERED*

**Why is it that the Enamel Insulation on an Aerial Wire does not prevent it from collecting energy from the passing waves?**

Electro-magnetic waves pass freely through all insulating substances, but are partially absorbed and partially reflected by conductors.

**What do you consider is the best type of outdoor Aerial where space is strictly limited?**

A single wire aerial of restricted length and height will have a short natural wave-length, and will not intercept and collect much energy from passing electro-magnetic waves. If the dimensions are particularly small, a large amount of inductance (in the tuning coil or coils of the receiving set) will have to be added in order to tune it to the desired wave-length, and the resistance of these turns will cause considerable damping. Under the circumstances the best thing to do is to increase the number of wires in the aerial, thus increasing the capacity and consequently its natural wave-length. A good effect can be obtained by the use of spreaders, say, 7 ft. 6 in. long, carrying four wires spaced 2 ft. 6 in. apart, or even six wires arranged on hoops to form a "sausage" aerial. The down-lead should also be of four wires joined together at the point where they enter the receiving room.

**Does the directional effect of a Receiving Aerial affect the strength of signals?**

Yes, to some extent, but in the case of comparatively small aerials, erected to comply with the requirements of the Post Office, the directional effect is very slight. It is most pronounced in the case of an inverted L type aerial, which responds most readily to signals in line with the horizontal portion of the aerial, and in such a direction that the down-lead is between the transmitting station and the free end of the aerial.

**What is the difference in sound between Spark and Continuous-wave Morse signals?**

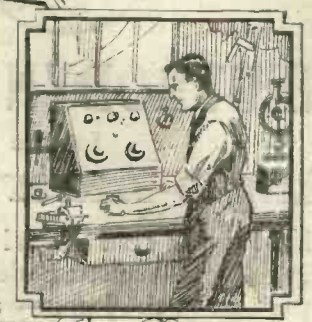
Spark signals do not as a rule possess a very musical sound, but may range between a harsh buzzing sound and a clear whistle. Their pitch is not altered by varying the tuning of the receiver, and when the set oscillates they are all heard with a rough, scratchy sound. Continuous wave signals, on the other hand, cannot be heard at all until the set oscillates or a local heterodyne is used, and have pure musical notes which can be adjusted to any pitch between the highest and lowest audible by varying the tuning of the receiver or the frequency of the oscillations generated by the separate heterodyne if the latter is used.

**What is the best time for attempting long-range receptions?**

When the area between the transmitting and receiving stations has been in darkness for as long as possible. This usually means, of course, that a short time before sunrise is the most promising hour.

# Radio Press News

*A Talk about Our Other Publications*

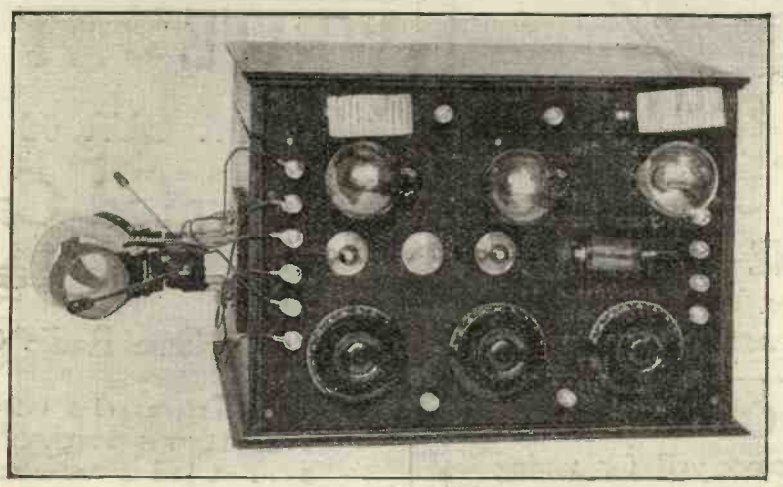


WE have pleasure in announcing this month the appearance of four new publications, which will be on sale a few days after this issue of THE WIRELESS CONSTRUCTOR. These consist of three new Radio Press Envelopes, with the usual wealth of elaborate detail, including the fullest instructions, blue prints, working diagrams, and generous photographic reproductions of the instrument and its construction. The fourth item is a book on the lines of the now well-known "Pictorial Wireless Circuits," details of which will be found in a later paragraph.

### An Experimental Laboratory

One of the most difficult problems of the genuine experimenter is to reconcile the flexibility of a real experimental outfit with the requirements of appearance and convenience when required for general broadcast reception. The ordinary outfit consisting of components upon a bench, wired up to form any desired circuit, has many drawbacks, some of the chief of these being the unsightliness of the resulting installation, the number of stray wires, and the difficulty of tracing faults resulting from something coming adrift. Such an installation can certainly be adapted to any new circuit which appears, and much experimental work can, no doubt, be done with it, but there are a very large number of experimenters who like to have a set with a neat appearance, and which may be readily operated by other members of the family than themselves at all times.

A remarkably successful solution of the problem has been devised by John Scott-Taggart, F.Inst.P., A.M.I.E.E. the Editor of *Wireless Weekly* and of *Modern Wireless*, and by him christened the "*Wireless Weekly* Omni-Circuit Receiver." This instrument is extraordinarily flexible, since literally hundreds of different circuits can be tried, and yet it always retains the neat appearance of a finished set. Furthermore, it is an extremely easy matter to wire up any one of the possible circuits, and the operation need never take more than a few minutes. The instrument has been appropriately described as "an experimental laboratory in a single cabinet." It consists of a complete equipment of the necessary component parts, mounted upon ebonite panels, and the various connections are brought out to terminals upon a board upon which the circuit can be wired up by means of short flexible leads. To each of these terminals a number is allotted, and wiring keys are provided consisting of tabulated numbers, indicating which terminals are to be connected together to form any particular circuit, so that quite elaborate circuits can be wired up by persons with only slight knowledge.



The "Wireless Weekly" Omni Receiver.

This instrument is described in Radio Press Envelope No. 5 (The *Wireless Weekly* "Omni" Receiver, by John Scott-Taggart, F.Inst.P., A.M.I.E.E., price 2s. 9d., post free), all the usual details being given, in addition to which will be found a special transfer for "engraving" the panel, and also a sheet of cartridge paper, carrying the numbers of the terminals, so that the terminal board can be marked out in this way if desired. A large number of new wiring keys which have not hitherto been published are also incorporated.

As may be seen from the accompanying photograph, one of the greatest attractions of the "Omni" set is that, when the lid is closed to cover the terminal board, the set has the handsome appearance of a closed-in cabinet receiver, there being little to indicate that it is an instrument of the experimental type, yet it will be found by the owner that there is scarcely any limit to the number

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(*Continued from p.* 348.)

of circuits which he can wire up on it, either from a circuit book, or from the numerical wiring keys which are constantly appearing in the Radio Press journals.

### The Interference Problem

To the really keen experimenter the pleasures of listening to the local broadcasting station are somewhat limited, and he very soon realises that his principal interest lies in receiving the more distant ones with the simplest apparatus and with the greatest possible perfection. Nevertheless, the mere construction of a set capable of receiving the distant stations is by no means the end of the story for him, however, since once a suitable instrument is built it is quickly realised that this alone does not suffice to enable the more distant stations to be received with ease and certainty, since there is always the problem of interference by the local station, and, however good the receiving set may be, it may be quite impossible to receive the more distant stations whose wavelength lies anywhere near to that of the local station, simply because the stronger transmission completely swamps them, and an instrument of ordinary selectivity will not suffice to perform the necessary separation. The expedient commonly adopted and

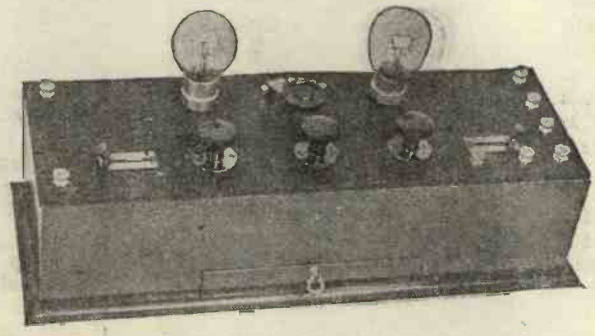
The A.B.C. wavetrap.

recommended in some quarters is to increase the selectivity of the receiver itself, but, since this invariably complicates the operation of the instrument and may in many cases actually reduce its powers of long-distance reception, a good deal of experimental work has been done along the lines of wavetrap circuits, and Radio Press is now in a position to publish details of a particularly successful instrument, which in the great majority of cases completely solves the problem. This is the "A.B.C. Wavetrap," described in Radio Press Envelope No. 6, price 1s. 9d., post free, by G. P. Kendall, B.Sc., staff Editor of *Modern Wireless* and of *Wireless Weekly*, who has devoted a great deal of experimental work to this particular problem. The author has found that a low-loss inductance is most essential to success in wavetrap circuits, and he has incorporated a very simple, but effective, inductance in this particular instrument, and a combination of switching and terminal devices is provided which enables any one of the three most successful types of wavetraps to be tried. The instrument is exceedingly simple in use, can be added to any set, and is so arranged that it can be kept permanently wired to a set and switched in or out of use as required. It can be put into any

convenient type of cabinet, either sloping or vertical front, so as to match the receiving set which is being used, and is of particularly handsome appearance. The A.B.C. Trap is cheap to construct, the parts costing not more than 30s., and in the very great majority of cases solves the problem of interference by the local station. It will also be found of considerable assistance in dealing with cases of bad interference by unwanted Morse signals between the wavelengths band of 300 to 600 metres. As usual, elaborate constructional details are given, with blue prints, working drawings and photographs.

**A Useful Addition to the Set**

Every experimenter who possesses a receiving set capable of giving headphone reception only must at some time or other feel that he would like to be able to use a loud-speaker, but in the very great majority of cases he is deterred by the belief that he would have to build a complete new set, with consequent expense and trouble, and it is therefore believed that Radio Press Envelope No. 7, "A Two-valve Amplifier de Luxe," by Herbert K. Simpson (Radio Press, Ltd., 1s. 9d. post free), will solve the problem for everyone in this position. The instrument described in this envelope is a two-valve low-frequency amplifier of good standard type, employing iron-core low-frequency transformers, and provided with a very convenient system of switching,



The Two-valve Amplifier de Luxe

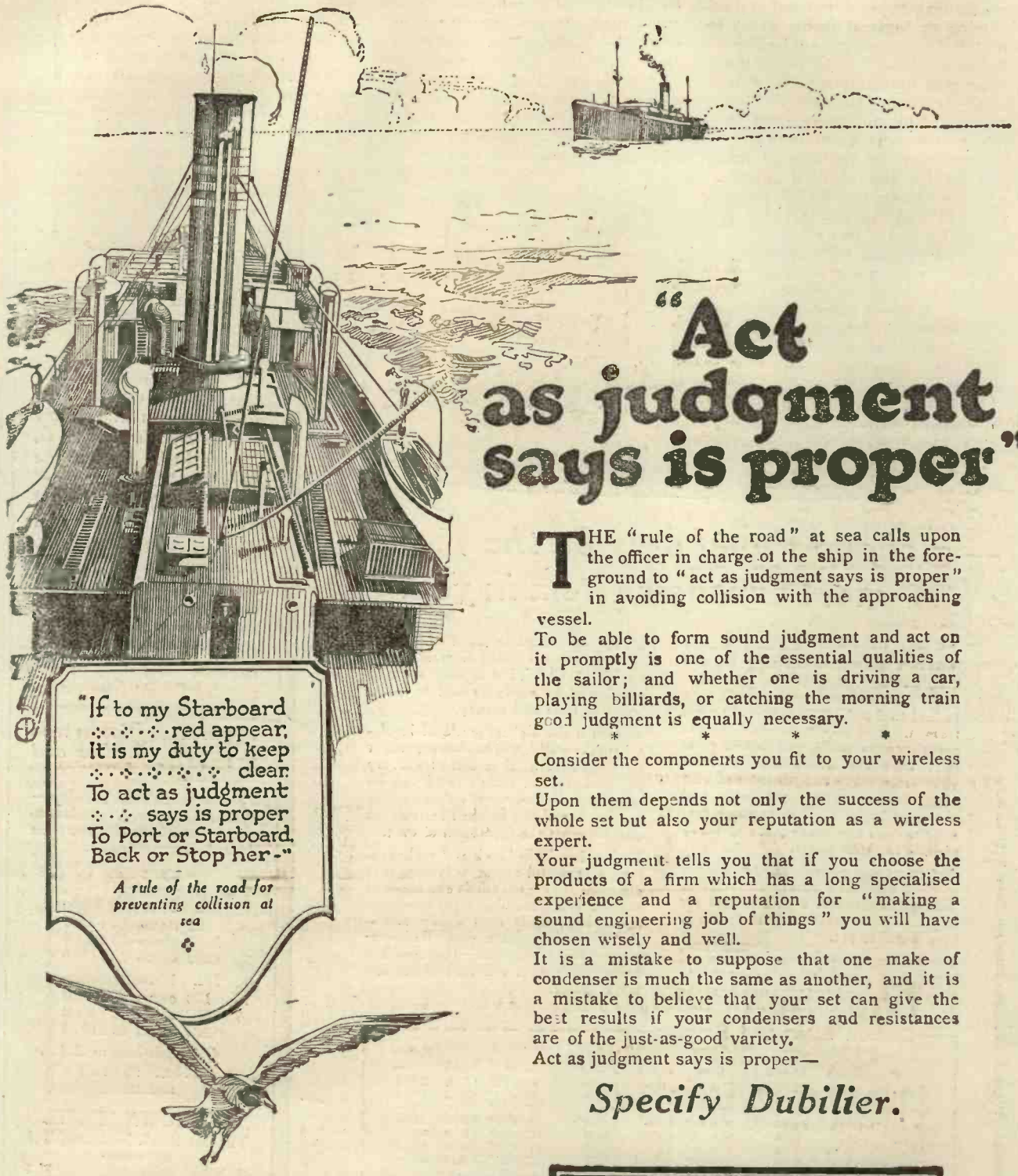
which enables one, both, or neither of the valves to be used at will.

Although the instrument can be used as a perfectly standard note-magnifier in conjunction with any receiving set which does not already possess low-frequency valves, it has been realised that provision must be made for the use of power valves and high anode voltages, in view of the increasing popularity of the smaller power valves of the semi dull-emitting type. An arrangement has therefore been incorporated of an internally mounted grid bias battery of adequate size, with a tapping switch and a potentiometer for the correct adjustment of grid bias.

**The Use of Switches**

The use of switches in wireless receivers and wireless circuits generally is a somewhat vexed question, but there can be no doubt that the large majority of people are prepared to sacrifice just a little efficiency to the great convenience given by a moderate and judicious use of good switching systems. The latest book of pictorial circuits published by Radio Press will therefore have a very wide appeal, its title being "Switches in Wireless Circuits," by Oswald J. Rankin (Radio Press, Ltd., 1s. 8d. post free). In this book each circuit is given in both the theoretical and the pictorial form, so that the book should appeal to both the advanced experimenter and those to whom theoretical circuit diagrams are as yet somewhat of a bugbear.

**Order Yours Now.**




# "Act as judgment says is proper"

THE "rule of the road" at sea calls upon the officer in charge of the ship in the foreground to "act as judgment says is proper" in avoiding collision with the approaching vessel.

To be able to form sound judgment and act on it promptly is one of the essential qualities of the sailor; and whether one is driving a car, playing billiards, or catching the morning train good judgment is equally necessary.

* * * *

Consider the components you fit to your wireless set.

Upon them depends not only the success of the whole set but also your reputation as a wireless expert.

Your judgment tells you that if you choose the products of a firm which has a long specialised experience and a reputation for "making a sound engineering job of things" you will have chosen wisely and well.

It is a mistake to suppose that one make of condenser is much the same as another, and it is a mistake to believe that your set can give the best results if your condensers and resistances are of the just-as-good variety.

Act as judgment says is proper—

## *Specify Dubilier.*

**DUBILIER**
**CONDENSER CO. LTD**

*Ducon Works, Victoria Rd., North Acton, London, W.3*

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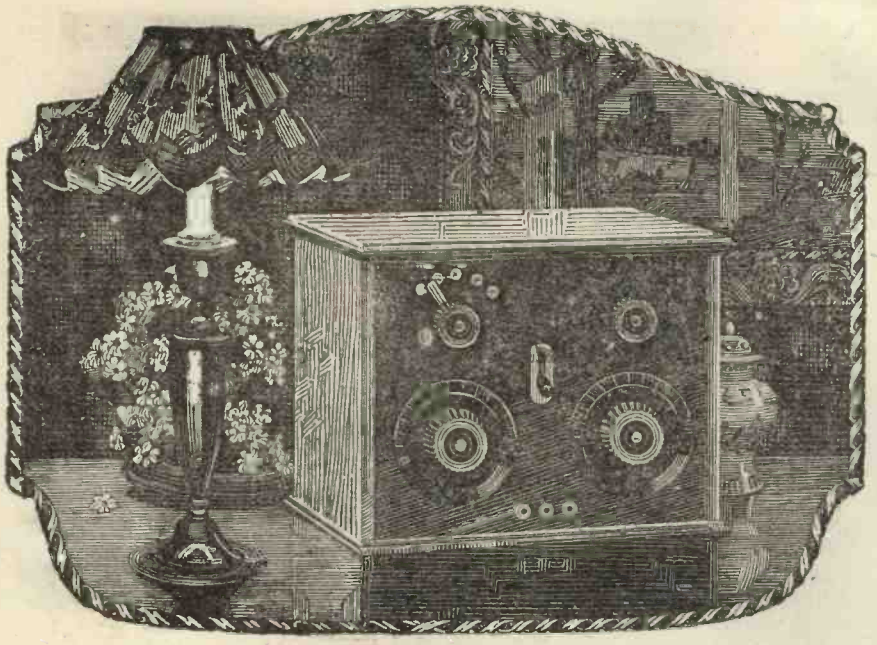

# —a cheap Panel may be the most expensive item in your Set

IF you have built a Set, you may have experienced the mortification of having spent several hours in drilling a panel and wiring it up only to find that not a note can be obtained from it. You may remember how, at great inconvenience, you looked carefully over the whole circuit. How you tested every component and still never a sound from your Set. And then, perhaps, you discovered you were using a low grade piece of leaky ebonite for your panel.

*Not everything masquerading as ebonite is worth using as a panel*—in fact, it is difficult to conceive a greater test for any insulation material than to use it in a Wireless Set.

The extremely weak impulses received upon your aerial, when conveyed to your Set, so readily leak away that the greatest care must be taken to preserve them if you are going to receive any signals at all. That is why a cheap panel can be easily proved to be a waste of time and money.

Radion is the highest grade of insulation in the world, and has been specially developed for wireless use. Its highly polished surface, which need not be removed before use, enhances the appearance of the finished instrument and prevents the formation of dust.

Radion is sold in black and mahoganite—a beautiful colour, very similar to old mahogany—with dials and knobs to match. It is packed in stout envelopes in the convenient sizes shown below. For your next Set choose Radion—every panel is stamped—then you can be certain that it will look better and work better.

**—Radion Sizes and Prices:—**

| Size | Black | Mahoganite | Size | Black | Mahoganite | Size | Black | Mahoganite |
|---|---|---|---|---|---|---|---|---|
| 6" × 7" | 3/6 | 4/3 | 7" × 14" | 8/- | 10/3 | 8" × 26" | 17/6 | 21/3 |
| 6" × 10½" | 5/3 | 6/6 | 7" × 18" | 10/6 | 12/9 | 9" × 14" | 10/6 | 12/9 |
| 6" × 14" | 7/- | 8/6 | 7" × 21" | 12/3 | 15/- | 10" × 12" | 10/- | 12/- |
| 6" × 21" | 10/6 | 12/9 | 7" × 24" | 14/- | 17/3 | 12" × 14" | 13/3 | 16/- |
| 7" × 9" | 5/3 | 6/6 | 7" × 26" | 15/- | 18/6 | 12" × 21" | 19/9 | 24/3 |
| 7" × 10" | 5/9 | 7/3 | 7" × 30" | 17/9 | 21/6 | 14" × 18" | 19/9 | 24/3 |
| 7" × 12" | 7/- | 8/6 | 7" × 48" | 28/- | 34/6 | 20" × 24" | 39/6 | 48/- |

Special Note.—All ¼ thick—quite sufficient owing to Radion's tremendous strength.

# RADION PANELS

American Hard Rubber Co. (Britain), Ltd., 13a, Fore Street, London, E.C.2

From all Dealers.

*Gilbert Ad.* 1950

# Experientia docet!

*THE very first Loud Speaker ever built for wireless use in this country was a creation of S. G. Brown Ltd. Indeed the very term "Loud Speaker" was actually originated by them to describe this entirely new Instrument. Its name on any Loud Speaker is visible evidence that it has been built by master craftsmen—that it definitely conforms to the highest scientific standards of sound reproduction—and that irrespective of purchase price its tone is perfectly lifelike and natural.*

*See it at your dealer's to-day—examine its superior workmanship—but, above all, hear it on actual demonstration.*

## Prices

H1. 21 inches high.
120 ohms £5 : 5 : 0
2000 ohms £5 : 8 : 0
4000 ohms £5 : 10 : 0

H2. 12 inches high.
120 ohms £2 : 5 : 0
2000 ohms £2 : 8 : 0
4000 ohms £2 : 10 : 0

Q. The de-luxe model £15 : 15 : 0 in all resistance

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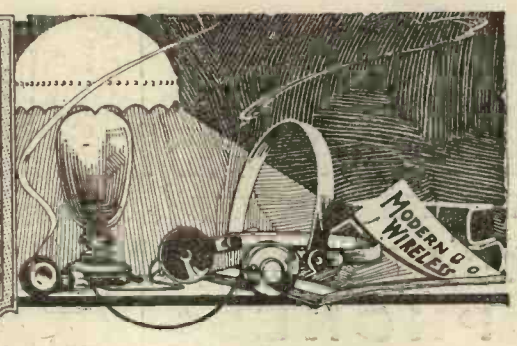
# Some Interesting Crystal Circuits

*Pictures and Diagrams of Simple Arrangements*




CRYSTAL receivers enjoy a large measure of popularity owing to the clear and pure reception obtainable with them. This quality given by a crystal detector is as vet unrivalled, and therefore to those who live within 10 to 15 miles of a main broadcast station the crystal receiver has a distinct appeal. This appeal is further strengthened by the fact that a crystal receiver costs next to nothing in upkeep, as there are no accumulators to be charged, no delicate filaments to break, and no high-tension batteries to be replaced. The only probable replacement is just a piece of crystal that can be renewed for the matter of a shilling or so.

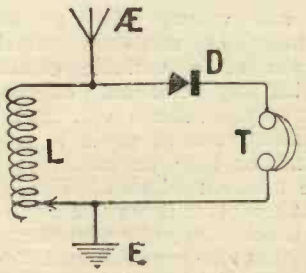



Fig. 1.—The slider method at its simplest.

### The Simplest Circuit

The circuit shown in Fig. 1 is one of the simplest. It consists of a coil with a single sliding contact, and can very easily be constructed by the absolute novice. Tuning is carried out by varying the position of the slider, and excellent results are to be obtained. The tuning coil for broadcast reception may

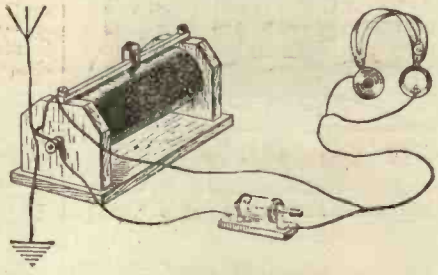


Fig 1a.—The first circuit shown in pictorial form.

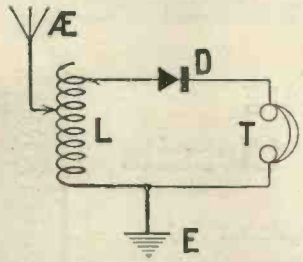



Fig. 2.—The use of two sliders.

consist of 100 turns of 20-gauge enamelled wire wound on a 3 in. cardboard tube, and if it is desired to receive the ship transmissions as well, this may be increased to 150 or 200 turns, depending on the size of the aerial employed. If the inductance is made large enough it can be used for receiving spark transmissions from ships and coastal stations on 600 metres, and gives a handy means for the amateur

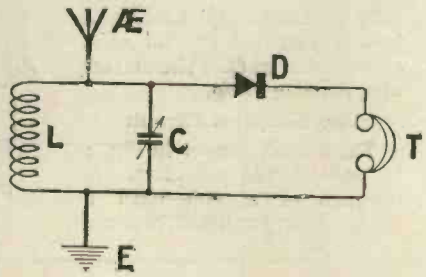



Fig. 3.—The plug-in coil and condenser method.

to obtain practice in Morse reception should he wish to do so.

### The "Two-Slider" Method

Fig. 2 shows another circuit, using a single-layer inductance in which two sliders are employed. By varying the position of the slider connected to the aerial, the aerial earth circuit can be tuned to the desired signal, and the slider connected to the crystal is then adjusted to give best results. It will generally be found that less turns of the inductance are required in the aerial circuit, thus giving a step-up effect to the crystal detector. When using either of the above

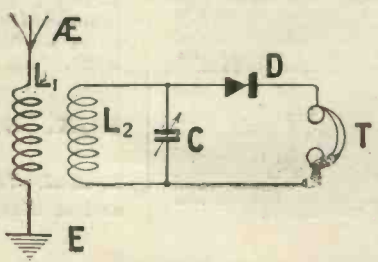



Fig. 4.—A little used method which is quite efficient.

receivers care should be taken to keep the sliding contacts clean, otherwise a loss in efficiency will result.

### For Plug-In Coils

For the experimenter who prefers to use plug-in coils, Fig. 3 shows the circuit that will be employed.

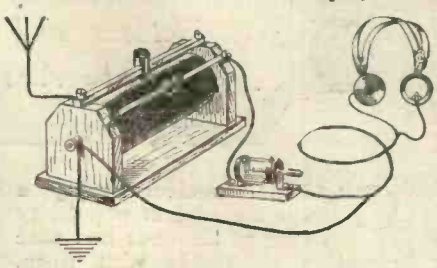


Fig. 2a.—The pictorial arrangement of Fig. 2.

A coil wound with a suitable number of turns is tuned by means of a variable condenser, which may be of ·0003 or ·0005 μF capacity. Such a coil may be a standard one as made by various firms, or may be constructed by the amateur himself. For broadcast reception it may be a 35 or 50-turn coil, depending on the wavelength to be received and the size of the aerial being used. Different size coils can also be plugged in to cover other wavelengths, such as 5XX or ship and shore spark transmissions.

If interference is experienced, a loose-coupled receiver as shown in Fig. 4 will probably assist in reducing it. This circuit employs two coils, which may be plug-in coils mounted in a two-coil holder so that the coupling can be varied between them, or it may consist of home-made coils mounted in any way the constructor may find

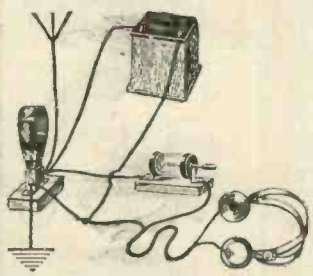


Fig 3a.—How to connect up the Fig. 3 circuit.

convenient to get the variation in coupling. The values of these coils will be a 35 or 50 coil in the aerial circuit and a 50 or 75 in the closed circuit for broadcast reception. This receiver is considerably more selective than the usual direct-coupled set and gives added experience to the beginner in tuning.

### The Variometer

If it is intended to receive over the broadcast band only, a receiver employing a variometer for tuning may be used. This is shown in Fig. 5. The variometer can be bought ready made or may be constructed by the amateur himself. The construction of a variometer is not a difficult matter, and the two windings can be wound on short pieces of cardboard tube so that one can rotate within the other. Wooden rotors of spherical

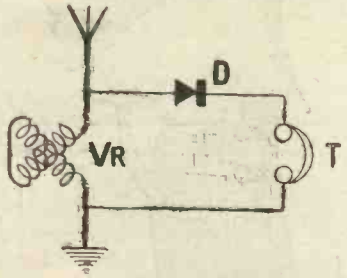



Fig. 5.—The variometer is very popular.

form can be obtained for a small sum, and the use of one of these allows the two windings to be much closer together, which, of course, increases the efficiency of the receiver. Approximately the correct number of turns to use for broadcast reception below 400 metres is 40; 20 to be wound on the larger diameter tube (a convenient size is 3 in. diameter), which is generally called the stator, and 20 turns on the smaller tube which turns inside the other and is

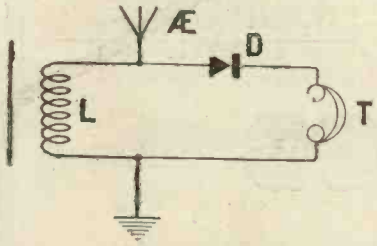



Fig. 6.—The metal "spade" is now used for tuning.

called the rotor. For wavelengths above 400 metres add ten turns to each winding.

### Spade Tuning

Fig. 6 shows a novel form of receiver which is very simple to construct and use. It employs a method of tuning known as "spade tuning." A coil is wound with a number of turns slightly in excess of that required to receive the local station, and a copper plate is mounted close to it so that it may be swung over the coil so as to cover it. It should, of course, be

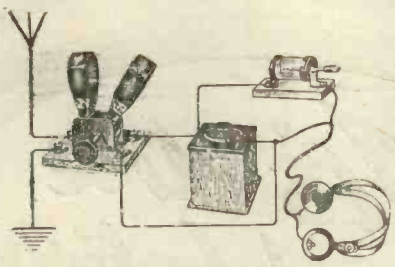


Fig. 4a.—The fig. 4 circuit shown in pictures.

quite close to the coil. The effect of covering the coil with this copper plate is to reduce its wavelength, and tuning may therefore be carried out by covering the coil more or less with the plate. A coil consisting of about 75 or 50 turns may be found suitable. This form of tuning does not appear to have been used to any extent, and we shall be glad to receive reports as to its effectiveness.

Lastly, remember that a receiver that gives excellent results on one aerial may not suit another, and therefore the amateur will do well

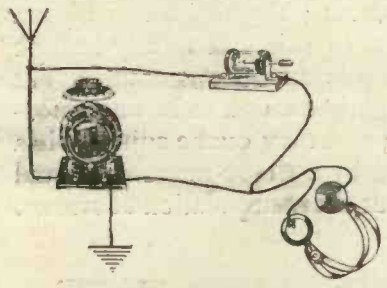


Fig. 5a.—How to join up a variometer.

to carry out experiments as to what receiver will give him the best results.

A hint or two may here be useful.

(1) Don't handle the crystal with your fingers. There is always a little natural grease on the skin and, if this is transferred to the crystal, it may spoil reception.

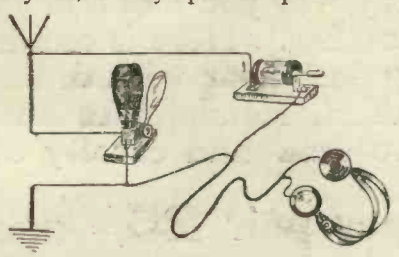
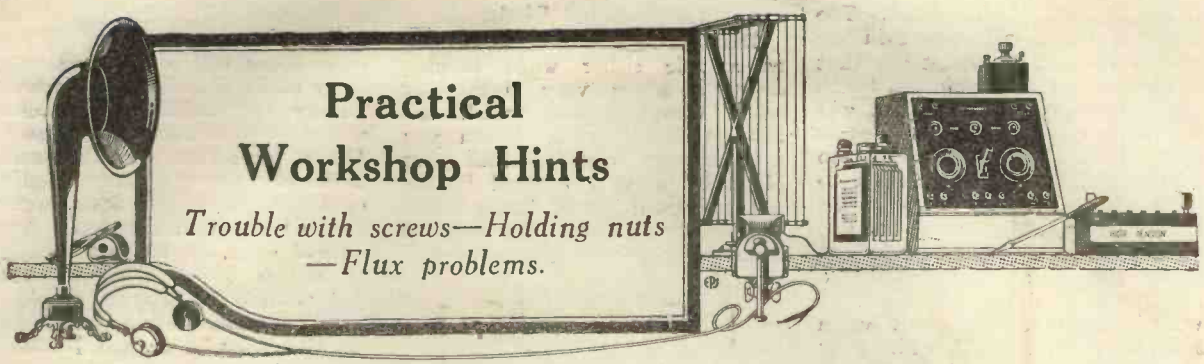


Fig. 6a.—How to tune by the spade method.

(2) If the crystal "goes off," don't scrape the surface; break a small piece off so as to obtain a new crystalline surface.



# Practical Workshop Hints

*Trouble with screws—Holding nuts —Flux problems.*

### Badly Mauled Screws

A blemish that one often sees both above and below the panels of a home-made set is that the heads of the various screws are rather badly mauled. The screwdriver has slipped whilst they were being turned home, with the result that the slots have lost their original clean-cut look. Often, owing to injuries of this kind, little jagged pieces of brass stand up on the heads of the screws waiting to catch one's fingers as they move over the panels. Screw heads are damaged in this way chiefly through the use of badly shaped screwdrivers whose blades do not fit properly into their slots. The constructor will find that the screw which he most commonly employs is that known as 4B.A., and he will be well advised if he provides himself with a screwdriver which is a really good fit for this size. The blade should be ¼ in. in width or a little less, but must not be very much less or it will not obtain a good enough grip. It must certainly not be wider if countersunk screws are used, for, if it is, its corners will scratch the ebonite panel when these screws are being driven right home. But the most important point of all is to see whether the blade of the screwdriver really fits into the slot of the screw. To do this, push the blade as far as it will go into the slot of a screw and then hold it up to the light. A well-fitting blade will seat itself in the slot as shown in Fig. 1A; that is to say, it will go right down to the bottom and

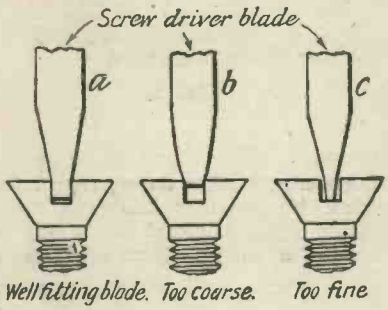
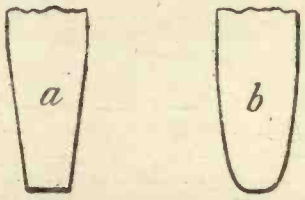



Fig. 1.—How a screw-driver blade fits.

it will fit closely to the sides. Too coarse a blade will appear in the slot as seen at B, whilst one that is too fine for the work will touch the bottom of the slot, but will not be in contact with its sides as seen at C. If the blade is too coarse it is absolutely certain to slip when the screw is being tightened up, whilst if it is too fine it will have a tendency to get "off centre" as the screwdriver is turned, in which case it will be wrenched out of the slot when any force is applied. Fit your screwdriver by filing it until it seats itself really well. With a screwdriver that is a good fit it is easy to do good work, but when it is either too coarse or too fine matters become difficult even for those who have some skill in the use of tools. When filing up your blade make sure that the edge is perfectly straight and that the corners are square (Fig. 2A). A sloping edge or corners that are round both mean that the blade will be very liable to slip. Always buy screwdrivers of good quality; cheap ones are usually either too hard, in which case they break when force is applied, or too soft, which means that the point soon gets out of shape.

### Centring the Blade.

Damage to screw heads is done as a rule either when turning down a screw very tightly or when loosening one which has become firmly fixed. When you are screwing down see that your blade is properly centred in the slot and push it well home before you start to turn. To keep it from going off centre it is as well




THE CORNERS MUST BE SQUARE AS AT "a." IF THEY ARE ROUNDED AS AT "b" THE BLADE WILL SLIP.

Fig. 2.

to use the left hand as a guide. Loosening a tight screw, especially when its head is made of such easily injured metal as brass, is always a matter that requires a little care. The great thing to remember is that the point of the blade must be well seated in the slot and pushed right home before any twist is given. A very tight screw will often come away fairly easily if a slight *clockwise* or "screw up" twist is given before any attempt is made to unscrew it. Always press heavily on the handle of the screwdriver when attempting to loosen a firmly fixed screw. Screws whose heads have been injured need not be thrown away as useless unless they are very badly mutilated. Any jagged pieces can be removed with a fine file and the slot may be deepened a little with a hacksaw. Whilst this job is in progress the screw should be held in the vice, but the soft sheet-lead protectors to which I have previously referred in these notes must be used in order to protect its threads from injury.

### Watch the Nuts!

Screws are not the only sufferers at the hands of a careless workman. If you look at the nuts on his set you will often find that the corners between the flat faces are so worn away that the nuts themselves are more nearly round than of hexagonal shape. This is nearly always due to the fact that pliers are used for tightening down nuts. Fig. 3 shows how poor is the grip

obtained on a nut by the jaws of a pair of ordinary pliers. It will be seen that they come into contact merely with its top edge and that they get no hold at all upon the flat faces. When any force is applied the pliers are almost certain to slip, chipping little pieces off the corners of the nut as they do so. Not everyone knows that special nut pliers such as those shown in Fig. 4 are obtainable quite cheaply from any good tool shop. As will be seen from the drawing, these obtain a firm hold on the faces of the nut and enable it to be turned home without injury to the corners. A pair 5 or 6 in. in length will enable the constructor to deal with any of the nuts that he is likely to use in making either complete wireless sets or small pieces of apparatus. Better still is the box spanner.

Fig. 3.—A bad grip.

This is simply a length of metal tubing one end of which is shaped to a hexagon form to make it fit tightly over nuts of a particular size. These are now obtainable from most wireless shops and tool shops in all B.A. sizes from 0 to 6. Their cost is only a few pence apiece. In most cases each box spanner is made to fit two different sizes of nut, one end being, say, 4B.A. and the other 6B.A. With a box spanner, if it fits properly, it is practically impossible to burr the edges of a nut, and it has the very great advantage that it enables you to get at nuts in all kinds of awkward corners into which the pliers will not go. There is, however, one slight drawback, which is not due to any fault of those who make the spanners. A great many of the B.A. nuts now sold at very low prices are made on the Continent and they are not of the correct dimensions, some being too large and some too small. This means that if you buy your nuts from several different shops you may find that your box spanners do not fit all of them as they should. The remedy is to purchase always from reliable firms. It is, after all, poor economy to save a halfpenny over the purchase of a dozen foreign-made nuts whose threads are often very badly cut, with the result that they are either so tight that they cannot be forced on to standard B.A. screws, or so loose that they strip if any force is used to tighten them.

### Fitting Valves

Many constructors have difficulty in marking out and drilling valve holders correctly. It is most important that the legs when mounted should be a proper fit for the pins of the valve. If they are too loose contact may be "chancy," whilst if the holder is too tight a fit the valve can be inserted or removed only by the exercise of a certain amount of brute force, which is not at all good for its health. There are two ways out of the difficulty. The first is to use good holders with the legs already in place, and which require only one screw to fix them. This is a satisfactory method, provided that well-designed holders made of good quality ebonite are used. Cheap ones not infrequently make the luckless constructor's last state worse than his first, for their legs may be very badly spaced, whilst the compound in which they are embedded is occasionally anything but a good insulator. Valve holders made by good firms have none of these drawbacks, and they may be mounted with every confidence. The second way of making matters easy is to provide oneself with a valve template, of which several types are now on the market. One very useful pattern has four little points correctly spaced. It is placed in the right position on the panel, and then a single tap with a hammer

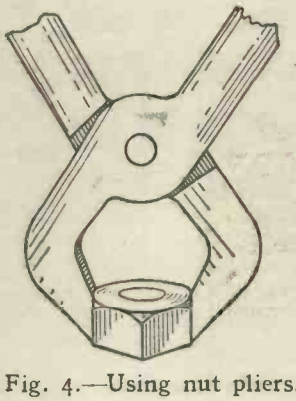


Fig. 4.—Using nut pliers.

serves to mark the centres of the four holes required when separate valve legs are used. Another kind is really a drilling jig. It consists of a metal plate containing four 4 B.A. clearance holes properly spaced to fit the prongs of a valve. To use this clamp it to the panel in the required position and run the drill through each of the holes in turn. Either kind is most useful,

for it removes almost every chance of error. If he is provided with a template or jig, the only way in which the constructor can go wrong is in failing to hold his hand drill quite straight whilst he makes the holes in the panel. When this happens, the valve holder may be a bad fit, since, though the holes are correctly spaced at their point of entry into the panel, the same will not be true of the tops of valve legs mounted in them, owing to the slope of their shanks. Should you find difficulty in drilling quite straight, it is not a bad tip to make valve leg holes with a drill one or two sizes larger than No. 26, which is the proper size for 4 B.A. clearance. Before tightening up the nuts on the shanks of the valve legs, insert an old valve into the holder. Thanks to the play which the larger holes give the legs will be able to take up their proper positions, and when the retaining nuts have been tightened down, a well-fitting holder will result.

### Types of Metal Screw

The constructor may use any of the four types of metal screw seen in Fig. 5. Of these the round head and the countersunk are the most suitable for the upper sides of panels, and the cheese head is very useful for securing components to the undersides. The grub screw, which has no head at all, is often employed for securing pinions, knobs and so on to spindles. A grub screw can be made quite easily by cutting a slot with a

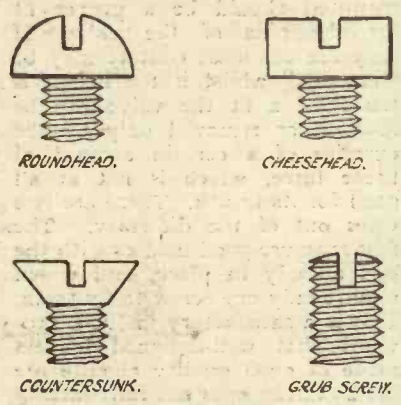



Fig. 5.—Four types of screw head.

hacksaw in the top of a piece of studding of the required length. Provided that it is properly fitted, the countersunk screw is the best type to use on the upper surface of one's panels, owing to its very neat appearance and to the fact that since its top is flush with the ebonite, it is quite out of the way. Few things, however, look worse than badly done countersinking, when the heads of some screws are slightly above the level of the panel, whilst others are too deeply sunk and only a few lie quite flush. Countersinking *can* be done by making a few turns with a large drill at the top of each clearance hole. This, however, is not a method to be recommended, for ebonite at any rate. Large drills, if sharp, make a deep cut, and it is so easy to get the hollow just a trifle too deep when they are used. Further, the slope of the drill point is not quite the same as that of the head of the countersunk screw, so that a good fit is not obtained as a rule when the required hollows are made in this way. The best tool to use is a small metal countersink with a ¼ in. shank, which fits easily into the chuck of the hand drill. These countersinks are made with several varieties of slope, but if you purchase from any good tool shop you will have no difficulty in getting one which is exactly right for 4 B.A. screws. The countersink should not be revolved rapidly, or it is liable to polish instead of cutting. Do not use too much pressure and turn the crank of your drill at quite a moderate speed, slowing down at once if the tool

shows any signs of failing to "bite." Before you attempt to countersink holes on a finished panel you will be well advised to practise a little on a piece of scrap ebonite. In this make a number of 4 B.A. clearance holes and countersink them one by one, taking out very little at a time and trying a screw at frequent intervals until you are able to make it lie quite flush. A little practice of this kind enables you to discover the right amount of pressure to apply and the number of turns of the crank needed to produce the required depth. When countersinking with a hand drill it is most important to see that the tool is kept at right angles to the panel. If this is not done the holes will be slightly oval in shape and the heads of screws will not fit properly into them.

### Which Flux ?

Which is the best flux to use for soldering? This is a question that one often hears asked. There are numbers of excellent prepared fluxes on the market any one of which will be found suitable for wireless work. Perhaps the most important thing about any flux used for this kind of job is that it should not have a strong corrosive action upon brass or copper. Tinsmiths and workers in many other trades use almost invariably "killed spirits." This is a delightful flux to use in many ways, for with it solder flows well and takes easily.

A pocket crystal set now being sold in Berlin.

### Corrosion

It is, however, quite unsuitable for wireless work, since it has a strong action upon brass and copper. If joints are made with its help corrosion will occur in time, with the result that a high resistance will be set up, or even that the joints may come apart of their own accord after some time. The safest of all fluxes to use is, I think, finely powdered resin. This has no corrosive action whatever, but it is not easy to use until one has acquired a certain amount of skill with the soldering iron. The beginner will do well to employ one of the pastes or fluids obtainable from tool shops, but he should assure himself by inquiry that it is not of the acid type. The great thing with any flux is not to use too much of it. If the iron is clean and properly heated only the tiniest touch of flux is needed to make a secure joint. Beginners generally make the mistake of using a half cold iron with a dirty point. With this solder cannot be made to run freely from the stick, and what generally happens is that large quantities of flux are used in the hope that matters will be improved thereby. The sequel is usually an unsightly and insecure joint, whilst the panels are covered with splutterings.

R. W. H.

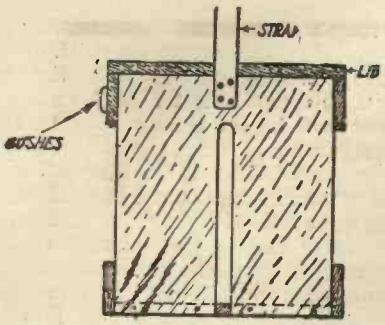


Fig. 1.—Showing the end slot.

# Take Care of Your Accumulators!

*A carrying case is really a necessity, and is quite easily made, as this article shows*

AN accumulator carrying case is one of the necessities of the amateur. Besides making the carrying of the accumulator to and from the charging station an easy matter, it will, if provided with a lid or top, keep the battery clean. If an accumulator is left even for a short time, it is surprising how much dust and dirt is collected. This partially short circuits the battery, not to any great extent, but sufficient to reduce its working life.

A suitable case which has given the writer much satisfaction is described here. A novel idea has also been incorporated, which makes the lifting of the cells from the case, when necessary, an easy matter.

### Accumulator Sizes

As accumulators vary considerably in size no sizes will be given, but a reference letter will be used. All that need be done, is to measure up your accumulator and add the measurements as given here.

A will be taken as the overall height of the battery.

B will be taken as the overall length of the battery.

C will be taken as the overall width of the battery.

The pieces of wood required to build this case are as follows :—

2 Pieces, A + 1″ × C + ¼″ × ⅜″ thick. (Ends.)

4 Pieces B + 1″ × 2 × ⅜″ thick. (Sides.)

1 Piece C + ¼″ × B + ¼″ × ⅜″ thick. (Bottom.)

2 Pieces B + 1″ × C + 1″ × ⅜″ thick. (Top.)

The wood should preferably be teak, but other woods may be used. In any case all the pieces of wood should be soaked in hot wax, or given a good coat of anti-sulphuric enamel.

Further requirements are :—

A leather strap.

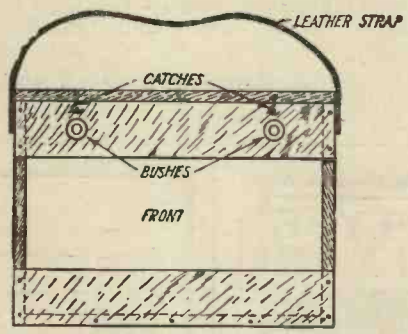


Fig. 2.—A side view.

About 3 doz. 1 in. No. 6 steel countersunk wood screws.

2 steel hinges.

2 finger catches.

And two ebonite bushes.

The two end pieces have a slot cut ¼ in. wide and 1 in. from the top, as shown in Fig. 1.

The whole case is then knocked together with small nails. The construction is shown in Fig. 2.

The steel screws are first given a liberal coat of vaseline, to prevent the acid from attacking the metal, and then screwed into position.

The lid is then fitted with a pair of hinges, which should also be treated with vaseline.

### A Novel Idea

Two holes are drilled in one of the front battens to take two ebonite bushes for the leads.

The leather strap, sufficiently long to allow of the lid opening, should now be fitted.

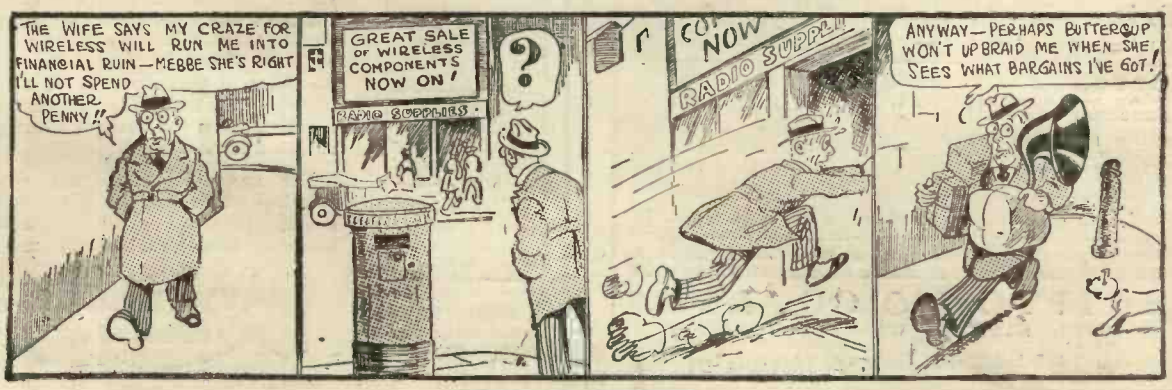
The finger catches may now be attached, and given a touch of vaseline.

A small piece of wood should be inserted in the slots and the accumulator lowered into the case, by means of it.

This, of course, should be removed when the accumulator is at the bottom.

## *TRY THIS!*

**If the filaments of your valves begin to flicker, the securing nuts on your accumulator are probably loose. Try tightening them.**



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| Brunet Transformer | 13 6 |
| L.E.S. Micro Control (Fil-Res.) | 3/6 |
| Telefunken Type, 4,000 ohms | 12 6 |
| 12 yds. Red and Black Twin Flex | 2 6 |

**MANSBRIDGE CONDENSERS (Fixed). Post 3d.**
Pass all tests. Accurate, Noiseless.

| | | | |
|---|---|---|---|
| ·01 | 2/3 | ·05 | 2/3 |
| ·25 | 2/11 | ·05 | 3/3 |
| 1 mfd. | 3/6 | 2 mfd. | 3/9 |

77, Wymering Mansions, Maida Vale, W.9. 20/8/24.

Have just tried out one of your Square-Law variable condensers with vernier attachments. As an instrument it fully maintains the high standard of efficiency which is to be found in all condensers hitherto sold by you, and I have found it unapproachable by any other type for use in tuned anode circuits. With all good wishes.
(Signed) CHARLES HAMBOURG.

**SUCCESS.**

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| 2-way Vernier | 5/6 |
| Super Black L.F. | 21/- |

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| PHILLIPS "R" VALVES | 6/11 |
| FRENCH "R" VALVES | 6/11 |
| ·06 VALVES | 12/6 & 13/11 |
| DUTCH "R" | 5/- |
| METAL ·06 | 15/11 |
| MYERS' (universal) | 12/6 |
| MYERS (D.E.) | 21/- |

Post 6d. each.

**L.F. TRANSFORMERS.**

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|---|---|
| Eureka Concert Grand | 30/- |
| 2nd Stage | 22/6 |
| Igranic New Model | 21/- |
| General Radio 83 | 15/- |

Also see illustrations.

## NOTE NAME RAYMOND

Nearest Tube: Leicester Square.

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| Lead-in tube, 6d., 7d., 8d. | |
| Valve Pins & Nuts, 2 a 1d. | |
| Stop Pins & Nuts, 2 a 1d. | |
| Nickel Terminals | 2d. |
| Nickel Contact Studs, 2 for 1½d. | |
| Nickel Switch Arm, (one-hole fixing) | 1/- |
| Volt Meter | 4/6 |
| Gamages Permanite | 1/- |
| Condenser Brushes | 6d. |

**RAYMOND FIXED CONDENSERS**

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|---|---|
| ·001, ·0001, to ·0005 | 10d. |
| ·002, ·003, ·004 | 1/- |
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**ACCUMULATORS**

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| 2 v. 40 amps | 9/6 |
| 4 v. 40 amps. | 16/6 |
| 4 v. 60 amps. | 18/6 |
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| Variometers (special) | 1/6 |
| Ditto, with clips, etc. | 2/3 |
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Also at 3/11, 4/3, 4/6, up.

**SPECIAL OFFERS.**

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| 2-way Coil Stands | 1/5, 1/9 |
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| Large Detectors | 11d. |
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| Ditto Extra Air Space | 1/8 |
| 'Phones, 4,000 ohms | 6/11 |
| N. & K. PATTERN, 4,000 ohms | 8/11 |
| Variable Grid Leaks | 1/2 |
| Valves for Unidyne | 12/- |
| 5-pin ditto | 13/11 |
| Porcelain D.P.D.T. | 1/4 |
| Ditto, S.P.D.T. | 11d. |

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**OUR WONDERFUL MICROMETER ADJUSTMENT GLASS ENCLOSED DETECTOR, WHY PAY MORE? 1/9**

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| 4 Taps & Wrench | 2/11 |
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| D.C.C. Wire, per ¼ lb.— | | | |
| 13 g. | 9d. | 20 g. | 9d. |
| 22 g. | 10d. | 24 g. | 1/- |
| 26 g. | 1/1 | 28 g. | 1/3 |
| 30 g. | 1/6 | etc., | etc |

**H. T. BATTERIES**

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|---|---|
| 60 v. | 7/6 |
| 30 v. | 4/6 |
| 60 B.B.C. | 9/6 |
| 36 B.B.C. | 5/6 |
| 9 v. B.B.C. | 2/6 |
| 1·5 (D.E.) | 1/9 |
| Ditto | 2/- to 3/- |

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|---|---|
| Legless Valve Holder | 1/- |
| Solid Rod Ditto | 1/- |
| Under Panel Ditto | 1/6 |
| Valve Templates | 2d., 4d. |
| Electron Aerial | 1/3½ |
| Adhesive Tape Roll | 2½d. |
| Copper Foil per foot | 2½d. |
| 1 in. Fibre Strip 3 ft. | 2d. |
| Insulated Hooks | 4 for 3d. |
| Ditto Staples | 5 a 1d. |

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| Microstat | 2/6 |
| Switch Arms, 8d. to | 1/- |
| Flex (Red and Black) 12 yds. | 2/- |
| Shellac | 5d. |
| Loading Coil and Plug | 8d. |
| Contact Studs, 4 for | 1½d. |
| Nickel Ditto, 2 for | 1½d. |
| Nickel Switch Arm | 1/- |
| Sorbo ear caps, pair | 1/4 |
| Tumbler Switches | 1/4 |

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| D.P.D.T. SWITCHES | |
| Min Panel | 1/- |
| On China base | 1/6 |
| On Ebonite base | 1/11 1/6 |
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| Miniature Panel | 10½d. |
| On China base | 11d. |
| On Ebonite | 1/3 to 1/9 |
| Murray Valve Holder | 1/3 |
| Spring Washer | 4 a 1d. |
| Coil Plug on Base | 10d. |

| | |
|---|---|
| Twin Flex, 4 yds. | 6d. |
| Twin Silk Small 6 yds. | 6d. |
| D.C.C. Bell Wire 10 yds. | 5d. |
| Knobs, 2 B.A. 2d., 3d., | 4d. |
| Small Knobs 6 B.A. | 3d. |
| Small Knobs 4 B.A. | 3d. |
| Wander Plugs pair | 3d. |
| Egg Insulators, each | 1d. |
| Tape Aerial, 100 ft. | 2/- |
| Valve Windows, 4d. to | 9d. |
| Mica | 2d. |

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| Phone Cords 6ft. | 1/- & 1/3 |
| Nugraving | 6½d. |
| Empire Tape, 2 yds. | 1d. |
| Allen Var. Grid Leak | 1/5 |
| Best Sleeving, 3 yds. | 10d. |
| Rubber Lead-in 10yds. | 1/- |
| Thick ditto, 1d., 2d. & | 3d. |
| Aerial, 7/22 100 ft. | 1/10½ |
| Ditto, Extra Heavy 100 ft. | 2/3 |
| Anti Cap. Handles | 8d. |
| Tumbler Switches | 1/- |

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|---|---|
| De Luxe Crystal Set | 7/11 |
| 4 Whiskers, 1 Gold | 2d. |
| Coil Plugs (ebonite) | 4½d. |
| Ditto | 6d., 8d. |
| Shaped | 8½d., 1/- |
| 5 ohm Rheostat | 1/3 |
| Various | 1/3, 1/6, 1/9, 1/11 |
| With Dial | 1/11 |
| Ormond | 1/9 |
| 'Phone Connector | 1d. |
| Nuts 2, 4, 6 B.A. doz. | 2d. |
| Washers | 12 a 1d. |

**RAYMOND CRYSTAL SETS 7/11 9/11 12/11**

**BUS-BAR**

| | |
|---|---|
| 1/16 sq. | 12 ft. 6d. |
| 18 g. sq. | 15 ft. 5d. |

BUY RAYMOND GOODS

**BOXES.**
7 x 5 10 x 8 12 x 12
3 x 6 9 x 4
16 D.C.C. STOCKED.

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|---|---|
| 4 B.A. rod, per ft. | 2½d. |
| 4 B.A. rod, per ft. | 2d. |
| Basket Holders | 8½d. |
| Also at 10d., 1/-, 1/3, | 1/6 |
| 2-way Coil Stands | 1/11 |
| 3-way ditto | 4/3 |
| 2-way with ex handles | 2/11 |
| 3-way ditto | 4/9 |
| 4·5 Batteries | 4½d., 5d. |
| Brass Coil Former | 2/11 |

| | |
|---|---|
| 5 waxless Coils | 1/4 |
| 200/2000 | 1/5 |
| 5 equal 25 to 100 | 1/11 |
| 5 ditto, Extra Air Space | 2/8 |
| 6 waxed 200/3600 | 1/8 |
| 7 waxed 150/3600 | 1/11 |
| Chelmsford D.C.C. | 1/-, 1/3, 2/6 |
| With adapter, 9d. extra. Switch Arm, 12 Studs, 12 Nuts, 12 Washers, Lot 10½d. | |

| | |
|---|---|
| EBONITE STOCK SIZES | 6x 6 .. 1/4 |
| | 7x 5 .. 1/10 |
| | 9x 6 .. 2/- |
| | 10x 8 .. 3/- |
| | 12x 6 .. 3/- |
| | 12x 9 .. 4/3 |
| | 12x12 .. 5/6 |
| 3/16 in. | 14x10 .. 5/6 |
| | WE STOCK |
| Cut to size ¼d. sq. in. | ¼-in. EBONITE. |

**ACCUMULATORS BOUGHT HERE CHARGED FOR 1/- TO 3/- ACCORDING TO SIZE**

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**All these Goods sent by Post. Foreign Packing & Post extra. Orders in rotation**

## "DE LUXE" MODEL

AS SHOWN, WITH DIAL, KNOB AND BUSH.

| | |
|---|---|
| ·001 ... | ... 7/3 |
| ·0005 | ... 5/11 |
| ·0003 | ... 5/4 |
| ·0002 | ... 4/11 |

POST 6d. SET.

UNSURPASSED FOR FINE TUNING.

John Blair, Esq., Rexall Pharmacy, Millom, says :—
"Your Condensers are a REVELATION to me as a Dealer. Sept., 1924."
C. Walton, Esq., Andover :—
"Tested your Condensers on Megger and got 'INFINITY.'"

## NEW MODEL

With knob and dial.
With Vernier.

| | |
|---|---|
| ·001 ... | ... 8/6 |
| ·0005 | ... 6/11 |
| ·0003 | ... 6/6 |

With EBONITE DIAL and Two Knobs Post 6d. Set.

## TWIN CONDENSER

SQUARE LAW
EBONITE ENDS.

| | |
|---|---|
| ·00025 | ... 12/6 |
| ·0003 | ... 12/6 |
| ·0005 | ... 18/11 |

TWIN (ordinary)

Equal units of ·00025 or ·0003, Complete with Knob and Dial. 9/-

## NEW MODEL

SQUARE LAW
WITH VERNIER.

| | AL'MN ENDS | EBONITE ENDS |
|---|---|---|
| ·0003 | 8/6 | 10/6 |
| ·0005 | 8/11 | 11/6 |

With Knob and Dial. Post 6d.

## HEADPHONES.

We can recommend these as being excellent Headphones, with a great reputation.

B.T.H. 4,000 ohms ... ... ... 25/-
G.R.C. 4,000 ohms ... ... ... 20/-
BRANDES 4,000 ohms (Matched tone) ... ... 25/-
BROWN'S 4,000 (featherweight) 25/-
STERLING 4,000 ohms ... ... 25/-

ALL POST FREE.

**DUBILIER.**

·001, ·002, ·003, ·004, ·005, ·006 Fixed .. 3/-
·0001, ·0002, ·0003, ·0004, ·0005 .. .. 2/6
Type 577, ·01 .. .. 7/6
Grid Leaks, each .. 2/6
Anode Resistance 50,000, 70,000, 80,000 100,000, on stand complete .. .. 5/6

**IGRANIC.**

Coils: 25, 5/-; 35, 5/-; 50, 5/2; 75, 5/6; 100, 7/-; 150, 7/10; 200, 8/8; 250, 9/-; 300, 9/5; 400, 10/3; 500, 10/6.
Fil. Rheostat .. .. 4/6
Potentiometer .. 7/-
30-ohm Rheostat .. 7/-

**WATES MICROSTAT.**

For D.E. or R. Valves 2/9 Post Free.

ACCUMULATORS FOR CALLERS ONLY at present. See Callers' List.

Formo, open 12/6

47 Bucks "Powquip," 12/6

Manchester "Powquip," 15/6

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Shrouded "Powquip," 18/-

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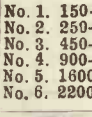
**BRETWOOD** (New Model)
Var. Grid Leak .. 3/-
Anode Resistance .. 3/-

**FRENCH THOMSON-HOUSTON**
4,000 ohms Phones.
Wonderful Tone. Magnificent for Crystal Sets. 15/11 pair.

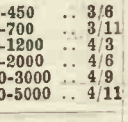
FERRANTI 17/6

No. H.F. 33 Plug-in ENERGO Transformers.

| | |
|---|---|
| No. 1. 150-450 | .. 3/6 |
| No. 2. 250-700 | .. 3/11 |
| No. 3. 450-1200 | .. 4/3 |
| No. 4. 900-2000 | .. 4/6 |
| No. 5. 1600-3000 | .. 4/9 |
| No. 6. 2200-5000 | .. 4/11 |



14 Voltmeter 5/-

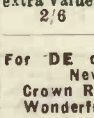


21 C and S, one-hole fixing, 1/6

16 Rheostat, with Dial, extra value, 2/6

44 Bretwood, Valve-holder 1/9

For DE or R Valves. New type Crown Rheostat. Wonderful Value. POST FREE 2/6



49 FORMO SHROUDED. 18/-

**WATMEL**

Var. Grid Leak .. 2/6
Anode Resistance .. 3/6

LONDON'S LARGEST Stockist of

## JACKSON BROS.'

**"J. B."** Variable Condensers, Complete with Knob and Dial.

| SQUARE LAW | | STANDARD | |
|---|---|---|---|
| ·001 .. .. | 9/6 | ·001 .. .. | 8/6 |
| ·0005 .. .. | 8/- | ·0005 .. .. | 7/- |
| ·0003 .. .. | 6/9 | ·0003 .. .. | 5/9 |
| ·0002 .. .. | 5/6 | ·0002 .. .. | 5/- |

Other sizes as advertised by "J.B."

**STERLING SQUARE LAW.**
With Vernier.

| | |
|---|---|
| ·001 .. .. | 30/- |
| ·0005 .. .. | 25/6 |
| ·00025 .. .. | 23/6 |

**POLAR.**

| | |
|---|---|
| ·001 var. Condenser | 10/6 |
| ·005 " " | 10/6 |
| ·0003 " " | 10/6 |
| Cam Vernier 2-way Coil Holder .. | 11/- |

"POLAR" MICROMETER CONDENSER. 5/6

41 AMPLION Dragon Fly. 25/-

43 BASKET 2-way, 4/11.

**McMICHAEL'S H.F. TRANSFORMERS.**

32

150- 300
300- 600 10/-
1,100-3,000 each (Manufacturer's advance.)
100,000 ohms Fixed .. 2/6
2 meg. Leak 2/6
Both with clips.

**N and K** No. 3, Latest Model 17/6

New 3-pole Laminated Magnets, which ensure an even magnetic pull and still greater volume. Windings well insulated. Large size earpieces and leather headbands of standard "N. & K." comfortable design. Technically, "N & K." Headphones represent the last word in Wireless Reception.

IMPOSSIBLE TO EQUAL FOR CRYSTAL SETS.

**EDISON BELL.**

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|---|---|
| ·0001 to ·0005 Fixed | 1/3 |
| ·002 to ·006 .. .. | 2/- |
| ·001 .. .. .. | 1/3 |
| ·0003 with Grid Leak | 2/6 |
| Variometer .. .. | 10/6 |
| Twin Detector .. | 5/6 |

**GOSWELL ENGINEERING.**

| | |
|---|---|
| Patent Valve Holder | 1/6 |
| Goswell 2-way Coil Holder .. .. | 5/6 |
| Goswell 2-way Vernier Coil Holder | 9/- |
| Goswell 3-way Coil Holder .. .. | 7/6 |
| Goswell 2-way Panel Mounting .. .. | 3/- |
| Goswell 3-way Panel Mounting .. .. | 5/- |
| Goswell 3-way Cam Vernier .. .. | 12/6 |

**LISSEN.**

| | |
|---|---|
| Variable Grid Leak | 2/6 |
| Anode Resistance | 2/6 |
| Lissen Minor .. | 3/6 |
| Lissenstat .. .. | 7/6 |
| Do. Universal .. | 10/6 |
| 2-way Switch .. | 2/9 |
| Series Parallel .. | 3/9 |
| T1 Transformers .. | 30/- |
| T2, 25/-; T3, 16/6; Coils: 25, 4/10; 30, 35, 40, 4/10; 50, 5/-; 60, 5/4; 75, 5/4; 100, 6/9. | |
| 5-point Switch .. | 4/- |
| Lissen Choke .. | 10/- |
| Aux. Res. .. .. | 1/3 |

"R.I." NEW MODEL IN SEALED BOX.
Don't Buy Otherwise.
Post 25/- Free.

**"BABY" COIL STANDS**

| | |
|---|---|
| 2-way on base .. | 3/- |
| 3-way on base .. (brass fittings) | 4/9 |
| 2-way ex. handles .. | 4/6 |
| 3-way do. .. .. (nickel fittings) | 5/6 |
| 2-way Cam Vernier, high-class .. .. | 5/9 |
| Several high-grade patterns. | |
| 2-way .. at 5/-, | 5/6 |
| 3-way .. at 6/11, | 7/6 |

ALL VALVES ON POST SENT AT PURCHASER'S RISK

## VALVES

THORPE K4 (5-pin) 17/6
PHILLIPS 4 ELECTRODE 12/6
(Both for UNIDYNE.)

**BRIGHT EMITTER.**

**12/6** each

| | |
|---|---|
| B.T.H. .. .. | R. Type |
| Ediswan | A.R. " |
| Marconi-Osram R. or R 5 V | " |
| Mullard-Ora .. | " |
| Cossor .. | P.1 " |
| Cossor | P.1 " |
| Myers-Universal | |
| Mullard H.F. (Red Ring) | |
| Mullard L.F. (Green Ring) | |

**DULL EMITTER.**

| 21/- each | Type |
|---|---|
| B.T.H. .. .. .. | B.3 |
| Ediswan .. | A.R.D.E. |
| Marconi-Osram | D.E.R. |

| 25/- each | Type |
|---|---|
| B.T.H. .. .. .. | B.5 |
| Ediswan .. | A.R.O.8 |
| Marconi-Osram | D.E.3 |
| Mullard .. .. | D.F. Ora |

**DULL EMITTER POWER VALVES**
For use with A.R.D.E. and D.E.R. Valves.
Marconi-Osram, Type D.E.6, 2-2·5 volt, ·25 amps. 25/-.

**DULL EMITTER POWER VALVES**
For use with ·06 Valves.

| | |
|---|---|
| B.T.H. Type B.6 .. | 35/- |
| Marconi-Osram Type D.E.4 | 30/- |
| Mullard, Type D.F.A.2 | 30/- |

**POWER VALVES.**
For use with Bright Emitters.

| | |
|---|---|
| B.T.H. .. B.4 | 35/- |
| Marconi-Osram .. D.E.5 | 35/- |
| Mullard .. D.F.A.1 | 35/- |

| | |
|---|---|
| ·06 French Metal | 16/11 |
| ·06 Dutch .. .. | 13/6 |
| Phillips' ·04 Type | 16/11 |

**FILAMENT RHEOSTATS**
Wire Wound Type, Rotary Action.

IGRANIC ohms each.

| | | |
|---|---|---|
| Plain Type | 4 & 7 | 4/6 |
| With Vernier Adjustment .. .. | 4 | 7/- |
| Plain Type .. | 30 | 7/- |
| The Raymond | 6 | 1/6 |
| The Ormond .. .. | | 2/- |

**GENUINE DR. NESPER HEADPHONES**

Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel-plated parts. Very comfortable fitting to the head.
LOOK FOR THE TRADE MARK.
4,000 ohms .. .. .. 13/6
Post 6d. pair

DIAMOND WEAVE BASKET COILS (5) EXTRA AIR SPACE (DUPLEX WAXLESS,
Equal to Honeycomb. 25, 35, 75, 100 (wave-lengths marked). Set of 5 .. 3/9

RIGHT OPPOSITE DALY'S GALLERY DOOR

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HOURS OF BUSINESS:
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'Phone: GERRARD 4637

# For Your Spare Moments

## USEFUL GADGETS TO MAKE AT HOME

*A simple soldering-iron heater—difficult screws—a useful turnscrew*

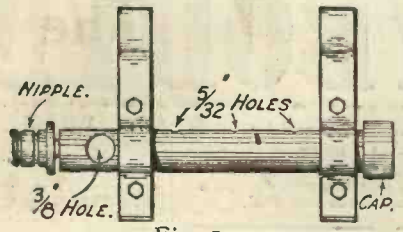



Fig 1.

### A Simple Soldering-iron Heater

A VERY simple gas soldering-iron heater can be made for a few pence.

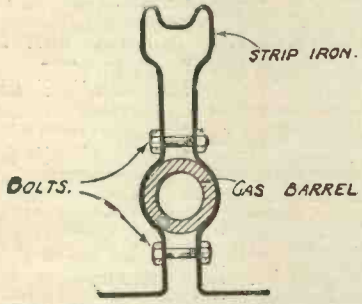



Fig. 2.—A good soldering-iron heater.

The requirements are as follows:

One piece of ⅜ in. gas barrel.

One nipple to fit ⅜ in. gas barrel, Fig. 3.

One ⅜ in. cap.

A few small pieces of strip iron.

Three 5/32 in. holes are drilled in the tube about three-quarters of an inch apart one inch from

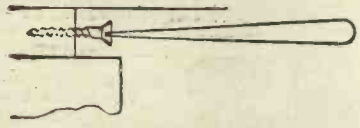

Fig. 3.—Further details.

one end. A ⅜ in. hole is drilled three quarters of an inch from the other end. The cap is screwed on to the barrel and the nipple forced in the other end. The strip iron is bent as shown in Fig. 2 and fastened to the barrel by 1 in. 4 B.A. screws.

The soldering-iron rests on the brackets formed by the strip iron.

### For Difficult Screws

THIS little gadget makes light work of putting a small screw into positions where little or no space is afforded for fingers. A piece of watch spring about 10 in. long and ⅛ in. wide is bent as shown in the figure. The spring should be first heated in a flame, and when bent, cooled suddenly by plunging into water, this treatment ensuring that the springiness is retained.



A useful device.

It is not intended that this should be used as a screwdriver, but merely as a gadget for inserting a screw.

The figure also shows the gadget in use. The two ends are pinched together and slipped into the slot in the head of the screw; when the tension is taken from the gadget, it will be found that the screw is held securely on the end.

### A Useful Turnscrew

THE insertion of a screw in an awkward corner can be greatly eased if a turnscrew as shown in the accompanying diagrams is used.

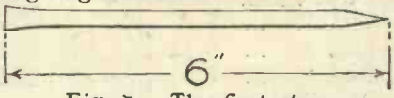



Fig. 1.—The first step.

Obtain about 6 in. of ⅛ in. silver steel. This can be bought from any ironmonger's.

Each end of the rod, after being made red hot in a fire, is flattened out with a small hammer, one end being flattened at right angles to the other (Fig. 1). The steel is then bent, by making it red hot, placing in the vice, and hitting with a hammer.

The edges and faces should then be finished with a file. Fig. 2 shows the finished turnscrew.


Fig. 2.—Bent to shape.

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# Easily Made Grid Condensers

*This article explains a quick, easy and inexpensive way of making any value fixed condenser up to ·0005μF.*

COMPARATIVELY few amateurs ever bother to make up their own small fixed condensers, preferring to use ready-made components. So long as they are of thoroughly reliable make good results will be obtained, but, if they are of poor quality, the capacity is as a rule anything but what it is stated to be. Cheap "·0003μF." condensers have been known to vary when actually tested between ·0001μF. and ·0005μF. Really good condensers with capacities up to ·0005μF. can be made very easily in the home workshop in the way to be described in this note. Fig. 1 shows the finished article, which consists, as will be seen, of a length of ⅜ in. ebonite rod, covered with copper foil. Above the foil is a layer of mica round which are wound a number of turns of bare tinned copper wire. A flap of the foil is attached to a short piece of 4 B.A. studding screwed into one end of the rod, and to a similar piece at the other end is fixed one end of the wire windings. The capacity depends, of course, mainly upon the quality and thickness of the mica used as dielectric and upon the number of turns of wire wound on to it.

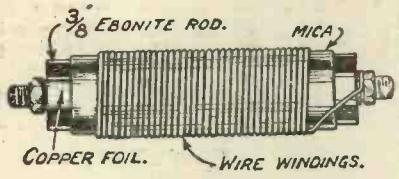


Fig. 1.—The finished Condenser showing outside winding and general construction.

To make up a condenser of ·0003μF., cut off a piece of ⅜ in. ebonite rod 1¾ in. in length. Drill and tap a 4 B.A. hole in the centre of each end. Cut out a piece of copper foil 1¼ in. wide by 1⅜ in. long. At the end leave a little flap, as shown in the drawings. Shellac the ebonite rod lightly and roll the copper foil tightly on to it. Then bind with thin string and leave in a warm place until the shellac has set hard. Next, take a piece of the best ruby mica, 0·002 in. thick and cut out the covering. It is important that the mica should be of the very best quality obtainable and that the thickness is guaranteed 0·002 in. Such mica is obtainable from

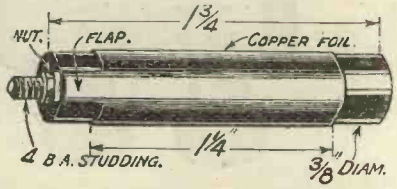


Fig. 2.—The first stage is to fix the copper foil with shellac.

advertisers in THE WIRELESS CONSTRUCTOR and is not expensive. The piece required will be 1¾ in. wide by 1⅜ in. in length. Roll it tightly over the copper foil and stick down the joint with shellac. Again bind with string and leave to set.

### Different Capacities Obtainable

Make a small hole in the flap and secure it to one of the pieces of 4 B.A. studding by means of a nut and a couple of washers. To the other piece of studding fix in the same way one end of a length of No. 24 bare tinned copper wire. Wind 42 turns evenly and tightly over the mica so that all are above the copper foil. When all the turns are on, hold the end of your wire tightly and with the soldering iron run a little solder right along the windings. Do this quickly so as to prevent the ebonite rod from being overheated. The end of the wire may now be cut close off.

It will be seen that as 42 turns of No. 24 wire are required to give a capacity of ·0003μF., 14 turns are equivalent approximately to ·0001μF. Bearing this in mind, the constructor can make up grid condensers of just the capacity that he requires. It should be pointed out that, besides the main considerations mentioned at the beginning of this note, the actual capacity will depend upon the closeness and tightness of the windings. Be careful therefore to put on the turns as evenly and as tightly as possible.

### Determining Correct Capacity

Small variable condensers are easily made on the same lines by making the wire windings movable. To do this, wind the required number of turns on to a rod of slightly larger diameter, solder them, and to the coil attach one end of a piece of flex, taking the other to the stud contact. If used as tuning condenser on the layout board, the wire coil can be moved with the point of a piece of ebonite rod.

R. W. H.

Mr. Kellaway, who has succeeded Mr. Godfrey Isaacs as Managing Director of the Marconi Company.

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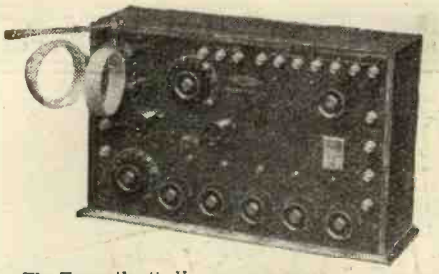

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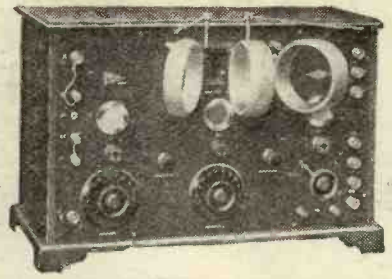

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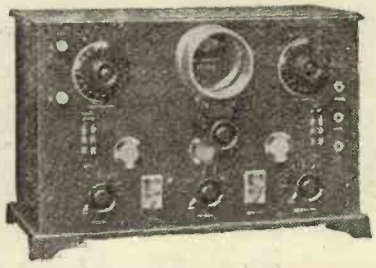

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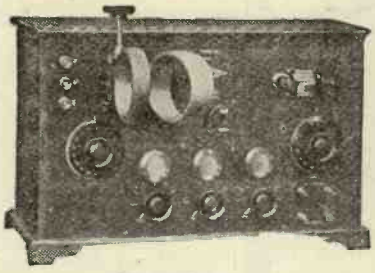

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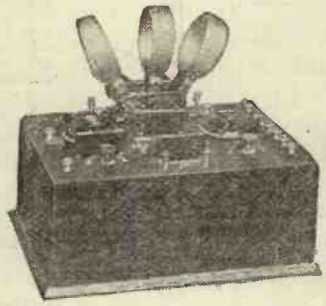

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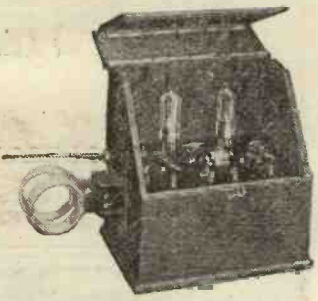

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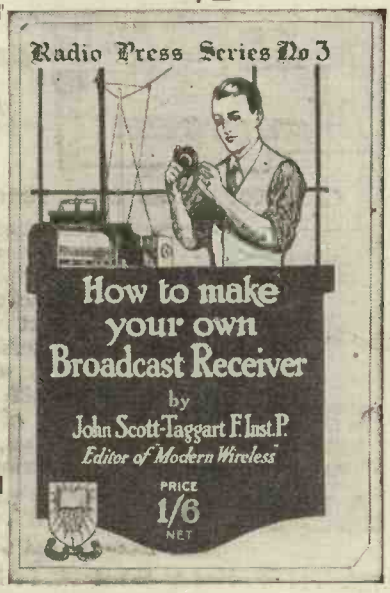


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