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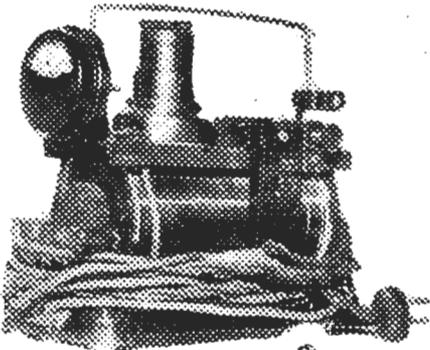
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# FOREWORD

By E. T. FISK, M. Inst. R.E., A.M.I.E.A.

**T**HE publication in Australia of a comprehensive handbook detailing the various activities both commercial and amateur of wireless in Australia is opportune. At no time since the science of wireless was first introduced to Australia has so much and such keen interest been displayed in the many phases to which wireless is at the present time being applied. One cannot emphasise too much the manifold advantages and almost unlimited possibilities of wireless communication. There is no country in the world to which wireless offers greater benefits than Australia; it enhances the safety of those who travel by sea around our extensive coast line; it can provide direct, cheap, and speedy telegraphic communication with any part of the world; it is to-day linking up those isolated inland areas where there are no telegraph or telephone lines; and it now provides the means for bringing news, entertainment, and instruction from the great capital cities into every home. It is but five years since the first wireless telegraphic message was transmitted from England to Australia, while in June of this year the human voice transmitted from England was distinctly heard in Australia by means of wireless telephony.

At the present time broadcasting is bringing pleasure to settlers in the most remote parts of Australia, and I feel confident that in the course of a few years it will be possible for residents throughout Australia to be able to "listen-in" to entertainments of many kinds, and to speeches of some of the world's leaders broadcasted from such distant places as London and New York.

Apart from the great progress that is being made in the application of the science in Australia, one cannot pass the subject without making reference to the great advancement that is being made in the manufacture of every type of wireless apparatus, including broadcasting transmitters and receivers, and the highly technical and complex electronic valve. Not only does this serve to build up a self-supporting industry in Australia giving training and employment to hundreds of Australians, and keeping in Australia money that would otherwise be spent outside, but it is providing a national wireless service indispensable alike in peace and war.

**Anthony Horderns' for Complete Wireless Outfits**

## INTRODUCTION

**T**HE radio age is with us. It is safe to say that this science has made more rapid progress than any other, and in a comparatively short span of years it has developed from a secondary and doubtful means of communication to the swiftest and one of the most reliable. Thousands of lives have been preserved by the use of wireless telegraphy; millions of pounds worth of property has been saved, and in many other ways has humanity benefited by its uses.

By no means least of these benefits is radio telephony. In the last few years this side of the science of wireless has made wonderful strides. Australia has heard the human voice from England, and there seems to be little doubt that the time is not far distant when Australia will be listening to music and speech from the heart of the Empire.

To Australia, a land of vast spaces, the radiophone comes more of a blessing than anywhere else, and its immense value to the people of the country will be amply demonstrated when it is better understood by the average citizen. Like all new inventions, wireless is looked upon by some with a certain amount of suspicion, and so rapid has been the growth of the science that but comparatively few realise the pitch of perfection to which it has advanced. It is now possible for the farmer in the remote country districts to instal a receiving set at a fairly low cost, with which he can listen to market reports and the latest news from the big broadcasting stations of the capitals. His family can hear excellent concerts and actual performances from theatres. Only those who have spent long periods in the remote country districts will realise what this means to these isolated folk.

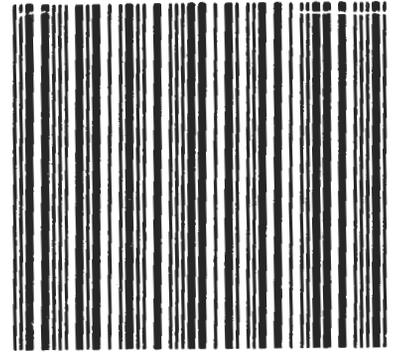
The transmitter of moderate power is of great value to the countryman, and several have already been installed. The farm that is remote from settlement could be more cheaply linked up by wireless than with the ordinary telephone. There are no miles of line to establish; no maintenance work, for the messages fly to and fro through the ether, despite fire, flood or gale.

At the outset it should be made clear that radio is not a thing to be approached in fear and trembling. It is available to all at very little expenditure. Sets can be made or purchased complete to suit all purses and the technical knowledge required to operate them is practically nil.

The object of this handbook is to reveal the radio science to the average person in the simplest language, and to lead him by easy stages from the elementary forms of reception to that point where, should he so desire, he may take up the text books and pursue the subject to its complicated end. There is nothing contained herein, with regard to construction and arrangement of apparatus, that will teach anything to the expert; that has been left to the text books. But to the man, woman, or child who, approaching radio uninstructed, wishes to partake of the delights of taking music and speech from the air, the contents of this Handbook should prove invaluable.

Anthony Horderns' for Crystal Sets

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## WIRELESS WAVES

**B**EFORE going on to the details of construction it is as well that the reader should understand the elementary principles of wireless transmission and reception. All wireless messages travel by means of a wave; generated at the transmitting station, the energy being put into the ether by way of the sending aerial. The waves are known as Hertzian waves, or electro-magnetic waves, and are generated by means of an electric current, as in the original experiments of Hertz. But the modern methods of using them are, of course, much improved. A hackneyed but excellent illustration of the spread of these waves is that of the stone in the pool. When the surface of the water is broken by the stone, the impact causes ripples to spread out in ever-widening circles. So it is with wireless waves, the impact of the stone representing the power at the transmitting station.

The waves travel by means of the ether, which, scientists tell us, is everywhere. All matter is porous, and the ether thus permeates everywhere, even our bodies. Strange as it may seem, the fact is that by means of the ether the wireless waves travel through substance with the greatest ease, and while we go about on our daily tasks the waves pass through our bodies, as they also pass through the walls of our houses.

### The Most Wonderful Feature

Fortunately for the users of wireless, these waves, or a proportion of them, follow the curve of the earth's surface, and thus we are enabled to send our messages round the world. Probably the most wonderful feature of the waves is the tremendous speed at which they travel. Careful tests and elaborate laboratory experiments have proved their speed to be 186,000 miles, or 300,000,000 metres, a second. It is truly wonderful when it is considered that a message travelling by means of the wave goes at a speed that would carry it nearly eight times round the world in a second!

It appears that the waves sent out from a station literally cover the earth, meeting at a spot directly antipodean to the station. That is, of course, if the power is sufficient to send the waves that distance. In considering these waves we are apt to think of them as small undulations, whereas they may be thousands of feet from crest to crest.

The ideal wave train is easily imagined. It is composed of peaks and hollows, and suggests the even roll of the sea. The nearest approach to this condition is the continuous wave (technically known as C.W.). Then there is what is known as interrupted continuous wave (I.C.W.), in which the waves are uniform but the train is periodically broken by a device at the transmitting station. Spark transmitters send out what are known as damped waves. In this case each succeeding crest, from the time of impulse, gets lower than the first, till the straight line is reached or the wave is "damped" out. To the layman the most wonderful of all the waves is the modulated continuous wave. The crests of these waves are varied in height at

Anthony Horderns' for Valve Sets

the transmitting station to correspond to modulations of sound, either the human voice or musical instrument. It is this wave that carries the sound and makes broadcasting possible. Thus the wave sent out from a broadcasting station is known as a "carrier wave," and from it we extract the desired sounds.

So we see that the ether is full of madly rushing wireless waves which none of our five senses can detect. To trap the waves and make them do our bidding we must call upon mechanical aid—the receiver. The first essential is the aerial, which serves to trap or attract a certain amount of electro-magnetism from the waves as they speed by. Down the wires to the receiving set and backwards and forwards the minute charges of electricity rush.

Now several waves from different stations may arrive at the aerial together, and it is necessary for us to pick out the station we require, and this is where the "tuner" comes in. Different sending stations have their sets so arranged that their waves are each sent out a different length (i.e., from crest to crest), so that one shall not interfere with the other. The function of the tuning coil at the receiving end is to put the receiving set in tune with the station sending.

## The Heart of the Receiver

What may be termed the heart of the receiving set is the detector. This piece of apparatus has a most important duty to perform—that of converting the rapidly oscillating current, generated in the aerial by the successive impact of the electro-magnetic waves, to a uni-directional flow. To put this in simple language, the current from the aerial flows first in one direction and then in another at very high speed. These current flows may be taken to correspond with the impact of a wave on the aerial, and it is seen, therefore, that the shorter the wave the more rapid will be the oscillations. On a wavelength of about 200 metres, the oscillations in the receiving set would be from 1,000,000 to 2,000,000 cycles a second. What this means may be judged from the fact that the keenest human ear does not respond to air pulsations of a higher frequency rate than 10,000 a second. Ordinary sound waves are only a small portion of this amount.

## The Telephones or Head-Set

The telephones, or head-set, uses the same principle as the telephone receiver on the land lines of everyday use. The telephones in use on the wired lines do not have to handle such minute currents, so their resistance is much smaller than those used in wireless. Wireless headphones are wound to a resistance of 2000 ohms, or even more, whereas the wired phone of everyday use is usually about 75 ohms. In each phone is a diaphragm that is made to move by the alterations in a magnetic field caused by difference in the electric current.

So our electro-magnetic waves have passed through our simple set, and are allowed to run to earth through the "ground" or earth wire; and we can now get on to the practical side of the science.

## Anthony Horderns' for Cabinet Receiving Outfits

# CIRCUITS AND SYMBOLS

**BEFORE** setting out on the construction of a set it is as well that the reader should understand something about circuits.

A circuit is nothing more than the wiring arrangement of the various pieces of apparatus used. There are many ways of connecting or "hooking up" the apparatus, and the diagram of each different method is referred to as the circuit. There are hundreds of

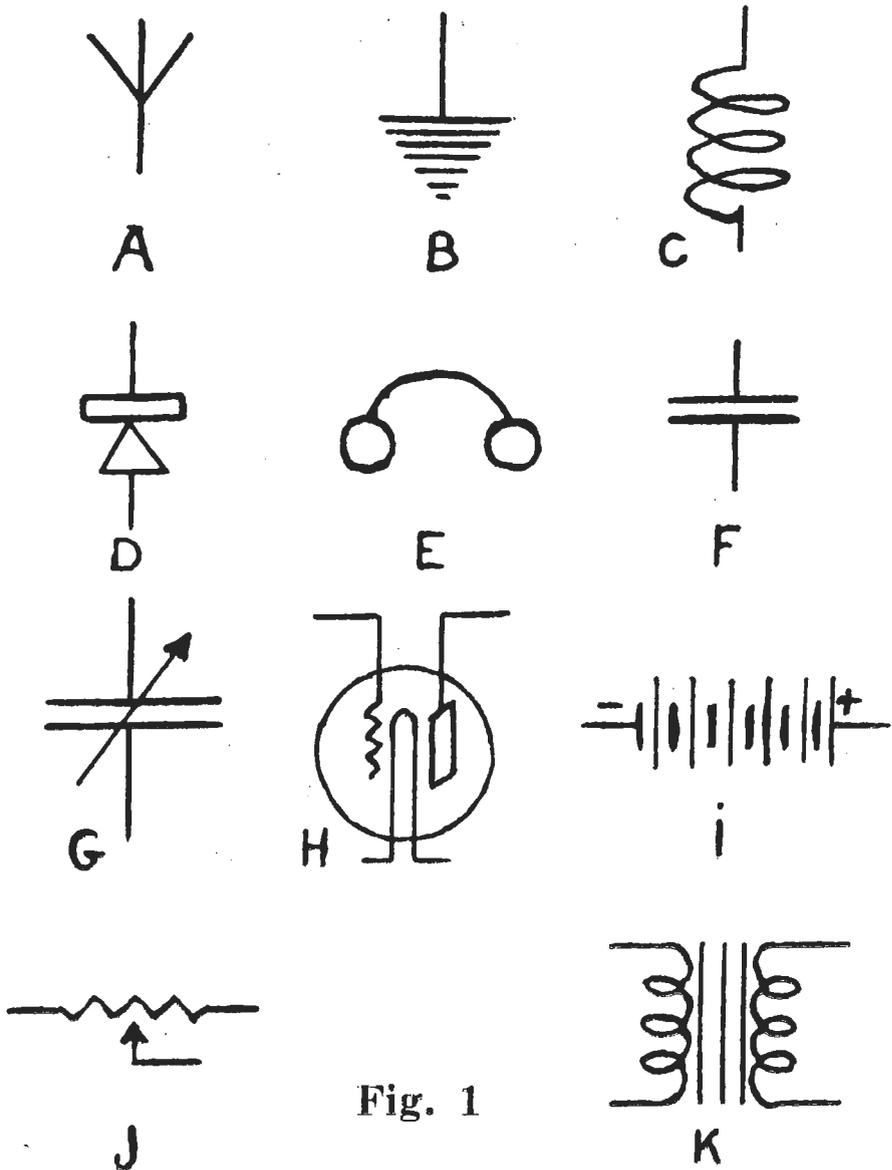


Fig. 1

circuits, the majority employing valves, and there is hardly a wireless enthusiast who has not a favorite "hook up," of which he is never tired of talking.

Now, it is obvious that it would be impractical to draw pictures of the various pieces of apparatus when arranging circuits, so symbols are used, each part having its own distinct sign. Some of the more common symbols are given in Fig. 1, and represent the following parts:

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Listeners-in are catered for every day of the week, including Sunday (in the "Sunday News"). Every Monday a page feature on wireless for amateurs, edited by the editor of this book, Mr. A. Mitchell, gives valuable information on construction, reception, and improvements in wireless.

Get the "News" every night  
and every Sunday morning

—"A," aerial; "B," earth or ground; "C," tuner or inductance; "D," crystal detector; "E," telephones; "F," fixed condenser; "G," variable condenser; "H," valve or vacuum tube; "I," battery; "J," variable resistance or rheostat; "K," transformer.

The uses of much of the apparatus mentioned will be explained as we go along; and the symbols can be referred to as the occasion arises.

### The Simplest Possible Circuit

The simplest possible circuit that can be used for receiving is given in Fig. 2. Here we see the only parts in use are the aerial, earth, a crystal detector, and the telephones. The detector is connected between the aerial and earth with the phones in what is termed "shunt." Telephony and other signals can be received with apparatus thus connected, but, of course, it is impossible to secure good results, and none at all will be obtained unless the set is very close to a broadcasting station.

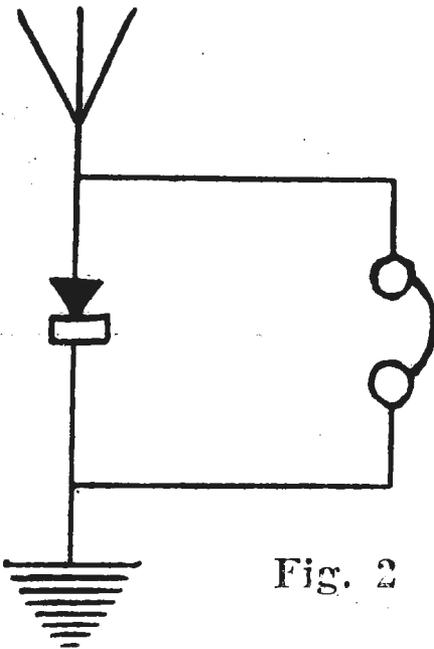


Fig. 2

Since there is no tuning apparatus, this set will respond over a wide range of wave lengths.

It may be of interest to mention here that most of the tiny "freak" sets of which we hear so much, employ this circuit. By "freak" sets are meant receivers on finger rings, tiepins, in nutshells, matchboxes, and the like. Such sets are certainly a novelty, but are of little practical use, and any child with nimble fingers could construct one.

The next circuit is similar, but with the addition of a tuner of the single slide type. By the arrangement of a sliding contact on a coil, the tuning is affected; the turns of wire being cut out or taken in 'n order that the set shall be put in tune with the sending station.

### How to Tell Slider

A slider, or variable connection, it should be mentioned, is always depicted in a circuit by an arrow head at the point of contact.

So we could go on, adding pieces of apparatus into the circuit and varying the arrangement.

Between the crystal set and the valve set there is a fairly wide gulf, both in the apparatus required and the strength of signals. But the valve and valve circuits will be gone into later.

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## THE AERIAL

**T**HE first consideration of everybody taking up wireless should be the aerial. It will be quite readily understood that this portion of the apparatus must be efficient, for its duty is to intercept the radio waves and conduct the minute charges of electricity to the receiving set. If any of the electricity is allowed to escape before it has done its work in the set, it necessarily follows that the strength of the signals will be diminished.

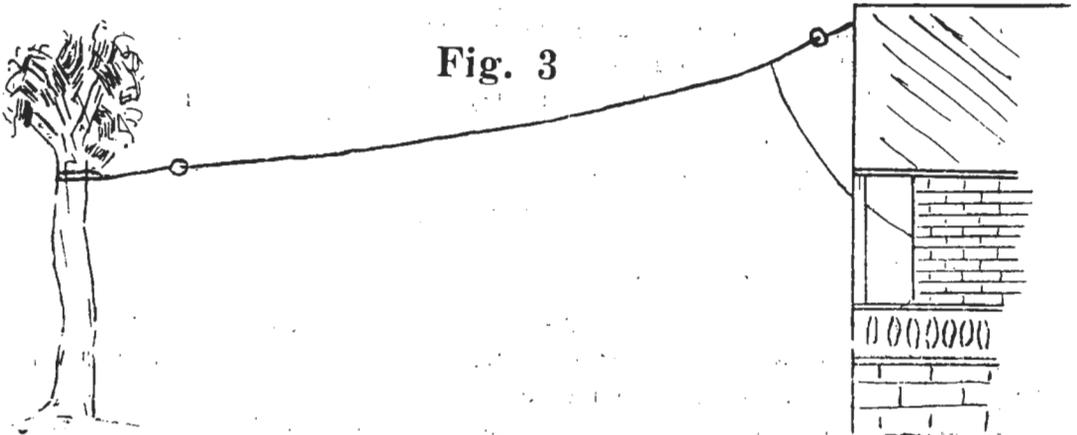
Even to the veriest novice the construction and erection of an aerial should present no difficulties. For use with a crystal set the aerial should not be less than 20 feet high. It does not necessarily follow that no signals will be received if the aerial is lower, but to obtain the best results it should be as high as possible. The accepted aerial is one not less than 60 feet and not more than 100 feet long, having two wires of equal length separated at each end by six foot spreaders made of wood.

Such an aerial if properly constructed is thoroughly efficient. Another type, which is daily coming more and more into favor, is the single wire aerial, of similar length. This is also efficient, and, from a constructional point of view, possesses many advantages. We will take the construction of the single wire aerial first.

### Solder the "Lead-In"

Procure from any wireless dealer 100ft of aerial wire and two good insulators. There are several types of insulators, the best of which are those of the long corrugated variety, though these are more expensive than others. For receiving there is, perhaps, no great advantage in buying the dearer type of insulator.

Measure off 75ft of the wire, cut it, and fasten an insulator to each end of the aerial. Now fasten on the "lead in" to the aerial. The "lead in" is that portion of the antenna system that conducts the waves



to the set, and should be kept as short as possible. The portion of wire cut from the aerial should be used for the "lead in," and care should be taken to attach it properly to the aerial. It is necessary to do more than just twist the wire round; it should be soldered.

If the point is not soldered dirt and the weather will place a fine layer of greasy matter between the wires and the signal strength will be

**Anthony Horderns' for Amplifiers**

cut down. There is no objection to slinging the aerial to a tree, provided the branches do not touch the wires. The other end may be attached to the upper part of a house. The halliards, or wire or rope tails supporting the aerial, should be fastened to the insulators. When a crystal set is being used it is not good practice to have the aerial "screened" by buildings or trees, but there are times when this cannot be avoided. The fact that there are high trees and buildings in the vicinity, however, should not deter the would-be wireless enthusiast. Those who intend operating a valve set need have little fear of "screening."

A method of slinging a single wire aerial is given in Fig. 3.

## How Two-Wire Aerial Is Made

The construction of a two-wire aerial calls for twice the quantity of wire, four insulators, two six-foot wooden spreaders, and rope for spans. The insulators should be attached one at each end of both spreaders by short lengths of wire or rope, a good scheme being to notch the woodwork to prevent the wire or rope slipping. Two more notches should be made just on the inner side of the others, these being to hold the rope slings, to which the halliards are secured. The wire of the aerial is now secured to one of the insulators and carried across to the corresponding one on the other spreader. After carefully measuring off 75ft between the two insulators, twist the wire round itself and take the free end through the other insulator of the same spreader. Twist the wire in a similar manner and measure another 75ft to correspond to

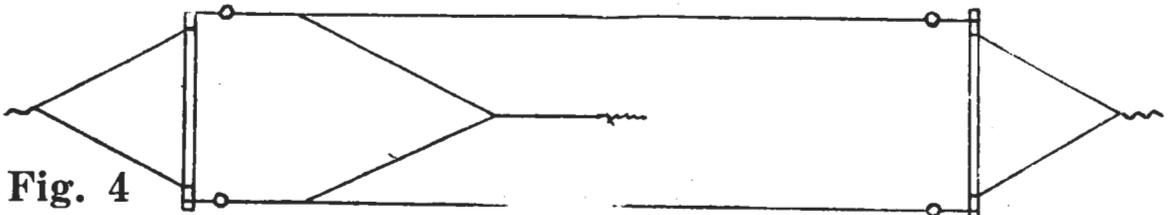


Fig. 4

the other side. The end is now attached to the remaining insulator, and a "Y" shaped "down lead" or "lead in" soldered on. The portion of the "lead in" on the aerial will depend on the relation of the operating room to the aerial. But the "lead in" should be kept as short as possible. The constructional details of the two-wire aerial may be seen in Fig. 4.

## Other Types of Aerial

There are many other types of aerials, notably the "fan," "cage," and "umbrella" varieties, but these should not concern the beginner. The "loop" aerial will be dealt with later.

Another important point is the method of bringing the "lead in" into the house. Where the wire comes near the building it should be well insulated, otherwise signals may be "earthed" before they reach the set.

It might be mentioned that the danger of an aerial being struck by lightning is very small, but the New South Wales Fire Underwriters' rules require that an approved lightning arrester be installed. Details of this will be found in the rules which are given in the appendix.

**Anthony Horderns' for Aerial Material**

## EARTHING SYSTEMS

**N**O effort should be spared to secure a good "earth" for your set. To the city dweller there is very little difficulty in this, for all that is required is a wire from the "earth" terminal of the set to the nearest water pipe of the house system.

It is advisable to keep this lead as short as possible, and care should be taken with the connection of the wire to the pipe. Do not try to solder the connection.

### Using the Water-Pipe

First thoroughly clean the pipe at the place where the wire will make contact by scraping it with a knife or rubbing with sandpaper. Now lay the wire along the pipe and secure tightly by means of an "earth clip." The clip is merely a strip of metal bent to fit round the pipe, and it can be tightened by a nut and bolt. Such a clip can be easily fashioned by a novice. If you have no clip twist the wire tightly round the cleaned pipe and inspect the connection frequently to see that it is clean and the wire tight.

To the countryman, or to the enthusiast who has no water system in his house, the arrangement of an "earth" will prove a little more troublesome. In this case it is necessary to bury some metallic substance in the ground, preferably in a damp spot.

### A Really Excellent Earth

A really excellent "earth" can be made with a small coil of old fencing wire, or a roll of old wire netting. Choose a damp spot somewhere near the house and dig a hole about six feet, the deeper (within reason) the better. Place in the wire, having first soldered the "earth" lead of the set to it. Fill in the hole and the "earth" is complete.

Another good "earth" can be made by driving a length of metal rod (preferably not less than six feet) into the ground at a damp spot. This method is especially useful if a set is being used in the open air on such occasions as picnics.

In small boats the "earth" should be a short length of wire hanging in the water.

### Never Use Gas-Pipe

There is no need to insulate the lead on its way from the set to the earth.

No matter what is told you to the contrary, never connect the "earth" lead to gas pipes.

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## SIMPLE CRYSTAL SET

**T**HE set about to be described in this chapter can be made by anybody.

The parts necessary for its construction, excluding aerial and telephones, will cost about twelve shillings. If properly put together, and used with a good aerial and efficient phones, the set will receive broadcasting within a radius of 15 miles from the station. This is not to say that 15 miles is the extreme limit of the set, but the distance is given as a guide. Those who are not within this radius are catered for in succeeding chapters.

The parts necessary for the construction of the set are:—

*Cardboard cylinder or former 6 inches long and  $\frac{1}{4}$  inches in diameter.*

*Half a pound of No. 24 enamel wire for winding coil.*

*Five small terminals.*

*Crystal cup.*

*Slider and slider bar.*

*Wooden ends and baseboard.*

*Crystal and catwhisker.*

*A piece of thin ebonite  $6\frac{3}{4}$  inches long and 2 inches wide.*

All these parts may be purchased at shops dealing in wireless goods. The wooden ends and baseboard can be made by any amateur carpenter.

### How To Wind the Coil

The first task should be to wind the coil. Measure half an inch from the end of the cardboard former and make two small holes, about half an inch apart, and both at an equal distance from the end, with a hat-pin. Take the wire and push it into the tube from the outside through one hole and back out by way of the other, pulling through sufficient to leave a "tail" about nine inches long. Now wind the wire on the former, keeping each turn tight and as close to the other as possible. Wind the wire to within half an inch of the other end of the former, and finish off by weaving the wire through two holes, as in the case with the start, and leaving the same amount of "tail." A thin coat of good shellac

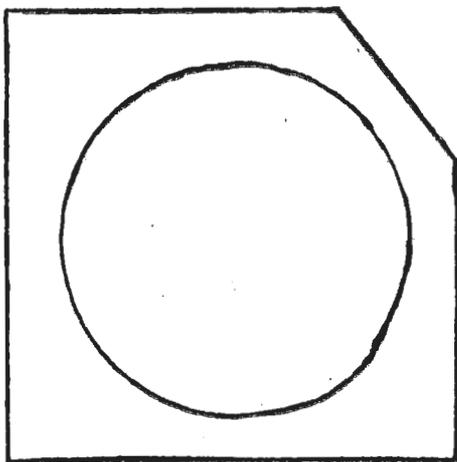


Fig. 5

may be put over the whole coil, though this is not really necessary.

Get a nice piece of wood, not less than half an inch thick, and cut two pieces each five inches square. These are the ends of the set. From

**Anthony Horderns' for Batteries**

the same wood, cut two circular pieces that will fit neatly and tightly, one in each end of the coil. Screw the circular pieces in the centre of the inside of each square end piece. Two corresponding corners should be cut off as in Fig. 5, the slope thus formed being to take the ebonite panel. Before leaving the woodwork cut a baseboard to the size required.

### The Arrangement of the Ebonite Panel

The next work is on the ebonite panel, and it is to mount the aerial, earth, and phone terminals and the crystal detector. The arrangement of the panel is given in Fig. 6, the dotted lines showing the wiring to be

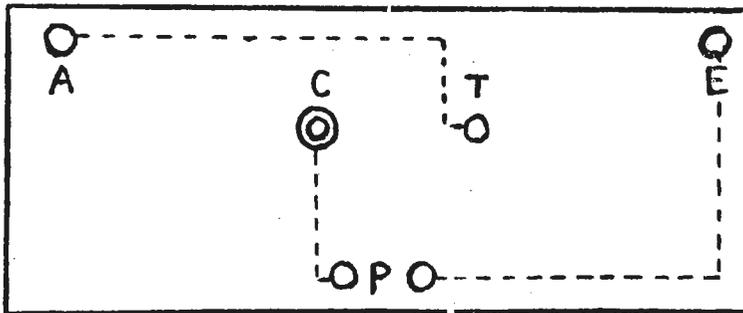


Fig. 6

carried out at the back. The letters on Fig. 6 represent: "A," aerial terminal; "E," earth terminal; "T," catwhisker terminal; "C," crystal cup; "P," phone terminals.

Now push the circular pieces into the ends of the coil and mount on the baseboard. Screw the slider bar on to the top of the end pieces, taking care that it is in the centre. Bend the slider arm so that it makes firm contact with the wire on the coil. It is a good scheme to varnish or stain the wooden parts at this stage.

Before mounting the ebonite panel on to the end pieces take the tail at the start at the end of the coil and attach it to the underside of the aerial terminal on the panel. Cut the tail off on the opposite end of the coil, for this end is left free. Run a piece of wire from the end of the slider, nearest the "earth" terminal on the panel to the underside of the "earth" terminal. Now screw the panel on to the wooden ends.

### Completing the Set for Use

A crystal (obtainable from any wireless shop) is screwed into the crystal cup, and the catwhisker screwed into the crystal terminal so that the free end can make contact with the crystal.

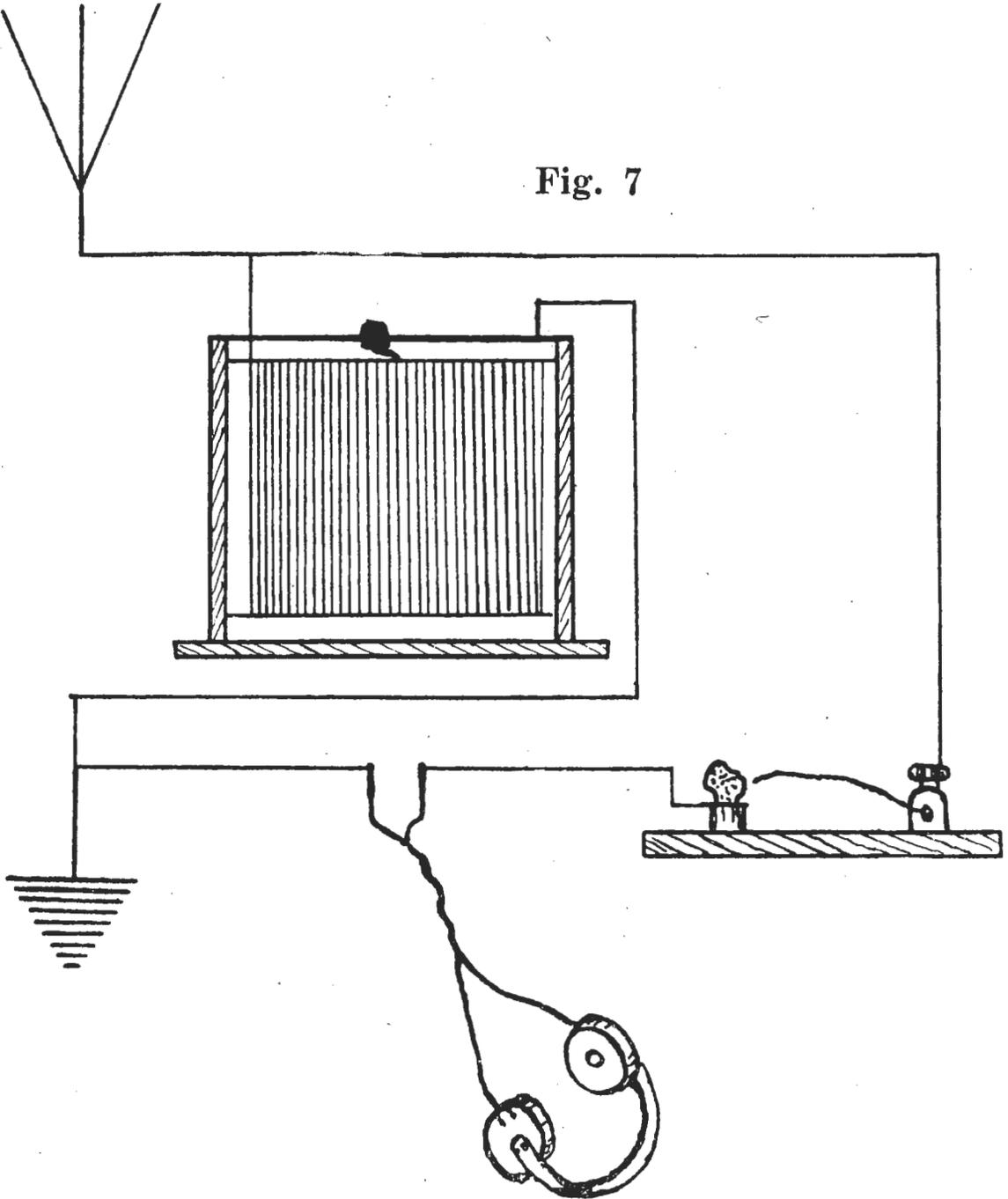
Run the slider along the coil and carefully scrape a narrow band of enamel from the wire on the mark made by the arm, to allow the arm to make contact with the bare wire. When making connections the enamel

Anthony Horder's' for Condensors and Parts

insulation should, of course, be scraped off the wire at the points of contact.

The set is now ready for use. To operate it, place the catwhisker on the crystal and run the slider to the starting end of the coil. Move

Fig. 7



the slider slowly along till signals are heard. Then try various parts of the crystal for the most sensitive spots where the signals come in loudest.

The best adjustments of this set will be found quite easily with a little practice. The wiring diagram of the set is given in Fig. 7. The wavelength range is from about 150 to 1200 metres.

Anthony Horderns' for Everything in Wireless

## LOOSE COUPLER SET

THE next step in crystal reception is the loose coupler, and the set here described is undoubtedly the best employing a crystal detector that can be devised for all round work.

The material for its construction, exclusive of aerial and phones, can be purchased for under £2, and when finished the set will look very nice. Its wavelength range is from 150 to about 1200 metres.

The radio enthusiast wishing to progress from the set described in the preceding chapter can, with but a little trouble and expense, convert his set to one of the loose coupler type, using the materials he already has in that set.

### Parts Required

The parts required for the loose coupler set are as follows:—

*Cardboard former, 6 inches long and 4 inches in diameter for the primary coil.*

*Cardboard former, 6 inches long and 3½ inches in diameter for the secondary.*

*Half a pound of No. 24 enamel wire for winding the primary.*

*Six ounces of No. 28 enamel wire for the secondary.*

*Wooden ends for primary and secondary formers and a base board.*

*Slider bar and slider.*

*Two rods for sliding secondary coil.*

*Seven contact studs.*

*One switch arm.*

*Five terminals.*

*Crystal cup.*

*Crystal and catwhisker.*

*One yard of flexible wire.*

*Piece of ebonite 6½ inches long and 2 inches wide.*

*One fixed condenser (.001).*

The set here described, and pictured in Fig. 8, employs two coils, a primary coil and a secondary. There is no wired connection between the two coils, and the current passed on to the secondary coil is referred to as an "induced current." In the primary coil the current sets up a magnetic field, and the secondary is so arranged that it can slide in and out of the primary coil, thus making it possible to vary the influence of the primary coil, and change the relations of the primary and secondary currents. This all makes for finer tuning. The secondary coil is arranged so that certain numbers of turns of wire can be switched in or out at will, but not with a slider, as in the case of the primary. The secondary coil is "tapped" at certain intervals and leads taken from the "taps" to contact studs on the outer wooden end of the secondary.

### First Meeting With a Condenser

In this set, too, the reader will meet for the first time with a condenser. A condenser is composed of alternate layers of conductive and non-conductive material, the non-conductive material being called the

**Anthony Horderns' for Induction Coils**

dielectric. Sufficient to mention here that the condenser—all condensers—act as storage receptacles for electricity, and their capacity for storing the current is measured in microfarads, technically termed mf. Con-

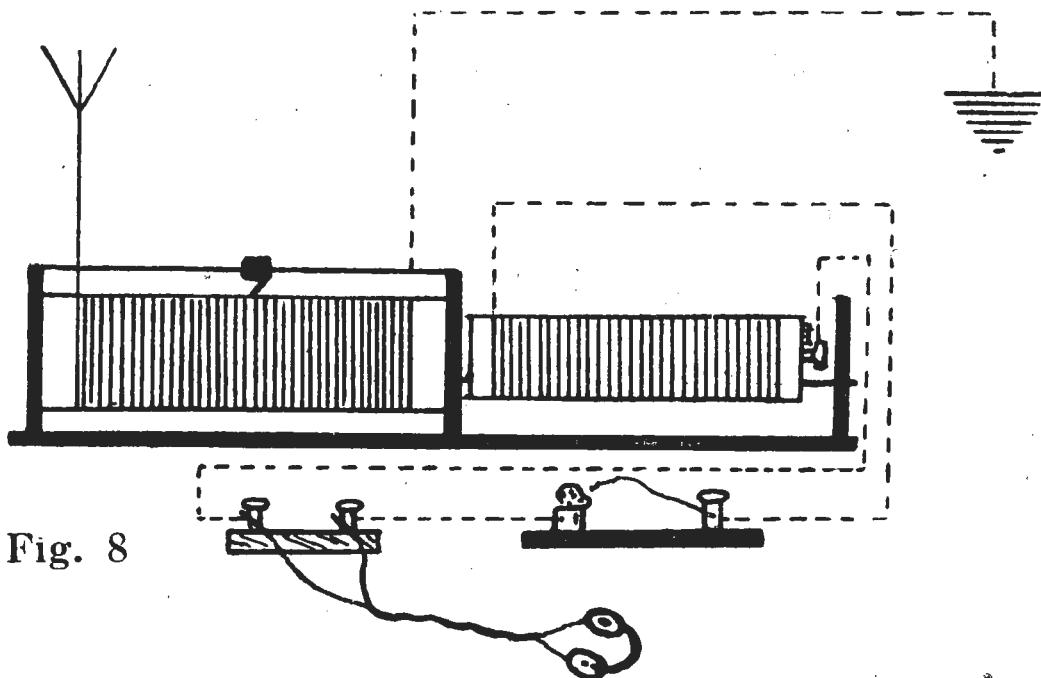


Fig. 8

densers are roughly of two types, fixed and variable. The variable condensers are, in the main, composed of two sets of metal plates. One set is on a spindle, and can be moved in and out between the fixed plate, thus varying the capacity. The variable condensers are also valuable aids to tuning. The dielectric in this case is air, and the two sets of plates are, of course, carefully insulated from each other on the frame.

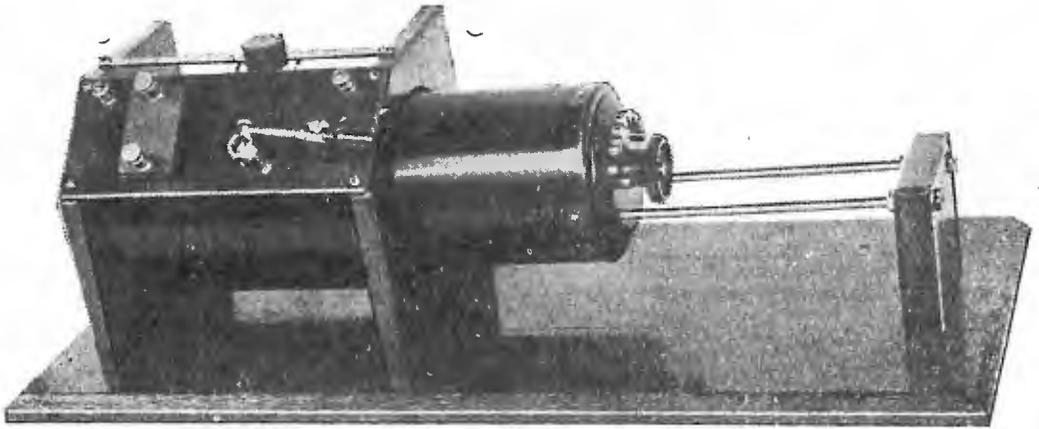
### The Secondary Coil

But to return to the construction of our loose coupler set. The first task again should be to wind the primary coil. This has already been touched upon in the last chapter, so we will get on with the secondary coil. Start the winding as in the primary, half an inch from the end, and wind on the wire till half an inch has been covered. Now stop and put in the first tap. This is done by making a small hole in the cardboard and pushing through the wire doubled, for about an inch. Twist the wire together inside the coil. Then continue winding as before till three-quarters of an inch from the first tap has been covered, and put in the second tap. Continue putting in taps every three-quarters of an inch, and you will find that you have put in six before the end of the coil is reached. Leave a good long "tail" of wire on the end of the coil.

Two wooden ends must now be cut to fit neatly into each end of the secondary coil, one, the outer, or furthest away, from the primary being drilled to take the contact studs and switch arm.

The best plan is to fit on the switch arm first, making the hole dead

**Anthony Horder's' for Potentiometers**



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in the centre of the circle. This having been done, the end of the arm is pressed against the wood and revolved and the seven stud holes drilled in the form of a semi-circle over the mark made. The arrangement of the studs and arm is given in Fig. 9, as is also the connection of the taps to the studs.

The enamel insulating should be carefully scraped off the "taps" and short lengths of wire joined to them to reach the contact studs.

The two holes marked "A" in Fig. 9 are to take the rods on which the secondary slides in and out of the primary. Corresponding holes to these must also be drilled in the other end, care being taken that the

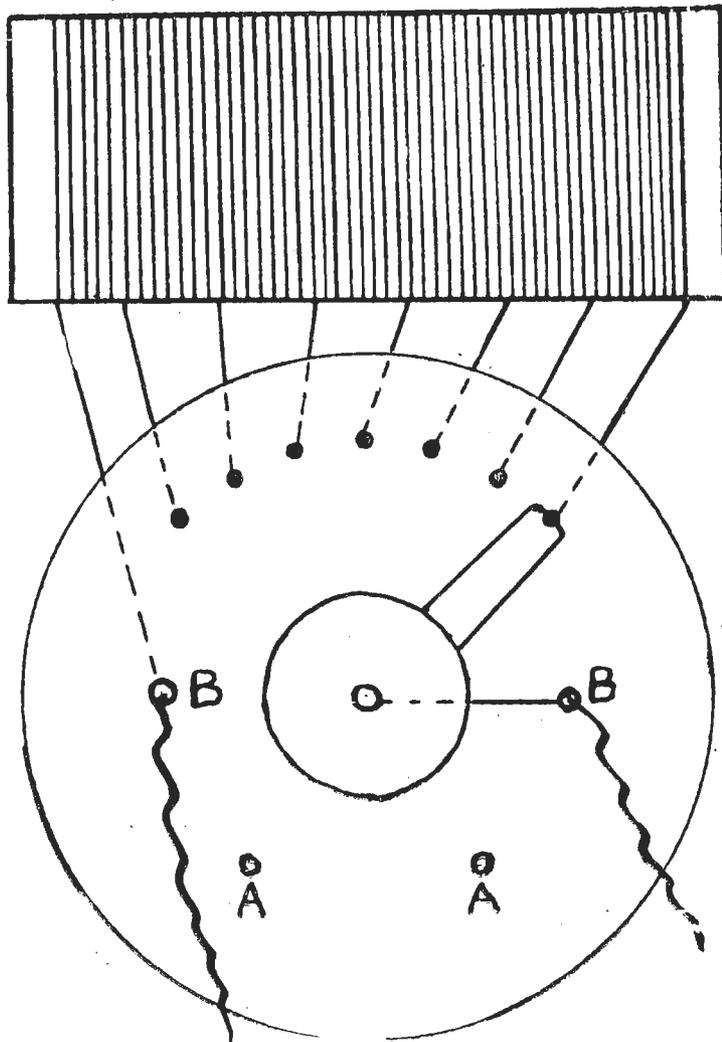


Fig. 9

holes in each end are directly opposite one another. The holes marked "B" are made for flexible connections. The flexible wire mentioned in the list of parts is two stranded, and the strands should be separated to go one in each hole. One strand is connected inside the end to the tail left at the start of the secondary winding and the other to the switch arm.

### Anthony Horderns' for Rheostats and Rectifiers

## The Finishing Touches

The primary coil is now mounted on its ends, one (the outer) of which must be open to allow of the secondary sliding in and out. The closed end has to be drilled for the secondary sliding rods, and a support must also be made for these rods at the opposite end of the baseboard. In fitting the rods care must be taken that they allow the secondary to slide in and out of the primary freely without touching. The primary ends should each have a corner cut off (as in Fig. 5) to take the ebonite panel. The terminals and crystal cup should be put on the panel in the same order as in Fig. 6, but the wiring will be slightly different. In this set the start of the primary winding is connected to the aerial terminal and a wire taken from the primary slider bar to the "earth" terminal. The flexible wire leading from the start of the secondary winding is connected to the catwhisker terminal, and the other flexible lead to one of the phone terminals. The other phone terminal is wired to the crystal cup. The 'phone terminals should pass through the holes in the condenser, securing it to the outside or underside of the panel.

The parts should now be secured to the baseboard, which must be sufficiently long to allow the secondary to be pulled out till the inner end is just about clear of the outer end of the primary.

This set will look better if a set of crystal detector parts are assembled on the panel in place of the terminal holding the catwhisker.

To tune the set, put the primary slider to the aerial end of the coil, and set the secondary arm on the centre stud. Slide the secondary coil half into the primary and move the primary slider along till signals are heard. The best results on various stations will be found by experiment.

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## THE WIRELESS WONDER LAMP

**T**HE step forward from the crystal to the valve is a big one but every wireless enthusiast takes it at some time or another. Therein lies the peculiar fascination of radio. The man with the crystal set, almost from the time he hears his first signal, hungers for the valve outfit, and the man with a single valve set longs for a multi valve set, and so it goes on. Therefore we will assume that the reader has given his crystal set to a delighted nephew and is looking round for a nice single valve outfit to suit his needs.

It would be hardly wise to make the big change without some knowledge of the working of the valve. The correct name for this wonder lamp of wireless is the thermionic valve, and it is the heart of the set, just as was the crystal. Like the crystal, the valve allows current to pass in one direction only, hence its name.

### What an Electron Is

To understand the working of the valve it is necessary to become acquainted with the electron. As is generally known, the smallest particle into which matter can be divided is the atom. This atom in turn is composed of a number of minute divisions of negative electricity grouped round a unit of positive electricity. The negative divisions are the electrons, and they are restless little fellows, for ever revolving at tremendous speed round the positive unit. The positive chap is particular. He likes to have in his group just so many electrons, no more or no less, and he will go to a lot of trouble to please himself in this respect. If the atom loses one electron, it has one unit charge of positive electricity, and if it gains one it has one unit charge of negative electricity.

Now suppose we take a piece of wire suitable for conducting electricity, and connect it to the negative side of a small battery and give the circuit some work to do, such as ringing a bell. It might be mentioned that the current flow is always from negative to positive. Having connected the circuit, there is now a negative charge on the wire. The wire is made up of atoms and the battery end becomes saturated with more negative electrons, than the fussy atoms want. They, therefore, pass on the surplus electrons, one to another, till the end of the wire is reached. The electrons cannot go back, and they ultimately return by going right round the circuit, or are spent in carrying out some work.

### Millions to the Inch

Now as to size: If you place atoms in a row (the task would be somewhat difficult, to say the least), it would take over twenty million of them to make an inch. The electron, in point of size, bears about the same relation to the atom as the atom would to an elephant.

There is one thing that disturbs the atom and electron family badly, and that is heat. If a piece of wire is subjected to heat the electrons are set into most violent motion, and seek to leave the happy family. In this fact lies the success of the valve.

**Anthony Horderns' for Valves of Every Type**

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## The Fleming Valve

After exhaustive experiments along these lines, Dr. Fleming, in 1904, produced the first valve. But this was by no means a success, though it was a step along the road of progress. The Fleming valve comprised only a filament, and a metal plate with an outside connection.

The operation of the valve was this: When the plate was connected to the positive side of a battery and the negative side to one side of the filament, a stream of electrons flowed from the negatively-charged filament to the plate which was positively charged. Imagine the agitation of the electron-atom family when the filament becomes heated; imagine the electrons all anxious to fly off, and you will be able to picture in your mind's eye their great migration to the attractive plate. And the electrons once they fly off, cannot return, for a negative charge is always repelled by its like. Thus we have the current flow through the circuit, the gap between the filament and the plate being filled by the electron stream, invisible, yet efficient.

If the plate battery leads were reversed and the plate impressed with a negative charge, the flow would cease, for the negative electrons would be pushed back by their like.

Put simply, the filament may be regarded as the source of the electron flow, and the plate as the means of exit for the electrons.

## What the Grid Does

We now come to the grid, or the third electrode of the valve. This is a little spiral of wire placed between the filament and the plate. The grid, the invention of Dr. De Forest, an American, vastly increased the sensitiveness of the valve. Its duty is to intercept and regulate the flow of electrons from filament to plate, and it does this in a thorough manner, provided the other elements in the circuit are efficient. The grid, unlike the filament, which is always negative, and the plate, which is always positive with regard to the filament, is alternatively negatively and positively charged, its condition being governed by the oscillations in the grid circuit. When the grid is negative the flow of electrons is checked. Along comes a signal into the aerial circuit, setting up oscillations which cause the withdrawal of the negative charge from the grid and the flow starts again. The great magnification by the valve is produced through the fact that a small variation in the grid potential produces a big change in the plate circuit.

In the grid circuit there is a grid condenser which aids the action of the important electrode, and in conjunction with the condenser is a grid leak. We have seen how important it is that the grid variations should occur without trouble, and the leak is a trouble-preventer. It allows the negative electrons left over after a change to leak away, thus enabling the positive change to occur properly and ensuring that the grid does not always remain negative, thus holding up the electron flow.

**Anthony Horderns' for Winding Wire**

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## Two Classes of Valves

Roughly, valves may be divided into two classes, those called bright filament valves and those known as dry cells, tubes, or dull emitters. The former take more voltage to operate the filament, which is always burned brightly, and the current must be supplied by an accumulator. The dull emitters, on the other hand, operate with the filament comparatively dull, and can be used with one or two ordinary dry cells. On account of the comparatively low temperature at which the filaments are burned, the life of the dull emitter is usually longer than that of the other type. They are favored by enthusiasts because there is no trouble with accumulators. It might be explained that in most cases violent emissions of electrons do not take place till substance is heated well above normal, but the filaments of the dull emitter valves are of a special type that give emissions at comparatively low temperatures, or when the filament is dull—hence "dull emitters."

The dull emitters valves may be used successfully with the valve set about to be described.

## A SINGLE VALVE SET

**T**HE single valve set described in this chapter will be found to be a thoroughly efficient and reliable receiver if properly put together and handled with a reasonable amount of care.

A set similar in every way to the one here described has been tried under local conditions and has been found to give excellent results. The wavelength range is from 150 to about 1200 metres, and the receiving range is above the average.

The enthusiast who decides to construct this set is advised to mount the parts on an ebonite or bakelite panel which can be put into a well-finished cabinet. Thus the set can be made to look very nice and it will be suitable to go with the furniture of any room.

There is nothing in the construction of this outfit to puzzle even the veriest novice, and the man who is handy with a pair of wire pliers can do the job as well as an expert.

## The Secret of Good Results

The secret of the excellent results obtained with this set lies in the fact that the circuit used is of the regenerative order. Briefly, this means that some of the plate circuit current is introduced into the grid circuit, thus "boosting" the action of the grid. The transfer of current is made possible by the operation of the "tickler" coil in the plate circuit, and is known as regeneration.

The tuning elements in this set are a vario-coupler and a variable condenser. The vario-coupler is a coil tapped at intervals having inside at one end a semi-ball rotor wound with smaller wire, which is adjusted on a shaft so that the angle of its wiring in relation to the wiring of the primary coil may be varied by the turning of a knob and dial on the outside of the panel. This rotor is the "tickler" coil before mentioned,

**Anthony Horder's' for Parts for Home-built Sets**

and, as will be seen in the wiring diagram in Fig. 10, is connected in the plate circuit.

The variable condenser assists in the tuning of the set to the wavelength of the incoming signal, and is so arranged in the circuit that, by

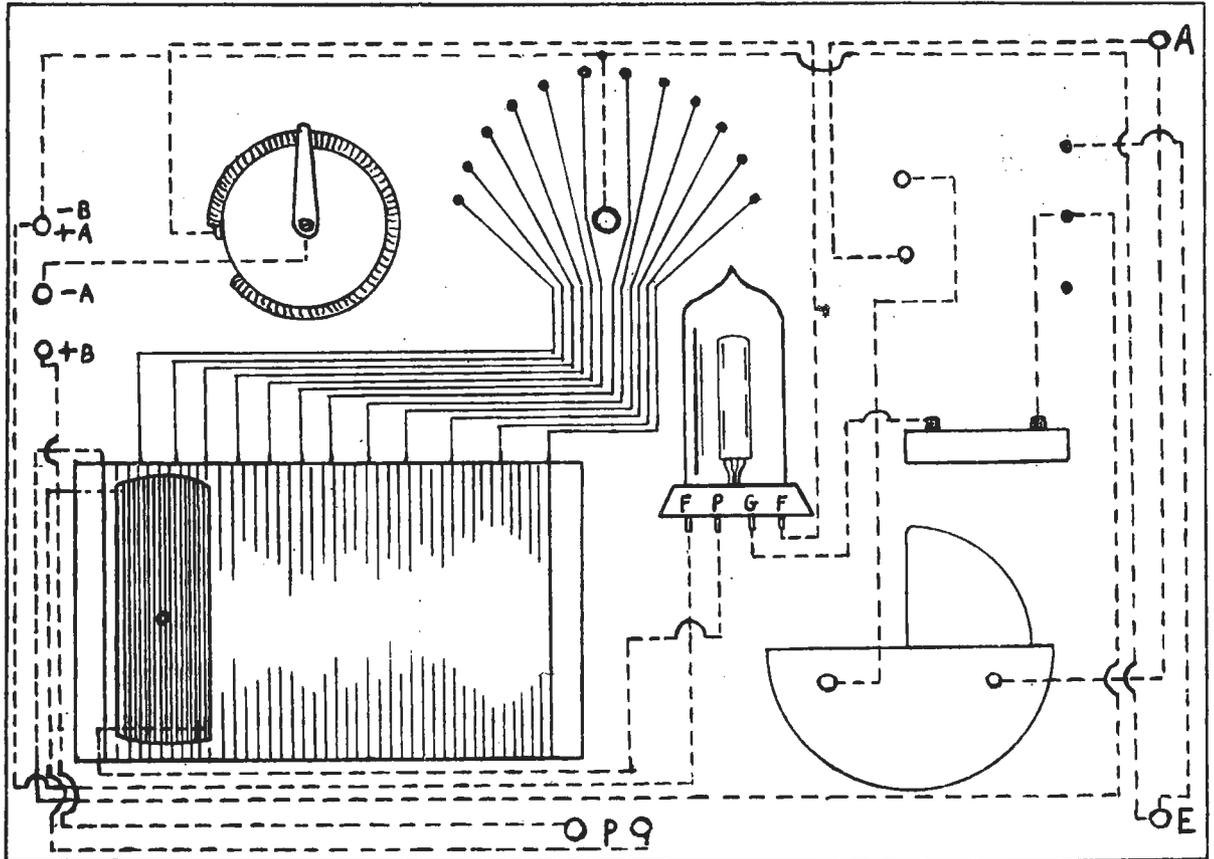


Fig. 10

means of the series parallel switch on the front of the panel, it can be put in series with the primary coil or in parallel with it. Thus fine tuning on all wavelengths is made possible.

### Task of the Rheostat

The only other piece of apparatus in this set to which the reader has not been made familiar is the rheostat or variable resistance, which is connected in the filament circuit. The task of the rheostat is to control the flow of current from the filament battery to the filament itself, thus, to a great extent regulating the electron stream from the filament to the plate. As we have already mentioned, the electron emission from the filament is greatest when the wire is bright hot, but it is not always good policy to burn your filament at its brightest. The life of the valve will be considerably lengthened if the filament is kept as dull as possible, compatible with good signal strength. By this it is not meant that the filament, even if burned at its brightest, would wear out in months. Valves are costly things, and he is a wise man who takes the greatest care of them. As to the construction of a rheostat: it is a length of

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resistance wire, which, as its name implies, resists the flow of current, wound in condensed spring or spiral form, and mounted on the edge of a circular piece of non-conductive material, such as ebonite. From the centre of the disc is a metal arm, which makes contact with the resistance wire at all points. The arm can be rotated by a knob on the outside of the panel, thus making it possible to cut in or out the required amount of resistance.

## Parts Required To Make This Set

The parts required in the construction of this set are:—

*Ebonite or bakelite panel 12 inches by 9 inches.*

*Primary former (composition), 4 inches in diameter and 5 inches long.*

*Rotor for "tickler" coil and shaft parts.*

*Sufficient No. 22 single cotton covered wire for winding primary and making tapping leads.*

*Half a pound of No. 28 enamel wire for winding "tickler" coil.*

*Fifteen contact studs, and seven terminals.*

*Rheostat.*

*Valve and valve holder.*

*Combined grid leak and grid condenser.*

*Variable condenser (.0005mf).*

*Switch arm for primary studs.*

*Knobs and dials (3½ inches in diameter) for condenser and tickler.*

*Series-parallel switch.*

*Panel wire.*

The primary coil should have 120 turns of wire tapped at the tenth turn from the start and thereafter at every ten turns.

The "tickler" coil should have 100 turns of wire.

The panel will be cut to size when you purchase it, but you would be wise to see that no rough or uneven edges have been left. If the edges are uneven a plane will quickly remedy the trouble.

The former for the primary should be a piece of ebonite tubing which is better fitted to take the shaft of the rotor than cardboard would be. This tube can be purchased at any radio dealers, together with the rotor to go with it and the shaft parts.

## Where To Start

The rotor should be wound first, the "tail" at the start of the winding and that at the finish being left on the inside of the rotor. To the "tails" should be attached lengths of fine, silk flex, with which to connect the coil into the circuit. Now mount the rotor inside the primary former so that, when in an upright position, the outside edge of the rotor is about half an inch inside the end of the primary.

When winding the primary start the wire, as in the case of the primary of the crystal set already described. The tappings, however, are not put inside the former in this case, but are simply left in the form of twisted loops of wire on the outside. The wiring is also finished off as before described.

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A thin coat of shellac may be added to the finished coil and the cotton covering of the wire scraped from the tappings. The tappings, by the way, should be at the top of the coil when it is mounted on the panel.

A hole is drilled in each end of the primary former for the purpose of securing it to the panel.

### Mapping Out the Panel

Having thus disposed of the coils, it is a good scheme to map out the panel and decide on the position of the various instruments. A suggested layout is given in Fig. 11, which shows the front of the panel.

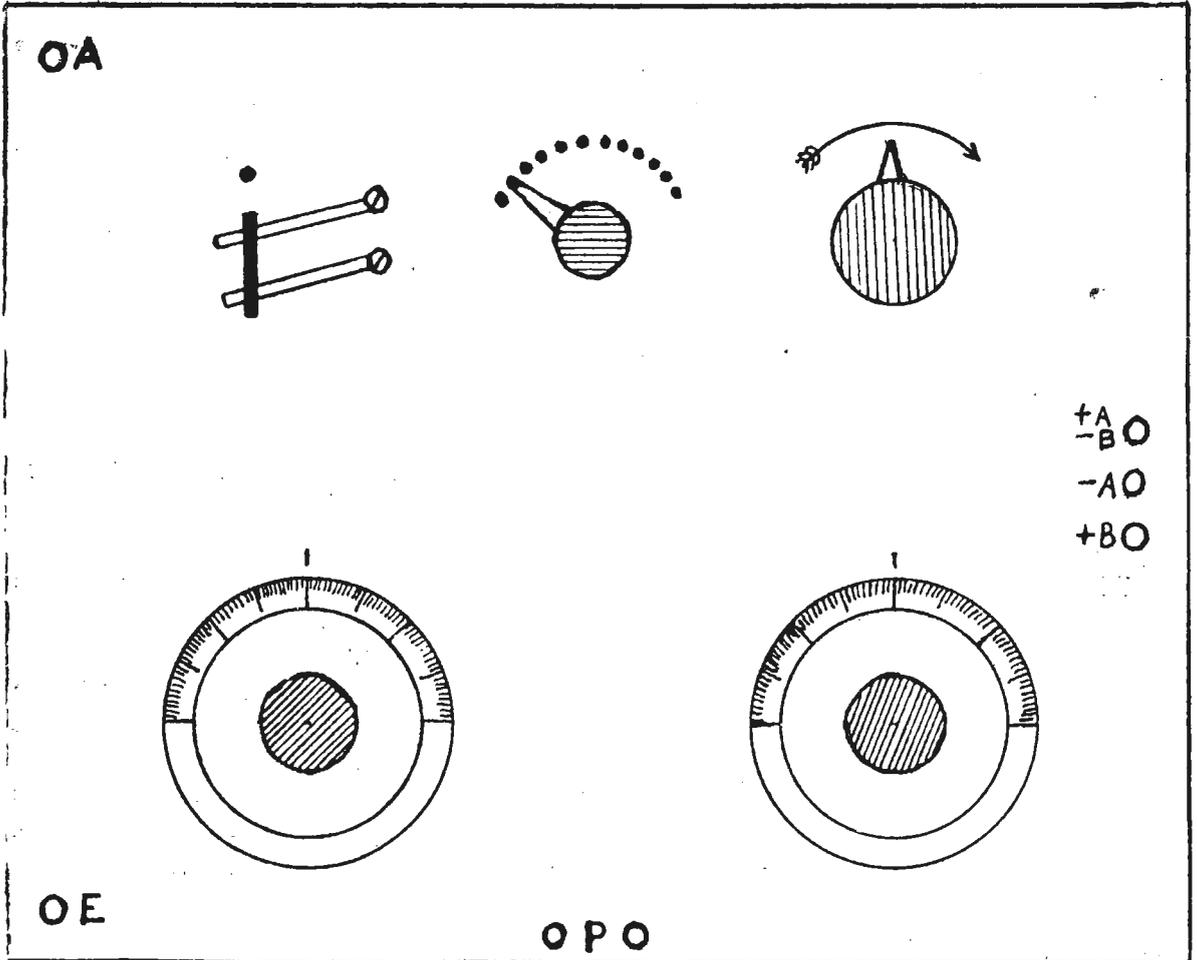


Fig. 11

Now put in the contact studs and switch arms for the coil tappings and mount the vario-coupler. The rheostat, variable condenser, and series-parallel switch should also be put into place. With regard to the variable condenser, it should be handled carefully, care being taken not to knock the plates which, if bent, are likely to touch as they move in and out, thus short circuiting the condenser. It should also be seen that the arm of the rheostat makes good contact with the resistance wire.

Mount the terminals in the positions shown in Fig. 11 and the set is ready for wiring. Before wiring the circuit, connect the tappings of the primary to the studs. This may be done with similar wire to that used.

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in the winding of the coil, and leads should be soldered to theappings. The first tapping lead goes to the first stud of the series, as is seen in Fig. 10, and so on to the "tail" of the coil, which goes to the last stud. Take care that the leads are kept away from each other as much as possible. They can be bent down over the inner curve of the coil so that they go up to the studs laying close to the panel.

### Wiring the Circuit

The wiring of the circuit is now carried out with panel wire, which is purchased in suitable lengths. For handling this wire use a good, small pair of wire pliers, and where the wire is connected to the back of studs and terminals bend it in a neat loop.

In Fig. 10 wires that are shown crossing one another with a curve do not touch, and care should be taken to keep them apart. The wires should not be up against the panel, but about half an inch from it. The

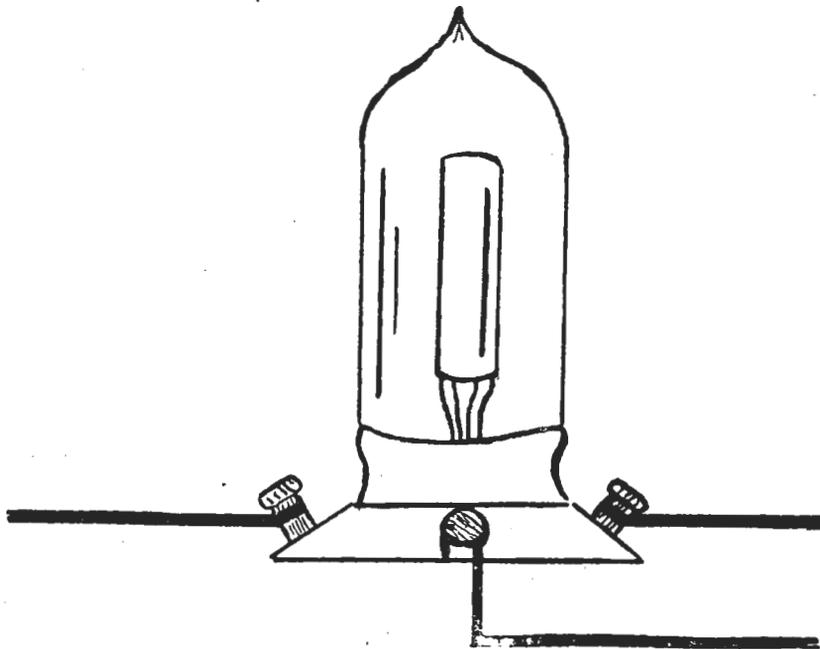


Fig. 12

panel wiring is represented (all but the coilappings) by the dotted lines in Fig. 10. In wiring the circuit it is a good scheme to keep this diagram handy, filling in the dotted lines with a pencil as you complete each connection.

All wire should be kept as short as possible and crossings should be at right angles.

It will be noticed that no provision has been made on the panel for the valve socket or the grid condenser. The condenser may be screwed to the back of the panel in a convenient space, but it is a good plan to "cushion" the valve on the wires in an upright position as in Fig. 12. By this means the valve is always on a spring, so to speak.

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# WIRELESS

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**BURGIN ELECTRIC CO.**

WIRELESS ENGINEERS & SUPPLIERS

Showrooms and Sales Dept.  
1st Floor, Callaghan House

**391 GEORGE STREET, SYDNEY**

## ANOTHER SINGLE VALVE SET

**N**OW, in wireless, as in other sciences or hobbies, there are various schools of thought. Adherents of these schools have varying ideas concerning the efficiency of the different methods of reception. For instance, one man will freely admit that the vario-coupler is a very efficient piece of apparatus, but he will maintain that honeycomb coils are a little bit better. Another enthusiast will declare that just the opposite is the case.

As a matter of fact there is very little to choose between either of these methods of tuning, but there is always the question of individual taste. If honeycomb coils are to be part of your set you must have several sets of them to use on the different wavelengths. The single valve set described in this chapter uses honeycomb coils, and if properly put together it will give equally good results as the set described in the previous chapter. The matter of choice of the two sets rests with the reader.

### The Honeycomb Coil

The honeycomb coil varies from the vario-coupler more in detail of construction than in principle of operation. In this set we still have two coils, primary and secondary or "tickler," and they are mounted side by side on the panel in a special holder, so constructed that the

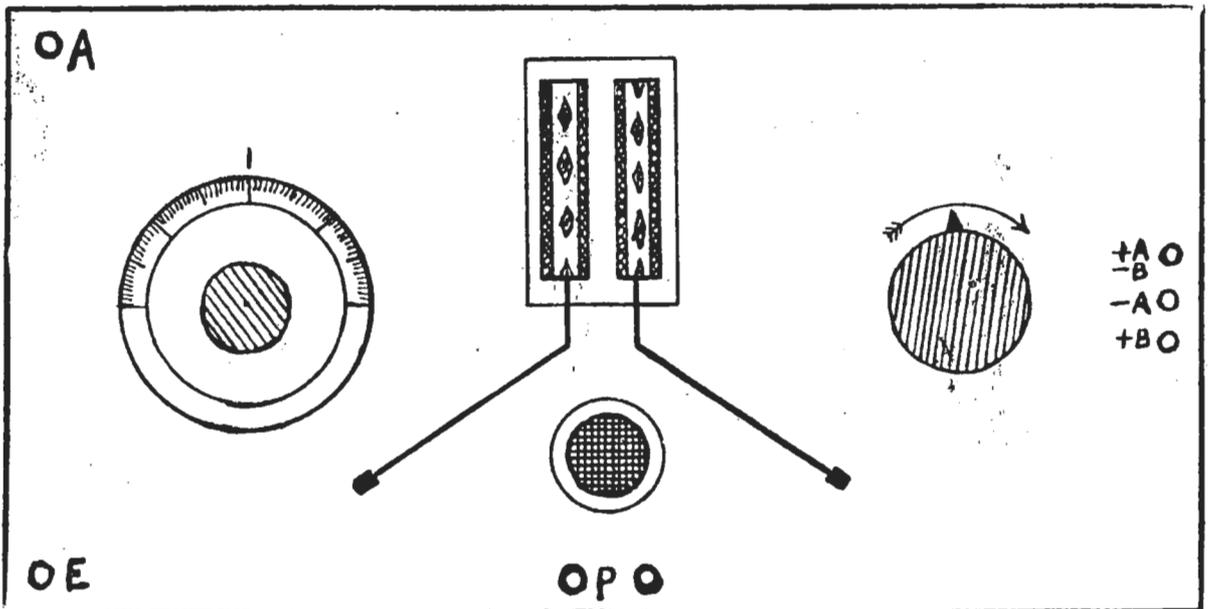


Fig. 13.

relation of the magnetic fields of the coils can be varied by opening or closing the two after the manner of a book. Called "honeycomb" from its appearance, this coil is wound on a narrow wheel-shaped former, the wiring going backwards and forwards across the coil one layer of wire over the other.

The winding of honeycomb coils is not, comparatively speaking, an easy task, and the reader is advised to buy them ready wound.

**Anthony Horderns' for Household Furniture**

The parts needed to construct this set are:—

*Ebonite or bakelite panel 12 inches by 8 inches.*

*Honeycomb (two) coil holder, and two honeycomb coil plugs.*

*Valve and valve holder.*

*Grid condenser and grid leak.*

*Variable condenser (.0005 mf).*

*Rheostat.*

*Seven terminals, and panel wire for wiring circuit.*

*Honeycomb coils.*

## How To Set About Work

The first task, again, should be the mapping out of the panel. A suggested layout is given in Fig. 13. In the centre of the panel are the honeycomb coils, and the rods protruding from beneath them are for use in varying the relation between the two. Immediately below the coils is a wire meshed "bezel" or peep hole, for observing the valve. On the left is the variable condenser dial and on the right the rheostat knob.

Having mounted the instruments on the panel we can turn our attention to the wiring of the circuit. Here there are no coils to bother one, so the work is simplified considerably. The panel wire is produced and the circuit as shown by the dotted lines in Fig. 14 col-

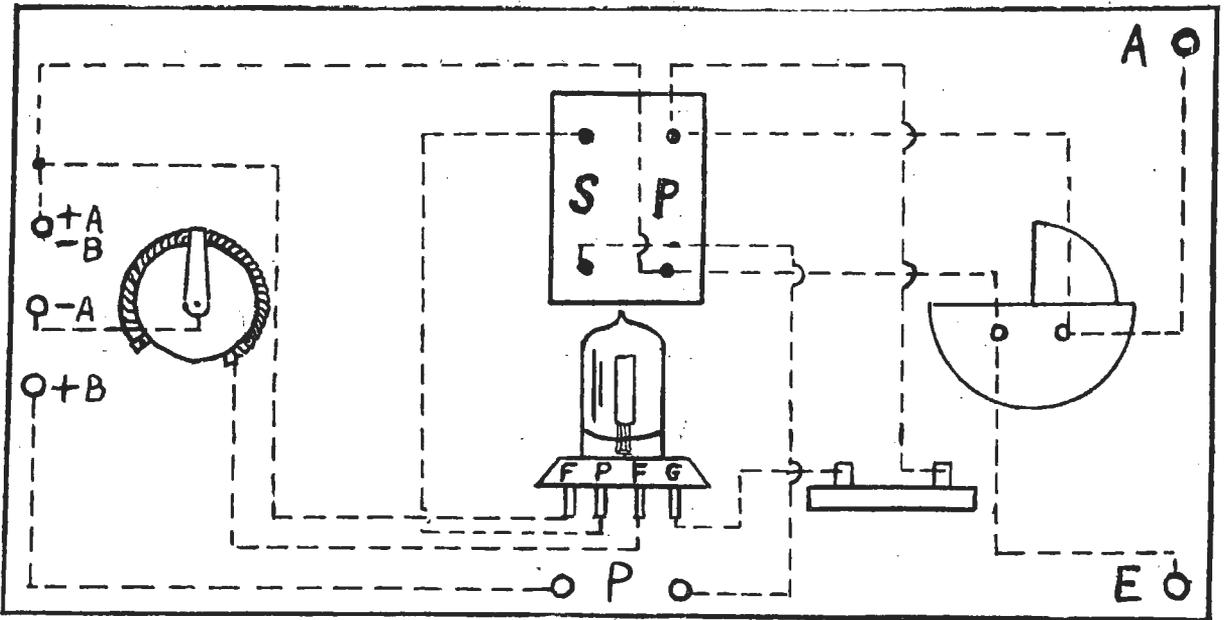


Fig. 14

lected. Do not forget that where there is a semi-circle at wire crossings the wire must be kept well apart. The valve in this case, too, may be "cushioned" on its connecting wire behind the peep hole. This peep hole can be left out if so desired.

## Tuning By Variable Condenser

Now as to the honeycomb coils. The primary, or grid coil, is, of course, not "tapped" as was the primary of the vario-coupler, and tun-

ing is effected by means of the variable condenser. The turns of wire necessary on each coil are contained in the following table:—

Primary coil.	"Tickler" coil.	Wavelength covered (metres).
25 .....	35 .....	150 to 250
35 .....	50 .....	200 to 400
50 .....	50 .....	270 to 550
75 .....	50 .....	400 to 800
100 .....	75 .....	550 to 1100
150 .....	100 .....	800 to 1600

Of course, it is not necessary for you to have the six sets mentioned. Sets, covering the wavelengths of the broadcasting or other stations you wish to receive should suffice.

It is a wise precaution to keep the coils in their proper pairs when not in use, and to paste a small label on the inside of the former of each bearing a number. Those for the longest wavelength range, for instance, could be marked "1," the primary also bearing the letter "A" and the "tickler" "B."

## TUNING THE SET

**BEFORE** leaving the single valve set, something should be said about tuning this receiver. Taken all round, the tuning of both the honeycomb coil set and the vario-coupler "hook up" is very similar.

And here a word of warning; both sets employ regeneration or reaction, and, if not properly used, are likely to energise the aerial and act as a transmitter, sending into the ether the weirdest shrieks and screams. These noises may be heard by receivers for miles around; turning the reception of entertainment into a nightmare. Prior to the issuing of the present regulations governing broadcasting, the authorities looked with disfavor on the use of reaction, and allowed it in special cases only. This, of course, meant that the benefits of this method of reception were denied to the majority, because of the carelessness of a few.

Now, however, reaction may be freely used, but the regulations demand that it must be used carefully. There is a clause in the regulations which makes it an offence to use regeneration in a manner that will cause interference with any other receiver. The penalty for a breach of this regulation is £20.

### Getting Ready To Receive "Signals"

Having connected the aerial, earth, battery, and phone leads to their proper terminals, adjust the phones and switch on the valve. If you are using honeycomb coils, open them out to the maximum; and if a vario-coupler, adjust the "tickler" to a horizontal position, when its windings will be at right angles to the winding of the primary. The coupling in each case is now said to be "loose." Set the tapping switch, if using the vario-coupler, for the wavelength

desired (it has been assumed that, in the case of the honeycomb coil set, that you are using coils suitable for the wavelength of the station you wish to receive).

Now, "search" with the condenser, varying the dial scale slowly from minimum to maximum. When the signal is heard, gradually close the coupling till the signals are comfortably loud and not distorted. Adjust the condenser again. The signal strength may also be increased by brightening the filament of the valve with the rheostat, but, as has already been mentioned, it is a good policy to receive with the filament as dull as possible.

If you are using a grid condenser combined with an adjustable grid leak (a really handy piece of apparatus), the leak should be set at the most suitable position, which may be judged by the strength of the signals in the phones. It will be found that it is hardly necessary to touch the leak again.

The "B" battery should next engage your attention. Try the "wander plug" in each voltage, tapping till the best results are obtained.

## When Your Valve Howls

If, during the tuning operations, the incoming music becomes mingled with a "howling" noise, and is badly distorted in consequence, the set is in a condition of oscillation, and the coupling should be opened at once, for you will be causing interference. If the set goes into oscillation easily, reduce the filament current.

Assuming that there is no station sending, and you are closing your coupling, at a certain point a dull "plop" will be heard in the telephones. This sound indicates the point of oscillation, and if you open the coupling the sound will be repeated as the set goes out of oscillation. You can always tell if your set is oscillating, if there are no stations sending, by tapping the aerial terminal with a moistened finger. If oscillating, a double click will be heard in the 'phones.

If good results are not obtained immediately you put your set into operation, do not despair. In wireless there are so many factors, many of them, quite insignificant in themselves, that contribute towards good results, that only by constant experimenting can the enthusiast get the best. By experimenting we do not mean that the set should be taken to pieces and rebuilt; nothing so drastic. Try different battery strengths for different stations; try different coils; in short, get thoroughly familiar with your apparatus.

## A Note of Warning

Another note of warning: Do not get a reputation as a "fiddler." A "fiddler" is the man who cannot let well alone; he, who while the other members of the family are listening-in, wants to play with the controls of the set in an endeavor to get the signals in a "little" better. Such a man soon becomes unpopular with his family and his

**Anthony Horderns' for Men's Clothing**

friends, and it is usually he who annoys his brother enthusiasts by allowing his set to oscillate.

The two single valve sets mentioned are, for broadcast reception, most efficient, and have been chosen for detailed description in this handbook on that account. But the enthusiast is by no means restricted to these sets. Many who take up radio are experimentally inclined, and for them there are scores of circuits to be tried. The changing of the circuit need not mean the total scrapping of the set, but only the alteration of the panel wiring. New circuits are constantly appearing, and it is an interesting pastime to try them. The reader will find little difficulty in tracing and understanding the circuits and their characteristics. A selection of single valve and other circuits is given in a later chapter.

## BATTERIES AND VALVES

**H**AVING completed the construction of the set we must now turn our attention to batteries. In single valve sets, as has been mentioned, there are two batteries—the "A" or low "tension," and the "B" or high tension. The work of the former is to light the filament, and that of the H.T. to supply the plate current. "A" batteries are roughly of two classes, dry cells and accumulators. Dry cells are, in the main, used with dull emitter or dry cell valves, as these require less voltage and amperage than the bright filament valves.

### The Battery

All batteries make use of the properties of certain chemicals and convert the chemical energy into electrical energy. Batteries essentially consist of two dissimilar plates immersed and separated in a chemical solution which acts more readily on one than on the other. When the two plates are joined by a conductor of electricity it is found that a current will flow in the circuit. In the commercial dry cell the

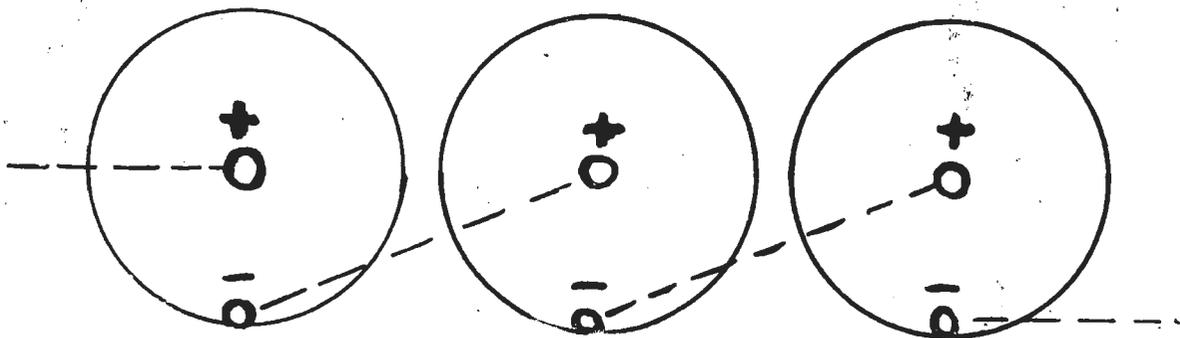


Fig. 15

two plates are zinc and carbon. The zinc, in addition, serves as a container for the rest of the materials. The zinc is completely lined with a layer of absorbent paper. A round carbon stick is set in the centre, and packed around it is a mixture of powdered carbon and managanese

**Anthony Horderns' for Sporting Outfits**



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Illustrated here is the

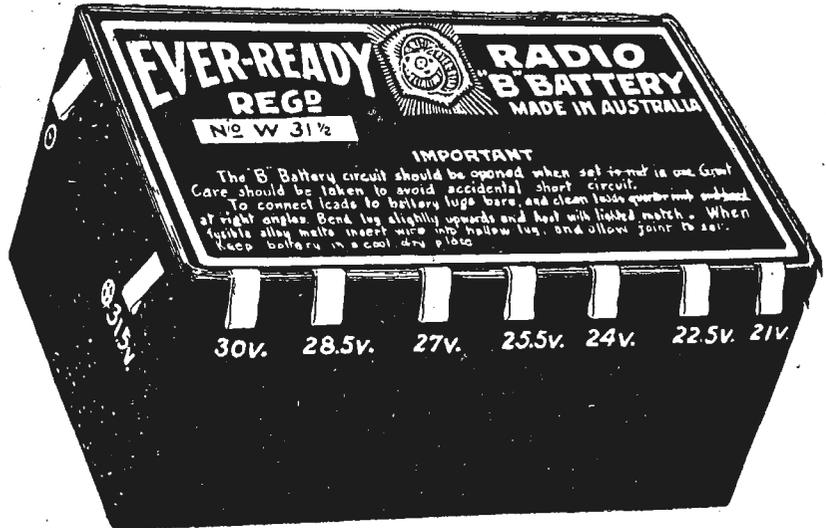
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L.T. 3.

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dioxide which has been well soaked in salammoniac (ammonium chloride). The paper lining is similarly soaked. The paper serves to insulate the powdered carbon from the zinc, as an internal short circuit would occur if these two touched.

### Making Cells Last

The carbon rod, which does not touch the bottom of the container, is equipped on top with a terminal or binding post and there is a similar fitting on the zinc container. At the top of the cell is a layer of sawdust and a finishing covering of pitch. It will be seen from the foregoing that the cells are not actually dry, though they can be placed in any position without fear of spilling. Cells last better if they are kept in a dry, cool place. The negative and positive terminals of the cylindrical cells are seldom marked, so it should always be borne in mind that the centre terminal is the positive and that connecting with the zinc case is the negative.

The accumulator is a delicate piece of apparatus, and needs special care. Briefly, it consists of the container, the sets of negative and positive plates and the electrolyte. When an accumulator is being charged the electrical energy used is converted by the battery into chemical energy. This chemical energy is re-converted into electrical energy when the battery is in use or discharging. The voltage and amperage is usually marked on the accumulator when it is sold, and care

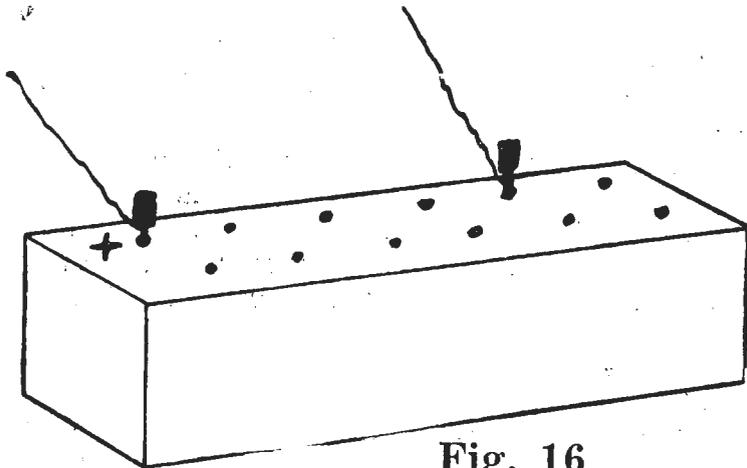


Fig. 16

should be taken that you get an accumulator to suit the valve you intend using. The radio dealer will advise you on this point.

### Choice Rests With You

As in the case of tuners, the choice of valve must rest with the reader. Many people do not like the idea of attending to accumulators and getting them charged constantly. For these there are the dry cell valves. Some of these valves work from two cylindrical dry cells and others from three, connected in series as in Fig. 15. However, complete instructions concerning the batteries for dry cell valves are usually supplied in printed form with the valves.

Anthony Horderns' for Men's Mercery

## Many Makes of Valves

There are many makes of valves, both bright filament and dull emitters, and as many are equally suitable for the work, it is hard to recommend any specific one. In this matter, too, the radio dealer will always be found ready to assist.

The "B" battery operates on the same principle as the dry cell, but is composed of a number of small cells connected under the pitch covering. The voltage of the "B" battery you will require will also depend on the type of valve you use, for different valves require different plate voltages. Most "B" batteries are "tapped" at various voltages so that the plate current can be readily varied. A common positive is used with the negative tapplings at different voltages as is shown in Fig. 16.

Accumulators need a lot of care and attention. They should not be discharged below a certain point, and should be re-charged every few weeks, even if not in use. Care should be taken not to spill any of the liquid from the accumulator, as it is damaging to clothes, carpets, etc.

Dry cells will give fairly long service, if used with care, but they are useless when exhausted and must be replaced by new ones.

## AMPLIFICATION

**WE** will assume that the enthusiast has his single valve set working nicely, but there is one drawback—only those can hear the broadcast for whom telephone headsets are provided.

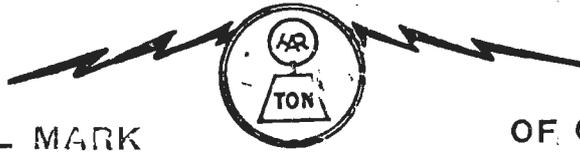
Somebody suggests: "Why don't you get one of those horn things, then we can all hear?" The trouble is that the enthusiast cannot work a loud speaker from a single valve set, for the volume of sound produced is not sufficient. So it becomes necessary to amplify our signals by addition of one or more valves and other apparatus.

### How To Amplify

Amplification can be carried out in two ways—by "boosting" the signals before detection (called radio or high frequency amplification), and by stepping up the detected signals (known as audio or low frequency amplification). As we are concerned principally with broadcast reception, we shall confine ourselves to audio frequency amplification. Where weak signals have to be picked up, radio frequency amplification is better used in conjunction with audio frequency. Weak signals may be missed by a detector valve, and it is obvious that the audio frequency valve can only amplify the signals passed on to them. Therefore, the radio frequency valves are of great value in "boosting" up the weak signals before passing them on to the detector.

Broadcasting stations, however, send out on good power, and the detector valve has therefore plenty of energy to pass on.

**Anthony Horderns' for Men's Boots and Hats**



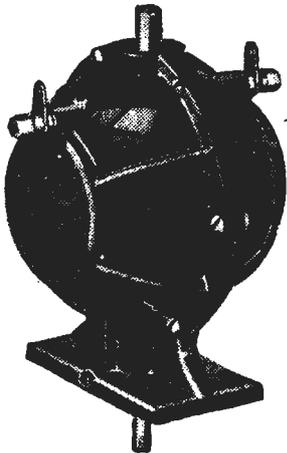
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## Heart of the Amplifier

The heart of the amplifier is the inter-valve transformer, which is composed of coils containing an iron core. Fundamentally the transformer is similar to other couplers with which the reader is now familiar. The iron core, which was absent in the other couplers, has in this case been introduced to facilitate magnetic action. The transformer has a primary and a secondary coil, the latter being wound with a larger number of turns of wire in order to "boost" the voltage of the induced current. The ratio of the windings is usually about one to four.

When added to the detector circuit the amplifier (audio frequency) occupies a much similar place to that usually taken by the telephones, the phones being moved along and connected to the plate of the amplifier and to the positive of the "B" battery.

## One Stage of Amplification

With the addition of one stage of amplification it is possible to get fairly good results with a loud speaker within a range of about 30 miles of a broadcasting station. Using phones only, splendid results, of course, can be obtained over a very long range. Outside a 30-mile radius it is advisable to put in three stages of amplification (audio frequency) in order to get good loud speaker results.

We will deal with one stage of amplification first. The only apparatus we shall need in addition to that already in the single valve

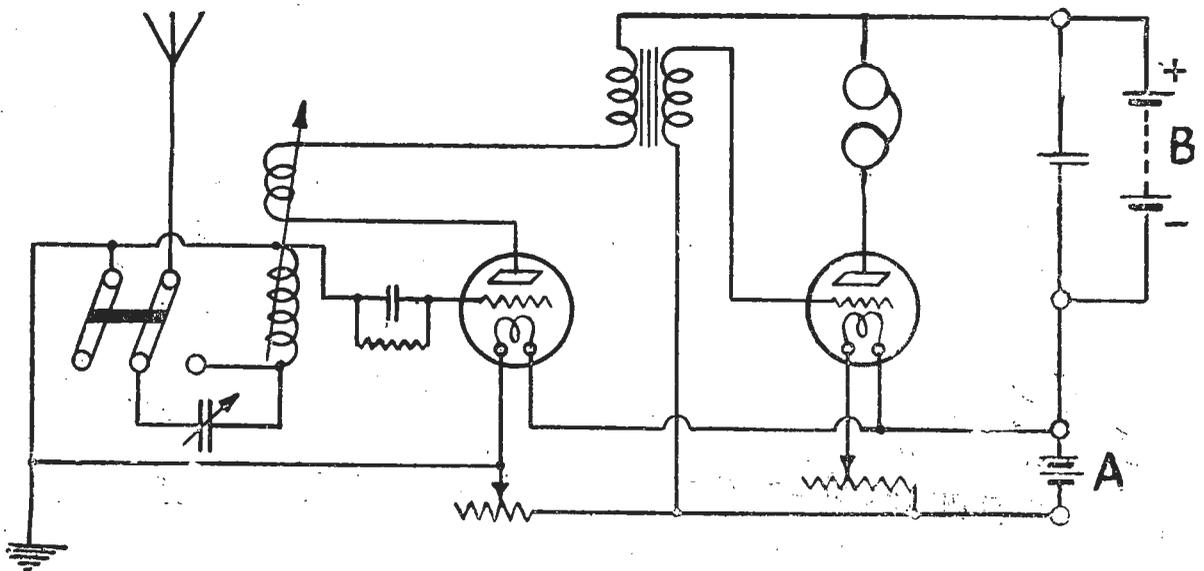


Fig. 17

outfit is an inter-valve transformer, a valve and socket, a filament resistance (rheostat), and a small fixed condenser. It will, of course,

Anthony Horderns' for Jewellery and Electroplate

be necessary to get a larger ebonite panel to accommodate the extra instruments.

The circuit recommended for converting the vario-coupler set into a two-valve outfit is given in Fig. 17. The reader will have no difficulty in following the diagram. The markings usually on the transformer, which has four connections, are OP, OS, IP, and IS. The lead from the detector valve plate goes to OP, that from the grid

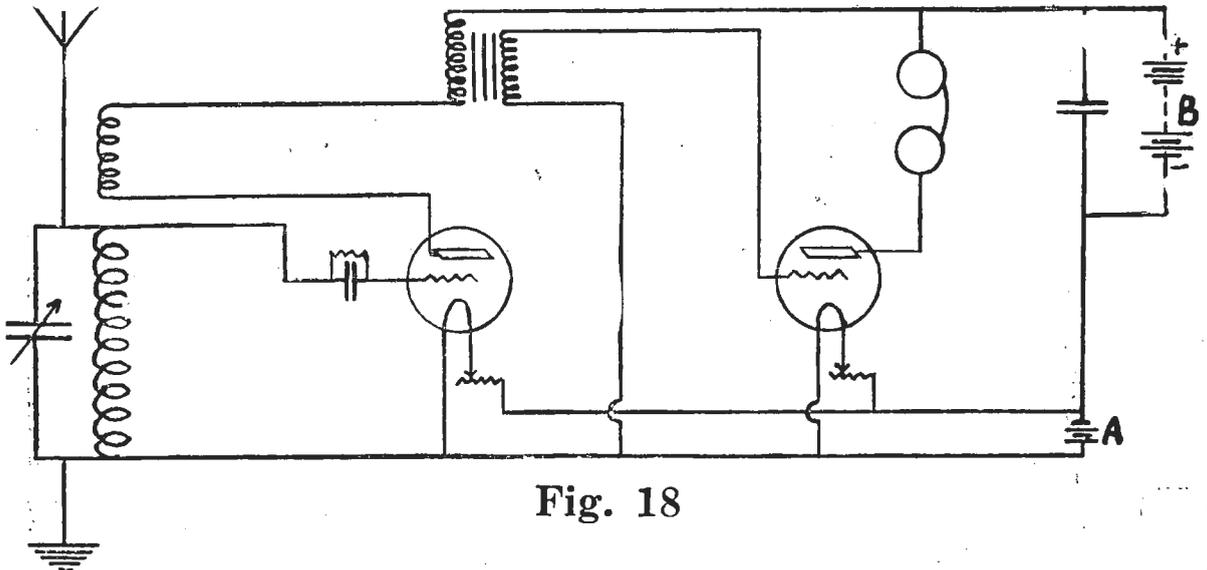


Fig. 18

of the amplifier is IS; that from the positive of the "B" battery to IP; and that from the negative of the "A" battery to OS. The loud speaker is connected in place of the telephones.

For the honeycomb coil set the connections for the addition of a single stage of audio frequency amplification is given in Fig. 18. It will be seen that the principle is just the same. Similar valves to the detectors may be used for amplifiers. Similar connections are used for each stage of audio frequency amplification.

### The Unit System

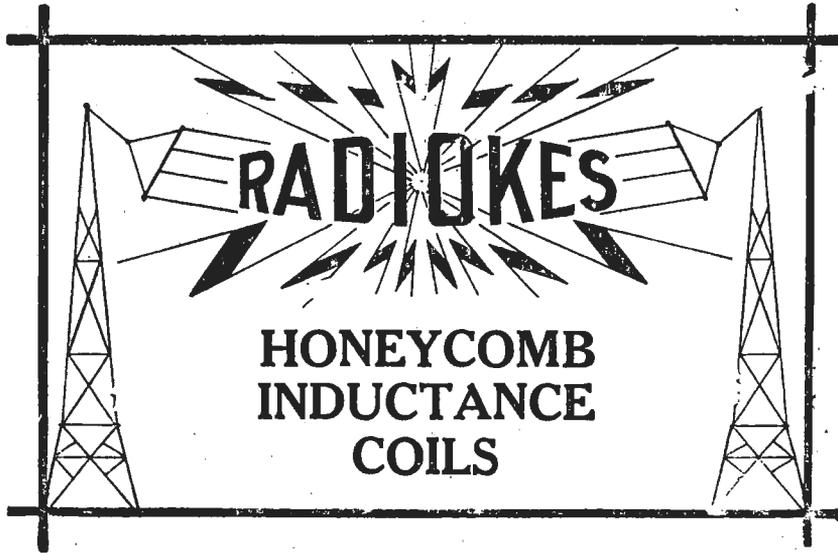
Those readers who desire to put in two stages of audio frequency amplification will find the circuit given among those at the end of the book. It is a good scheme when rebuilding for three-valve outfit to do so on the unit system.

This system is the placing of the various parts of the set on different small panels, each panel being mounted in a cabinet of the same size. In the case of a three-valve set, four panels could be utilised, one for the tuning elements, one for the detector unit, and one each for the stages of amplification.

Thus there would be four small cabinets, which could be arranged in block fashion and fitted with terminals or plugs to cut in or out the amplification stages. The "hook up" for this scheme is given among the circuits at the end of the book.

Anthony Horder's' for Tobacco and Cigars

# HAVE YOU TRIED



Approximate Wave Length with .001 Condenser

Turns	Wave Lengths
25 .....	60-230 Metres
35 .....	85-340
50 .....	150-500
75 .....	200-750
100 .....	280-1000
150 .....	360-1450
200 .....	470-2000
250 .....	530-2500
300 .....	700-3000
400 .....	900-4000
500 .....	1150-5200
600 .....	1350-6100
750 .....	1600-7700
1000 .....	2200-14700
1250 .....	2700-18200
1500 .....	3200-22200

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## ASK YOUR RADIO DEALER

## WITH THREE VALVES

**T**HE three valve set is the ultimate aim of every wireless enthusiast, and those with the necessary experience usually lose no time in constructing this most sensitive of receivers. Of course, every radio dealer will sell you a handsome and efficient set of this type, but there are few who would not rather make their own. There is a wonderful sense of satisfaction and achievement in getting good results with a set that one has built. The set about to be described can be built by anybody who has constructed the single valve set or the two valve outfit beforementioned. The three valver, if properly put together, will give excellent results over a long range, and the man who uses it should have no difficulty in receiving the Californian Broadcasting Station, KGO.

### Can Use Single Valve Parts

Those who have the single valve set employing either the honeycomb coils or the vario-coupler, can make use of all their apparatus in this set. In addition to the parts mentioned for a single valve set, the extra parts needed for this set are:—

- 1 variable condenser.*
- 2 rheostats.*
- 2 valves and valve holders.*
- 2 audio-frequency transformers.*
- 3 telephone jacks and two plugs for same.*
- A loud speaker.*

### Must Have New Panel

The panel that we used for the single valve set will not, of course, accommodate the extra apparatus, and we shall have to procure a larger one. It is a good scheme to allow yourself plenty of room for the wiring of this panel, so one 24 inches long by 12 deep is recommended. The valves for the amplification stages may be of the same type as you are already using as a detector, providing your existing valve is suited for general work. The extra variable condenser added in this set (when using honeycomb coils) is connected across the secondary coil, and is for the purpose of tuning the coil.

In this set the reader will meet for the first time the telephone plugs and jacks. These are merely devices used in place of terminals for speedily connecting a loud speaker or telephones into the circuit. This set has three such jacks, the object being to enable the telephones to be plugged into the plate circuits of the detector or the first or second stages of amplification. They are so arranged in the first two instances that the telephones may be connected without interfering with the following portions of the circuit, and this enables the operator to listen in with the phones on either the detector or the first amplifier without interfering with the operation of the loud speaker, which is plugged in to the second amplifier.

**Anthony Horderns' for Books and Stationery**

## The Wiring Diagram

The diagram for wiring the back of this panel is given in Fig. 32. On the extreme right of this sketch may be seen the honeycomb coil connections (primary and secondary), and the next instruments toward the left are the two variable condensers, that on the top tuning the aerial coil, and that on the bottom being across the secondary to tune that. The next in order toward the right is the combined grid leak and grid condenser. The condenser should have a capacity of .0001, and the grid leak should be variable. Next is the detector valve, with the rheostat controlling its filament directly below it. Then comes the first inter-valve transformer, and then the first amplifier, with its rheostat below it. The second transformer is next followed by the second amplifier and its rheostat. Immediately below each rheostat are shown the jacks.

## Housed in a Nice Cabinet

When mounting the instruments on the panel, the two transformers should be put at right angles to each other. The valves,

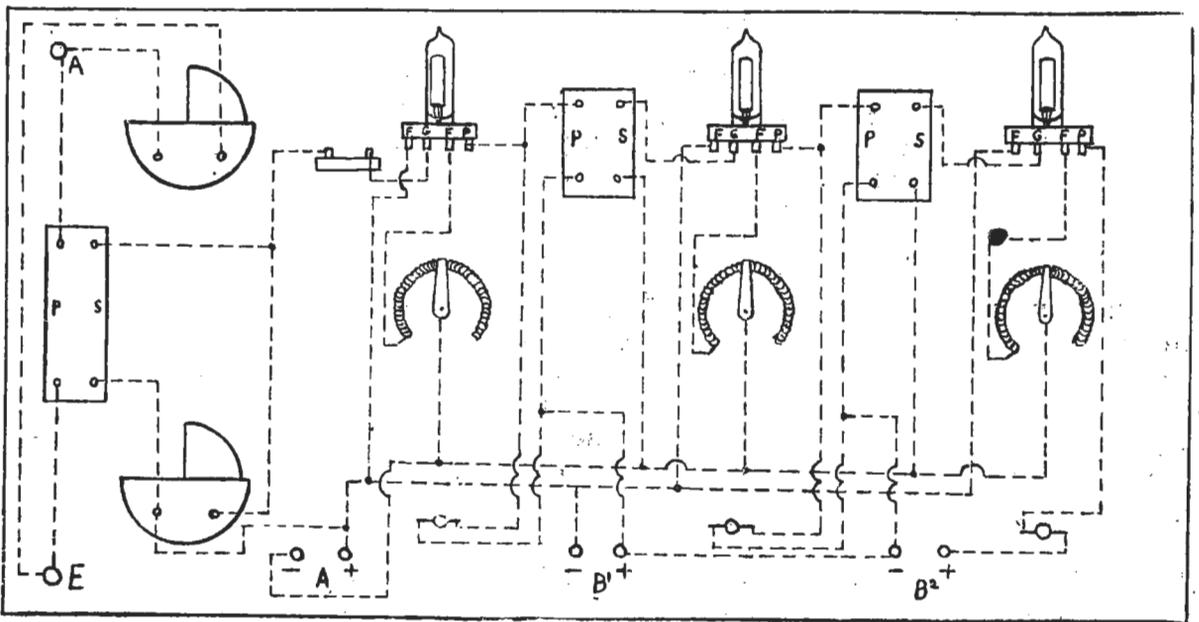


Fig. 32

if of the dry cell type, may be "cushioned" on the wires connecting them into the circuit and not secured to the panel. When wired up the panel should be mounted in a well polished cabinet, and it will look a very nice job. If it is desired, "bezels" may be let into the panel for the purpose of inspecting the valves, but they are not really necessary. A better plan, perhaps, is to have the top of the cabinet hinged so that the valves can all be inspected by lifting it.

**Anthony Horderns' for Suits-to-Measure**

## No Tuning Difficulty

The tuning of this set is by no means critical or difficult, and the hints given in the chapter on tuning apply here. Special care should be taken with the adjustment of the filament resistances of the valves and the voltage of the "B" battery.

In this set two "B" batteries are used to supply the plate currents, and they are indicated in Fig. 32 by the lettering "B 1" and "B 2."

## TELEPHONES AND LOUD SPEAKERS

**WIRELESS** telephones play a very important part in the receiving set. It is their duty to convert the minute one-way pulsations of current, passed on by the detector, into sounds audible to the human ear.

### Inside the Telephone

In principle the telephones used for wireless work differ very little from those on the wired lines of every day use. If you unscrew one of the earpieces of your wireless phones you will see the ends of an iron magnet around which are two coils of very fine wire. The wire windings create what is known as a magnetic field when a current passes through them. The influence of this field on the iron magnets makes the iron still more magnetic and the metal diaphragm is attracted by the magnetic force. When there is no flow of current in the coils the reduced force of the magnet allows the diaphragm to spring away. So we see that when a succession of signals is passing through the phone windings the diaphragm is alternately attracted and allowed to rebound, thus setting up air vibrations, causing the sounds that we hear.

### Different From Ordinary Receivers

Fig. 33 shows the inside of an average phone and the arrangement of the magnet and winding. Though on our line telephones we use but one earpiece, two are usually employed in the wireless headset. This is

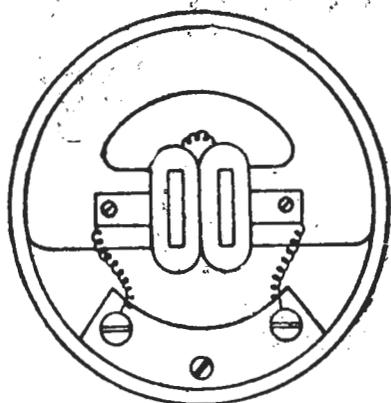


Fig. 33

to obtain a greater volume of sound; one only could be used. The resistance of the line telephone is usually about 75 ohms, but the radio phones may have a resistance up to 2000 ohms apiece. The resistance of the wired phones does not need to be so great because the current in the circuit is strong, but the radio headset has to operate on small currents so the magnetic field is made stronger by the increased resistance of the windings. In some cases, notably for commercial work, radio headsets may

have a comparatively low resistance, the current being transformed or "stepped up" by a telephone transformer, which usually shunted across the phone terminals.

Anthony Horderns' for Garden Tools

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 23 PITT STREET (Circular Quay), SYDNEY.



## Handle Them With Care

In order to get the high resistance in wireless telephones the coils in the earpieces are wound with very fine wire; the higher the resistance the finer the wire. It will be seen, therefore, that radio headsets should be handled with reasonable care and not subjected to such rough usage that may tend to fracture the windings. If the windings are broken the phone will refuse to function. Broken windings can be repaired, but it is advisable to let an expert do this work.

## How Loud Speakers Work

Loud speakers mainly operate in a manner similar to the radio telephones, the unit of the speaker really being a type of phone. These instruments, however, are specially designed to give big volumes of sound, which is thrown into a room by means of a trumpet. Many people have been disappointed with the results of a loud speaker, but this is not always the fault of the instrument. The speaker takes a fair amount of current to operate it, therefore two stages of amplification are advisable. Again, too much current may be used, which will cause the diaphragm of the instrument to vibrate so heavily that it produces a rattle and consequently distorts the music. Many loud speakers are fitted with a device for adjusting the diaphragm in its proper relation to the magnet and care should be taken that this adjustment is made. Some phones, too, have this fitting.

## Power Amplifiers

When it is necessary to fill a very large room or hall with music a specially devised power amplifier is used. This instrument employs its own valves, independent of the receiving set, and will handle the heavy currents thus produced.

# INDOOR AERIALS

**I**F you live in a flat, or if you cannot put up an aerial in your garden, do not for one moment imagine that the joys of the wireless game are not for you. Put your aerial up indoors and you will be able to hear equally as well as the man with an elaborate mast. This does not mean to say that the small indoor aerial is as efficient as the outside antenna; far from it, but with a two-valve set, within a reasonable radius of a broadcasting station, you can hear at splendid headphone strength.

At the outset it would be as well to mention that you cannot work a crystal set from a "loop" or indoor aerial. A single valve set using regeneration, has been worked ten miles from a station with an 18ft wire strung across a room, the signals coming in strongly. As a general rule, however, two valves should be used.

**Anthony Horder's' for Paints and Oils**

## Simplest Indoor Aerial

Before touching on "loop" or "frame" aerial we will deal with a more simple type. The most simple is a single wire strung from one side of a room to the other; say from the picture rail. This wire need not be unsightly—a length of No. 24 enamel wire will do, and very few people will notice it. Two small, thin nails driven upright in the picture rail and covered with a piece of rubber tubing will serve to secure the ends of the aerial, and the "lead in" to the aerial terminal of the set may be a continuation of one end. If the "lead in" is joined on to the aerial, do not forget to scrape the insulation from both wires at the point of connection.

As our little indoor aerial is working under certain disadvantages, we must avail ourselves of every means of improving its chances of picking up the ether waves. One way of doing this is to make the aerial directive; that is, to point it towards the station we wish to receive. This, of course, may be easily done in any room if you know the direction of the sending station.

## Round the Picture Rail

If it is desired that the aerial be more concealed, this may be done by running the wire right round the picture rail, but raised from it on insulated nails at each corner.

In a two-storeyed house a good aerial, and a long one, can be placed directly under the roof, above the ceilings of the upper rooms. This aerial should be made as long as possible.

I have heard the uninitiated ask: "But you have to open the windows and doors when you want to receive, don't you?" This may seem silly, but it must be remembered that there are people interesting themselves in wireless to-day who, six months ago, would not know a terminal if they saw one, and whose knowledge of the science was confined to the sending of S.O.S. messages by a ship in distress at sea. We already know that all matter is sponge-like and that that mysterious thing, the ether, is everywhere in the matter cells, even of your body. Very well, our electro magnetic waves travel per medium of the ether, so it is easily imagined that the walls and doors of our house would prove simple obstacles for them to overcome.

## The Loop or Frame

But we will get back to our indoor aerials. The accepted indoor aerial is either the "loop" or the "frame." Briefly, these are merely frames of wood, so constructed that they can revolve on a base, with the wire wound in an ever-widened manner on the arms, or on brackets on the extremities of the arms. The "loop" possesses decided directional properties. That is, the waves are intercepted best, and the maximum current is gathered when the "loop" is pointing toward the transmitting station, so that the waves strike one end first. This can be easily proved by revolving the frame while a station is being

**Anthony Horderns' for Columbia Storage Batteries**

received. As the "loop" is turned broadside on to the transmitter, the signals will become very faint, and, under certain circumstances may be tuned out altogether.

There is nothing difficult in the construction of a "loop" or "frame" aerial, and users of two or three valve sets will find them a welcome addition to their equipment, even if they have an efficient outside aerial. A distinct advantage of the "frame" is that it cuts down "static," or atmospheric, interference, and may make reception pos-

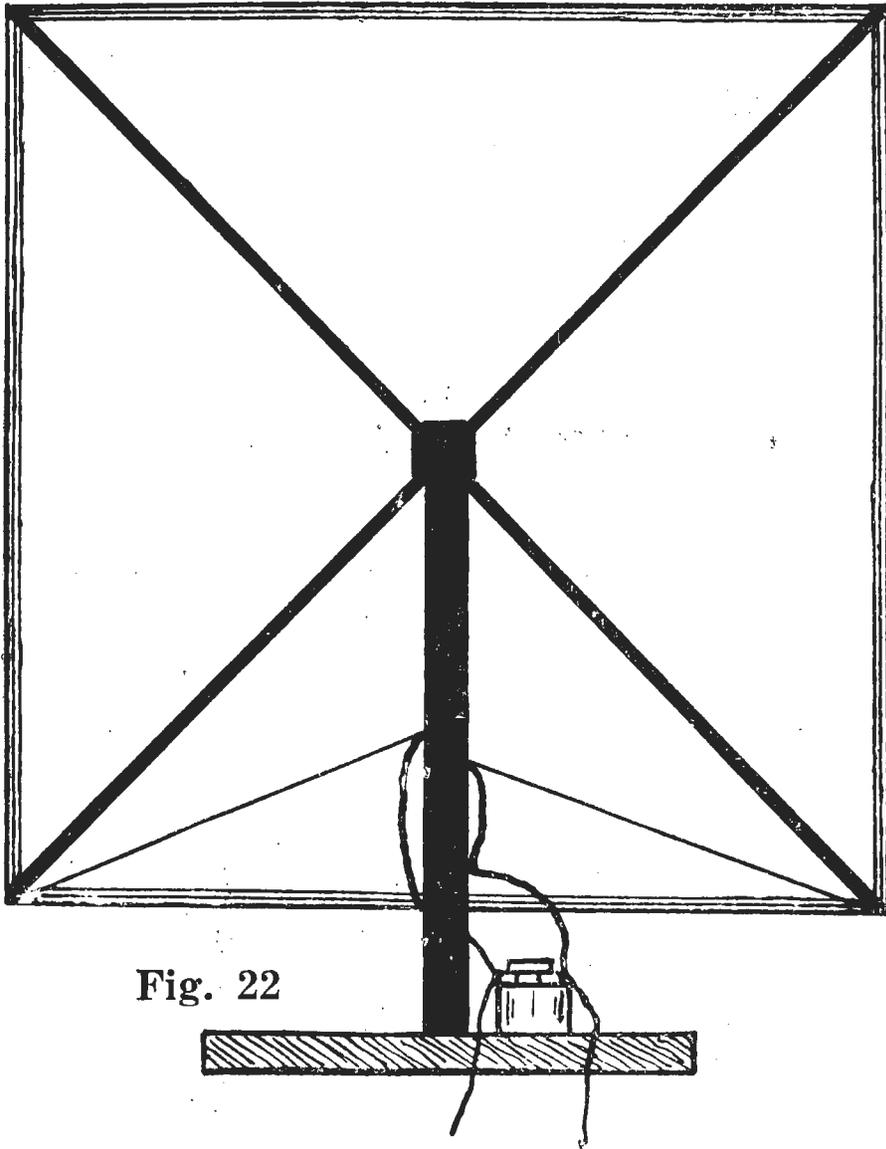


Fig. 22

sible when the outside aerial would fill your ears and drown signals by a succession of hideous cracking and roaring.

### How To Build

The parts necessary for the construction of a "frame" aerial are two light battens of wood, five feet nine inches long and six inches

**Anthony Horderns' for Motor Accessories**

wide; a wooden "leg," on which to mount the "frame;" a fairly heavy base to take the "leg" and the necessary wire. The battens are joined together with the flat sides up, and arranged in the form of a Maltese cross, so that a wire run round the edges will form a square with each side measuring four feet.

At the start a tail of wire is left and secured to the leg. To this tail is fastened a length of flexible wire for connection to the set. In winding the "frame" take the wire over one edge of the ends of the

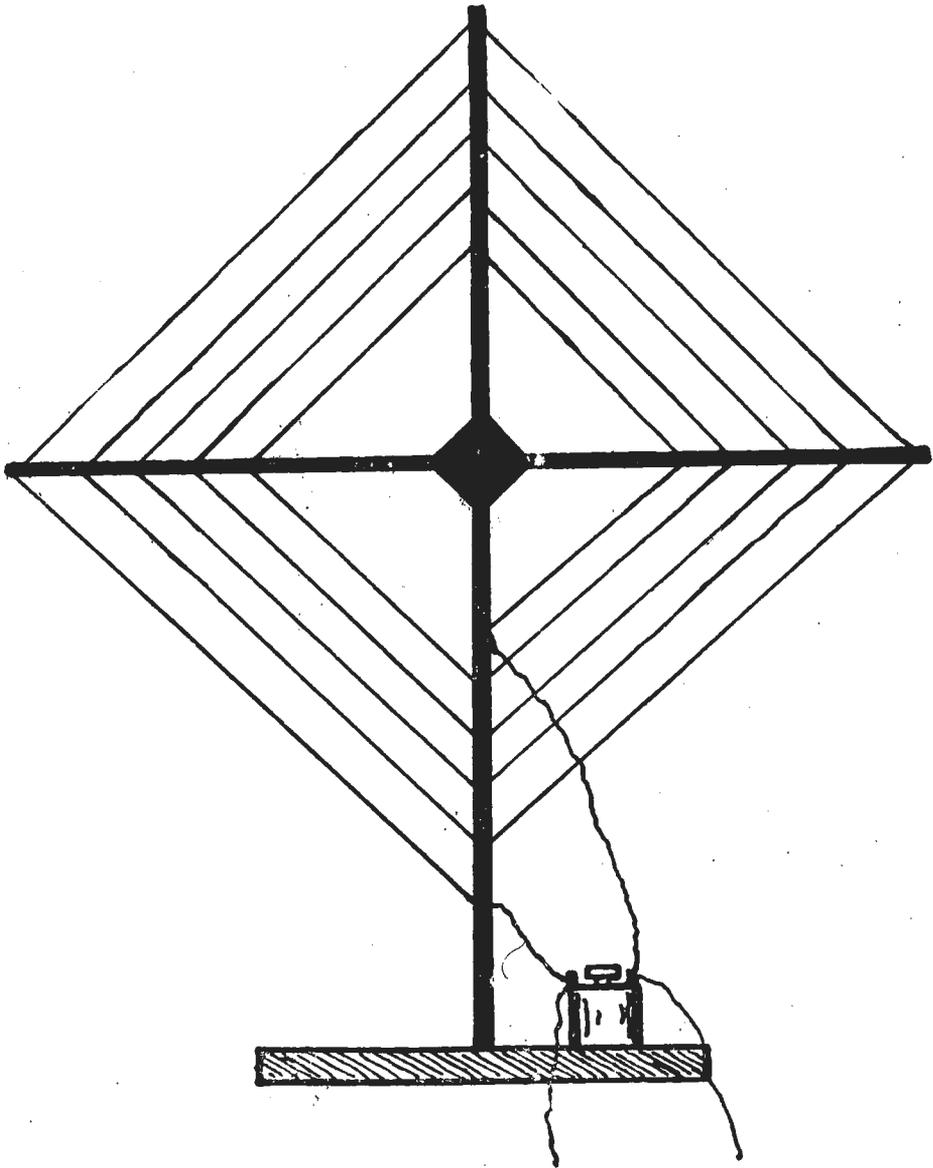


Fig. 23

wooden arms, and, keeping the turns separate, work toward the other edge. Ordinary insulated winding wire may be used for the "frame" and the "loop." The "frame" may be constructed half the size of that mentioned above, and thus take up less room in a house. The "frame" aerial is illustrated in Fig. 22 and the "loop" in Fig. 23.

**Anthony Horder's' for Complete Wireless Outfits**

### Wave-length Table

The number of turns of wire necessary on two and four foot frames to get the best results on the wavelengths mentioned are given in the following table:—

Wavelength Metres.	2 feet turns.	4 feet turns.
400 .....	7 .....	3
600 .....	11 .....	—
800 .....	12 .....	6
1000 .....	16 .....	—
1200 .....	19 .....	12
1400 .....	22 .....	—
1600 .....	24 .....	—
1800 .....	26 .....	—
2000 .....	28 .....	—
2200 .....	30 .....	24

In each case the "frame" is used with a .001 variable condenser in "shunt."

### No Earth Necessary

No "earth" connection is used with the "loop," one lead being taken to the aerial terminal of the set and the other to the "earth" terminal. In some modern multi-valve short-range sets of the phonograph cabinet type, no aerial or earth are used, their work being done by two specially-designed plates. Such sets are not, however, for a man of moderate means.

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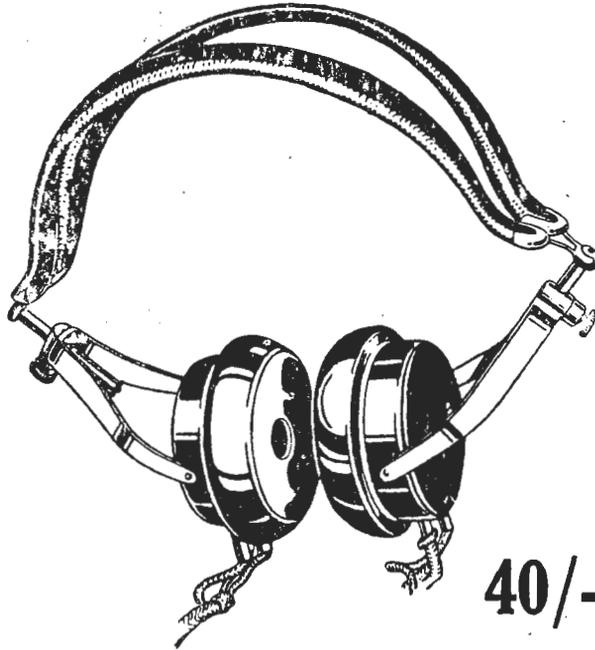
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## BUYING A WIRELESS SET

**T**HERE are many who desire to take up radio but who have neither the time nor inclination to build their own set. For these there are the sets sold by the various radio dealers, and a few hints to the intending purchaser will, perhaps, save disappointment.

### Learn a Little of the Science

Now, radio dealers are long suffering people. They have to answer innumerable questions by those who know nothing about the science, and if the set they sell, though it may be quite efficient, does not act up to the customer's expectations, they have to endure heaps of blame. Even the man who buys a complete set should understand the principles of wireless, for no book of instructions for operating gives a complete understanding of the set. The instructions may say, "complete the tuning with the condenser;" all very well, but the operator should know what the condenser does when he turns the knob and just how it affects the set.

### Decide on Type You Want

Before visiting the radio shop the prospective purchaser should decide just what type of set he will need. If he lives reasonably close to a broadcasting station and does not want to operate a loud speaker, then a crystal set will suit him. There are, mainly, two types of crystal sets, those using a simple single slide tuner, and the loose coupler sets. The latter costs a little more than the former but is more selective in tuning and should be worth the extra money.

### Watch the Circuit

Outside a radius of 15 miles from a broadcasting station it is advisable that at least a single valve set be used, but it must be remembered that this will not work a loud speaker efficiently. When buying a single valve set it should be made certain that a good circuit is employed. A circuit using regeneration is far more sensitive than a plain detector circuit and should not cost any more. The only thing is that the regenerative set requires careful handling to prevent it interfering with neighboring receivers, but hints for its proper control are given elsewhere in this book.

### If a Loud Speaker is Wanted

A two valve set, provided a good circuit is employed, will operate a loud speaker over a distance of 15 or so miles from a broadcasting

**Anthony Horderns' for Crystal Sets**

station, but to get really satisfactory results outside that radius three valves should be used.

It should be noted, too, what type of valves are in the set. Any standard valve is good, but may be the purchaser does not want the trouble of caring for an accumulator. In this case he should see that dry cell valves have been put in. In any set there are certain portions of the apparatus that should be inspected; not that radio dealers knowingly sell defective apparatus, but such things are liable to be overlooked by the makers. Here are some of the points that should be noted.

## Points To Be Noted

**Dials.**—See that they turn easily and do not scrape against the panel.

**Studs and Arms.**—See that switch arms make good contact with all the studs and that the arm travels smoothly from one stud to the other.

**Rheostats.**—See that the arm makes good contact with the resistance wire. The turns of wire should be of equal height, so that the arm slides over them smoothly.

**Variable Condensers.**—Make sure that movable plates do not touch the fixed ones when the dial is turned.

**Valves and Sockets.**—See that the socket is the right type for the valve and that the legs of the valve make good contact with the holder fittings.

**Tuner.**—Make sure that this will enable you to tune in the stations you desire to receive. You may safely take the radio dealer's assurance on this point.

## Get the Right Batteries

**Batteries.**—Procure batteries to suit the set and be very careful that you know where each one should be connected. Should you connect the "B" or high tension battery in place of the "A" battery your valve is likely to be rendered useless.

It has been estimated that fully 75 per cent. of the valves that "go dead" do so because the filament leads are mixed up with the high tension battery.

**'Phones.**—Make sure these are of the right resistance (usually 2000 to 4000 ohms). Low resistance telephones may be used with a telephone transformer. A test for 'phones is given in the chapter "Things You Should Know," of this book.

With any set it is advisable to get the dealer to give you a practical demonstration.

**Anthony Horderns' for Valve Sets**

## A WIRELESS MAST

**S**INCE radio began to boom in Australia, the most weird masts for supporting aerials have appeared in suburban gardens. Some seem to have been constructed with two clothes props lashed together, others are ominously-bending, untrimmed saplings, and there are also hideous contraptions built of any old timber at hand.

In addition to being most unsightly, some of these makeshift masts look dangerous, and one can imagine the first good blow taking a severe toll of these aerial supports.

### Flagpole Owners Fortunate

Those who have flagpoles in their grounds are fortunate, for a good height of aerial can, in most cases, be obtained with them. But the majority were not put up for the purpose of carrying an aerial, and as the antenna is much heavier than a flag, care should be taken to see that the halliards are strong enough to bear the extra strain.

The imposing wooden mast of the conventional design is a comparatively costly affair, but the aerial support here described should

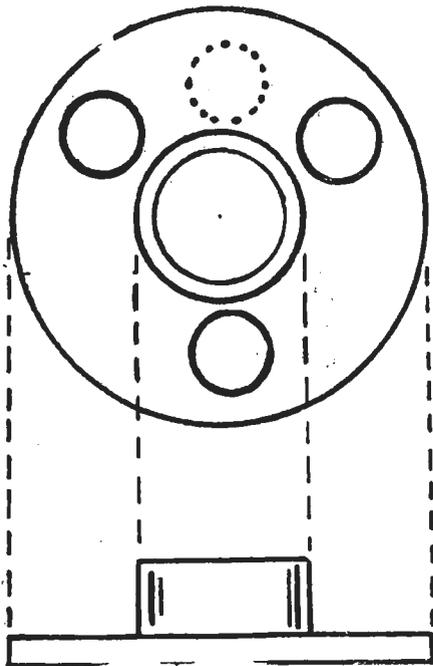


Fig. 29

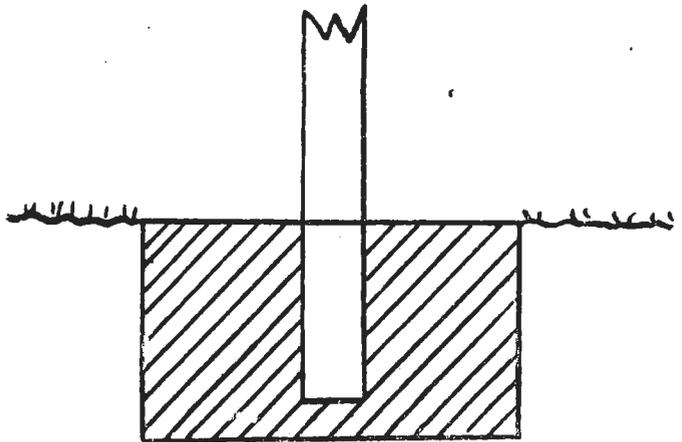


Fig. 31

not impose any undue strain on the pocket of the average citizen, especially if he carries out most of the work himself. The mast, which is of ordinary iron piping, is shown in Fig. 30.

The first thing to do, if you intend putting up one of these masts, is to choose the site for it. It must not be forgotten that your aerial span should be at least 60 feet from insulator to insulator, and the mast must be placed with this end in view. If you have a nice long garden, put up the support at the end furthest away from the

**Anthony Horderns' for Cabinet Receiving Outfits**

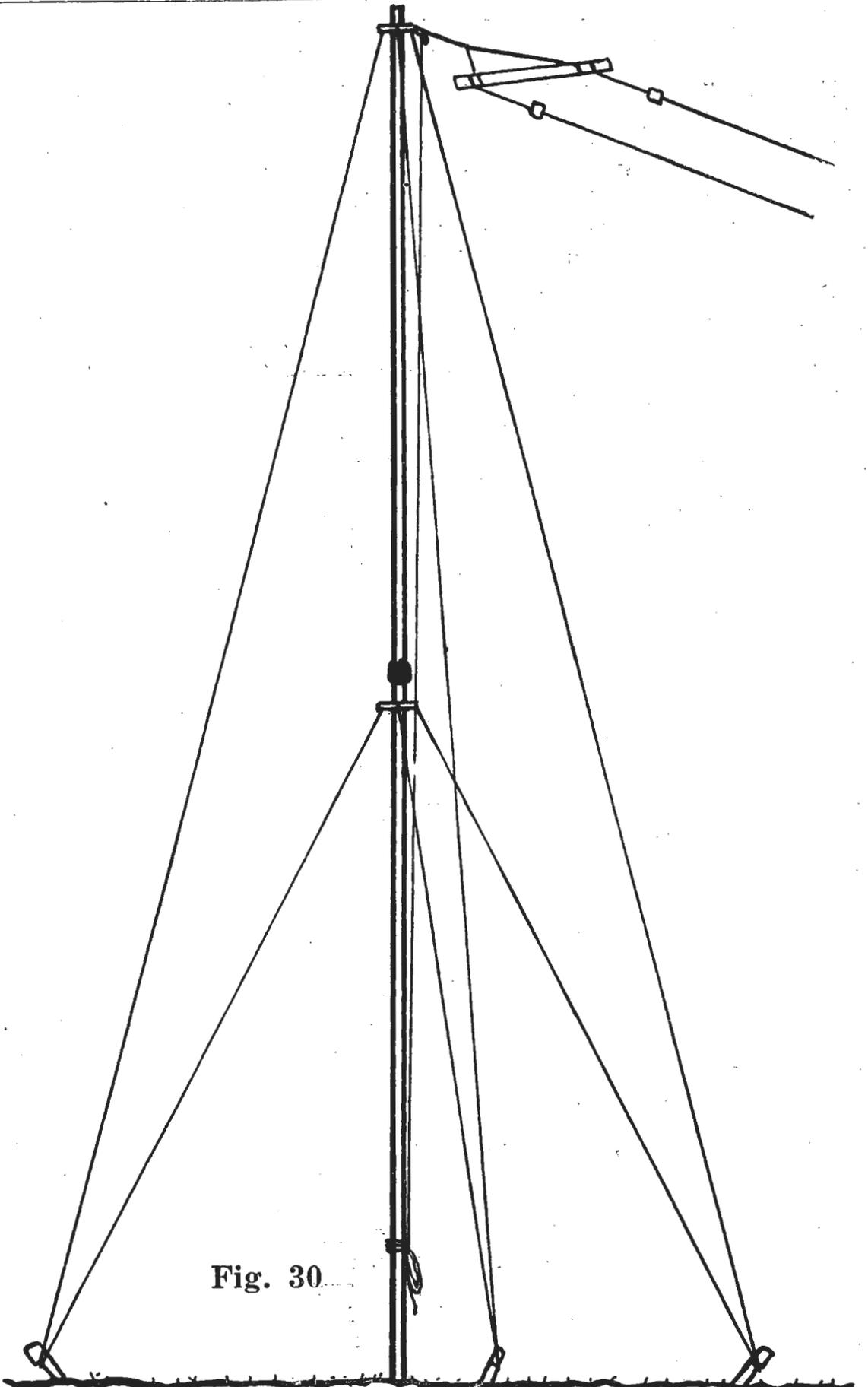


Fig. 30

Anthony Horderns' for Loud Speakers

house, then a chimney or other high part of the house may be utilised as a support for the other end of the aerial.

## How To Make Mast

For the construction of the mast itself, get two 15ft lengths of ordinary iron water piping, one end of each length being cut to take a screw connection. The screw joint for joining the pieces together should also be procured. The piping should be one and a half inch in diameter (outside). Now get a blacksmith or engineering shop to make two collars and flange to fit closely over the pipe. The collar should be an inch deep, and the flange an inch and a half wide from the collar to the outer edge. The collar and flange are shown in Fig. 29. One of the fittings should contain the three holes shown, and the other must have four holes, the additional hole being that shown by the dotted line in Fig. 29.

The fitting containing the three holes is now slipped over one of the lengths of pipe at the screwed end and temporarily secured about 9 inches from the end. A hole is then bored through the collar of the fitting and the pipe, and a bolt inserted and screwed tight to keep the fitting in place. This fitting is to take the stays at the middle of the mast (shown in Fig. 30).

The other fitting (that with the four holes) is put on in the same manner to the unscrewed end of the other length of pipe. This fitting is to take the top stays, and the block or pulley, for the halliard, on which the aerial is raised or lowered. Before drilling the collar of the second fitting and the pipe, see that the three holes for the stays are in corresponding positions to those of the lower fitting. It would be better if the two lengths of pipe are screwed together before the top fitting is put on.

When putting up the mast, see that the hole for the halliard faces the other aerial support.

## How To Fit the Stays

For the stays, 125 feet of strong light wire will be needed. The ends of the stays that go on the mast fittings should have eyes spliced into them, and they can then be secured to the fittings by means of small shackles. A neat wire strop to hold the halliard block should be fitted, and the halliards, for which 50 feet of strong light rope will be needed, must be rove before the mast is raised. The stays are secured on the lower end to three pegs driven into the ground. These pegs should be of hardwood, and not less than eighteen inches long. The bottom ends of the stays should be spliced, and an eye put in each, and they can then be secured to the pegs by rope.

Before the mast is raised, it should be given a coat of paint, some good aluminium coating for preference.

## Fill Hole With Concrete

At the spot on which it is proposed to stand the mast, a hole two feet square and two feet deep should be dug. The mast is

**Anthony Horderns' for Telephone Headsets**

"stepped" in the centre of this hole, and when adjusted in an upright position by the stays, the hole is filled in with concrete. Fig. 31 shows this arrangement, the concrete being represented by the shaded portion.

A better scheme is to put into the concrete, in place of the mast, a stout length of pipe, into which the end of the mast may be fitted. This will allow of the mast being taken down for repainting or repairs to the stays.

Drive the stay pegs well into the ground, and space them properly well away from the mast. The pegs should be so driven into the ground that they are leaning at right angles to the direction of the strain.

## THINGS YOU SHOULD KNOW

**B**EFORE handling any wireless apparatus, get a license. There is a penalty of £20 for operating an unlicensed receiving station.

It is an offence to sell radio apparatus, or to construct sets for sale, unless you hold a radio dealer's license.

Before deciding on purchasing a set, or before constructing one, see that you have sufficient room to put up a suitable aerial. A crystal set requires a span of at least 40ft of wire to give good results.

### Use Valves Over 15 Miles

If you live outside a 15 mile radius from a broadcasting station it is best to get a valve set.

If you are using a crystal set do not handle the crystal with the fingers, as this will put a fine film of grease on it and make it unsensitive. When moving the crystal, do so with a pair of tweezers.

Much of the success of good reception with a crystal depends on the telephones. See that you get a good pair. In order to test 'phones, place them in position over the ears, put one terminal between the lips and gently scrape the other terminal on a piece of metal held in the hand. If the 'phones are sensitive faint clicks or scratching noises will be heard as the terminal scrapes over the metal.

### If You Want Loud Speaker

You cannot add anything but valve amplification to the crystal set to make it more sensitive. If more powerful signals are wanted you will have to use valve apparatus. It is not practicable to operate any form of loud speaker with a simple crystal set.

The single valve set is excellent for use with 'phones, but it will not successfully operate a loud speaker.

When purchasing a valve get the dealer to light the filament to see that it is in good order. Once you have paid for and received the valve

**Anthony Horder's' for Amplifiers**

the dealer will take no responsibility. The valve may serve you only ten minutes before burning out, but you must not expect to get it changed. The average valve should, with care, give long service, but a sharp knock may break the filament, rendering the valve useless.

## Watch Your Valves

Be careful not to get the high tension battery through the filament or it may burn out. Some "dull emitter" valves will become insensitive if an excessive current is applied to the filament. Some may be made sensitive again by burning the filament at the rated voltage for some time with the plate current off.

Broken filament valves are of no use. There is nowhere in Australia where they can be repaired. Valves are repaired in America, but the cost of mending them is nearly as much as for a new valve. Repaired valves are said to be inferior to new ones.

Careful adjustment of the rheostat will mean many hours added to the life of the valve. The filament should always be burned as dull as possible without interfering with good signal strength. Dull down the filament with the rheostat before switching off the current, otherwise the filament will "crystallise" and tend to become brittle.

It is not practicable to work a valve taking six volts on the filament from dry cells, an accumulator should be used. Special valves are sold for use with dry cells.

## When Tuning-In

When tuning a valve set employing regeneration, do not tune in on the carrier wave. If you do your set will be in a state of oscillation and will energise your aerial, thus causing interference with other receivers.

A valve set is improved by a variable grid leak, which should be adjusted carefully. Make-shift grid leaks are all very well in their way, but they do not assist in producing the best results.

Many enthusiasts neglect the "B" battery. This should be placed in a position where it can be easily reached. Try varying the voltage as a means of improving the signal strength.

Take care in the selection of valves for amplifiers; some work better in this capacity than others.

## Keep Dry Cells Cool and Dry

If dry cells are used keep them in a cool, dry place. The same applies to the "B" batteries. Accumulators need very special care and should be charged frequently even when not in use.

When wiring valve panels keep the wires as short as possible without cramping the instruments. Where wires cross one another see that

Anthony Horder's for Aerial Material

they do so at right angles and that there is a reasonable space between them.

In a set employing more than one stage of amplification, place the intervalve transformers well apart and at right angles to one another.

Noted "trouble spots" in a valve set are: The variable condenser, in which the plate may touch; the batteries, which frequently go "dead" when least expected; the 'phones, fine winding of which is likely to be broken by dropping them; and the rheostat, the arm of which may not be making contact with the resistance wire.

## Understand Your Set

A thorough understanding of every piece of apparatus in your set will help you a lot towards getting better results. Therefore, study the subject and become familiar with the principles.

Telephones should be handled with reasonable care. In each ear-piece is a delicate wire winding which is likely to be fractured by a hard knock. Should the winding be broken it can be repaired, but it is not a job that the amateur is advised to tackle.

An efficient "earth" connection goes a long way toward success in wireless. See that the water pipe where "earth" lead is attached has been thoroughly cleaned of dirt and paint.

## Watch Power Lines

Never place your aerial near and parallel to ordinary power lines. If you do the inductance from the power line will cause unpleasant noises in your set. Run the aerial at right angles to the power line and keep it as far away as possible.

Another warning concerning aerials—do not string your antenna over any electric light or power wires. By doing so you may endanger human life.

There is a severe penalty for using a transmitting set without a license to do so. Remember that the authorities, by means of direction finders, can locate any station sending out signals, or causing interference.

## No Loose Connections

If you are troubled by a scratching noise in your receiver it may be due to a loose connection, or to a faulty high tension battery. If it occurs at regular intervals the noise may be due to too much oscillation.

Do not forget to connect up your aerial before switching on the valve. Many amateurs have tried for hours to get in signals only to find when their patience was exhausted that the aerial had been disconnected all the time.

Remember that a wireless set is only as good as its worst part. Use only reliable apparatus.

**Anthony Horder's' for Accumulators**

## ATMOSPHERICS

**T**HE greatest bugbear to all users of wireless, both amateur and professional, is "static."

You will not be connected with wireless for long before you will know all about this curse. Some night, when there is a good programme to be picked up, you will switch on the set, only to find the music and speech interspersed with fearsome crackling, hissing, or grinding noises. This will be "static," x's or "strays."

These little charges of electricity go wandering about in the ether till they hit your aerial and produce the noises mentioned, and when they are bad they can almost drown a broadcasting station, or, at least, make the music scarcely worth listening to. You cannot tell when the "static" is coming to annoy you. Sometimes, especially in the winter, weeks or months may go by without so much as a splutter of it, and then will come several nights within a week when it will be very bad.

### The Elusive "Static"

"Static" has baffled the experts, and inventors are constantly at work endeavoring to find some method of eliminating it. They have not been successful so far, though some "eliminators" do minimise the trouble to a certain extent. It is quite easy to eliminate "static," but the difficulty lies in the fact that in doing so the signals are eliminated, too. Elaborate circuits have been devised with a view to rejecting the unwanted "strays," but these have only been successful up to a certain point.

Commercial stations suffer severely from the pest as it holds up their work, and is the direct cause of thousands of pounds being lost. Were it not for "static" wireless stations working together could guarantee a continuous service of 24 hours each day. Probably the most erratic element known to science, "static" knows no particular wavelength, but can make trouble on them all. One night it will be found that the trouble is less on the short waves than the long ones, and the next it will be equally bad on them all.

### Probably Caused By Heat

Where the "static" originates and the cause of it, the scientists are unable definitely to determine, so they refer to them as x's. From constant observations it has been definitely established that certain parts of the world suffer more than others from the trouble. There is a very bad spot, for instance, off the West Coast of Africa, about on the equator, and another in the vicinity of Durban, South Africa. Northern Queensland gets more "static" than New South Wales, and several other examples could be given. It is held in some quarters that "static" is directly caused by heat. This seems very likely, for there is no doubt that the electrical disturbances are much more frequent in summer than in winter.

Anthony Horder's' for Batteries

Strange as it may seem "static" is not always present when there are visible electrical disturbances about, such as flashes of sheet lightning on the horizon, though the majority of electrical storms are attended by x's.

Whatever the "static" is and whatever its origin, there is a fortune for the inventor who succeeds in finding a method whereby it may be eliminated without loss of signal strength. If you are experimentally inclined you may yourself seek a way—one never knows one's luck.

## Reducing the Trouble

Though in the main, the user of radio must perform "grin and bear it," there are several simple ways of reducing the trouble. The best for the user of the multi-valve set is to use a "loop" or "frame" aerial. The longer the outside aerial, the more "static" it will bring in, and this is one of the arguments against having an aerial over certain reasonable limits.

A scheme for minimising the effect of "atmospherics," said to work effectively with either crystal or valve sets, is the "shunting" of aerial and "earth" with a high frequency choke. The method of connecting this choke in the circuit is given in Fig 24.

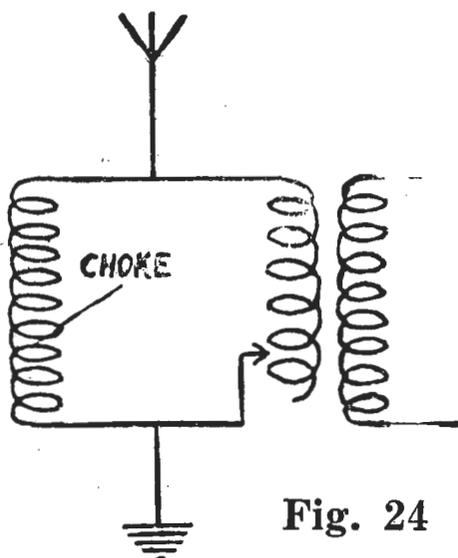


Fig. 24

The inductance of the choke must be several times greater than that of the primary of the tuner. The choke may be about 300 turns of wire (say No. 40 enamel) on a cardboard former. When an untuned impulse, such as a burst of "static," strikes the aerial, it will pass to earth partly by the way of the choke and partly through the primary of the tuner. On the other hand, signals to which the primary of the tuner is adjusted will mainly use the tuner. Thus the signals passed on to the secondary circuit of the receiver will be louder in proportion to the "static."

But, as has been said, "static" can only be reduced slightly, and till a successful eliminator is evolved, it will have to be put up with.

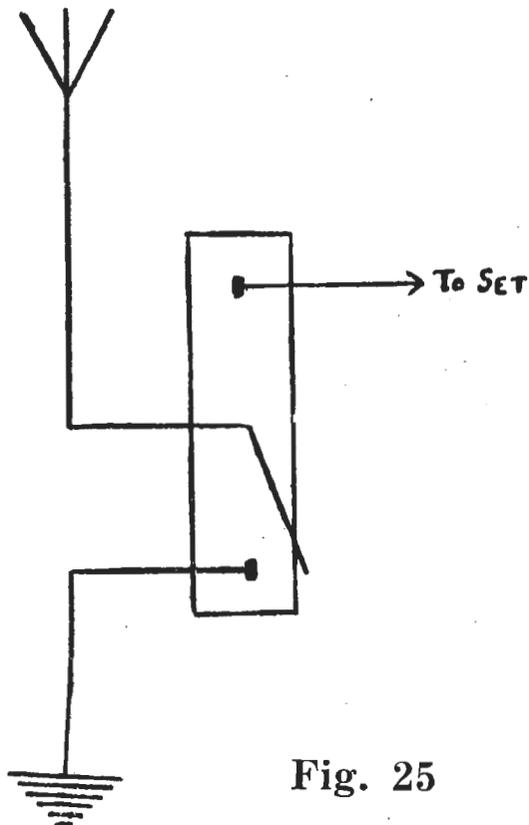


Fig. 25

## A Word About Thunderstorms

While on the subject of electrical disturbances it would be as well to mention something about thunderstorms. With proper and approved devices in the set it is safe to receive during a thunderstorm, but the enthusiast is advised against doing so. Protect your set from damage by using a grounding switch, arranging it as shown in Fig. 25. The switch should be a fairly heavy one of the double throw, knife blade type, and should be fixed outside the house near where the "lead in" enters. When a thunderstorm comes up change over the switch to the "ground" position and leave it there till the storm is over.

The use of an approved lightning arrester is insisted on by the N.S.W. Fire Underwriters.

## HANDY TOOLS

A handy kit of tools for the enthusiast who constructs his own apparatus may be got together fairly cheaply.

The following tools are suggested:—A drill and bits, a pair of pliers and wire cutters, one long handle screwdriver with 1-8in blade, another with 1-4in blade, a soldering iron, a hack saw, a small hammer, a small file, and a pair of tweezers (for handling crystals).

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## FAULTS AND REMEDIES

**I**N many ways a wireless set resembles a motor car. Like the car, the set may be working perfectly, and then, for some reason or other (probably a very trivial one) suddenly stop or begin functioning in an erratic manner.

### Locate the Trouble

Should this happen, there is no need for the operator to become "panicky." In nine cases out of ten the trouble is a very simple one, and, once located, may usually be put right in no time. The biggest difficulty confronting the amateur is the locating of the trouble.

Illustrating this difficulty is a case that went the rounds in amateur wireless circles recently. An experimenter, who knew wireless from A to Z, so to speak, was giving a demonstration of the reception of radio-telephony to a party of friends. All went well for half an hour or so, and then the signals began to fade and return to normal with annoying frequency. The experimenter got to work and overhauled his set rapidly, but everything seemed to be in order, and the trouble continued. After the guests had gone, the puzzled one took his set practically to pieces, tested everything, and put it together again. Then an idea struck him, and he telephoned to a brother amateur and told him all about it. This man had had the same trouble, and the two made inquiries, and got to the bottom of the mystery.

### A Simple Cause

They found the fault was not in their sets at all, but that the fading signals had resulted from the transmitting station's aerial swaying in the wind and making contact with a steel support.

This is not likely to occur with our Australian broadcasting stations, but the incident is worth bearing in mind, as it goes to show how trouble may be hidden.

Here are some of the more common faults and their remedies:—

**Gradually Fading Signals.**—"A" or "B" batteries getting weak. If using an accumulator "A" battery, get it re-charged; dry cells should be renewed.

**Intermittently Fading Signals.**—Receiving aerial or lead-in may be blowing against support or roof. Tighten aerial halliards or strain it away from anything it may be likely to touch.

### Humming Noise

**Loud Humming Noise in Phones.**—Probably induction from some nearby power lines. Place the aerial at right angles to the power lines, and as far away from them as possible.

### Crackling Noise

**Crackling Noise in Phones.**—Possibly faulty "B" batteries. Try varying the "B" battery voltage or renew the battery. This noise may

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also be due to a loose connection in the set. Examine all the connections, especially those made by nuts on screws.

Fading Signals and Crackling Noises when Condenser is Varied.—Plates of the condenser may be touching. The condenser must be straightened up, and the plates made to run true.

## Intermittent Stoppage

Intermittent Stoppage of Signals when Rheostat is Turned.—Contact arm is not working smoothly over the resistance wire. Arm and wire should be adjusted.

No Signals in One Earpiece of Phone.—Winding of that phone fractured; get it re-wound.

## Weak Signals

Weak Signals During Rain.—A leak to earth somewhere in the aerial system. Examine especially the lead in where it enters the house.

## Total Stoppage

Sudden Stoppage of All Signals.—Possibly filament of valve has burned out. The valve must be replaced if the filament refuses to light. The signals will disappear if there is a complete break anywhere in the circuit.

## Rattling Noise in Loud Speaker

"Fuzziness" or a Rattling Noise in a Loud Speaker may be caused by there being too much power or punch behind the speaker causing the diaphragm to rattle. Lessen signal strength.

## In Crystal Sets

Weak Signals with Crystal Set.—Crystal probably becoming insensitive, either from long use or because it is dirty. Give the crystal a wash in warm water with a tooth brush. If this does not improve signals, break the crystal and seek a sensitive spot on the new surface thus made.

These are the most common troubles. There are others, but they are mostly directly caused by accidents.

## Static and Battery

You must learn to distinguish static crackling from a "B" battery fault.

It sometimes happens that a valve filament is burning brightly, yet no signals are heard. It may be that the filament is just making contact with the grid, in which case the valve will not function.

Dry cell valves may become inoperative if given an excess of current on the filament. They may be made normal sometimes if burned for a while at the rated voltage with the plate current off.

## Anthony Horderns' for Induction Coils

## PORTABLE SETS

**CAMPERS** and those who seek relaxation from the hurry and scurry of the busy cities during their holidays, can fill in the evenings when away in the wilds, by wireless entertainment. In this case, too, the receiving set may be their daily newspaper, bringing in the world's doings, accounts of which are sent out by the broadcasting stations.

The majority of cabinet valve receivers are awkward things to transport, and would be likely to suffer damage in transit. The crystal set, of course, is more suitable for carrying about, but most holiday makers would be out of crystal reception range.

The most suitable set to incorporate in a portable outfit is a single valve combination, using regeneration. This set would not operate a loud speaker, but several pairs of phones could be used.

### Must Use Dry Cells

A good scheme is to arrange this set in a small suitcase, one of the type that opens at the top; or in a nicely finished box fitted with a lock and key and a carrying handle. The lay-out of a portable set is suggested in Fig. 19. The circuit and set that should be used is either of the single valve outfits described in the preceding chap-

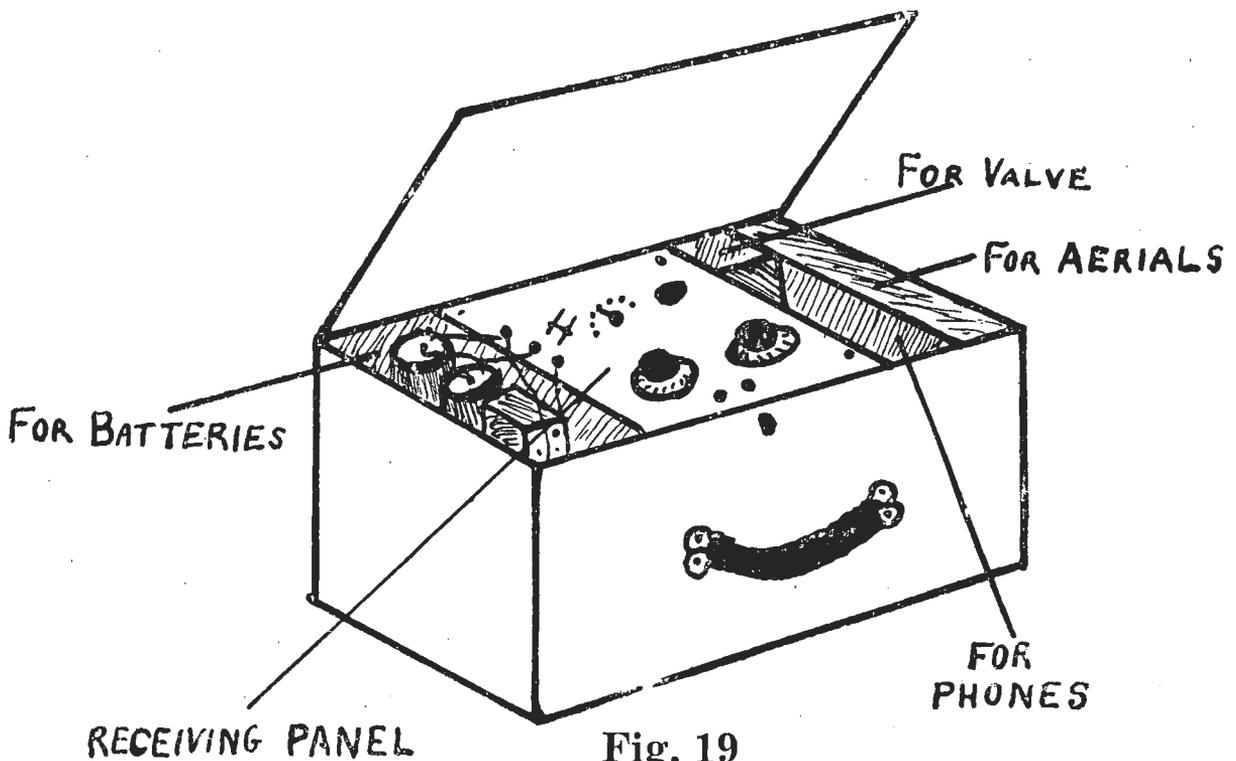


Fig. 19

ters. A dry cell valve is essential as the transportation of an accumulator, and its re-charging would be a cause of trouble. The dry cells for lighting the filament may be packed in the case, together with the "B" battery, and carried in any position without fear of accident.

Anthony Horderns' for Potentiometers

## Take Special Care of Valve

Special care should be taken with the valve, for it is extremely delicate, and if carried unprotected a knock might break the filament. A separate small compartment should be provided in the case, in which the valve may be packed in layers of cotton wool when not in use.

It is well to remember that the vibration of a train or motor car will cause nuts to come loose on their screws. So all circuit connections on the portable set would be better soldered. If this is not done, they should be frequently inspected.

In the compartment of the case set apart for the telephones there should be soft packing to protect the headsets from rough handling. If subjected to a hard knock, the fine wire of the coils in the ear-pieces is likely to be fractured, and they would consequently go "dead."

## Improving the Aerial

For the holiday-maker away in the open spaces, the rigging of an aerial should not be a difficult proposition. The portable outfit should include 100 feet of aerial wire, 100 feet of strong light rope, and two insulators.

Sixty feet of aerial wire strung between two trees and suspended about 25 feet above the ground will serve admirably. The rest of the wire may be used for the "lead in" and the "earth" connection. If the camper has the choice of putting up his aerial in any direction, he should arrange it with the ends pointing toward and away from the broadcasting station he wishes to receive. This directional arrangement will greatly improve the signal strength. If there are not any trees in the vicinity of the camp the aerial may be rigged comparatively low, with good results.

## And the Earth

As the holiday-maker will in all probability not be near water pipes, another kind of "earth" must be arranged. There are several ways of doing this. The best, perhaps, would be to drive a short length of metal rod, or thick wire, a few feet into the ground, preferably in a damp spot. Failing this, dig a hole about three feet in a damp place and bury a large tin, after having attached a length of wire to it. If you are near a waterhole or a creek, a length of wire thrown into the water will serve as an "earth."

The equipment of the portable set should include a length of spare flexible wire and a pair of wire pliers.

## Remember Your License

It should be borne in mind that your broadcast receiving licence does not allow you to move your set from place to place at will. Before operating the portable set, permission must be obtained from the authorities to transfer it temporarily.

**Anthony Horderns' for Rheostats and Rectifiers**

## FREAK SETS

**I**T is a peculiar thing that a freak receiving set should appeal to the imagination of the layman. But this is the case, and hardly a week goes by without the publication in some newspaper of a freak set.

### On Finger Rings

There are sets on finger rings, sets in matchboxes, sets in nutshells, and scores of others. Of course, the truth of the matter is that those who understand nothing of wireless think such sets are wonderful. They picture a wireless receiver as a collection of wires, knobs, dials, and handles, and when somebody comes along with a set in a matchbox their surprise knows no bounds. There is absolutely nothing wonderful about these sets; the workmanship is good, especially in the smaller ones, but any child of average intelligence could construct one.

However, quite a lot of amusement can be derived from such freaks, and it is always a pleasant feeling to baffle one's friends.

### In a Matchbox

The writer knows an amateur who built himself a splendid three-valve outfit. One night he entertained a friend who, on leaving, said he must "really get a set." The amateur replied, "Don't bother, I will fix up and give you one that will receive telephony." The friend, somewhat surprised at the other's generosity, departed. A day or two later the amateur called upon his friend and presented him with a matchbox on which were several pins and a piece of crystal—it was the set he had promised. Of course, the friend declared that such an arrangement would not work. So the amateur connected his aerial to one of the pins and the earth to another pin, and it did work. So impressed was the friend with this demonstration of the simplicity of wireless that he became an enthusiastic amateur himself.

The moral of this story is: If the principles of wireless were more widely understood, the more benefit humanity would derive from the science.

Any enthusiast possessing a good aerial and a pair of 'phones can make a set that will receive music and speech for nothing; that is to say, with a few simple things that can be found in almost any home. All that is needed is a cork from an ordinary medicine bottle, three brass fasteners, and a few odd scraps of wire.

### How to Make One

From the cork cut a piece brick shaped, an inch long, half an inch wide, and a quarter of an inch deep. Push a paper fastener through the cork at each end, and push one through in the centre from the under side, so that the two prongs can be bent to form a clip for the crystal. Two pieces of stiff wire are now bent into U-shaped fittings and pushed into the cork. These take the tags of the 'phones. The

**Anthony Horder's' for Valves of Every Type**

set is now wired up as in Fig. 27. The catwhisker, a thin piece of wire, is connected to the clip that takes the aerial. All you have to do now

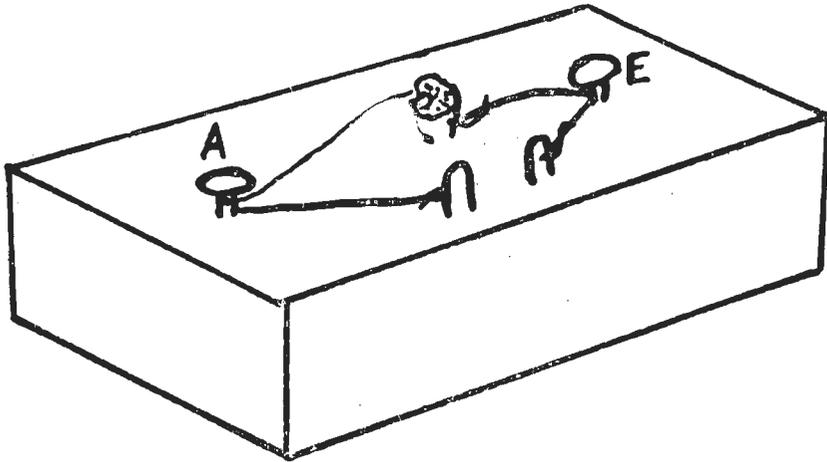


Fig. 27

is to get a wireless friend to chip a small piece off his crystal for you and you can listen in to the broadcasting.

### A Little More Elaborate

Another set, a little more elaborate this time, can be constructed from a round cardboard box, about 2½in in diameter, and 2in deep; an ounce or so of No. 40 enamel wire, 16 paper fasteners, and a few odds and ends. Arrange the paper fasteners on the circular top of the box as shown in Fig. 28. The ten in the form of a semi-circle are for the tapplings from the coil, two are for the 'phones, two more for the earth and aerial, and the others for the crystal detector. The one to hold the crystal should be put through the cardboard the opposite way to the rest so that the arms can serve as a clip for holding the crystal.

Wind the wire on the box, putting in nine tapplings at equal intervals. The start of the wire on the coil should be connected to the aerial clip and the finish of the coil to the last of the semi-circle of clips. The first tapping of the coil is fastened to the first clip of the semi-circle, the second tap to the second clip, and so on. To make the switch arm, cut a suitable piece from any old tin. A piece of wood or cork may be fashioned into a knob, with which to vary the arm, but care should be taken to see that the arm is suitably connected to the earth clip. The knob and arm are fastened to the cardboard with a stout piece of wire.

### In a Cigar Box

And so we could go on for hours describing freak sets and their construction. Such sets, by a skilled workman, can be made wonderfully small and compact, and they will bring in signals quite well within a range of a few miles. The ideas here expressed, however, can be developed till a really useful set is evolved. There are many very efficient

**Anthony Horderns' for Winding Wire**

crystal sets housed in cigar boxes, sets that use primary and secondary coils for tuning. But for the best results it is hard to recommend anything other than the sets dealt with elsewhere in this book, from the point of view of size.

Often we see pictures of a few turns of wire wound round the inside of an umbrella, allegedly operating a crystal set mounted on a finger ring. Unfortunately, the photograph does not permit of us hearing the signals,

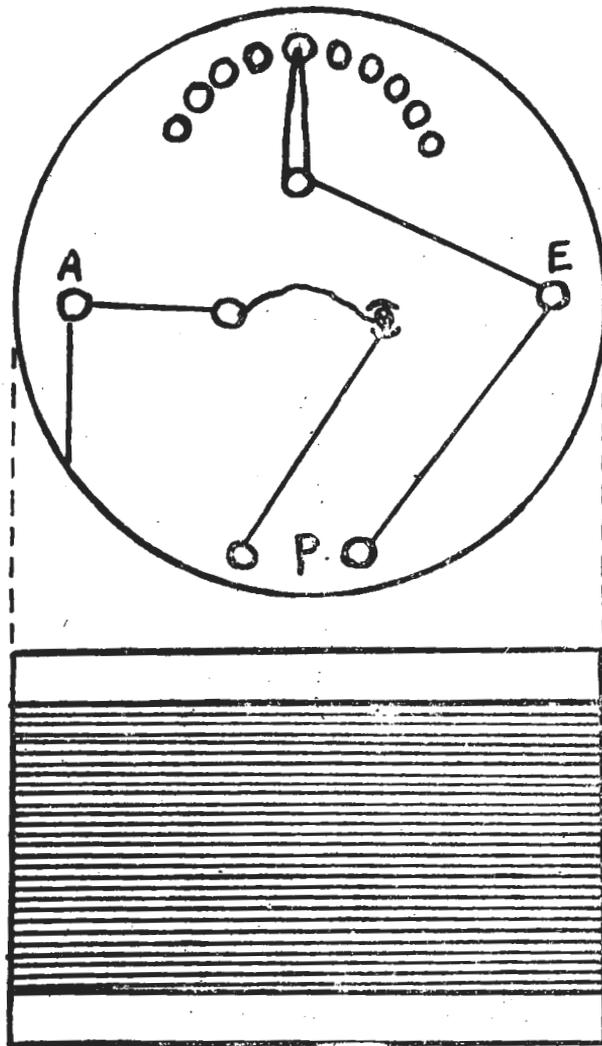


Fig. 28

and it is almost impossible that there could be any unless the carrier of this novel outfit is standing almost directly under the transmitting aerial.

### Don't Play With Valves

Freak valve sets are also made, but it is not advisable to go in for them. Valves are costly things, and can be more profitably employed than in experimental work of such doubtful value.

**Anthony Horderns' for Parts for Home-built Sets**

## THE TRANSMITTING END

**A**NY handbook on the absorbing subject of wireless would be incomplete without, at least, a brief mention of what happens at the sending station. The reference made here is not for the purpose of equipping the enthusiast with sufficient knowledge to run a transmitting station, even if his inclination lies in that direction.

Already Australian manufacturers have devised a sending set specially adapted for use by persons without any technical training, but this is more of a semi-commercial proposition than for experimental purposes. In any case, nobody would be allowed to operate a set such as this without the necessary Government license. It may not be long before the foolproof transmitter comes to light, but that time is not yet.

### Considerable Knowledge Required

In the case of the receiver, as the reader has seen, very little technical knowledge is required. But to build and operate one's own transmitter necessitates considerable knowledge of the subject, in order to both pass the Government examination and to manipulate the instruments in a manner that will cause no interference. In Australia there are a large number of amateur transmitting stations which are operated in a way that reflects the highest credit on the experimenters concerned. These experimenters all graduated from the ranks of the large army of those who own only receiving sets, but the proportion of amateur transmitting stations to amateur receiving stations is relatively small. Should the enthusiast desire to ascend to the higher realms of the science and become the owner-operator of a transmitting station he should not be discouraged by the foregoing, but he will not find the technical knowledge necessary to his equipment in these pages. If this handbook has helped the enthusiast to build and derive the maximum amount of pleasure from his receiver, and has provided him with an insight of the wireless art, it will have served its purpose.

### Principles of Broadcasting

There are several methods of radio transmission, but here we are concerned principally with the system used in our broadcasting stations. This system is what is known as the modulated continuous wave. As has been mentioned before, when the broadcasting station is "on the air" a continuous wave is radiated from the aerial, the wave being varied in amplitude to correspond with the modulations of the human voice or musical instrument.

Strange though it may seem to the layman the principles of the transmitting set do not vary much from those of the valve re-

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ceiver. We have seen in our regenerative sets how every valve capable of producing oscillations may act in its own way as a transmitter. You will understand this more readily when you hear a nearby receiver sending out fearful screams from his badly-controlled set. Of course, the equipment of a modern broadcasting station is very elaborate, as big currents have to be handled to give the necessary radiating energy.

## How Voice is Produced

One of the problems of broadcasting has been the devising of an efficient system whereby the voice may be modulated for transmission. So well has this obstacle been overcome by the radio engineers

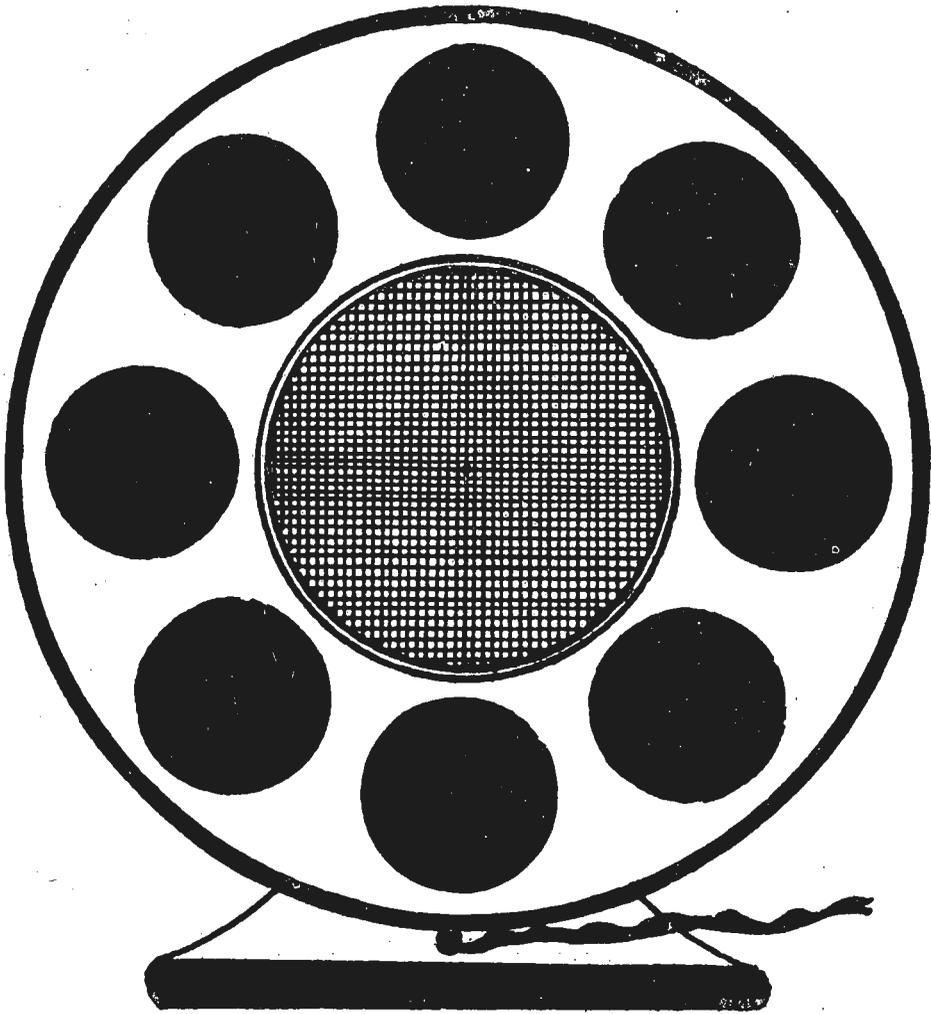


Fig. 20

that the voice we now take from the air may be as pure and undistorted as it is humanly possible to make it. Let us follow the voice from the studio to our receiving aerials. The modern studio is prepared with the greatest care and thought. The voice of the artist must

**Visit Anthony Horder's Radio Department**

be transmitted without any objectionable features such as revibration or re-echo from the walls of the studio; in other words, the studio must be "dead" to all other sounds. In order to make it so the walls are specially designed and on the inside are draped with heavy hangings and the floor is also thickly padded. The equipment of the studio itself is confined to a piano, the microphone, and the switching devices for cutting the studio "on and off the air." Of greatest interest to us is the microphone.

### The Microphone

This little instrument, depicted in Fig. 20, collects the sound to be transmitted. The vibrations of the voice impressed upon the diaphragm of the microphone are converted into minute electrical pulsations, and these in turn are magnified and handed on to the other components of the transmitter. The busy little electron is frantic in the transmitting circuit, and through the agency of his oscillations the voice finally leaves the aerial.

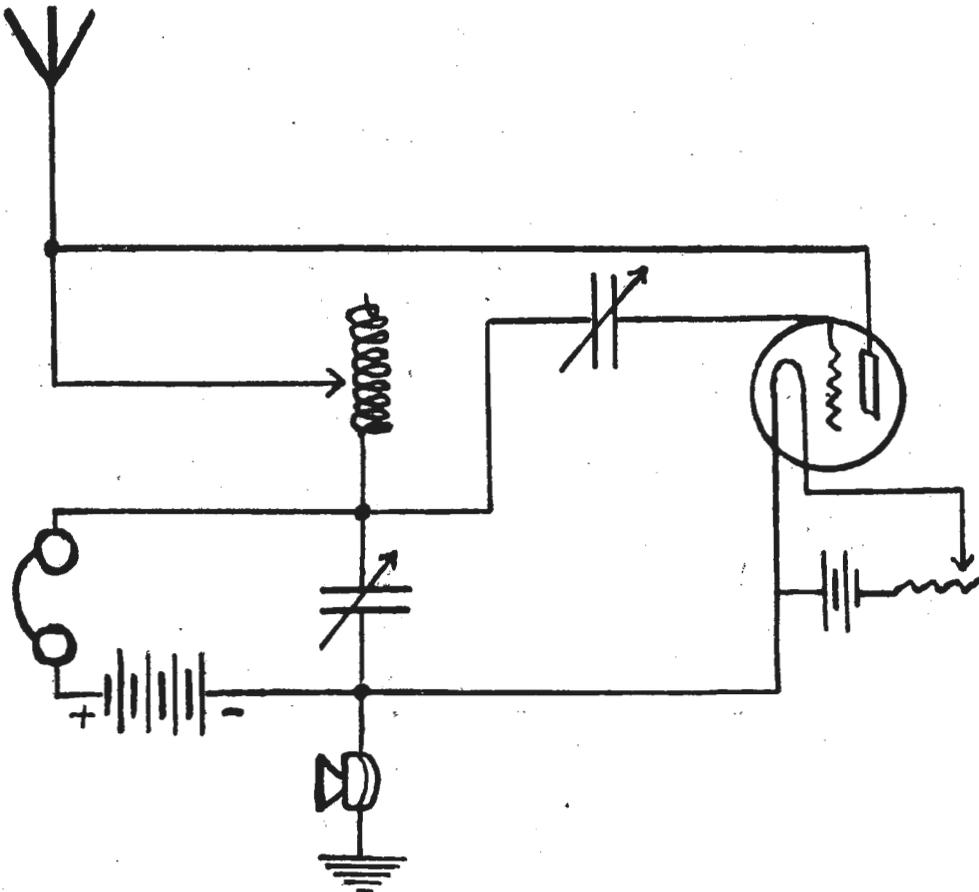


Fig. 21

### From Concert Hall or Theatre

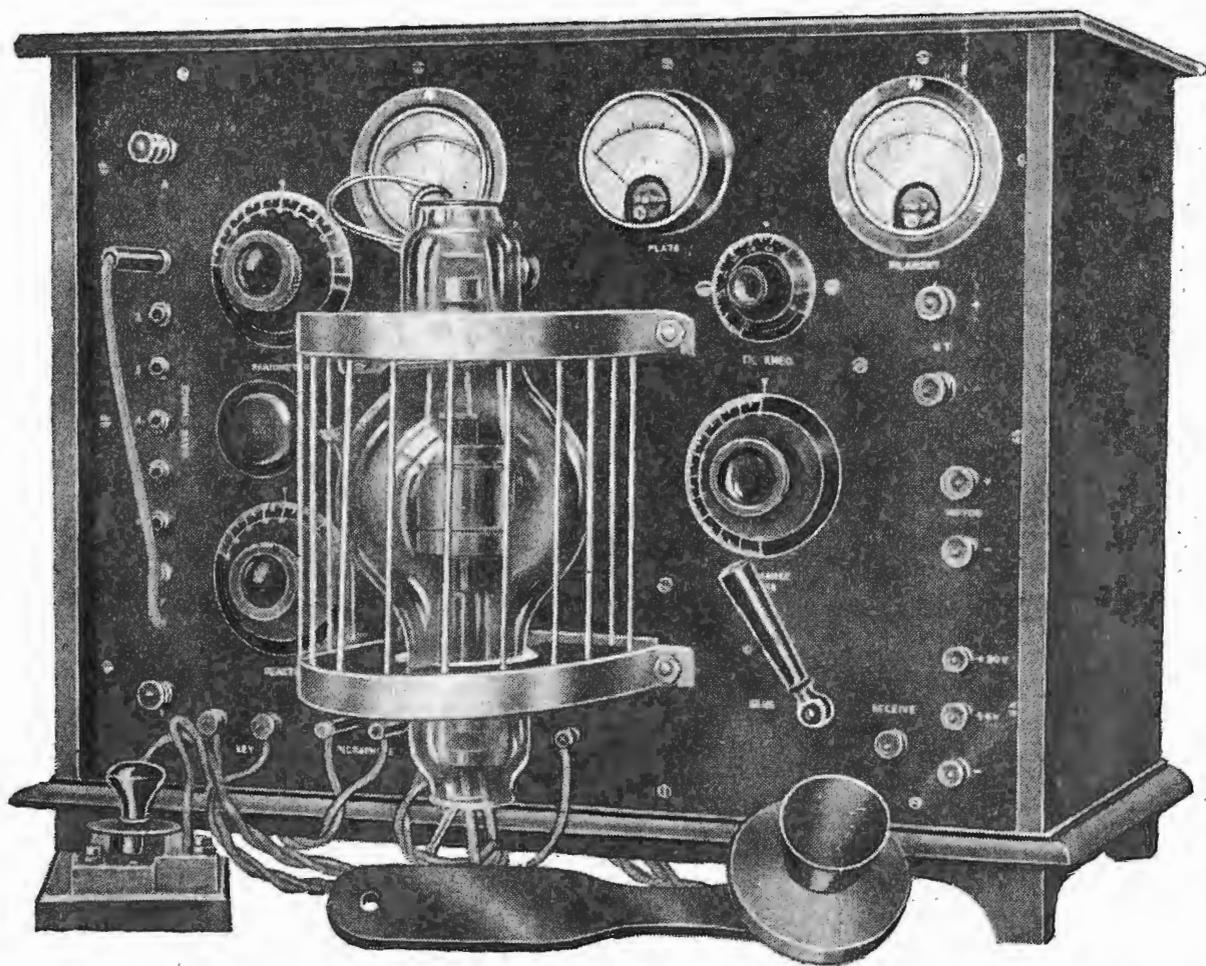
Many broadcasting stations have their actual transmitters miles from the studio and are operated by the system of remote control.

**Anthony Horder's' Radio Experts Will Help You**

The stepping up of the microphone current is carried out at the studio, and it is then sent by the ordinary telephone method to the actual transmitting station. This is what happens when an entertainment is broadcast from a concert hall or theatre. It is necessary that the operator at the broadcasting studio should know how the transmission is progressing, so the studio is equipped with a receiving set with which the operator is always listening in. Should he detect any fault in the transmission he is able to put it right almost before the vast unseen audience has noticed anything wrong. Though it differs vastly in nearly every way from the big station set, a simple telephone transmitter circuit is given in Fig. 21. A set using this circuit will operate over a short range and can be used as a receiver as well.

## TELEPHONE TRANSMITTER

THIS 1 K.W. set has been specially designed to permit of operation by persons without technical training.



It will be seen in the illustration that the transmitting part of the

**Anthony Horderns' for Everything**

set comprises a heavy bakelite panel mounted in front of a highly-polished mahogany box. On the face of this panel are mounted the various controlling handles and the valve.

## Instrument Described

The left-hand instrument indicates the current flowing in the aerial the centre one, the current flowing to the plate circuit of the valve, whilst the remaining one indicates the voltage across the filament of the valve. The uppermost dial on the left-hand side of the valve is the variometer for varying the wavelength of the set above and below a fixed amount, which, in this case, is about 600 metres. The lower dial operates the re-action coil which controls the oscillations of the set, while the instrument between these two handles is the tone-buzzer and is used for communicating telegraphically by interrupted C.W.

The uppermost dial on the right-hand side of the valve controls the voltage across the filament. The lower dial is connected to a small variometer and takes the place of the usual anode tap which is used for obtaining the best working position of the valve.

The handle below this dial is connected to the "send and receive" switch. In the illustration, this handle is shown in the "send" position.

The valve supplied with the set is of the type technically known as "T250," and requires 12 volts on its filament and up to 2000 volts on its plate, and is suitably guarded by a metal grille.

The plug and cord shown on the extreme left-hand of the panel is associated with the aerial loading coil, and by its means the wave length of the aerial can be adjusted to set values.

## Power Supply

The operating key is shown in the foreground on the left-hand side, while the microphone is shown immediately in front of the "send and receive" switch.

The power supply is provided by a specially designed double current generator, the low tension side of which supplies energy for the heating of the filament of the valve, and the high tension set energy voltages up to 2000 for supply to the plate circuit on which it is to operate, or it may be driven either directly or by belt from a suitable engine.

**Anthony Horderns' for Household Furniture**

## NEWER DEVELOPMENTS

**P**ROBABLY the most important of the newer developments of wireless is the Marconi "beam" transmitter. After exhaustive tests, this system has now been perfected to the extent that telephony from England can be received in Australia. The first telephony message on the "beam" system from England was received by Mr. E. T. Fisk, managing director of Amalgamated Wireless (Australasia), Ltd., in June, 1924. This was in the course of experiments, and the system has not yet been generally adopted for commercial use. It is claimed that with the "beam" it will be possible for telephony to be transmitted to any part of the world, and that the cost of beam stations will be much less than the ordinary stations.

### The Beam System

The principle of the "beam" system has been made known, but no details of operation have been announced. We know that the ordinary transmitting aerial radiates electro-magnetic waves in all directions. Thus anybody with receiving apparatus that is tuned to the wavelength of the transmitting station, can pick up the message. In addition to the lack of secrecy, much energy is wasted in sending the message to the places other than the receiving station for which it is intended. The "beam" system, as its name implies, is the sending out of a series of waves in one direction only. The waves are concentrated in the beam and shot forward by a suitable reflector to the receiving station. Naturally the "beam" will suffer from spread, the further it goes, the greater the width, but it is understood that this objectionable feature has been overcome, and that the "beam" can be concentrated. The great secret of successful "beam" transmission lies in the aerial arrangement. If a special receiver is used the signal strength is greatly improved.

### The Radio Compass

The Radio Compass is another important development of the wireless science. Many ships are equipped with the Radio Compass, which contributes largely to the safety of navigation in times of fog or thick weather when near a coast. By means of this instrument bearings of two or more shore stations may be obtained and the ship's position calculated therewith.

It might be said that the Radio Compass is closely bound up with the "loop" aerial. This type of aerial (see chapter on indoor aerials) receives best when pointed toward the transmitting station, so that the waves strike one edge before the other. This is called directional effect. When the "loop" is rotated and is side on to the station the signals are very weak. Thus it is possible by rotating the "loop" to determine the direction of the sending station, and if two or more such directions are obtained aboard the ship the navigator is enabled to plot his position.

Anthony Horder's' for Family Drapery

## Beating Fog at Sea

There are also direction finding stations ashore, usually three in a group. A ship in a fog asks for her position by wireless and sends out a pre-arranged signal. By means of this signal the shore stations get the direction of the ship, and pass on the information to the central shore station. Here the bearings are ruled on a chart and the spot where the lines intersect is the position of the ship.

The direction finding apparatus was used with great success on the British coast during the war. With three stations working along the coast it was possible to keep track of many of the German warships when they put to sea.

Another use for the direction finder is the detection of unlicensed radio stations, and those which cause interference.

## Distant Control

Another side of wireless that is receiving the attention of experts is the control by radio of distant apparatus. The "distant apparatus" may be anything movable, such as a motor car, a boat or a train. The radio waves, of course, do not supply the power necessary for propulsion, but doubtless even this will come in the course of time. The starting and stopping of an engine, or steering of a motor car, can be done from a distant position by radio. The apparatus to be controlled is connected with a switch, which is brought into action by the closing of the contacts of a sensitive relay. This relay is so arranged that the feeble radio currents will operate it. In this way it is possible to control a crewless power boat from the shore by the sending of different signals.

Successful experiments were carried out recently by the United States Navy, when a battleship was manoeuvred by radio control from another vessel.

## Transmission of Pictures

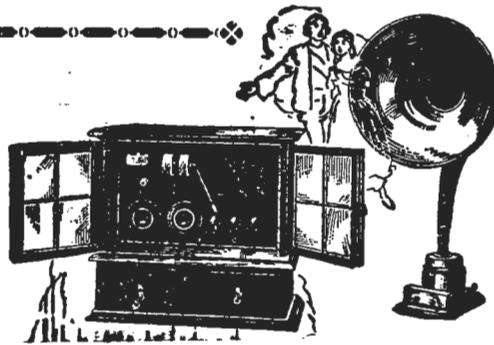
The successful transmission of pictures and photographs by wireless is proving a difficult proposition to those engaged in the pursuit of a sound method. Several systems have been devised, and pictures, more or less faithful, have been transmitted. So far, however, there is no method that can be termed successful in a commercial sense, but so rapidly do events in this science move that success in this direction may be very near.

## Prospecting by Radio

As proof of the wide use of the radio science we have the fact that it is now possible to locate minerals without using the tedious methods usually associated with prospecting. An apparatus for locating minerals by radio has been evolved by a Sydney man—Mr. F. Hamilton Frazer.

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The presence of minerals is detected by means of a beam of Hertzian rays from a ray emitter, and responsive instruments.

The radiator is placed in a mine, on the surface of the ground, or on the side of a hill or mountain, as the case may be. The receiver is located either underground or on the surface, in a position to receive the beam transmitted direct in the event of there being no intervening ore body, or reflected when a lode is in between the two instruments.

In actual practice this is what happens: When there is barren ground, the receiver is energised; but when minerals intervene the receiver is silent, thus proving that in the imaginary line between the two instruments, minerals have absorbed or reflected the electro-magnetic beam. By re-adjusting the position of the receiver, the actual area of the mineral can be ascertained.

## AUSTRALIAN BROADCASTING STATIONS

The broadcasting stations of Australia are:—

### N. S. WALES.

CALL LETTERS.	CONDUCTED BY	WAVELENGTH.	POWER.
2 F C	Farmer and Co., Ltd.	1100 metres	5000 watts
2 B J.	Broadcasters (Sydney), Ltd.	350 metres	$\frac{1}{2}$ K.W.

### VICTORIA.

3 L O	Australian Broadcasting Company	1250 metres	5000 watts
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### WEST AUSTRALIA

6 W F	Westralian Farmers, Ltd.	1750 metres	5000 watts
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## BROADCASTING HISTORY

IT has often been said that Australia lagged behind the rest of the world in regard to broadcasting. This was certainly true, but instead of being a matter to be sneered at, as is often the case, it has really been a fault that was a blessing in disguise.

### A Good Start

Australia was still without a single broadcasting station when the radio boom was in full swing in other parts of the world. At that time, however, some of the broadcasting in other parts of the world left much to be desired. Wireless telephony is still a young science, and the handling of big power at the broadcasting stations was still a problem for the engineers.

Anthony Horderns' for Men's Clothing

By the time popular opinion had made ready for broadcasting in Australia, the science of radio telephony had been brought up to a very high standard, and we were spared the indifferent transmissions of other countries in the early days.

## The First Regulations

As there had to be some regulations for the broadcasting concerns to work under, a conference of experts was called and sat in Melbourne. The Federal Government subsequently issued regulations based on a scheme put forward at the conference. Under these regulations broadcasting in Australia was born. The broadcasting companies were empowered to obtain their revenue by the sale of licenses to listeners-in and sealed sets were sold that would respond only to the wavelength of the station for which the set was licensed. Hence the regulations at that time became known as the "sealed set" regulations.

## Open Sets Agitation

From the first these regulations, which were issued in August, 1923, seemed to be unpopular. Listeners-in wanted "open" sets and an agitation grew for the amendment of the regulations. Demonstrations of "open" and sealed sets were given, the Government was approached, and finally the Postmaster-General agreed to give official notice to a conference of those interested in the wireless position.

This conference was held in Sydney early this year (1924), and, as an outcome, the sealed set regulations were repealed and replaced by those permitting "open" sets. The text of these regulations, under which broadcasting is now being controlled, is given in the appendix of this book.

## The Stations

The pioneer broadcasting station of Australia is 2 B L (Sydney). This station, with its aerial system, is located on the "Daily Guardian" building in Philip-street, and is now a familiar Sydney landmark. The station was designed by experts and was practically constructed by Mr. Ernest Jones, the present chief engineer. The studios of 2 B L are also in the "Daily Guardian" building. The station has been very successful in obtaining results over long distances.

## Farmer's Station

Station 2 F C was next in the field, and it is one of the most up-to-date stations in the world. It was constructed by Amalgamated Wireless (Australasia), Ltd., for Farmer and Co., Ltd. The studios of the station are on the top of Farmer's buildings, Pitt and Market streets, Sydney, and the aerial system and transmitting station is located at Northbridge, a suburb on the northern heights. The aerial

**Anthony Horderns' for Sporting Outfits**

system is of the cage type, and is suspended between two lattice steel towers, each 200 feet high and about 600 feet apart. The actual transmitting apparatus is most modern and the station has no trouble in working over big distances. The studios are connected by land lines with theatres, etc., and the music and speech from these places and from the studios is sent to the Northbridge station by landline for transmission.

## Westralian Farmers

The next big station was that of Westralian Farmers, Ltd., Perth. This station was also put up by Amalgamated Wireless, Ltd., the various apparatus being manufactured in Sydney. The aerial system is on top of the West Australian Farmers building, Murray-street, Perth. The masts are 180 feet above the pavement, and they are 270 feet apart. The studios are located in the same building, and are very large, to accommodate bands, choirs, etc. As with the other studios, this one has been specially designed with a view to making it absolutely sound proof. Station 6 W F was officially opened by the Premier of West Australia on June 4, 1924.

## Melbourne Station

Melbourne's broadcasting station is located at Baybrook, about six miles from the centre of the city. It was built by Amalgamated Wireless, Limited, for the Australian Broadcasting Company. The station is on a four-acre area of flat land. The aerial system is supported by two lattice steel masts, each 200 feet high and 575 feet apart. The operating house and quarters for the staff is situated directly beneath the aerial. The transmitting set is of the latest type, and the station is looked upon as being one of the best in the Southern Hemisphere. The studios of the station are located on the roof of the Melbourne "Herald" office, the music and speech therefrom being conveyed to the transmitting station by a land line.

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We have the largest wireless stock in Manly, at prices the lowest obtainable in Sydney, so see us before you buy or build your Receiving Set.

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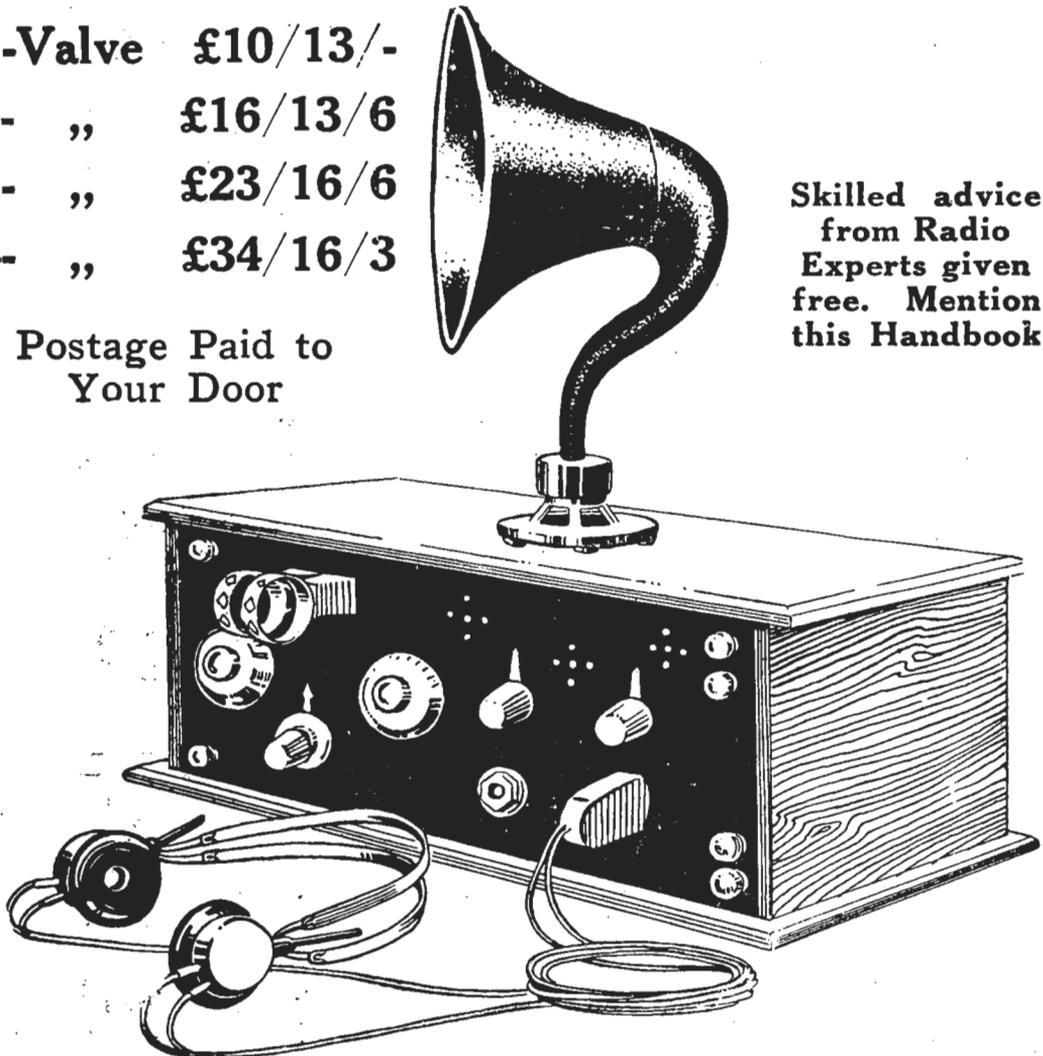
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this Handbook



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# AMATEUR TRANSMITTING STATIONS OF AUSTRALIA

## NEW SOUTH WALES.

CALL SIGN.	NAME.	LOCATION.
2 A A	Radio Inspector	Sydney
2 A J	W. Short	Kirribilli
2 A L	A. C. Cooper	Ashfield
2 A R	W. H. Hudson	Dulwich Hill
2 A S	H. E. Grigg	Mosman
2 A Y	J. P. Cureton	Burwood
2 B B	E. B. Crocker	Marrickville
2 B C	N. J. Hurl	Killara
2 B F	L. E. Forsythe	Northbridge
2 B K	F. N. Leverrier	Vaucluse
2 B M	E. F. Vears	Leura
2 B V	Waverley Amateur Radio Club	Waverley
2 B Y	E. C. Arnold	Tamworth
2 C A	E. W. Bonwill	Cowra
2 C B	D. J. K. Sidey	Lindfield
2 C L	G. Caletti	Redfern
2 C I	R. D. Charlesworth	Haberfield
2 C J	P. L. H. Sewell	Paddington
2 C M	C. D. Maclurcan	Strathfield
2 C R	L. V. G. Todd	West Tamworth
2 C S	L. T. Swain	Hamilton
2 C W	J. Beer	Ashfield
2 C X	H. A. Stowe	Chatswood
2 C Y	P. S. Parker	Burwood
2 C H	C. J. Henry	Uralla
2 D E	W. P. Renshaw	Roseville
2 D H	E. R. Mawson	Campsie
2 D K	R. P. Whitburn	Leichhardt
2 D N	G. E. H. Blanchard	Newtown
2 D S	J. R. Davis	Vaucluse
2 D J	David Jones, Limited	Sydney
2 E C	C. A. Gorman	Arncliffe
T E D	H. R. Gregory	Abbotsford
2 E R	W. G. Best	Rose Bay
2 E M	E. G. T. Moore	Neutral Bay
2 E U	A. F. Peters	Rose Bay
2 F B	F. E. Bishop	Kirribilli
2 F A	S. V. Colville	Drummoyne
2 F F	Western Suburbs Amateur Wireless Association	Auburn
2 F P	E. J. Baker	Newcastle
2 F S	A. C. Smith	Croydon
2 G C	G. R. Challenger	Auburn
2 G D	Concord Radio Club	Concord
2 G F	G. F. Chilton	Pennant Hills
2 G M	G. M. Cutts	Croydon
2 G P	C. S. Mackay	Urunga
2 G Q	E. Barlow	Armidale
2 G R	J. S. Marks	Rose Bay
2 G V	R. Dunn	Kensington
2 H B	H. W. Botten	Sydney
2 H F	F. Thompson	Balmain
2 H F	Wireless Institute, N.S.W. Division	Sydney
2 H M	H. A. Marshall	Armidale
2 H P	W. J. Maclardy	Neutral Bay
2 H Y	G. S. Bongers	Rockdale
2 I J	A. H. Gray	Killara
2 I N	J. Payne	Randwick

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NEW SOUTH WALES—(Continued).

2 I Y	C. V. Stephenson	Randwick
2 J C	H. Fraser	Tamworth
2 J I	W. A. Wilson	Roseville
2 J M	R. C. Marsden	Edgecliffe
2 J S	J. M. Stanley	Orange
2 J T	C. Luckman	Croydon
2 K C	R. H. Fry	Croydon
2 L F	L. V. Ginger	Mosman
2 L I	Radio Company, Limited	Bondi
2 L O	L. N. Schultz	Lane Cove
2 L Y	R. H. Shaw	Woollahra
2 L R	Lismore and District Radio Club	Lismore
2 M E	Amalgamated Wireless Company	Willoughby
2 M J	W. H. Newman	Artarmon
2 M R	J. E. Stewart	Mayfield
2 M U	J. Nangle	Marrickville
2 O I	A. T. Whitaker	Banksia
2 Q V	E. A. Williams	Wollongong
2 R A	K. J. Vickery	Hurlstone Park
2 R Y	Reg. V. Volkman	South Grafton
2 R J	R. J. Fagan	Mandurama
2 R V	R. V. Vaulkman	Grafton
2 S O	Newcastle District Radio Club	Hamilton
2 S P	R. Evans	Clovelly
2 S S	A. E. Wright	Scarborough
2 S T	S. E. Tatham	Neutral Bay
2 S K	H. C. Slade	Croydon
2 S H	T. R. Troy	West Maitland
2 T S	A. W. McK. Gill	Killara
2 U I	Illawarra Radio Club	Kogarah
2 U R	A. A. Craemar	Glebe Point
2 U W	O. Sandel	Bellevue Hill
2 U U	R. G. C. Roberts	Ashfield
2 V M	V. M. Derrick	Bellevue Hill
2 V X	D. G. McIntyre	Pymble
2 W N	F. J. N. Lett	Annandale
2 W V	Burgin Electric Company	Sydney
2 W U	W. H. Morey	Watersleigh
2 X A	H. K. James	Summer Hill
2 X I	W. A. Graig	Croydon
2 X X	O. F. Mingay	Turrumurra
2 Y A	B. L. H. Haynes	Armidale
2 Y B	Croydon Radio Club	Croydon
2 Y C	C. T. Crawford	Burwood
2 Y D	C. W. Dunne	Neutral Bay
2 Y E	Manly District Radio Club	Manly
2 Y F	F. P. R. Clarke	Manly
2 Y G	R. C. Allsop	Coogee
2 Y H	W. H. Hannan	Balmain
2 Y I	P. S. Nolan	Double Bay
2 Y J	R. H. Sainsbury	Concord West
2 Y K	N. P. Olsen	Newcastle
2 Y L	A. Lendrum	Kensington
2 Y M	J. L. Scott	Sydney
2 Y N	C. P. Thomas	Granville
2 Y P	M. A. Bergin	West Maitland
2 Z A	W. G. Keogh	Stanmore
2 Z B	Balmain District Radio Association	Balmain
2 Z C	F. M. E. Lavington	Bondi
2 Z D	S. F. Brain	Ashfield
2 Z E	F. J. Laker	Deniliquin
2 Z F	Newtown District Radio Club	Newtown
2 Z G	R. E. McIntosh	Lane Cove
2 Z H	New Systems Telephones	Sydney
2 Z K	S. Marsh	West Wallsend

Anthony Horderns' for Men's Boots and Hats

## NEW SOUTH WALES—(Continued).

2 Z J	A. W. Simpson	Duri
2 Z L	W. Otty	Killingworth
2 Z M	P. W. Deane	Burwood
2 Z N	J. W. M. Cotterell	Coogee
2 Z O	T. R. Willmott	South Grafton
2 Z R	W. J. S. Perdriau	Manly
2 Z T	L. P. R. Bean	Mosman
2 Z U	N. G. Gilmour	Neutral Bay
2 Z V	Universal Electric Company	Sydney
2 Z W	D. R. Huggins	Neutral Bay
2 Z X	N. P. Olsen	Waratah
2 Z Y	R. L. Sidey	Lindfield
2 Z Z	C. P. Smith	Cremorne

## VICTORIA.

3 A B	W. H. Weatherston	St. Kilda
3 A F	A. F. Bent	Geelong West
3 A G	A. F. Gurr	Geelong East
3 A J	E. Salamy	Warrnambool
3 A P	R. D. Morris	Caulfield
3 A M	G. A. Dohrmann	Canterbury
3 A U	A. A. Milligan	Geelong
3 A Y	W. W. Jenvey	Caulfield
3 B C	W.I.A. Brighton Section	Brighton
3 B D	E. H. Cox	Elsternwick
3 B G	L. Osborne	Terang
3 B H	C. R. Whitelaw	Mooroolbark
3 B K	W. H. Cumming	Armadales
3 B L	J. C. Fichett	Balwyn
3 B M	H. K. Love	Malvern
3 B P	J. H. Hood	St. Kilda
3 B Q	W. F. M. Howden	Box Hill
3 B U	D. A. Connelly	St. Kilda
3 B Y	H. Holst	Caulfield
3 C A	W. A. Dorward	Hampton
3 C B	W. F. Sievers	East Richmond
3 C C	University	Univ. of Melbourne
3 C D	Corbett, Derham, and Co., Pty., Ltd.	Melbourne
3 C H	F. W. Clarke	Carlton
3 C J	C. W. Jamieson	St. Kilda
3 C P	C. H. Philcot	North Geelong
3 C Z	H. B. Mitchell	Elwood
3 D B	W. D. Hobart Duff	East Malvern
3 D D	L. F. G. Osborne	East Malvern
3 D F	F. B. Short	St. Kilda
3 D L	L. C. Falls	Caulfield
3 D M	J. Chambers and Company	Melbourne
3 D P	N. Culliver	E. Melbourne
3 D V	H. S. Beattie	Box Hill
3 D X	J. R. Van Booth	East Malvern
3 E C	Y.M.C.A. Wireless Club	Bendigo
3 E F	H. W. Maddick	Elwood
3 E L	N. J. Boyd	Elsternwick
3 E M	H. W. Doudney	Balaclava
3 E N	A. B. Leonard	Drouin
3 E P	J. Givens	Canterbury
3 E R	E. R. Rivers	Essendon
3 F A	F. Abrahams	South Yarra
3 F H	R. F. Hall	Toorak
3 F M	R. C. De Crespigny	Middle Brighton
3 G B	M. A. Glover	Camberwell
3 G H	W. M. Hale	Anglesea
3 G I	F. G. Cresswell	East Kew
3 H B	Sunshine Radio Club	Sunshine

Anthony Horderns' for Jewellery and Electroplate

VICTORIA—(Continued).

3 H E	F. Kruger	Charlton
3 H H	F. H. Maughan	Malvern
3 H J	O. D. Johnson	Surrey Hills
3 H L	A. F. Hutchings	Callawadda, via Stawell
3 H Q	E. J. Good	Glen Rowar
3 I I	G. T. Miles	East Camberwell
3 J D	J. E. Dane	Hawthorn
3 J H	F. H. J. Holland	Essendon
3 J I	H. W. Garrett	Box Hill
3 J M	H. W. Bryson	Kew
3 J P	H. Mitchell	Caulfield
3 J R	W. J. Dunstan	Ballarat East
3 J U	R. A. Hull	St. Kilda
3 J Z	R. P. Whalley	Sandringham
3 K F	D. J. Harkin	Kensington
3 K S	D. M. McDonald	Yarraville
3 K T	L. M. Secombe	Ascot Vale
3 L F	L. R. Freestone	Ballarat
3 L M	Malvern Sec. W.I.A.	Armadale
3 L O	L. P. Moore	Seymour
3 L Q	W. F. Downing	Warrnambool
3 L S	R. T. Busch	Moonee Ponds
3 L W	C. Hiam	St. Kilda
3 M P	S. V. Hosken	Hawthorn
3 M A	Amal. Wireless Company	Melbourne
3 M B	Amal. Wireless Company	Kooweerup
3 M C	S. N. Newman	Canterbury
3 N N	H. R. Brown	Manac
3 N S	Norris and Skelly	Melbourne
3 N T	New Systems Telephones	Bendigo
3 O K	W. H. Conry	Armadale
3 O T	R. M. Cameron	Malvern
3 P O	A. H. Roberts	Northcote
3 P R	H. H. Blackman	East Malvern
3 P S	V. L. Smyth	Bendigo
3 Q W	J. A. Muir	Brighton
3 R F	C. H. Cordingby	Ascot Vale
3 R G	S. G. Humberg	East Malvern
3 R P	R. L. Payne	Newtown
3 R Y	W. A. G. Wilson	Ballarat
3 S J	S. J. Mitchell	Brighton
3 S K	O. Short	St. Kilda
3 S L	L. W. Southwell	Seymour
3 S M	A. H. Gay	Warragul
3 S W	S. W. Gadsden	Kew
3 T K	T. W. Kinsella	Lybeck
3 T M	A. H. Buck	Glen Huntly
3 T U	R. C. Leckie	Sandringham
3 U I	R. M. Dalton	Mildura
3 U X	G. W. Steane	Mont Albert
3 U Z	O. J. Nilsen	Melbourne
3 V R	R. N. Abbott	Alphington
3 V S	O. J. Philpot	Caulfield
3 W S	W. M. Sweeney	East Melbourne
3 W T	W. L. Tresidder	Bendigo
3 X C	Xavier College	Kew
3 X F	M. Chaffer	Moonee Ponds
3 X N	W. G. Leaney	Northcote
3 X O	F. J. Adams	Brighton
3 X Q	Ballarat Sec., W.I.A.	Ballarat
3 X U	Box Hill Sec. W.I.A.	Box Hill
3 X Z	T. F. Gibbons	Kew
3 Y D	C. W. Donne	East St. Kilda
3 Y W	J. M. Edgar	Geelong

Anthony Horderns' for Tobacco and Cigars

## VICTORIA—(Continued).

3 Y Y	A. M. Bush	Bendigo
3 Y Z	A. McKeown	Alphington
3 Z A	W. F. Bardin	North Carlton
3 Z C	H. E. E. Brock	Moonee Ponds
3 Z D	S. F. Taylor	Kew
3 Z E	K. W. McGregor	Armadale
3 Z J	C. L. Lempriere	Vermont
3 Z I	K. H. Barbour	Armadale
3 Z K	F. R. Bradley	Sandringham
3 Z L	New Systems Telephones	Melbourne
3 Z M	C. Owen	South St. Kilda
3 Z N	M. S. Israel	Malvern
3 Z O	E. N. Johnston	Geelong
3 Z P	H. A. George	Footscray
3 Z S	C. McMahon	Diamond Creek

## QUEENSLAND.

4 A A	W. H. Bright	Toowoomba
4 A C	L. Waters	Innisfail
4 A E	W.I.A., Queensland Division	Brisbane
4 A K	J. Milner	Brisbane
4 A N	E. M. Gibson	Greenslopes
4 A P	T. W. Bridger	Hamilton
4 A U	W. Finney	Red Hill
4 B I	Junction Park Radio Club	Fairfield
4 B K	C. O. Randell	Innisfail
4 B O	N. F. Odgers	Charters Towers
4 B W	A. Couper, junr.	Mareeba
4 C C	C. W. Isles	Ascot
4 C G	A. N. Stephens	Clayfield
4 C H	A. E. Dillon	New Farm
4 C M	V. McDowell	Brisbane
4 C K	E. L. Norris	Toowoomba
4 C S	J. A. Geraghty	Townsville
4 C V	N. E. Husband	Charters Towers
4 C W	A. T. Buck	Geebung
4 D O	A. L. Hobler	Rockhampton
4 E G	E. E. Gold	Toowoomba
4 E H	H. Miller	Ascot
4 E I	J. W. Sutton	Brisbane
4 E Z	Queensland Institute of R.E.'s	New Farm
4 F E	Y.M.C.A.	Brisbane
4 F I	J. C. Price	Paddington Heights
4 F K	F. T. Matthews	New Farm
4 G C	Maryborough Wireless Club	Maryborough
4 G E	C. Fortescue	Toowoomba
4 G F	R. H. Dixon	Herbert River

## SOUTH AUSTRALIA.

5 A C	V. R. P. Cook	Prospect
5 A D	A. R. Snoswell	Exeter
5 A E	J. Honner	Prospect
5 A G	W. J. Bland	Alberton
5 A H	P. L. Williamson	Kent Town
5 A I	H. H. Lloyd	College Town
5 A Q	Brother Joseph	Glenelg
5 A V	W.I.A. S.A. Division	Hindmarsh
5 A W	University	Adelaide
5 B D	F. E. Earle	St. Peters
5 B F	F. G. Miller	Murray Bridge
5 B G	H. A. Kauper	Dulwich
5 B I	School of Mines	Adelaide
5 B M	E. A. Cooper	Adelaide
5 B N	H. L. Austin	Norwood
5 B P	W. A. Caldwell	Unley
5 B Q	L. C. Jones	Westbourne Park

**SOUTH AUSTRALIA—(Continued).**

5 B S	W. J. Davey	Sturt
5 C M	E. N. Sagar	Largs Bay
5 D A	S. R. Buckerfield	Parkside
5 D N	L. C. Jones	Adelaide
5 D O	St. Peter's College Radio Club	Adelaide
5 F T	L. J. Fitzmaurice	Walkerville
5 C B	W. H. Scott	Adelaide
5 G B	G. Bailey	Mount Gambier
5 H R	H. Rhodes	Kadina
5 R B	R. Bedford	Kyancutta
5 W A	W. K. Adamson	Parkside

**WEST AUSTRALIA.**

6 A B	C. Cecil	Kalgoorlie
6 A C	J. Spark	Perth
6 A F	A. Sibly	North Perth
6 A G	W. E. Coxon	North Perth
6 A I	S. A. Shaw	Dalwallinn
6 A K	University	Perth
6 A M	P. Kennedy	Mount Lawley
6 A Q	V. J. Matthews	Bayswater
6 B B	J. C. W. Park	South Perth
6 B G	Technical School	Perth
6 B H	F. H. Burrows	Perth
6 B N	A. E. Stevens	Perth
6 B P	Stott's College	Perth
6 B R	W.I.A., W.A. Division	Perth
6 C J	E. J. Darley	South Perth
6 D A	F. W. Saw	Armadale
6 D Z	E. W. Burrows	Geraldton
6 D Y	H. Thomas	Inglewood
6 W P	W. R. Phipps	Subiaco

**TASMANIA.**

7 A A	W. T. Watkins	Hobart
7 A B	A. C. Smith	Launceston
7 A G	J. C. Milne	Gretna
7 A K	S. E. Deegan	Hobart
7 A Q	W. B. McCable	West Tamar
7 A R	C. F. Johnson	West Hobart
7 B P	J. C. McMillan	Hobart
7 B N	A. Smith	Launceston
7 B K	T. A. C. Preston	Queenstown
7 A L	L. W. Scanlon	West Hobart
7 B E	J. Stipek	St. Helens
7 B H	E. C. Sheldrick	Launceston
7 F P	F. P. Philbin	Queenstown
7 O M	R. D. O'May	Bellerive

**A FIELD FOR EXPERIMENT**

**T**HOUGH there are many good types of loud speakers on the market, there seems to be plenty of room for improvement in tone quality. This offers a good field for experiment to any enthusiast so inclined. Many home-made instruments give excellent results with a single 'phone unit. Continuous experimenting in regard to the shape of the horn and the material with which it is constructed may reveal the perfect combination. In England many experimenters have obtained good results with home-made papier mache horns, while from America comes the report that an enthusiast worked wonders, using a huge spiral sea shell as a horn.

**Anthony Horderns' for Suits-to-Measure**

# AUSTRALIAN COAST AND ISLAND RADIO STATIONS

STATION	Location.	Call Letters	Normal Wave Length	Normal Range in Nautical Miles.	Class of Work.	Hours of Work.
Adelaide	S. A.	VIA	600	450	Com.	Continuous.
Brisbane	QLD.	VIB	600	450	Com.	Continuous.
Broome	W.A.	VIO	600	450	Com.	9.30 a.m.-1 p.m.; 2 p.m.-5.30 p.m.; 6.30 a.m. - 12.30 p.m.; 12.30 a.m.-6.30 p.m.
Cooktown	QLD.	VIC	600	450	Com.	7 a.m.-8 p.m.
Darwin	N. T.	VID	600	450	Com.	Continuous.
Esperance	W.A.	VIE	600	450	Com.	6 a.m.-8 p.m.
Flinders Is.	TAS.	VIL	600	450	Com.	9.12 and 2.6 p.m., Sat., 9.12; Sundays closed.
Geraldton	W.A.	VIN	600	450	Com.	6 a.m.-8 p.m.
Hobart	TAS.	VIH	600	300	Com.	6 a.m.-8 p.m.
King Is.	TAS. (Bass Str.)	VZE	600	200	Com.	9.12 and 2.6 p.m.; Sun. and holidays; Sat. aft. closed.
Melbourne	VIC.	VIM	600	450	Com.	Continuous.
Perth	W.A.	VIP	600	400	Com.	Continuous.
R'ckh'pton	QLD.	VIR	1800-3500 600	1500 450	Com. Com.	Continuous. 9 a.m. - 5.30 p.m. weekdays; 9.1 p.m. and 2.5 p.m. Sundays.
Sydney	N.S.W.	VIS	600 1800-3500	400 1500	Com.	Continuous
Thurs. Is.	QLD.	VII	600	500	Com.	9.30 a.m.-1 p.m.; 2.20 p.m.-5.30 p.m.; 6.30 p.m.-6.30 a.m.
Townsville	QLD.	VIT	600 1800-3500	400 1500	Com.	Continuous.
Willis Is.		CGI	600	300-600	Com. and Meteo?	Open only Nov.-Apl. 9-11 a.m., 3-5 p.m. and 7-9 p.m.
Wyndham	W.A.	VIW	600	450	Com.	9 a.m. to noon and 2-6 p.m.; Sat., 9 a.m. to 1 p.m.; closed Sun. and holidays.
Pt. Moresby	Papua.	VIG	600	500	Com.	7 a.m.-1 p.m. and 2-5 p.m.; closed Sundays.
Samarai	Papua.	VIJ	600	350	Com.	9-12 a.m. and 2-4 p.m.; closed Sundays.
Rabaul	N. Guinea	VIZ	600	1000	Com.	6 a.m.-12 p.m.
Eitape	N. Guinea	VZX	600	200	Com.	Mon.-Friday.
Kieta	N. Guinea	VIU	600	200	Com.	9 a.m.-10 a.m.
Kaewieng	N. Guinea	VZR	600	200	Com.	Noon-5 p.m. Sat.
Manus	N. Guinea	VZO	600	200	Com.	9 a.m.-10 a.m.
Morobe	N. Guinea	VZK	600	200	Com.	Noon-2 p.m.
Mandang	N. Guinea	VIV	600	200	Com.	Sundays closed

These stations are owned and controlled by Amalgamated Wireless (Australia), Ltd.

Anthony Horderns' for Garden Tools

# PERSONALITIES OF AUSTRALIAN RADIO

**A**USTRALIA is extremely fortunate in numbering among those prominent in her radio world many men of exceptional and outstanding skill and ability. It is to these men, to a large extent, that the broadcast listener-in owes his success in reception.

## E. T. FISK

**I**T is probable that the most spectacular figure in Australian wireless to-day is Mr. E. T. Fisk, Managing Director of Amalgamated Wireless (Australasia), Limited. Mr Fisk was born in England in 1886

Australia, Mr. Fisk, now Managing Director of the company, negotiated the agreement between his company and the Commonwealth Government in 1922. It was Mr. Fisk who framed the scheme for broadcasting in Australia, which was accepted by the Government and incorporated in the regulations known as the "sealed set regulations." When Marconi experimented in England in the transmission of wireless telephony on his beam system Mr. Fisk received the speech at his experimental station at Vaucluse.



## C. D. MACLURCAN

**A**USTRALIA'S leading amateur is the accepted title of Mr. C. D.



and entered the service of the Marconi Company in that country in 1905. Five years later he visited Australia in the Orient liner Otranto for the purpose of demonstrating Marconi apparatus for the Orient Line. He came to Australia again in 1911 and was appointed general manager of Amalgamated Wireless with a seat on the board, in 1913. After having tested the possibility of communication by wireless between England and

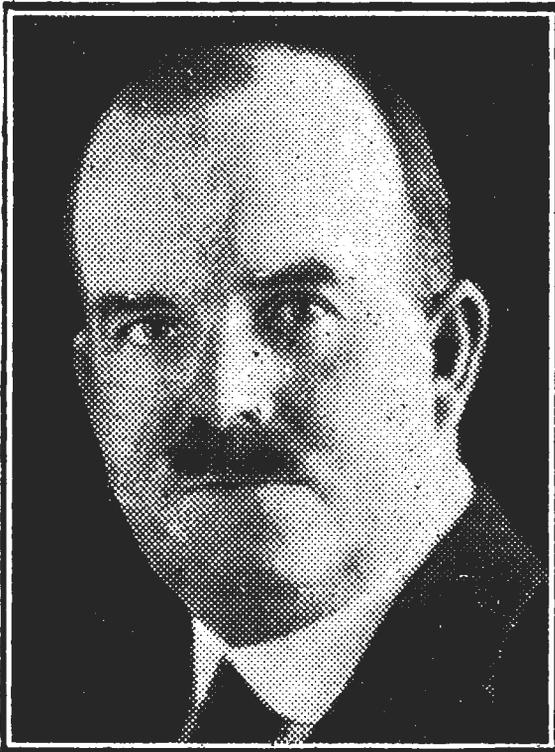
Maclurcan, of Strathfield, Sydney. Mr. Maclurcan interested himself in

**Anthony Horderns' for Paints and Oils**

the wireless science when spark coils and crystal detectors were the last word. In the early days he had a well equipped station on the roof of the Wentworth Hotel, Sydney, the aerial system of which was an object of much wonder in those days. Moving with the times he was one of the first in Australia to employ the thermionic valve in both reception and transmission. Before broadcasting came to Australia Mr. Maclurcan was constantly "on the air" with music and speech, and many present-day experimenters started their hobby in the days of 2CM's Sunday night entertainments. A firm believer in low power for transmission, Mr. Maclurcan has covered distances that constitute world's records. His station is probably the best equipped of any amateur station in the Southern Hemisphere.

### A. B. COCHRANE

**K**KNOWN to thousands who have never seen him as the owner of

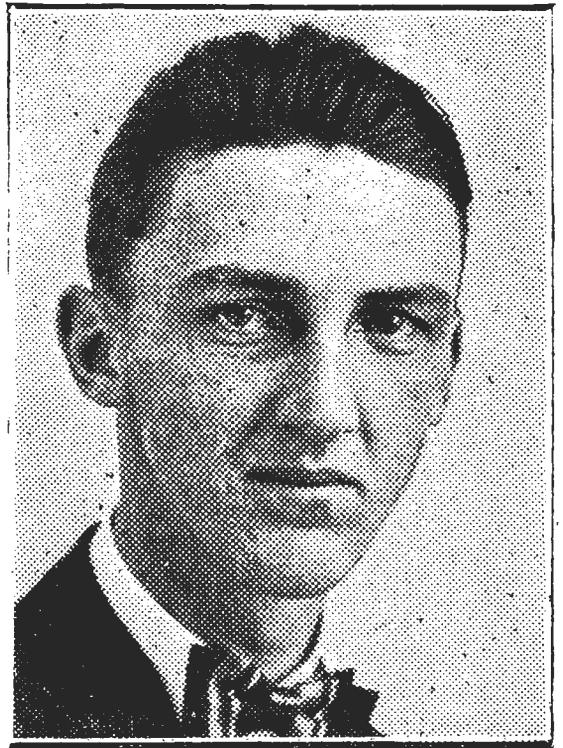


a well-modulated and pleasing voice, Mr. A. B. Cochrane, announcer at

2FC, Farmer's Sydney broadcasting station, speaks to the huge, unseen audience daily per medium of the ether wave. And the kiddies love him. He tells them tales, points morals and lectures on what are to them wonders untold. The radio home would be dreary indeed without the pleasant voice of the "Hullo Man." Mr. Cochrane loves the kiddies as much as they do him and he has always made it a point to study their peculiar little ways.

### E. MARTYN-JONES

**M**R. E. MARTYN-JONES, though not yet 22 years of age, has had the honor of constructing the first



commercial station in the Southern Hemisphere. This station is 2BL. Broadcasters (Sydney), Limited, of the transmitting plant of which he is in complete charge. Born at Albury, N.S.W., Mr. Jones first became interested in wireless in 1914, when he met Mr. Frank Leverrier, K.C., another of Australia's wireless pioneers, under whose kind guidance he studied and experimented. Mr. Jones, who was educated at the Waverley Christian Brothers' College,

**Anthony Horderns' for Columbia Storage Batteries**

is the son of Mr. G. Martyn-Jones, a well-known musician and conductor. His mother, under the name of Miss Mabel Martin, is well-known in many parts of Australia as an oratorio soprano. Mr. Jones is of opinion that there are many discoveries yet to be made in the wireless science. He is always ready and willing to help legitimate experimenters out of their difficulties.

### GEO. APPERLEY

**T**HE sound technical training of many commercial operators has been in a large measure due to the



work of Mr. George Apperley, now superintendent in charge of the Technical and Research Department of Amalgamated Wireless, Limited. Born at Hastings (N.Z.) in 1887, Mr. Apperley commenced his career in the Dominion Post and Telegraph Department. In 1911 he was attached to the laboratory of the department to study problems in connection with the wireless station at Wellington. Later he was in charge of one of the first wireless stations in the Pacific—Fiji. When Amalgamated

Wireless, Limited, opened the Marconi School in 1913, Mr. Apperley was appointed to compile and take charge of the technical and operating courses. Two years later he was appointed to organise and superintend the company's manufacturing activities, which position he vacated to take charge of the company's technical and research work. After a spell in the Commonwealth radio service, Mr. Apperley returned to Amalgamated Wireless two years ago and was appointed to his present position.

### MALCOLM PERRY

**M**R. MALCOLM PERRY, now sales manager of New Systems Telephones Proprietary, Limited, is another pioneer of Australian amateur wireless. Born in 1891, he was educated at the Sydney Grammar School.



While senior captain of the Hobbies Club, in 1905, he became interested in the science and subsequently gave a demonstration, transmitting 80 feet on a two-inch spark coil. In 1910, Mr. Perry put up two 100-foot masts

**Anthony Horderns' for Motor Accessories**

at his home and with his aerial thus supported he was able to transmit 50 miles with a  $\frac{1}{2}$ -inch motor coil, and 10 miles on a bell buzzer. Mr. Perry was hon. secretary of the N.S.W. division of the Wireless Institute from 1910 to 1921, hon. treasurer 1921 to 1922, and member of the council from 1922 to 1923.

### A. S. M'DONALD

**T**HE splendid results obtained by 2FC, Farmer's Sydney Broadcasting Station, are largely due to the man who was principally concerned

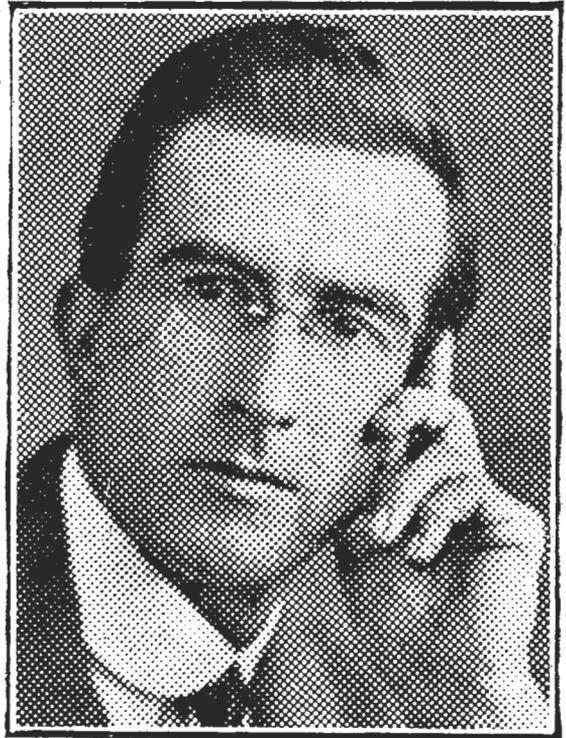


in the construction of this station. This man is Mr. A. S. M'Donald, chief engineer of Amalgamated Wireless, Limited. Born in Victoria in 1890, Mr. M'Donald received his technical education at the Melbourne Technical College. Entering the electrical engineers' branch of the Postmaster-General's Department in 1911, he was the following year appointed erection engineer in the Commonwealth Government radio service. At the outbreak of war Mr

M'Donald became assistant engineer for equipment, and in 1918 was appointed radio engineer. When the Commonwealth Government radio activities were taken over by Amalgamated Wireless in 1922 he took charge of the engineering division. In the same year he was admitted a full member of the Institute of Radio Engineers, New York. When Mr. Fisk went abroad in 1922 he took Mr. M'Donald and other engineers with him. While away Mr. M'Donald spent a lot of time at the modern stations in England, France and Germany. The latest equipment used in England and on the Continent for broadcasting also claimed his attention. Since his return to Australia Mr. M'Donald has been engaged in connection with his company's wireless undertakings.

### H. A. STOWE

**A**NOTHER of Australia's front-rank experimenters is Mr. H. A.



Stowe. Mr. Stowe first interested himself in wireless in 1908 and was one of the first to hold an experi-

**Anthony Horderns' for Complete Wireless Outfits**

mental license. In those days it was considered quite a feat for an Australian amateur to receive the Suva station on a crystal, and Mr. Stowe was one of the first to do it. Since the war Mr. Stowe's station (2CX) at Chatswood has housed a very complete set of instruments and he is carrying out definite experiments in connection with special methods of transmission and modulation. Always an advocate of home-made apparatus he has constructed practically all the gear at his station, including a wave meter, and special testing instruments.

**MISS F. V. WALLACE**

There is scarcely an experimenter in N.S.W. who does not know Miss F. V. Wallace, one of the few women experts in the radio science in Australia. Educated at the Sydney Technical College she had little difficulty in securing a diploma for electrical engineering. For some time Miss Wallace was engaged in elec-



trical contracting, often working on installations with her employees. Later she took over an electrical busi-

ness in the Royal Arcade and was one of the first to realise that a radio boom would strike Australia in due course. Thereupon she blended wireless with her other business and was forced to exclude the electrical side, so great had the demand for wireless goods become.

**R. C. MARSDEN**

Another of the Australian pioneers of amateur wireless is Mr. R. C. Marsden, of Edgecliff,



Sydney. He became interested in the science in his youth when crystals and spark coils held sway. In those days Mr. Marsden frequently disturbed the atmosphere with a spark coil and later he went to England and took a course of electrical engineering and chemistry at a Liverpool seat of learning. After serving with the British forces during the war, Mr. Marsden returned to Sydney and became connected with the motor trade, resuming the study of wireless in his spare time. He was one of the first to be granted an experimental license on the conclusion of hos-

**Anthony Horderns' for Crystal Sets**

ilities. As the owner-operator of a fine transmitting station (2JM) Mr. Marsden is known in several States.

## BASIL COOKE

MR. BASIL COOKE, F.R.A.S., commenced wireless experimenting in Perth in 1904, getting splendid results on crystal detectors used in conjunction with home-made apparatus. When the war came Mr. Cooke volunteered, but was rejected owing to a blind eye. He was allowed to keep his set at Sydney Observatory, under military guard, because he was assisting in important longitude work by wireless. At the end of 1914 Mr. Cooke received the first three-electrode valve in Sydney and with it broke world's records by hearing American and German stations. During the war his services were accept-



ed by the military authorities, and he had charge of the wireless training of the A.I.F. for Mestopotamia and Palestine.

## J. MALONE

THE name of Mr. J. Malone, chief manager of Telegraphs and Wireless, is known to everybody interested in radio throughout the Common-



wealth. Mr. Malone controls Australian wireless on behalf of the Commonwealth Government, and it is safe to say that no better man could be found for the position. Joining the Post and Telegraph Department at Lismore as a telegraph messenger in 1898, he was appointed as a relieving officer two years later. In 1906 Mr. Malone joined the engineering branch of the department, and occupied various important posts till the outbreak of war, when he enlisted. By the military authorities he was immediately appointed instructor in wireless at the Moore Park (Sydney) School. Later he went to France where he had charge of all A.F.C. wireless activities, and was awarded the M.C. On the conclusion of hostilities he studied wireless and engineering in Europe for 12 months, and on his return to Australia was

**Anthony Horderns' for Valve Sets**

appointed Deputy State Engineer at Perth. Mr. Malone was selected to take over the Commonwealth radio service when the change was made from the Navy Department to the Post Office, and when, by reason of the agreement between the Government and Amalgamated Wireless Limited, the company took control of the service, he was made controller of wireless. When the administration of the Wireless Act was handed over to the P.M.G.'s Department, Mr. Malone was appointed to his present office.

### D. CAMPBELL

**F**EW men, especially in Australia, can claim to have been associated with wireless activities for such a long period as Mr. D. Campbell, constructional engineer of Amalgamated Wireless, Limited. On the inception of experimental wireless in H.M.



Navy in England in 1898, Mr. Campbell, having had an electrical training and being chief signal instructor at Portsmouth Signal School, was one of the first detailed to carry on experiments in connection with the new

method of communication.

Having completed his service he left for Sydney in 1909. The following year he joined up with the Australasian Wireless Company, taking charge of the workshops

### J. C. REED

**A**BOUT 1910 an experimenter gave a wireless demonstration at the Newcastle School of Arts, the apparatus consisting of a large spark coil



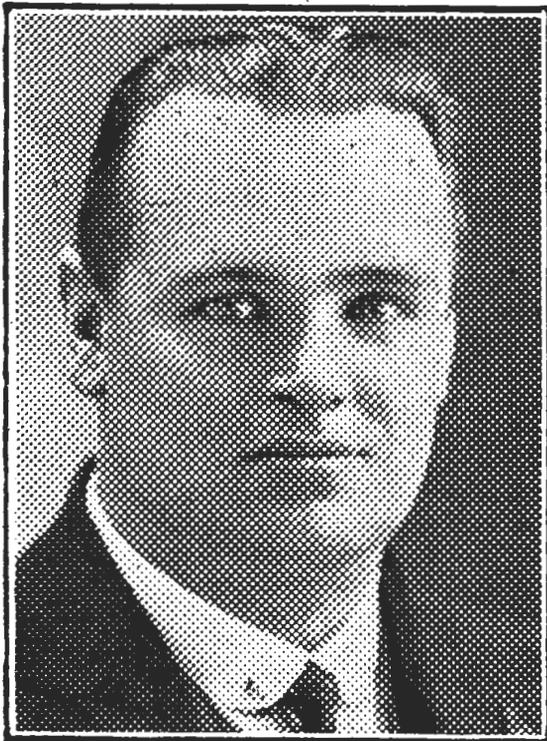
connected to two long brass rods for a transmitter, while across the room was a similar system connected to a coherer and bell for the receiver. The operation of this apparatus made a vivid impression upon the audience, one of whom was no other than Mr. J. C. Reed, now radio engineer of Amalgamated Wireless, Limited, who thereupon decided that wireless had more than a passing interest for him; and he commenced a new hobby. In 1914, Mr. Reed was carrying out radio experiments in conjunction with Lieut. Bracegirdle, S.D.N.O., and the signal staff of the Newcastle Naval Depot, and in 1915 he joined the Naval Shipping Exami-

**Anthony Horderns' for Cabinet Receiving Outfits**

nation Service, later taking up duties as telegraphist and electrical artificer at Sydney Radio and Garden Is'and finishing up in 1918 as assistant to Radio Inspectors Weston and Crawford. Subsequently he was for some time engaged as engineer in the Telephone and Telegraph Department of the Sydney G.P.O. Mr. Reed joined the Commonwealth Government radio staff in 1921, from which service he was transferred to Amalgamated Wireless, Limited, in 1923. In collaboration with the company's engineers he has done excellent work in connection with the equipping of Farmer's broadcasting station 2FC.

### MAJOR W. H. NEWMAN.

**F**OR 15 years Major W. H. Newman, now secretary to the Chief Railway Commissioner of New South Wales, has been experimenting



in wireless telegraphy and telephony. Born in 1889, he was educated at the Goulburn Superior Public School and later at King's College, Goulburn. One of the early members of the N.S.W. Division of the Wire-

less Institute, Major Newman is now a member of the Council of that body, and was one of the three who supervised the successful wireless and electrical exhibition at the Sydney Town Hall in December, 1923. Recently he has been experimenting with Mr. Basil Cooke, in connection with the adoption of wireless telegraphy and telephony to railway uses.

### MR. O. F. MINGAY

**M**R. O. F. MINGAY, manager of the wireless department of the Burgin Electric Co., Ltd., commenced his career in the Postal Depart-



ment at Lithgow, entering the telephone department on his transfer to Sydney in 1911. He was associated with all the latest automatic and telephone equipment in the city, prior to his enlistment early in 1915. After service in France and Belgium, he returned to Australia in 1919, and decided to concentrate on wireless, and in 1922 he became associated with the Burgin Electric Company, Ltd.

**Anthony Horderns' for Loud Speakers**

## A TWO-ELEMENT VALVE

**T**HERE is a valve on the market now called the diode, a two-electrode valve from which the grid has been removed. This is, of course, our old friend, the Fleming valve, and it costs less than the three electrode tube.

At the outset it must be said that this valve is not as sensitive as the usual type and regeneration cannot be obtained with it. It is, however, a cut above the average crystal, and has many advantages over the mineral detector. No "B" batteries are required with this valve and the filament current is supplied by two dry cells in series.

Users of the crystal are often troubled by the ease with which the "catwhisker" is jolted off a sensitive spot, and the trouble of finding one. This is where the two element valve has the advantage. A single slide or loose coupler crystal set may be converted for use with the diode with little trouble. The only extra apparatus needed is the valve and socket, a rheostat and two dry cells.

A suitable circuit for using the valve with a single slide tuner is given in Fig. 26.

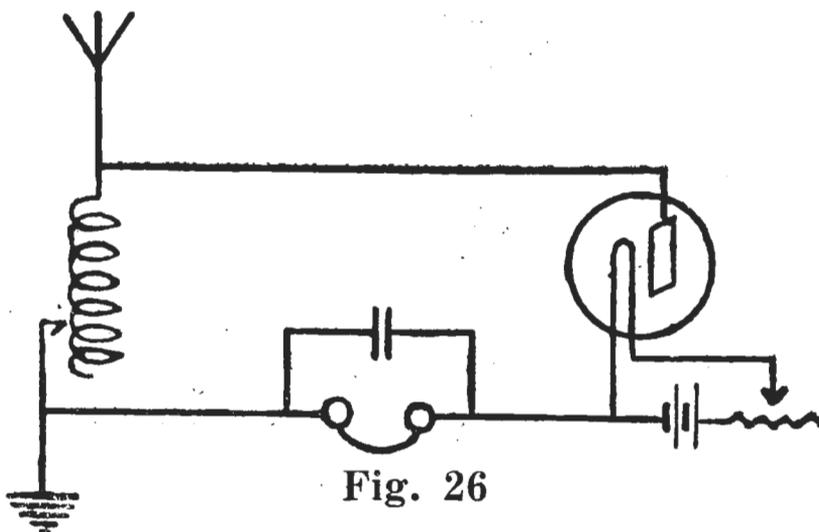


Fig. 26

Enthusiasts who have used this Fleming valve say that they prefer it to the crystal. It is said to be absolutely silent in operation and very sensitive. Care must be taken to get just the right amount of current to the filament by careful adjustment of the rheostat. Of course, valve amplification by means of the three electrode tubes can be used with the diode, but if distances have to be covered it is not advisable to use the two electrode as a detector, no matter how many stages of audio frequency follow it. But the diode can work anywhere that the crystal does, and there are many ways of arranging it in the circuit.

**Anthony Horderns' for Telephone Headsets**

## A RADIO GLOSSARY

**A.C.**—Alternating current.

**Aerial.**—A system of wires for intercepting or radiating electro-magnetic waves. (Also termed antenna.)

**Accumulator.**—A storage battery.

**Ammeter.**—An instrument for measuring an electric current.

**Amplifier.**—An arrangement for increasing the strength of received signals.

**Audio.**—Capable of being heard.

**Audion.**—Another term for a three-element valve or vacuum tube.

**Battery, "B."**—A number of cells, usually of the "dry" type, connected together for the purpose of producing a high tension current for the plate circuit of a valve receiver.

**Binding Post—Terminals.**—Metal fixtures to secure the ends of wires.

**Buzzer.**—A variety of electro-magnetic interrupter.

**Capacity (Condenser).**—That property of the condenser which determines the quantity of electricity which may be impressed upon it with a given voltage.

**"Catwhisker."**—A thin piece of wire used in conjunction with a crystal detector.

**Circuit.**—A wired path through which a current may flow. **Open Circuit:** A circuit that is broken in continuity. **Closed Circuit:** A circuit that is uninterrupted by breaks.

**Code (Morse).**—An alphabet, the letters of which are represented by combinations of dots and dashes; used in wireless and other methods of telegraphy and signalling.

**Condenser.**—An instrument made up of conducting elements separated by non-conducting substances, capable of storing electrical energy.

**Coil.**—A series of turns of wire on a cylindrical former.

**Counterpoise.**—A kind of second aerial placed directly under the main aerial, usually about 12ft from the ground; used instead of an "earth."

**Coupling.**—The means for transferring energy from part to part of a circuit.

**Continuous Waves (C.W.).**—A train of waves of equal amplitude.

**Crystals.**—Minerals used to rectify radio frequency currents.

**Damped Waves.**—Radio waves which gradually lessen in amplitude till disappearing point is reached.

**Detector.**—Any device that converts oscillation into direct pulsations.

**Diaphragm.**—A thin iron disc (in telephones) that converts pulsation of current into audible sounds by vibration.

**Dielectric.**—Any non-conductor of electricity; material that offers high resistance to the passage of electrical currents.

**Duo-Lateral.**—A type of inductance coil which resembles a honeycomb; called honeycomb coil.

**Dry Cell.**—An enclosed cell that gives electrical energy through the medium of chemical action.

**"Earth" (or "Ground").**—A connection from wireless apparatus to the earth.

**Ebonite.**—Vulcanised rubber; a non-conductor of electricity.

**Electrolyte.**—The active liquid in an electric battery.

**Electron.**—A minute charge of negative electricity forming portion of the atom.

**Ether.**—The medium that fills all space and matter, through which the electro-magnetic waves are said to flow.

**Anthony Horderns' for Amplifiers**

- Farad.**—A unit of electrical capacity. If a steady current of one ampere flows into a condenser and the voltage across the condenser is one volt at the end of one second, the capacity of the condenser is one farad.
- Filament.**—One of the elements in a valve that, when heated, emits electrons.
- Fleming Valve.**—A valve having only two elements, the filament and plate.
- Frequency.**—The number of complete current cycles, or reversals, per second.
- Generator.**—A machine for converting mechanical energy into electrical energy.
- Grid.**—One of the elements of a valve; usually a spiral of metal. In operation the grid controls the action of the valve.
- Grid Bias.**—A negative potential applied to a grid.
- Grid Leak.**—A form of resistance used in conjunction with a grid condenser, to permit excess grid charges to escape in a backward direction.
- Henry.**—The practical unit of inductance.
- Hertzian Waves.**—Ether waves.
- I.C.W.**—Interrupted continuous waves.
- Impedance.**—The total opposition offered by a circuit to the passage of a current.
- Inductance.**—The property of a wire coil which determines the strength of the magnetic field around it when a given current is flowing through the wire.
- Insulator.**—A non-conductor of electricity.
- Inverted "L" (Aerial).**—An aerial from which the "lead in" is taken from one end.
- Key (Operating).**—A device for making and breaking a circuit, thus starting and stopping the current for signalling.
- Kilocycle.**—1000 cycles.
- Kilowatt (K.W.).**—1000 watts.
- Lead.**—A wire connecting two or more pieces of apparatus.
- Loading Coil.**—A simple coil inserted into the circuit for tuning.
- Loop Aerial.**—A special type of aerial formed by winding wire round a frame.
- Megohm.**—A million ohms.
- Microfad.**—.0000001 farad.
- Microphone.**—An instrument for collecting sound and converting it into minute electric currents.
- Millihenry.**—.001 henry.
- Natural Wavelength (Aerial).**—The wave produced by the aerial's own capacity and inductance.
- Negative.**—One of the electric charges usually indicated by the minus sign.
- Ohm.**—The practical unit of electrical resistance.
- Oscillation.**—A very rapid vibration.
- Oscillator.**—A device for producing oscillation, or high frequency currents.
- Plate.**—An element of the valve; usually a cylinder of metal surrounding the filament and the grid. A heavy positive charge is impressed on the plate to attract the negative electrons from the filament.
- Potential.**—An electrical pressure.
- Potentiometer.**—A resistance, having a movable contact, through which current flows.
- Primary.**—The first winding of any transformer; connected to the source of supply.
- Reactance.**—The portion of the total impedance that is due to capacity and inductance.

- Rectification.**—The conversion of an alternating into direct or pulsating current.
- Refraction.**—The bending or changing direction of radio waves.
- Regeneration.**—A method of increasing signal strength by returning part of the output of a valve to the grid to be re-amplified.
- Resistance.**—The property of a conductor tending to oppose the flow of current through it. Everything in a circuit offers resistance to a certain degree.
- Rheostat.**—A variable resistance chiefly used to regulate the flow of current to the valve filament.
- Rejector Circuit.**—A circuit is so arranged to reject unwanted signals that cannot be tuned out by the usual means.
- Series.**—An electrical connection, such as a number of lamps in a circuit, arranged in a manner that the current flows through each in turn.
- Secondary.**—The coil of a transformer into which the energy is induced.
- Shellac.**—A tree gum used in the form of a varnish in wireless and electrical work; a good insulator.
- Shunt.**—An instrument connected in parallel.
- Spark Coil.**—An insulated wire wound round an iron core used for producing a spark from a low voltage source.
- Static.**—An electrical disturbance due to atmospheric discharges.
- "T" (Aerial).**—An aerial from which the "lead in" is taken from the middle of the span, thus forming the letter "T."
- "Tickler" Coil.**—A coil used to obtain regeneration.
- Tuner.**—That portion of the apparatus concerned with tuning the wavelength.
- Transformer.**—A device used to either raise or lower the voltage of the alternating current in a circuit.
- Undamped Waves.**—Continuous waves.
- Valve.**—A closed glass vacuum receptacle containing three elements—plate, filament, and grid. Serving a similar purpose in the circuit to that of the crystal, but is much more sensitive.
- Vario-Coupler.**—A device for varying the inductance in a circuit; primary and secondary not connected electrically.
- Variometer.**—A device for varying the inductance in a circuit; constructed by connecting two inductances in series, one inside the other, so that the magnetic field may be varied by revolving the inner coil.
- Variable Condenser.**—A condenser of which the capacity may be varied; most commonly two sets of plates, one moving in and out between the other with air as the dielectric.
- Vernier.**—A device for securing very fine adjustments of apparatus.
- Voltage.**—Electrical pressure.
- Watt.**—A unit of power; voltage multiplied by amperage.
- Wired Wireless.**—The application of the principles of wireless to wired communication.
- Wavelength.**—The distance between the crest of one radio wave and the next in metres.
- Wavemeter.**—An instrument for measuring wavelengths.

## WIRELESS REGULATIONS

**T**HE use of wireless in Australia is governed by the Wireless Telegraphy Act of 1905-1919, and regulations made under it from time to time. The latest regulations, which are of particular interest to wireless enthusiasts, were approved on July 17, 1924.

Under these regulations the following licenses are provided for: Coast station, ship station, land station, broadcasting station, broadcast listeners', temporary, dealers', experimental, portable station, aircraft station, and special licenses.

The regulations pertaining to broadcasting provide for two classes of broadcasting stations, "A" and "B." In the case of the "A" class stations the licensee receives a proportion of the revenue, but no revenue is available for "B" class stations. Two "A" class stations are allowed in both New South Wales and Victoria, while the remaining States may have only one each.

The power to be used by the "A" class stations in the various States is as follows: New South Wales and Victoria, one not less than 5000 watts, and the other not less than 1500 watts. In Queensland, South Australia, and West Australia, the power of the "A" class station is to be not less than 5000 watts. In Tasmania the power must not be less than 3000 watts.

Broadcasting station licence continues in force for five years from the date of granting and is thereafter to be renewable annually. Class "A" stations must support their undertaking to give a reliable service by a guarantee of £1000 from a surety approved by the Postmaster-General, or deposit with him cash or securities for that amount.

Licensees of class "A" stations and such "B" class stations as the Postmaster-General approves may broadcast advertisements, and any station desiring to do this must publish the advertising charges. The broadcasting of advertisements from class "A" stations shall be confined to periods not exceeding five minutes in duration, and not exceeding, in the aggregate, thirty minutes in any regular programme or sixty minutes in any twelve consecutive hours.

The clause in the regulations pertaining to the payment of revenue to broadcasting stations reads as follows: (1) Subject to the Postmaster-General being satisfied with the service provided by the licensee. . . . a licensee of class "A" station shall be entitled to receive the following proportion of the available revenue obtained in the State in which his station is located, namely: (a) the existing licensee of the high power station in New South Wales or Victoria, seventy per centum of the available revenue; (b) the other licensee in New South Wales or Victoria, thirty per centum of the available revenue; and (c) a licensee in any of the other States, the whole of the available revenue.

Provision is made for arbitration proceedings if the proportions in which the available revenue in New South Wales and Victoria are divided are not acceptable to any licensee entitled thereto. The available revenue means the balance of the fees collected by the department under the regulations in respect of broadcast listeners' licences, dealers' licences, and experimental licences, after deducting from each licence the following amounts respectively: Ordinary broadcast listeners' licence, five shillings; special broadcast listeners' licence, five shillings; temporary broadcast listeners' licence, twenty-five per cent. of fee; dealers' licence, twenty-five per cent. of fee; experimental licence, ten shillings.

Licence fees for the first class "A" station is £15 per annum, and for any subsequent station, operated by the same licensee in the same State, £5 per annum. The fee for "B" class station is £5 per annum.

The division dealing with broadcast listeners' licences provides for the granting of such licences on the zone system. For the purpose of the

**Anthony Horderns' for Batteries**

payment of fees therefor, each State is divided into three zones as follows: (a) In Queensland, New South Wales, Victoria, and South Australia—(i) zone 1 shall include the territory between the coast line approximately 250 miles north of Brisbane and 250 miles west of Adelaide, and a line running about 250 miles from the coast, with such local variations as it is expedient to introduce; (ii) zone 2 shall include the contiguous territory reaching about 150 miles further beyond zone 1; and (iii) zone 3 shall comprise the remaining territory in those States; and

(b) In West Australia and Tasmania—(i) zone 1 shall comprise the territory of the State embraced by a circle of approximately 250 miles radius drawn from the centre of the town or city in which the station is erected; (ii) zone 2 shall lie between the 250 mile circle and another concentric circle of approximately 400 miles radius; and (iii) zone 3 shall include the rest of the State outside the 400 mile boundary.

The fees payable for the licences are as follows: Ordinary licence, thirty-five shillings per annum during the first year and thirty shillings during the second year, in zone 1; zone 2 thirty shillings for the first year and twenty-five shillings for the second year; zone 3 twenty-five shillings for the first year, and one pound for the second year. A special licence: Zone 1, £10 per year; zone 2, £9 per year; and zone 3, £7/10/- per year. Temporary licence: Zone 1, twenty shillings per week; zone 2, seventeen shillings and sixpence per week; zone 3, fifteen shillings per week.

All broadcast listeners' must sign an undertaking to respect the secrecy of defence and commercial messages.

The use of reaction in receivers is permitted on condition that the user does not interfere with neighboring receivers. The penalty for so doing is twenty pounds. The division dealing with the sale of apparatus provides that no person or firm shall manufacture, sell, let on hire, or otherwise dispose of equipment for use as broadcast receivers, or for use in those receivers, until he has been granted a dealer's licence. The licence fees are: Zone 1, £5; zone 2, £3; and zone 3, £2.

The dealer's licence enable the holder to operate a set for the purpose of demonstrating.

Experimental licences are only issued to those who can satisfy the Postmaster-General that they possess sufficient knowledge to undertake research investigations, and, except where exemption is granted, an applicant shall be examined by an authorised officer regarding his qualifications. A fee of 2/6 will be charged for each examination.

Experimental licensees may be required to keep a log book containing a chronological record of the investigations carried out, and such log is to be available for examination by an authorised officer at all reasonable times.

The fees for experimental licences are: Zone 1, twenty shillings; zone 2, seventeen shillings and sixpence; and zone 3, fifteen shillings per year.

Experimenters who desire to transmit shall be in possession of an amateur operator's certificate of proficiency. Before such certificate is granted the experimenter must indicate a satisfactory knowledge with regard to: (a) transmitting and receiving at a speed not less than twelve words per minute (five letters being counted as one word); (b) the adjustment and operation of low powered apparatus and knowledge of its working; and (c) knowledge of the principal abbreviations and regulations laid down by the International Radio Telegraph Convention.

The power used in experimental transmitting station shall not exceed 10 watts unless specially authorised. The wavelength range of an experimental transmitting station shall be between 125 and 250 metres.

The usual clauses concerning the seizure or control of apparatus in times of emergency are included in the regulations.

**Anthony Horder's' for Condensers and Parts**

## UNDERWRITERS' RULES

**T**HE Fire Underwriters' Association of New South Wales requires that the following rules shall be observed by users of radio equipment. In setting up wireless apparatus all wires relating thereto must conform to the association's "general rules for wiring for the utilisation of electrical energy":—

### For Receiving Stations Only

**Antenna (a)** Antennas outside of buildings shall not cross over or under electric light or power wires, nor shall they be so located that a failure of either antenna or of the above-mentioned electric light or power wires can result in a contact between the antenna and such electric light or power wires.

Antennas shall be constructed and installed in a strong and durable manner, and shall be so located as to prevent accidental contact with light and power wires by sagging or swinging.

Splices and joints in the antenna span, unless made with approved clamps or splicing devices, shall be soldered.

Antennas installed inside of buildings are not covered by the above rules.

**Note.**—Outdoor antennas should be of rugged construction, held securely in place and kept well away from electric light and power wires. It is advisable for the amateur not to make any connections to poles carrying light or power wires. Those unfamiliar with electric wiring will do well to have antennas and other apparatus installed by competent electricians.

The size of the antenna will depend on the span; for the ordinary receiving antenna about 100ft long, No. 16 gauge soft drawn copper wire may be used, or other wire of equivalent strength. Where the span is long, or where the antenna crosses other wires, it should be larger.

### Care of Lead-In Wires

**Lead-in Wires (b)** Lead-in wires shall be of copper, approved copper-clad steel, or other approved metal, which will not corrode excessively, and in no case shall they be smaller than No. 16 S.W.G., except that approved copper-clad steel not less than No. 18 (0.044) S.W.G. may be used.

Lead-in wires on the outside of buildings shall not come nearer than twelve (12) inches to electric light and power wires unless separated therefrom by a continuous and firmly-fixed non-conductor that will maintain permanent separation. The non-conductor shall be in addition to any insulation on the wire.

Lead-in wires shall enter building through a non-combustible non-absorptive insulating bushing.

**Note.**—Although desirable from a signalling viewpoint to prevent partial grounding in wet weather, these rules do not require the insulating of lead-in wires, except where they pass through the building wall, where a bushing is specified. This is to protect against possible contact with wires, pipes, or other grounded metal, which may be concealed in walls.

### Approved Lightning Arrester

**Protective Device (c)** Each lead-in wire shall be provided with an approved protective device properly connected and located (inside or outside the building) as near as practicable to the point where the wire enters the building. The protector shall not be placed in the immediate vicinity of easily ignited stuff, or where exposed to inflammable gases or dust or flyings of combustible materials.

**Anthony Horderns' for Everything in Wireless**

The protective device shall be an approved lightning arrester which will operate at a potential of five hundred (500) volts or less.

The use of an antenna grounding switch is desirable, but does not obviate the necessity for approved protective device required in this section. The antenna grounding switch if installed shall, in its closed position, form a shunt around the protective device.

Note.—The protective device should be an approved lightning arrester; the use of cheap home-made devices should be discouraged. Fuses are not required, but if installed should be between the lead-in and the lightning arrester.

## The Ground Wire

**Protective Ground Wire (d)** The ground wire may be bare or insulated, and shall be of copper or approved copper-clad steel. If of copper the ground wire shall not be smaller than No. 16, S.W.G., and if of approved copper-clad steel it shall not be smaller than No. 18 (0.044) S.W.G. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for grounding protective devices. Other permissible grounds are artificial grounds such as driven pipes, plates, cones, etc.

The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping.

Note.—The proper connection of the antenna to the ground minimises the lightning hazard. A satisfactory ground and properly-run ground wire are of primary importance.

## Inside Your Home

**Wires Inside Buildings (e)** Wires inside buildings shall be securely fastened in a workmanlike manner, and shall not come nearer than two (2) inches to any electric light or power wire unless separated therefrom by some continuous and firmly-fixed non-conductor making a permanent separation. This non-conductor shall be in addition to any regular insulation on the wire. Porcelain tubing or approved flexible tubing may be used for encasing wires to comply with this rule.

**Receiving Equipment Ground Wire (f)** The ground conductor may be bare or insulated, and shall be of copper, approved copper-clad, or other approved metal which will not corrode excessively under existing conditions, and in no case shall the ground wire be less than No. 16, S.W.G., except that approved copper-clad steel not less than No. 18 (0.044), S.W.G., may be used.

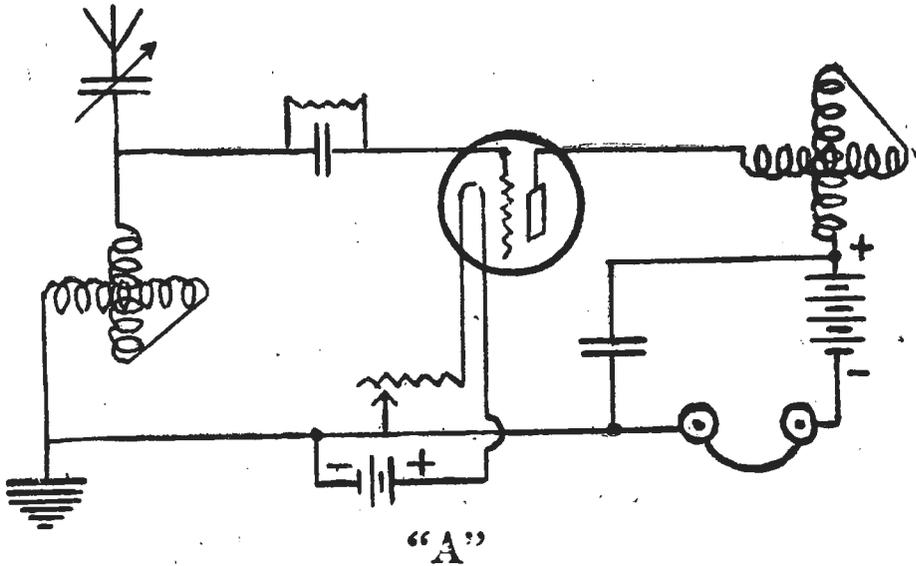
The ground wire may be run inside or outside of building. When receiving equipment ground wire is run in full compliance with rules for Protective Ground Wire, in Section (d); it may be used as the ground conductor for the protective device.

## For Transmitting Stations

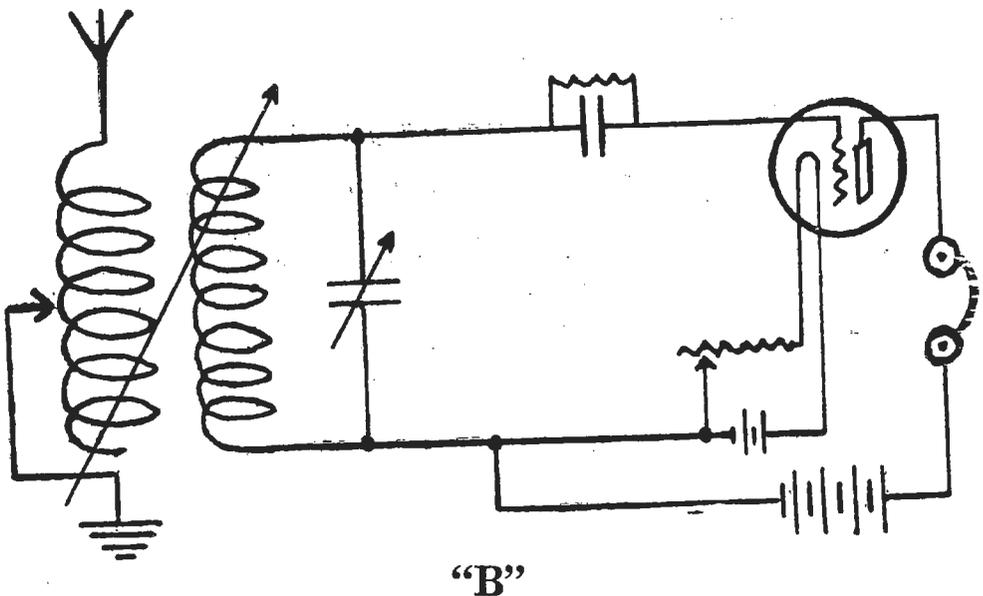
The rules pertaining to transmitting stations are a little more stringent. Details may be obtained from the New South Wales Fire Underwriters' Association.

**Anthony Horder's for Induction Coils**

# CIRCUITS



**Circuit A.**—A circuit in which the aerial and plate sections are tuned by variometers. The grid condenser should have a capacity of .0003 mf and that across the "B" battery and 'phones .01 mf. The aerial tuning condenser may be .0005.



**Circuit B.**—This is a simple valve circuit arranged for use with a loose coupler. It is selective, but without regeneration.

**Anthony Horderns' for Potentiometers**

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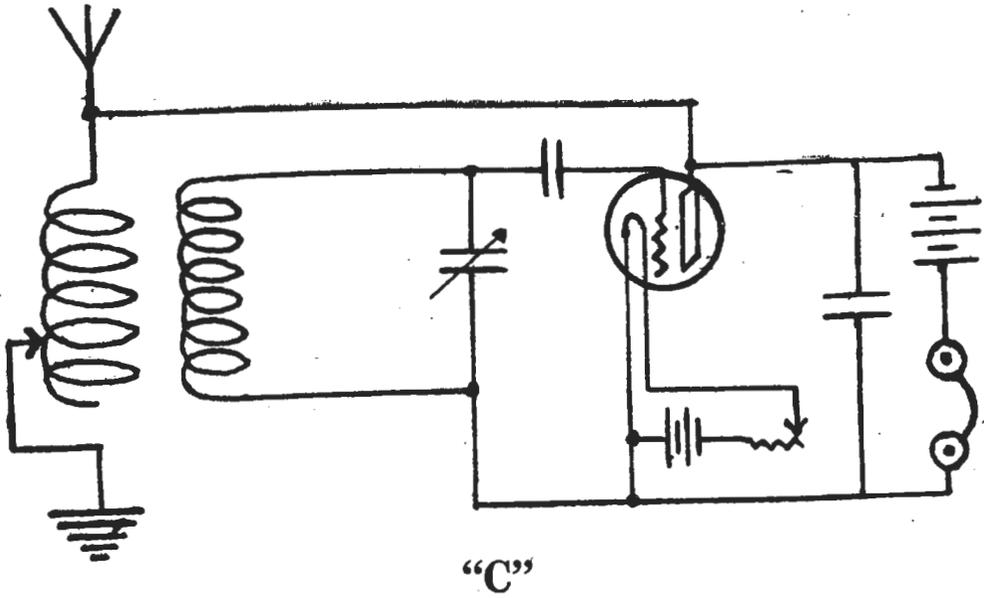
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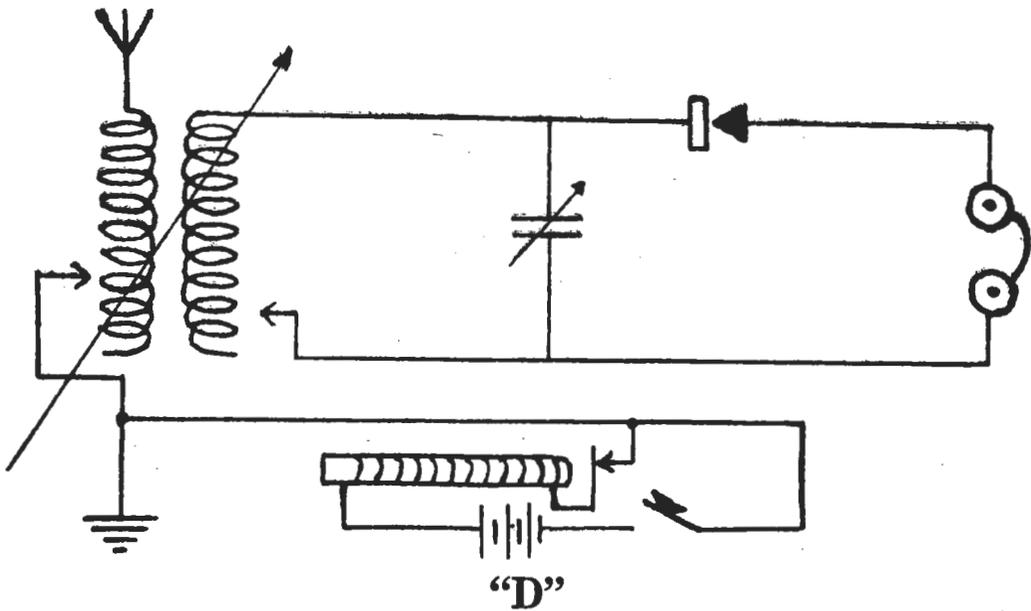
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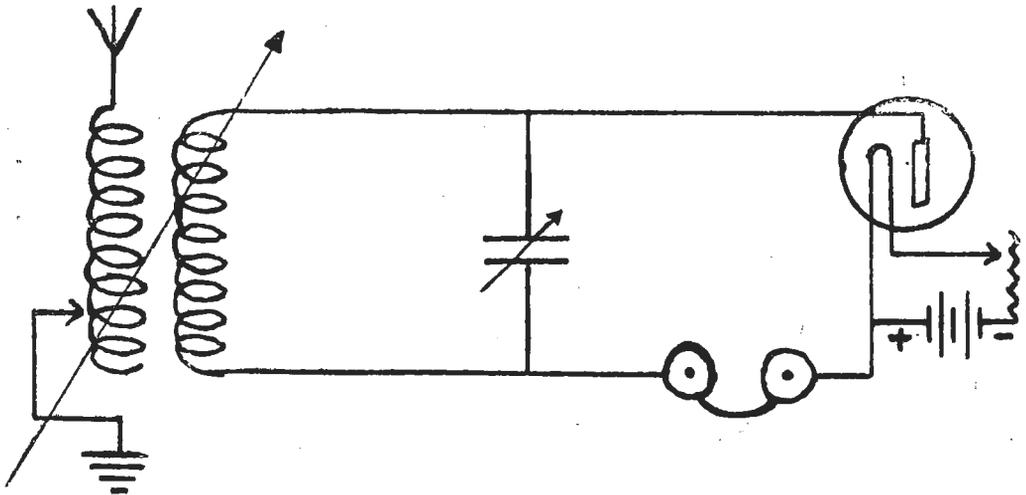


**Circuit C.**—In this circuit a feed-back effect is obtained by connecting the plate to the aerial. This circuit is not particularly good for telephony work as it is not easy to control the oscillations.



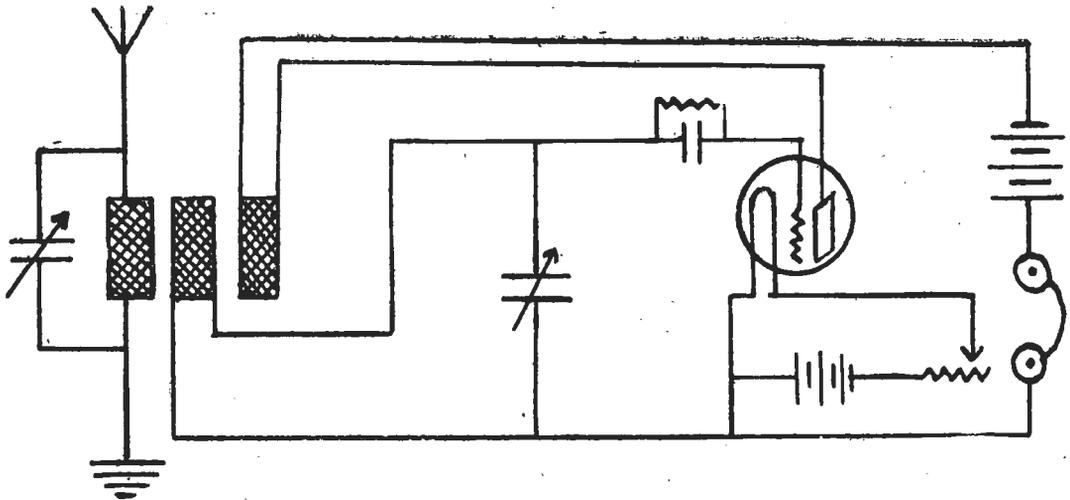
**Circuit D.**—This shows a simple loose coupler crystal receiver with a variable condenser shunting the secondary coil. The circuit also shows the arrangement for making a buzzer test for sensitive spots on a crystal. The key in the buzzer circuit is depressed and the operator listens in at the same time "searching" over the crystal with the catwhisker. The most sensitive spot on the crystal is reached when the buzzing noise is loudest in the 'phones.

**Anthony Horderns' for Rheostats and Rectifiers**



"E"

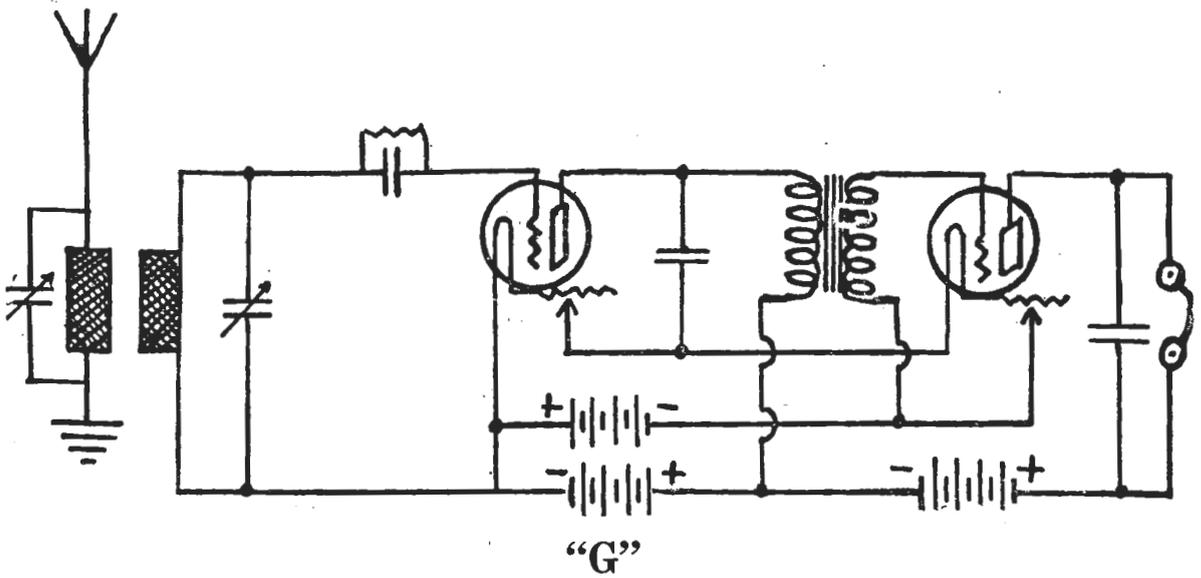
**Circuit E.**—This circuit shows the two electrode valve as a detector in conjunction with a loose coupler. The two electrode valve is rather more stable than a crystal but is not to be compared with the three element valve from the point of view of sensitivity.



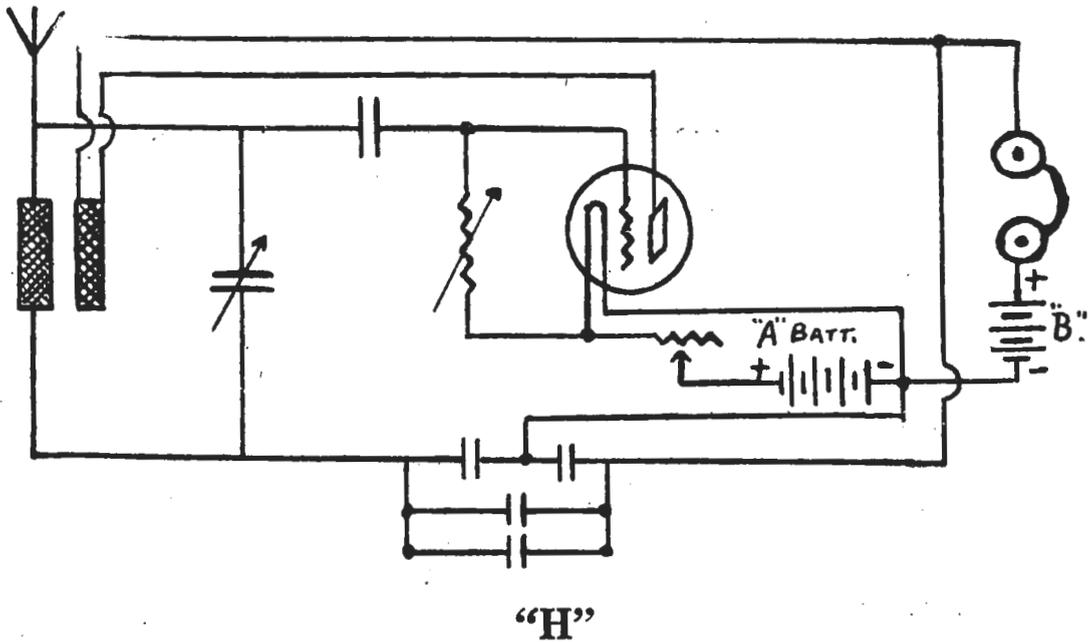
"F"

**Circuit F.**—Here we have a simple three honeycomb coil circuit. The coil between aerial and earth is the primary, the centre coil the secondary, the third coil, connected in the plate circuit, is the "tickler." In this circuit the coupling is varied by moving the primary coil while the oscillation strength is controlled by the "tickler."

**Anthony Horderns' for Valves of Every Type**

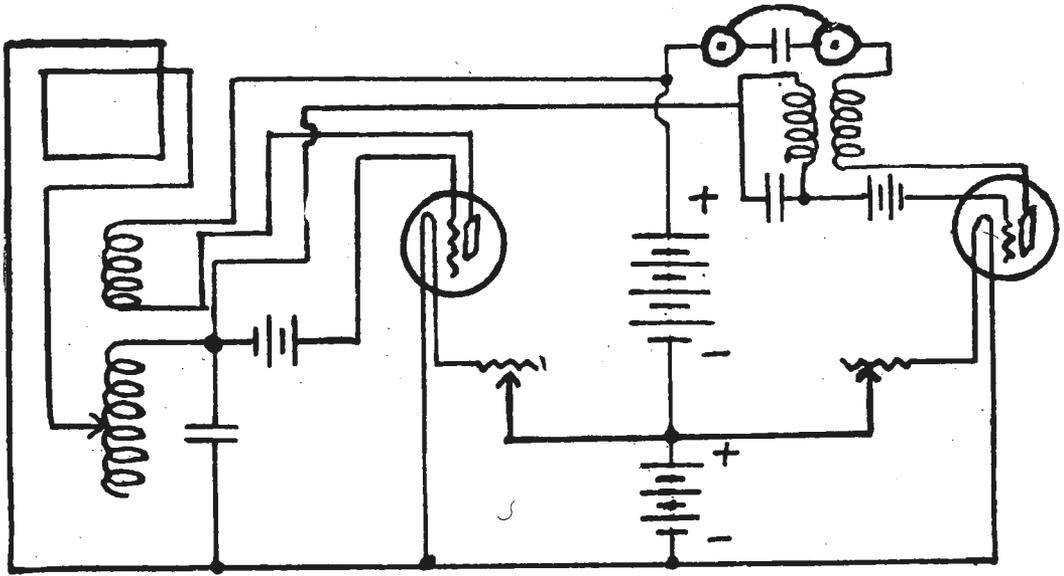


**Circuit G.**—This circuit has been designed for two valves, detector, and audio-frequency amplifier. Honeycomb coils are used. The fixed condensers shunting the 'phones, and primary of the transformer should have a capacity of .001 mf. Properly wired up and using a suitable inter-valve transformer (one, the curve of which is comparatively flat over the 100 to 5000 cycles per second range), the circuit will give good results on broadcast reception.



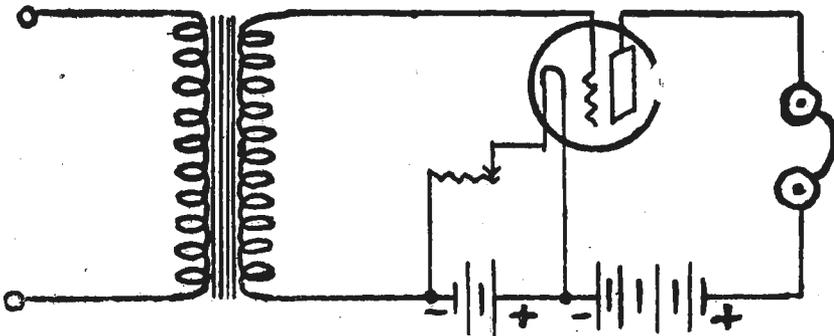
**Circuit H.**—This is the famous Flewelling hook up. It is a super-regenerative circuit and when properly constructed and well operated will give splendid results. But the circuit is a difficult one to handle.

**Anthony Horderns' for Winding Wire**



"I"

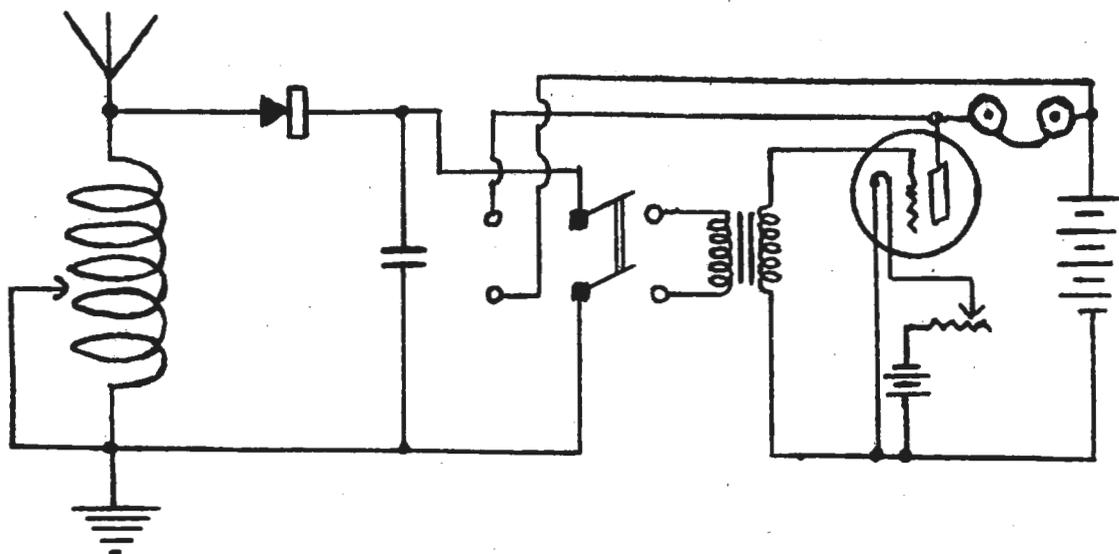
**Circuit I.**—Is a simple two valve super-regenerative circuit. The "hook up" is shown here with a loop aerial. The primary and secondary should have values to suit the desired wavelengths and be so arranged that they can be tightly coupled. The other inductances are for the purpose of producing suitable frequencies in the oscillator valve circuit. The frequencies should be so arranged by means of the condenser (.0025 mf) in this circuit that they are just above audible frequency.



"J"

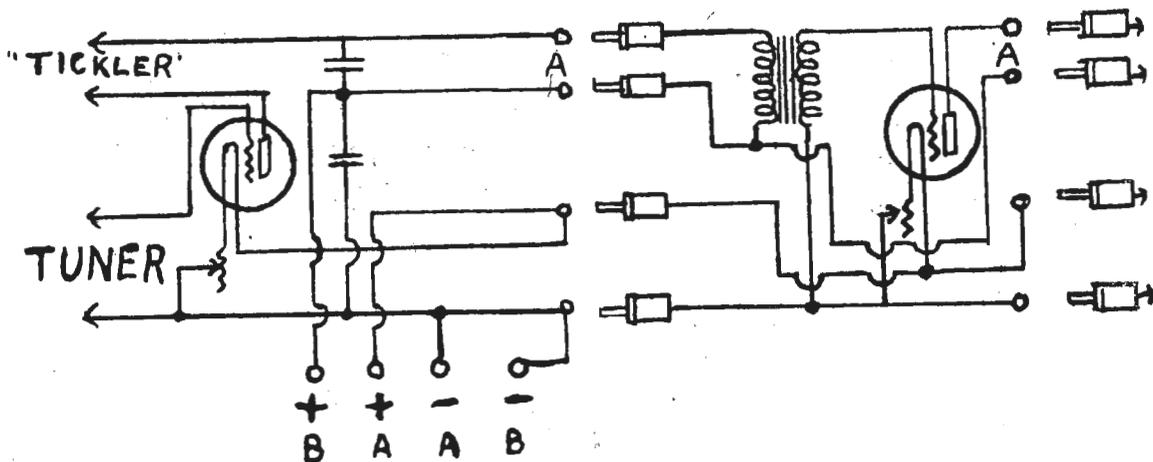
**Circuit J.**—This is a circuit for a single stage of audio frequency amplification which can be added to any detector. If being added to a single valve set the "A" and "B" batteries of the detector may be used but sometimes it is advisable to use a separate high tension battery. The input leads marked "A" are connected to the 'phone terminals on the detector panel.

**Anthony Horderns' for Parts for Home-built Sets**



"K"

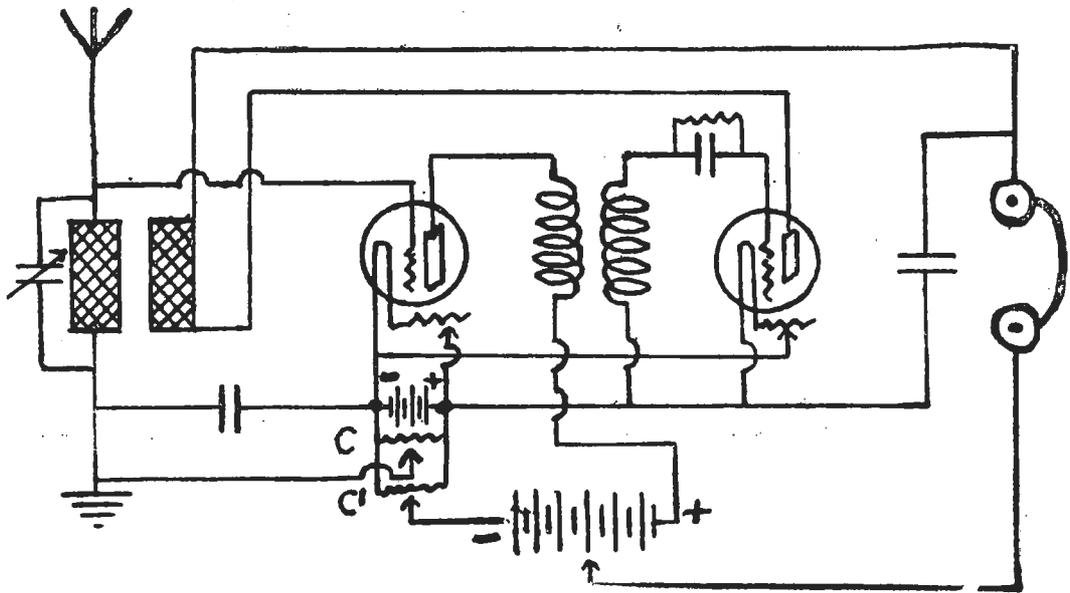
Circuit K.—This shows the "hook up" for a crystal detector and valve audio frequency amplifier. In the centre is seen a double pole double throw switch which is used to cut the amplifier in and out at will. Users of the crystal and valve combination will find this a handy arrangement.



"L"

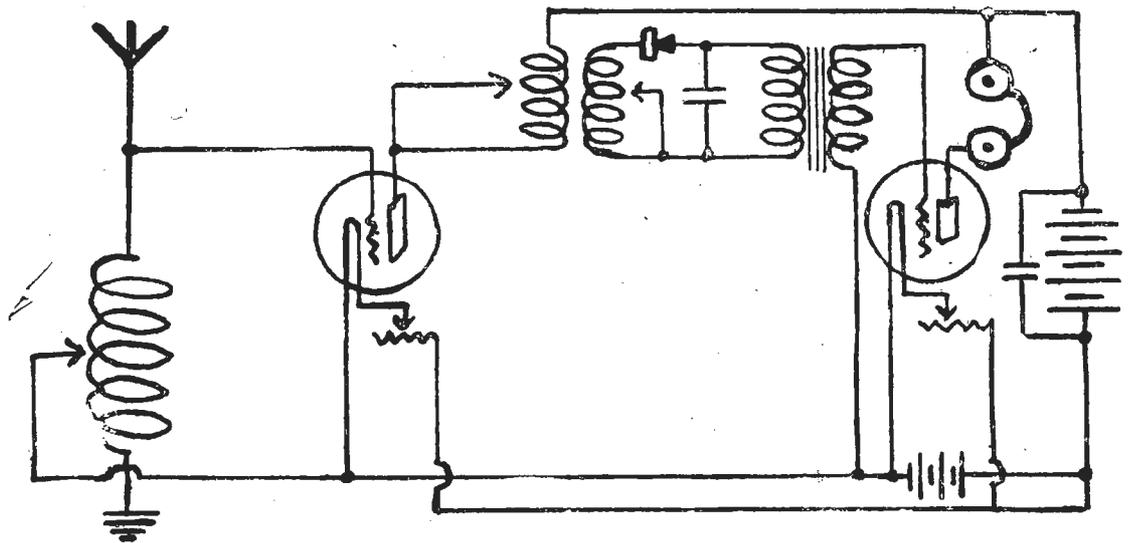
Circuit L.—This shows how a multi valve set may be connected up on the unit system. On the left is the detector panel and on the right a single stage of audio frequency amplification. Plugs and jacks are shown for adding more stages. When using one stage of amplification, on the detector alone, the 'phones should be plugged in at the pair of sockets marked "A."

Anthony Horderns' Radio Catalogue is Free



"M"

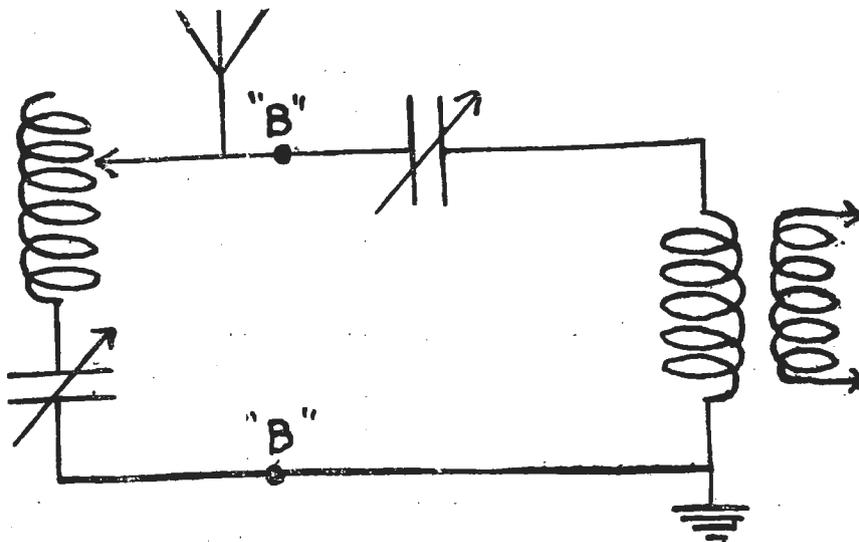
Circuit M.—This is for two valves, one as a radio frequency amplifier and the other as a detector. The potentiometers C and C1 should have a resistance of about 400 ohms each and they will prevent unwanted oscillations.



"N"

Circuit N.—An arrangement is here given for using one stage of radio frequency amplification and a stage of audio frequency with a crystal detector. The transformer used in the plate circuit of the radio frequency valve provides a maximum potential for operating the crystal.

Visit Anthony Horder's Radio Department



"O"

**Circuit O.**—Illustrates a circuit for tuning out an interfering station. The condenser "A" should have a capacity of .0005 mf. This circuit will only eliminate C.W. or I.C.W. signals of the frequency to which the coil and condenser are tuned. The portion to the right of "BB" represents any receiving set.

## VALVE INFORMATION

**T**HE following operating particulars should be handy to those who use the valves mentioned. The filament voltage given is the voltage at the terminal, after the battery current has passed through the rheostat, so it will easily be seen that the filament battery voltage will be slightly higher, depending on the resistance of the rheostat used:—

Type	Fil. Volts	Fil. Amps.	Plate Volts
UV 199 .....	3.0 ..	.06 ..	20 to 40
C 299 .....	3.0 ..	.06 ..	20 to 40
D.E.R. ....	1.8 ..	.4 ..	30 to 50
MARCONI "R" .....	4.0 ..	.67 ..	70
MULLARD ORA .....	3.3 ..	.6 ..	30 to 60
EDISWAN A.R. ....	4.5 ..	.65 ..	70 to 80
COSSOR P 1 .....	3.5 ..	.6 ..	20 to 30
COSSOR P 2 .....	3.5 ..	.7 ..	60 to 70
MULLARD LF ORA "A" .....	1.5 ..	.2 ..	15 to 50
V 24 .....	5.0 ..	.75 ..	24 to 30
Q .....	5.0 ..	.45 ..	150 to 200
PHILIPS .....	4.0 ..	.6 ..	30 to 80
EDISWAN A R D E .....	1.8 ..	.3 ..	20 to 50
W D 12 .....	1.1 ..	.25 ..	20 to 40
W D 11 .....	1.1 ..	.25 ..	20 to 40

**Anthony Horderns' Radio Experts Will Help You**

# USEFUL TABLES

## RELATIVE INSULATION VALUES

Substance	Dielectric Constant
Paraffined rice-paper .....	3.65
Beeswaxed rice-paper .....	2.53
Shellacked rice-paper .....	3.50 to 4.25
Mica sheet (pure) .....	4.00 to 8.00
Flint glass (light) .....	6.85
Common glass (radio frequency) .....	3.25 to 4.21
Common glass (audio frequency) .....	3.02 to 3.09
Castor oil .....	4.80
Transformer oil .....	2.50
Ebonite .....	2.05 to 3.15
Air (at ordinary pressure) .....	1.00

## RESISTIVITIES AND CONDUCTIVITIES OF METALS

Substances	Specific Resistance	
	Per Cubic Centremetre in Microhms	Relative Conductivity at Zero Centigrade
Pure Silver .....	1.49	100.00
Refined Copper .....	1.59	99.90
Pure Gold (unalloyed) .....	2.04	86.65
Aluminum (annealed) .....	2.89	63.09
Swedish Iron .....	10.08	16.00
Platinum (pure) .....	11.00	10.60
Lead .....	19.63	8.88
German Silver .....	30.00	7.70
Mercury .....	94.30	1.60

## CONVERSION TABLES

### (1) Watts to Horse Power

Watts	Horse Power	Kilowatts	Horse Power
1	.0014	.5	.670
5	.0067	.75	1.005
10	.0134	1.0	1.34
20	.0268	2.0	2.68
25	.0335	3.0	4.02
30	.0402	4.0	5.36
40	.0536	5.0	6.70
50	.067	6.0	8.04
75	.100	7.0	9.38
100	.134	8.0	10.0
200	.268	9.0	12.1
250	.335	10.0	13.4

### (2) Horse Power to Watts

Horse Power	Watts	Horse Power	Kilowatts
1/16	46.62	4	2.984
1/8	93.25	5	3.730
1/4	186.5	6	4.476
1/2	373.0	7	5.222
3/4	559.5	8	5.968
1	746.0	8	6.714
2	1492.0	10	7.460
3	2338.0	20	14.920

**Anthony Horderns' for Everything**

## RADIO SOCIETIES

**T**HE Radio Clubs and Societies of Australia have done much toward educating the people in the use of wireless. Most suburbs and big centres have their club, and the beginner in the science will benefit by joining one.

The premier wireless society of the Commonwealth is the Wireless Institute of Australia. The Institute is famous for the fact that it is the oldest amateur wireless organisation in the British Empire. It has branches, or divisions, in all the capital cities of the Commonwealth, and in many of the important cities.

The principal wireless organisations of New South Wales are:—

- Artarmon Radio Club—Myles Ariel, 22 Hampden-road, Artarmon.
- Armidale Radio Club— — Barlow, 149 Faulkner-street, Armidale.
- Balmain and District Radio Club—F. W. Riccord, 77 Grove-street, Balmain.
- Bega Radio Club—Mrs. H. V. Ritchie, Bega.
- Bondi Radio Club—A. L. Prince, 269 Birrell-street, Bondi.
- Campsie and District Radio Club—E. R. Mawson, Wonga-street, Campsie.
- Concord Amateur Radio Club—A. Smith, 47 Shaftsbury-road, Burwood.
- Croydon Radio Club—G. Maxwell Cutts, Highbury-street, Croydon.
- C. of E. Grammar School Radio Club—Hon. Sec., c/o The School, North Sydney.
- Drummoyne Radio Club—H. G. Lucas, Tavistock-street, Drummoyne.
- Illawarra Radio Club—W. D. Graham, 44 Cameron-street, Rockdale.
- Katoomba School of Arts Radio Club—R. V. Stewart, Murri-street, Katoomba.
- Kuringai District Radio Society—R. R. Wilshire, Help-street, Chatswood.
- Leichhardt and District Radio Society—W. J. Zech, 145 Booth-street, Annandale.
- Leichhardt J.T. School—Hon. Sec., c/o Leichhardt Junior Technical School, Leichhardt.
- Lindfield Radio Club—Hon. Sec., "Rosemount," Wolseley-road, Lindfield.
- Marrickville and District Radio Club—A. W. Hemming, 23 Central Avenue, Marrickville.
- Metropolitan Radio Club—D. M'Intyre, Livingstone Avenue, Pymble.
- Military Radio Association—Lieut. H. Greenberg, 169 Cowper-st., Waverley.
- Manly Radio Club—G. M. Brown, 24 Reddall-street, Manly.
- Mosman Radio Club—J. Goldsmith, Ellalong-road, Cremorne.
- Northbridge and District Radio Club—A. F. Cameron, Clanwilliam-street, Chatswood.
- Newcastle and District Radio Club—L. T. Swain, 49 Everton-street, Hamilton.
- Neutral Bay Radio Club—E. T. T. Moore, 180 Kurraba-road, Neutral Bay.
- Naremburn Technical School Wireless Club—Hon. Sec., c/o The School.
- Northern Suburbs Radio Association—R. Primmer, Gordon-road, Gordon.
- Postal Institute Radio Club—J. F. Nichol, 7 Australia-street, Croydon.
- Parramatta Radio Club—H. Melville, Parramatta.
- Railway and Tramway Radio Association—W. L. Carter, Box 14, G.P.O., Sydney.
- Sydney Grammar School Radio Club—Hon. Sec., c/o The School.
- Strathfield Radio Club—Mr. Wraxall, Long-street, South Strathfield.
- St. Joseph's College Wireless Club—Hon. Sec., c/o The College, Hunter's Hill.
- University Radio Club—Hon. Sec., c/o The University, Sydney.
- Waverley Radio Club—R. H. Howell, 71 Curlewis-street, Bondi.
- Wentworth Radio Club—P. Nolan, 152 Bellevue-road, Woollahra.
- Wireless Institute of Australia (N.S.W. Division)—Phil. Renshaw, Box 3120, G.P.O., Sydney.
- Western Suburbs Amateur Wireless Association—G. R. Challenger, c/o 77 Park-road, Auburn.
- Wagga Wagga Radio Club—A. R. C. M'Garry, Box 89, P.O., Wagga Wagga.
- Wyong Radio Club—S. Adams, Wyong.

**Anthony Horder's' for Household Furniture**

# WIRELESS ALPHABET

## INTERNATIONAL MORSE CODE

A	● ■■	T	■■■
B	■■●●●	U	●●■■■
C	■■●■■●	V	●●●■■■
D	■■●●●	W	●■■■■■
E	●	X	■■●●■■■
F	●●■■●	Y	■■●■■■■
G	■■■■●	Z	■■■■●●
H	●●●●		
I	●●		
J	●■■■■■	1	●■■■■■■■
K	■■●■■	2	●●■■■■■
L	●■■●●	3	●●●■■■
M	■■■■	4	●●●●■■■
N	■■●	5	●●●●●
O	■■■■■	6	■■●●●●
P	●■■■■●	7	■■■■●●●
Q	■■■■●■■	8	■■■■■■●●
R	●■■●	9	■■■■■■■■●
S	●●●	0	■■■■■■■■■

# Wireless Trade Directory

**ANTHONY HORDERN AND SONS, LTD.**, Brickfield Hill, Sydney.  
—For All Wireless Needs.

**AMALGAMATED WIRELESS (Australasia), LTD.**—All Classes of  
Wireless Services.

**BEAN, L. P. R. AND CO., LTD.**, 229 Castlereagh-street, Sydney.—  
Stocks Stromberg-Carlson 2A Radio Headset.

**BRETT, E. H., AND SONS, LTD.**, Little Avenue, Balmain East.—  
Suppliers of Portable Poles and Aerials.

**BRITISH EVER-READY CO., LTD.**, 163 Pitt Street, Sydney.—  
The Battery for all Wireless Operators.

**BLAKE'S BUSY BOOK BAZAAR**, Albury and Wagga.—Agents for  
Aireola Sets. Accessories Stocked.

**BURGIN ELECTRIC CO.**, Wireless Engineers and Suppliers, first  
floor, Callaghan House, 391 George Street, Sydney.

**CAMPBELL, M., & CO., LTD.**, Muswellbrook.—All Radio supplies,  
Complete Sets of Parts, Aerials erected, Batteries charged.

**CHAPMAN AND SONS**, Wyong, N.S.W.—Everything for Radio.

**CLARKE, A. A. A. (A.E.)**, "Marsden," 34 Botany-street, Waverley,  
Bondi Junction.—See Special Advt., Page 2.

**COX BROS.**, Coff's Harbor, N.S.W.—Wireless Apparatus of every  
description, Receiving Sets, etc.

**COLVILLE-MOORE WIRELESS SUPPLIES, LTD.**, 10 Rowe  
Street, Sydney (next Hotel Australia).

**CULLEN, E. R.**, 96 Bathurst-street, Sydney.—Radio Electrical Store  
Satisfaction, or Money Back.

**DALGETY AND CO., LTD.**, 136 Phillip Street, Sydney.—For Rolls-  
Royce, Hudson Super Six, Essex-Six, and White Trucks.

**DAVID JONES, LTD.**, 252 York Street, Sydney.—For Radio  
Service.

**DOBSON & MOASE**, Corso, Manly.—Everything in Radio. Ex-  
pert Advice Gratis. Sets Installed.

**EASTWOOD RADIO SUPPLIES**, West Parade, Eastwood, N.S.W.  
W. M. Rodgers, Prop. Receiving Sets, Batteries charged, Aerials erected.

**HAMILTON AND BAKER**, Radio, Electrical and Biograph Sup-  
pliers, 302 Pitt-street, Sydney. Tel. C2064.

**HARRINGTONS, LTD.,** Photo and Radio Warehouse, 386 George Street (near G.P.O.), Sydney.

**HILL, E. M'C. S.,** North Coast Licensed Radio Dealer, Wingham, Manning River.—Sets supplied and erected on shortest notice.

**HUNTER BROS., LTD.,** Wagga, N.S.W.—Complete Stocks of Wireless Parts and Sets, Aerials, Batteries, etc.

**INTERNATIONAL CORRESPONDENCE SCHOOL (Aust.), LTD.,** 399-401 George Street, Sydney.—For a Practical Book on Radio.

**LASSETTER, F. AND CO., LTD.,** George-street, Sydney.—Stock All Wireless Accessories.

**MARCONI SCHOOL OF WIRELESS,** 97-99 Clarence street, Sydney.—Trains Wireless Operators.

**MICK SIMMONS, LTD.,** 720V Haymarket, Sydney.  
"Simolian" Radio Equipment.

**MILNE, R.,** Byron Street, Inverell, N.S.W.—Receiving Sets, Valves, and All Radio Supplies Stocked.

**MURDOCH'S IN PARK STREET, LTD.,** Sydney.—Murdochs for Valve Sets.

**O'DONNELL, GRIFFIN, AND CO., LTD.,** 51 Druitt Street, Sydney.—Radio Rectifier for Charging Batteries.

**OLSEN, N. P.,** 18-22 Hunter-street, Newcastle, New South Wales.—The Recognised Radio House of the North.

**PITT, VICKERY, LTD.,** 335-337 Pitt Street, Sydney.—Crystal Sets, Valve Sets, Head Phones, Loud Speakers.

**RADIOKES HONEYCOMB INDUCTION COILS.**  
Ask Your Dealer.

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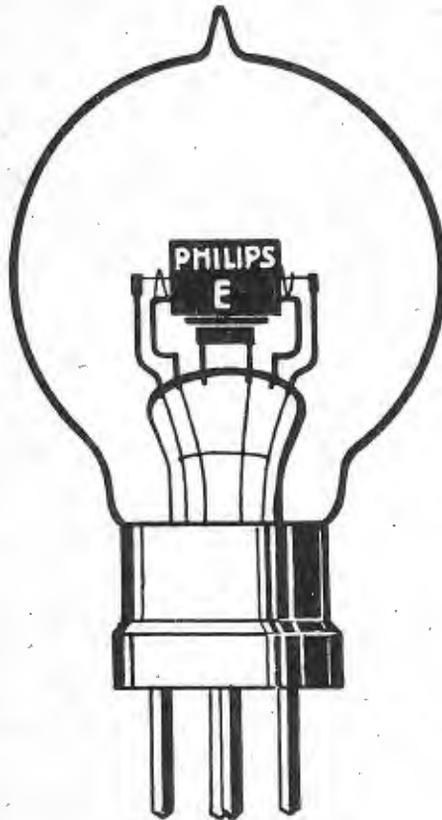
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