PROPOSE A GOOD FEATURE & TRY TO WIN £1

Amateur Wireless And Electrics

"QAP" (Queries Answered Promptly)

No. 7 SATURDAY, JULY 22, 1922 Price 3d

Wireless Crystal of Iron Pyrites, magnified about Three Times.

(See "All About Crystals" on pages 130 and 131.)

Our Chief Features This Week

Can You Send "A.W." Any Interesting Photographs?

Lavishly Illustrated

A Typical Crystal Detector

Amateur Wireless and Electrics

No. 7 July 22, 1922

A SIMPLE THREE-COIL TUNER

An Instrument of Wide Range Made from Oddments

UNTIL recently I have been satisfied with a tuner consisting of A.T.I. and reaction coil. But with the advent of short wave-lengths for telephony I have found it necessary to use a two-circuit set for maximum efficiency, and since it will be necessary for amateurs to discard their single circuits shortly, I think it will help them to get good results if I describe my tuner, which is made up of odd parts which I had at hand.

The base of the tuner consists of an old valve panel box 7 in. by 5½ in. by 2 in. The ebonite panel which used to form the top of this box was too badly damaged to be used again, and not possessing much ebonite I had to be content with a top partly wood and partly ebonite, both ¼ in. thick. The wood, which is fretwood ready planed, is 4¼ in. by 1¾ in. by 7½ in. The two fit close together and leave ¼ in. overlap all round the box. On the top are mounted two wood pillars ¼ in. by 1 in. by 4½ in. supporting a piece of ebonite 4 in. by 2 in., which has a projection of 1 in. towards one side of the base, preferably that side fitted with ebonite. This allows the primary and reaction coils to swing well away from the secondary, which is fixed. The coil holders are composed of three pieces of ebonite 3 in. by 1 in by ⅜ in. which were cut from the top of a Mark III tuner (see Fig. 1). These are drilled at each end about ½ in. from one edge, and are tapped 3 B.A. to accommodate pieces of brass rod, which should be 1 in. long for the top and 1¼ in. for the bottom of each holder. In addition, the rods of one holder, which is to be the centre one, should be threaded for about ¼ in. of their length. Holes are also drilled right through the breadth of the holder about ⅞ in. apart to accommodate ordinary valve sockets. Next drill three holes in the top piece of ebonite ⅜ in. from the edge and ¾ in. apart to accommodate the brass rods, the centre hole being tapped 3 B.A. The bottom rods of the holders fit in corresponding holes in a small strip of ¼ in. ebonite 3½ in. by ½ in., which is supported on brass screws ½ in. above the wooden baseboard. The outer holes should be drilled not quite through the ebonite, the centre one being tapped right through as above.

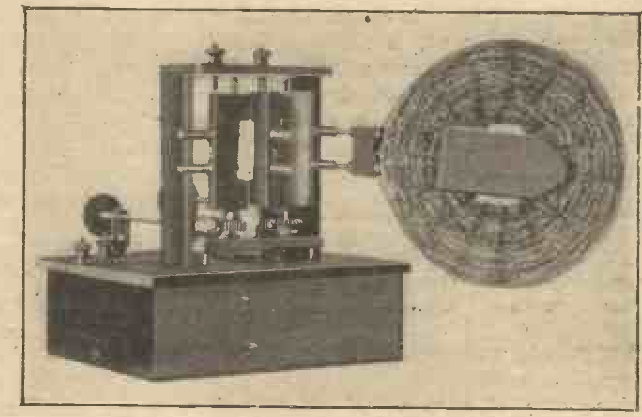
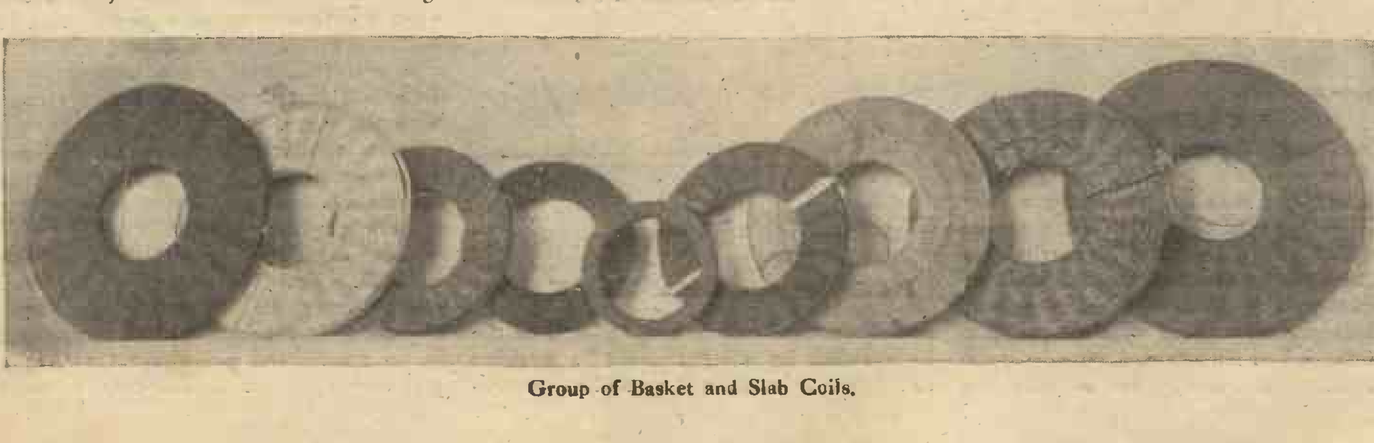


Fig. 1.—Photograph of Complete Tuner.

In order to provide means of moving the coils I have made use of "Meccano" parts. On the bottom rod of the primary holder I have clamped a bevel gear, and on the reaction holder a pinion. The holders are now assembled, the centre one being screwed into the top ebonite, then the bottom ebonite screwed on to the bottom rod. Then screw the bottom strip of ebonite to the baseboard and slip in the side holders, the rods being inserted in the top holes first. The bevel gear of the primary engages with a bevel on a "Meccano" rod, supported in rear by a "Meccano" strip bent twice at right angles. The pinion of the reaction engages with a worm gear on a second "Meccano" rod. I have fitted a slow motion gear in this case for fine adjustment, though a bevel gear may be used if preferred. The free ends of the "Meccano" rods are threaded 3 B.A. and screw into tapped circles of ebonite for handles.

The only thing remaining is to fit terminals and wire up. The terminals are in three sets of two, one set at each end of the ebonite base strip and one pair either in the middle of this strip or on the top piece of ebonite. Though I have put the strip of ebonite at the side of the base nearest the handles, it is preferably placed at the other side, under the coils, to do away with capacity effects when the hand approaches the handles. Flex should be used in the wiring of the moving coils, the wires being separated, brought through holes in the base and soldered to the terminals.

The coils used are baskets for short



Group of Basket and Slab Coils.

waves, giving better coupling than honeycomb coils. Each is clamped between two pieces of wood, one piece being sufficiently

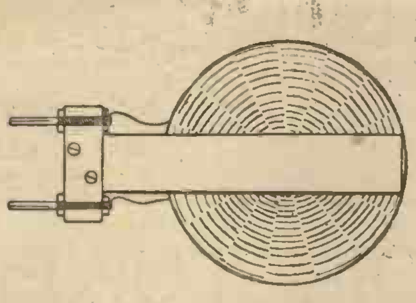


Fig. 2.—Coil Holder.

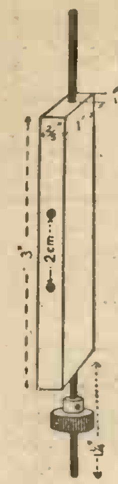


Fig. 3.—Method of Mounting Coils.

long to protrude 1 in. from the side of the coil. Small pieces of ¼ in. ebonite 3 cm. by 2 cm. are drilled with two holes 2 cm. apart, and are fitted with valve legs to plug into the sockets. These may be obtained quite cheaply. The ebonite is screwed to the wood projection and the coil ends soldered to the pins. This is clear from Fig. 3.

The following table gives an idea of the turns needed on the coils with a .001 condenser on the primary and a .0005 on the secondary. Reaction is obtained from a coil not in use as primary or secondary.

Mean Diam. (cms)	*No. of turns*	*Wave-length (metres)*	*Gauge*
6	9	180-360	Primary
6½	22	320-640	22 S.W.G.
10	60	600-1,500	d.c.c.
7	36	180-400	Secondary
8	68	370-800	30 S.W.G.
12	120	600-1,200	d.c.c.

The coils are easily wound on a former consisting of a piece of curtain pole about 2 in. in diameter having fifteen holes drilled at equal distances round its circumference. Into these holes are inserted 2½-in. nails. The wire is wound round and round, basket fashion, until the required number of turns is completed, then the coil is dipped in a bath of molten paraffin wax, is removed, and when the wax has set the nails are taken out and the coil eased off the curtain pole. The photograph (Fig. 1) shows the finished instrument.

F. C.

The Nature of the Ether

THE first question to occur to those whose interest has been newly awakened in wireless matters is, "In what manner is one station in touch with another?" We may not know the technical details of the transmission of speech and written messages sent by wire, but at least there is some material connection between sender and receiver in that case, whereas with wireless there appears to be none. Modern science, though it cannot claim to have fully answered this, can yet provide an explanation which gives us a very satisfactory understanding of what takes place. Much of this explanation is wrapped up in mathematical formulæ, but a good practical conception may be obtained without making use of these by considering other similar, though more familiar, problems.

Analogy

This method of gaining an insight into the less obvious workings of nature will prove very helpful in introducing us to new ideas, but such comparisons are only for the purpose of getting a first grasp or impression and should not be carried too far. It cannot be expected that an analogy, however well it illustrates some points, will compare throughout with the problem it is intended to illustrate.

For our first analogy let us take the case of a man looking at a lamp. By some means the source of light is creating an impression on the retina of his eye,

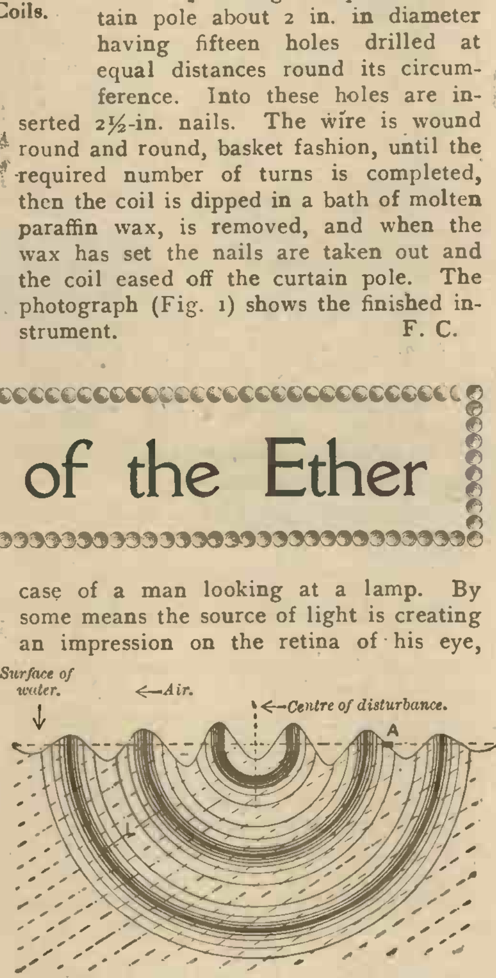


Fig. 1.—Sectional View of a Pond showing Waves on the Surface and in the Water.

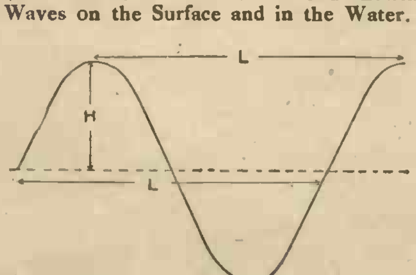


Fig. 2.—Representation of Wave Motion.

and if a second person has his hand on the light switch he may "transmit" a message to the first by turning it on and off according to some mutually understood plan or code. Yet there is apparently no material connection between the "transmitter" and the "receiver." The only alternative to regarding this as a case of action at a distance, which is irrational, is to acknowledge that the space between the lamp and the eye must be filled by some medium having definite physical properties and functions. In fact, to explain fully this and other similar problems it is necessary to imagine this medium, which is known as the ether of space, as existing everywhere, permeating even the most dense matter, as water does a sponge or a bucket of sand.

The above illustration is something more than an analogy; it is an actual case of wireless telegraphy, differing only in means, though not in underlying principle, from the system in commercial use at present.

Science has certainly discovered the existence of the ether and determined some of its properties, yet it is strangely elusive owing to its immaterial nature. It cannot be handled or examined, as, say, a newly discovered gas.

The property of the ether we are most interested in is its ability to vibrate if set in motion by suitable means.

Wave Motion

It is worth while to get as clear a conception as possible of wave-motion. It is the essential of wireless transmission, and the clearer our ideas on the point the better will be our understanding of the whole subject. With vibration or wave-motion of any sort one usually associates the ripples on the surface of a pond. These ripples are, however, only the surface manifestation of the actual wave-motion itself. Beneath the surface, waves of alternate compression and rarefaction are travelling outward from the centre of disturbance in the manner shown in Fig. 1. But for the disturbance of the surface we should be unaware of their existence. The motion we see, however, helps us to visualise and represent what takes place in the body of the water.

Before going any further we must notice one important point. It is only the wave—which is nothing more nor less than strain, or energy in tabloid form, so to speak—which moves forward. The water itself merely surges forwards and back again. This is illustrated by the effect upon a cork floating at A (see Fig. 1). As each successive wave reaches it it will both rise and fall, and move backwards and forwards, but it will not travel onwards with the wave.

In a similar manner a succession of waves or strains in the ether will travel out from a centre of disturbance (a transmitter) in spheres of ever-increasing radius without entailing any motion of the ether in bulk. From this train of waves the energy may be liberated by suitable apparatus (a receiver) placed at any point in their path and made to actuate, say, a pair of telephones. In this case, of course, there is no surface, as the ether is continuous in all directions. It is, nevertheless, still useful to represent a train of waves by a rippling line such as is shown in Fig. 2.

Characteristics of Waves

Waves differ in three important respects—in length, in intensity or strength, and in shape. The length is the distance L in Figs. 1 and 2, and the intensity is represented by the maximum height H. For the present we will neglect the equally important factor of shape and assume them to be sine waves, as are those shown in Fig. 2.

Whatever their length or shape, they travel at a constant speed in all directions, so long, of course, as they move in the same medium. This is an important point.

The speed with which they travel is dependent solely on the ratio of the elasticity of the medium to its density. Thus in a dense substance which is highly elastic disturbances will travel at the same speed as in an attenuated, inelastic substance, provided the ratio between the two properties is the same in the two cases; but if either density or elasticity changes independently of the other, it will entail a change in the speed. This fact is mentioned as it has a bearing on long-distance wireless transmission.

300,000,000 Metres per Second

The speed of wave-motion in ether is 300,000,000 metres a second, and is the greatest velocity known. It corresponds to a journey eight times round the earth in a second. All ether waves in space, of whatever intensity, length or shape, travel at this speed, but as they move outwards from the point where they are generated they decrease in intensity or height.

The number of waves which pass a fixed spot in a second is known as the frequency, and a moment's consideration will show us that this rate (measured in waves per second) multiplied by the wave-length (measured in metres) is equal to the speed of transmission (in metres per second). But we have just seen that this speed is the same for waves of all lengths, consequently we arrive at the important conclusion that the greater the frequency of a disturbance the shorter the length of wave generated, and vice versa.

The range of wave-lengths in which it is possible to make the ether vibrate is extremely wide, varying from less than a thousandth of a millimetre on the one hand to thousands of metres on the other. Naturally the properties of waves at different points on such an extensive scale vary very considerably, and the only portion of the scale which is at present found suitable for wireless transmission is that containing wave-lengths of from 30 to 20,000 metres.

Making the Ether Vibrate

The next point to consider is how we are enabled to set such an intangible substance as the ether vibrating. In our first illustration it was brought about by the heating and consequent energetic and rapid motion of the particles of which the lamp filament was composed. For producing the infinitely longer waves used in wireless a somewhat different method has to be employed. The electrons of which all matter is ultimately composed may be regarded as centres of strain or knots tied in the ether itself. The passage of an electric current consists in the handing on of some of these electrons from molecule to molecule. The process is almost as rapid as the motion of the waves of which we have been speaking, but it is slowed down somewhat by the disturbance it creates in the material of the wire or conductor. As the electrons, the motion of which constitutes the current, are thus part and parcel of the ether, their progress naturally produces an effect on the ether surrounding the wire, and if the current is made to oscillate backwards and forwards in a suitable circuit, as in the transmitting apparatus of a wireless station, waves of strain will be flung clear of the wires forming the aerial of the station and set free to travel outwards in the ether or space. SIGMA.

A Weather-proof Lead-in

A CORRESPONDENT writes as follows: "As rain is likely to be led into the leading-in tube by running down the wire and by capillary attraction, I suggest that a copper funnel be soldered in an inverted position on the down lead." This is a useful suggestion where it is necessary for the lead-in to be brought down vertically, but it is a bad way of

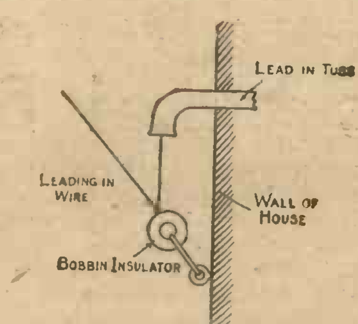


Diagram of Weatherproof Lead-in.

leading-in because any pull on the wire strains the tube. The better arrangement is shown in the illustration. In this the strain on the wire is taken by the insulator attached to the wall, and the lead-in is run upwards into the tube. However, this is only necessary for heavy wire; a light wire can easily be bent round the tube. A glass tube answers well for this purpose; it can be bent to any shape in a gas flame. J. F. S.

A Receiver Weighing 28 oz.

THIS is a portable receiving station complete in a polished mahogany box 6 in. by 6 in. by 3¼ in., with a wave-length range of 200 to 1,000 metres. Although so small it is quite efficient. A single receiver is used in place of the usual double-headgear telephones. There

The Receiver Open.

are only three components in the set—the "figure-of-eight" variable inductance, the detector, and the telephone. A "blocking" condenser across the telephones is found unnecessary, as the difference in signal strength with and without this is almost imperceptible.

The detector crystal cup is mounted on a flat nickel silver spring, and the "point" can be moved about to touch any

The Receiver Closed.

portion of the crystal without disturbing the cup.

No buzzer is included in the set, but it is advisable to have one, as the detector can be adjusted much more easily. However, it is often found that the buzzer will automatically start the detector working.

The makers of the instrument are Mitchells Electrical Wireless, Ltd., 188, Rye Lane, London, S.E.15.

HIGH-TENSION BATTERY NOTES

ONE of the most important units of the valve receiver is the high-tension battery. The 30 to 60 volts most commonly needed must be above suspicion or the reliability of the set is very questionable.

Current Requirements

Fortunately, the B. Battery, as our American confrères call it, is not asked to provide much more than a milliampere of current, and so the size of the components need not be great. The cells must, however, be of reliable make, but this does necessarily mean high in price. The man who makes up his high-tension battery by buying up a dozen or two pocket flash-lamp batteries because he can get them for so many, or so few, pence per dozen, is asking for trouble, especially if the vendor, to convince him of the freshness of his wares, lights up a small bulb lamp with each one in turn to "test" it. One of these little lamps may easily require the best part of an ampere to light it up brilliantly, and that amount of current for ever so short a flash would do even good little cells irreparable damage.

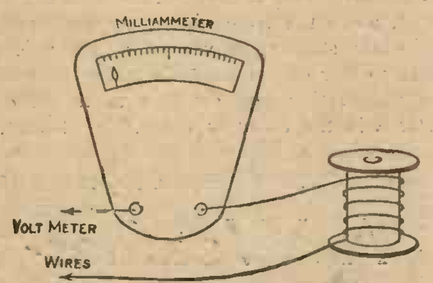
Purchase

In buying a new battery get one of a reputed make, and see that it is not tampered with by the ignorant. Above all, if you wish to test the voltage don't put a low-resistance voltmeter on it, or a high-resistance voltmeter either, for more than an instant. If, like the writer, you are fortunate enough to get hold of a lot of larger cells which have been rejected by the manufacturer for having too high an internal resistance for their intended use, you will get, at a low price, a high-tension battery, which, with proper care, will last for years.

Testing

However careful the user, there are bound to be a number of cells that will "peter out" and lower the efficiency of the battery, and the difficulty will come in weeding these out. Nowadays one ought to be able to acquire fairly cheaply a sensitive milliammeter. Choose one, if possible, that has a wide range up to two milliamperes. Now get hold of a coil of resistance wire measuring just short of 1,000 ohms. Your dealer will let you have a reel of wire of that resistance for a few pence. You can use it just as it is, on the reel, if both ends can be got at. It ought, of course, with the milliammeter in series to measure exactly 1,000 ohms, but an ohm or two more or less will not make much difference.

Connect one end of the coil of wire to one of the terminals of the milliammeter. The other terminal and the other end of the resistance coil will be the connections for the voltmeter, as shown in the accompaning illustration. If the instrument is put across a cell it will read volts, because one volt pressure applied to a circuit of 1,000 ohms will cause one milliampere of current to flow. Any cell tested this way which shows one volt or more can safely be left in the high-tension battery and others weeded out and *thrown away*. Don't play about trying to repair or recharge the cell. It is mere waste of time. A cell, when once exhausted, is only fit for the dustbin. Also, don't attempt to charge up the cell as one would an accumulator. Careful tests have proved that the result, however promising looking, is a failure.



Method of Testing a High-tension Battery.

Reliability

The great secret of the superiority of some makes of cells is the fineness of grinding which the powdered contents receive. The "depolarising" element of a dry cell is manganese peroxide, and in either a crystalline or amorphous state it it much too hard for the cell to extract all the associated oxygen as it requires it, its funds are invested, so to speak. Ground to an impalpable powder and mixed with fine graphite and carbon dust it performs its functions faultlessly.

The active element in dry cells is a paste mixture containing flour, plaster-of-paris, and sal-ammoniac. This is smeared all over the inside of the zinc containing case. A carbon rod is supported in the centre so as not to touch the paste or the zinc case, and this rod carries the positive terminal. The space left between the rod and the paste is rammed tightly with the powdered peroxide mixture, leaving enough room to seal off the cell at the top with pitch. A cell so formed gives a small fraction over 1.5 volts when new.

The current drawn from a dry cell should never exceed one milliampere per cubic in. of the black compound—that is, the carbon rod and the peroxide mixture.

For many purposes, the life of a dry cell ends when its terminal voltage drops to one volt, but a wireless high-tension battery, if the cells are not too small, can be used until the voltage falls to .8, or even .7, provided that the internal resistance of the cell is not excessive.

The wise and careful user of a high-tension dry-cell battery insulates each cell from its neighbour so as to avoid the battery running down by leakage, or even worse, picking up stray noises from the floor upon which it stands.

G. S.

Electrical Benchwork

Blowpipe Soldering

THE process of soft soldering with the ordinary soldering iron was dealt with in No. 4. For small parts such as are required for wireless apparatus the blowpipe (a typical example of which is given in Fig. 1) is equally satisfactory.

Advantage of the Blowpipe

The particular advantage of a blowpipe is that it gives a fierce heat at a very localised area beyond which the solder does not run. You can solder spots, and also unsolder, resolder, or adjust soldered parts without allowing heat to stray and cause trouble in other places.

Operating the Blowpipe

The blowpipe needs a fair amount of knack in use, as it is no use blowing in gasps; a continuous blast is necessary. The best way to maintain a continuous blast is to breathe naturally through the nose and at the same time keep the cheeks distended (see Fig. 2). By adopting this simple dodge you will be able to keep up a steady blast of air through the blowpipe. If you are working the blowpipe flame right the flame is almost silent, whereas a roaring, irregular flame is produced otherwise.

A Lip Guard Necessary

Unless you are more careful than I am you will often carelessly place the blowpipe after use on the bench and as carelessly replace it in the mouth when it is required. The filings, dirt, etc., which the mouth end picks up are very distasteful, and to avoid this I place a thick tinplate washer near the mouth end (see

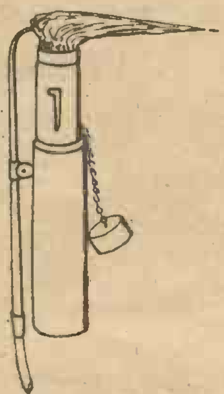


Fig. 3.—Reservoir Blowpipe.

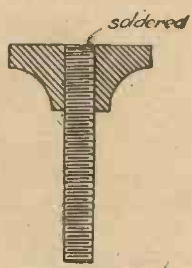


Fig. 4.—Built-up Finger Screw.

A, Fig. 1), the object being to raise that end off the bench.

Spirit Lamp and Blowpipe is Best

There are several types of blowpipe on the market, but you will find the one shown in Fig. 1 the best for use with a spirit lamp or wax taper, whilst the combined blowpipe and spirit lamp shown by Fig. 3 is a great improvement. If you decide to have the type shown by Fig. 1, one about 9 in. long should be chosen, so that the eyes are kept well away from the flame.

The type shown in Fig. 3 has a reservoir into which methylated spirit is poured. The wick is lit and the blowpipe operated in the ordinary way.

Soft Soldering with the Blowpipe

Place the work in such a position that you can conveniently blow on the spot to be soldered. Then insert the blowpipe in the mouth, and with a stick of solder in the right hand and the taper or spirit lamp in the left, a steady blast is maintained. The joint or spot should be frequently touched with the solder (not forgetting to use sufficient flux), when the solder will soon flow into the joint.

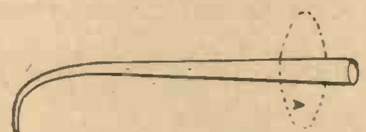


Fig. 1.—Simple Blowpipe.

If (as is likely when using a taper) soot tends to form; this must be wiped away with a cloth-covered stick soaked with flux. Smoky flames are produced when the blast is too weak; after a little ex-

Fig. 2.—Method of Using Blowpipe.

perience you will soon acquire the knack of regulating the supply of air.

Some Examples of Soldering

So far all that you need know about soft soldering in order to do it has been dealt with. Some further examples are given which show the application of soft-soldering to the building up of parts. Suppose, for example, you want some detector

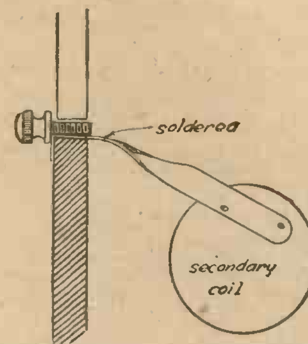


Fig. 5.—Method of Fixing Ebonite Knob to Arm.

adjusting screws. The proper way to make them (although it hardly pays, so cheaply may they be bought) is to turn and knurl them in the lathe. A simple method where a lathe is not available is to solder terminal screws to pieces of screwed rod or a piece cut off a screw (see Fig. 4).

A simple method of fixing the ebonite knob to the operating lever is shown in Fig. 5, a small ebonite knob is fitted on to a brass screw and the latter soldered to the lever.

You have probably tried at some time or other to solder connections to the mica-foil type of condenser and suffered the annoyance of melting the protruding ends of the foil! This operation cannot satisfactorily be done with the soldering-bit or mouth blowpipe. A special solder (Wood's metal, which melts at a lower temperature than boiling water) is melted, and the foil ends of the condenser, with the wire pressed into contact with them, is rapidly drawn through the solder. It will be found that a very neat connection is made by this method. INGOT.

WHAT WIRELESS TERMS MEAN.—V

Some Technical Words Explained as Correctly as Popular Language Allows

ELECTRO - MAGNETIC INDUCTION.—The effect produced by a conductor being caused to cut a magnetic field. For instance, if a wire is passed across the pole of a magnet a current of electricity will be induced in the wire.

RESISTANCE.—The property possessed by all substances of offering in a greater or less degree opposition to the passage of electric currents. This term must not be confused with inductance or impedence. Iron and steel offer more resistance than does copper. This property is made use of when it is desired to limit the current in a circuit. The effect of resistance is to produce heat. It is a determining factor in arriving at the amount of electricity that will flow in a given circuit at a given voltage. Where a maximum flow is desired, the minimum resistance must be secured.

INDUCTION.—The effect produced upon a coil of wire in juxtaposition to another coil in which a current of electricity is made to flow, at the moment this current of electricity is started, stopped or varied.

POTENTIOMETER.—A variable high resistance, usually of the order of 200 ohms through which a current from a battery is passed and applied to some types of crystals. Also used in high-frequency circuits to apply a negative potential to the grid to stop the valve oscillating when receiving telephony.

LOADING COIL.—A coil by means of which further inductance is added to the circuit in order to enable higher wave length to be received. It is inserted in series with the tuning coil and may itself be variable. When added to a valve circuit it must always be placed below the grid connection and in front of the tuning coil. It may consist of a cylinder of cardboard wound with thick wire, or a number of slab coils.

CONDUCTOR.—The opposite to an insulator, i.e. a substance that permits the free flow of an electric current and by which it is conducted from point to point. Copper, brass and most metals are conductors in a greater or less degree, as also are water, the human body, etc.

FILAMENT.—That part of a valve to which the accumulator is connected, causing it to become incandescent, and in that state to discharge electrons from its surface (*see* Valve). It consists of very fine tungsten wire and is suspended between two supports. It is very fragile and easily broken, particularly when cold. The filament must never be in contact with any other part of the valve.

STARTING WIRELESS.—VII FINISHING THE SIMPLE RECEIVER

The Crystal Detector

THERE are a number of different forms of detectors, perhaps the most stable type being the carborundum and steel-plate combination. However, this usually re-

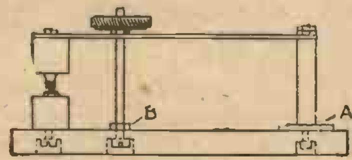


Fig. 1.—Simple Detector.

quires a potentiometer, and it is therefore a little more complicated for a beginner. Another type consists of a very fine wire (called a cat-whisker in America) which bears lightly on the surface of the galena crystal. This combination is perhaps a little more sensitive than others, but at the same time it is rather erratic in behaviour. Reference was made to the Perikon detector in a previous section, and this will therefore be described. Many designs of detectors have been put on the market from time to time, each claiming some special merit. However, the reader is advised to begin with the simplest form possible, so that when he has gained more experience he will be able to judge which type he prefers.

The detector will be better understood by reference to Fig. 1 than by a lengthy description. The base may be of ebonite, 4 in. by 3 in. and ½ in. thick. The crystal cups may be drilled or turned from brass rod ½ in. diameter, or they may be bought for a few pence. The success of the detector depends upon its rigidity; a weak or springy detector will never keep sensitive for more than a few minutes, and it will be found a source of everlasting annoyance. One crystal cup is fixed near the end of the base, as shown in Fig. 1, and the other is screwed to the end of a piece of brass 2½ in long, ½ in. wide, and a little less than 1/16 in. thick.

A thick brass screw about 2 in. long is passed through a hole drilled at the other end of the base. A strong washer (A, Fig. 1) is put on the screw, together with a length of stout brass tube about ⅜ in. external diameter. This is followed by the brass strip, which is finally secured by two nuts. The length of the brass tube will depend, of course, upon the height of the crystal cups. A similar but longer screw is fixed to the base with a nut B, and the end is allowed to project through a slit in the brass arm. A nut to fit the screw is soldered to a small piece of thin brass, which is then screwed to an ebonite knob. It will be understood that by screwing the knob downwards the two cups will be brought nearer together, thus varying the pressure between the crystals. The crystals are set in the cups with either molten solder or Wood's metal. It is usual to employ a pointed piece of bornite or copper pyrites resting on a flat face of a piece of zincite. Two terminals mounted on the base complete the detector; connection is made, of course, to the fixed cup and the screw holding the upright.

The Telephone Condenser

This can be made very simply from tinfoil and paper. The actual value of the condenser is not of very great importance, so that the following details need not be adhered to very strictly. Eight pieces of tinfoil 3 in. by 1½ in. and nine pieces of thick writing paper 2½ in. by 2½ in. will be required. Fig. 2 illustrates the method of assembling the condenser, only four plates being shown for clearness. It is essential that the insulation of the con-

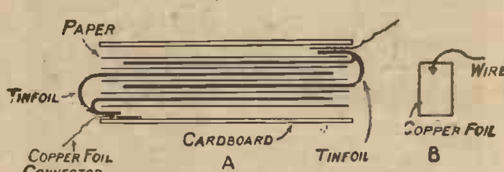


Fig. 2.—Diagram showing Construction of Telephone Condenser.

denser should be as good as possible, and therefore before the plates are assembled the paper should be well soaked in paraffin wax. When the tinfoil plates are assembled the four plates which project on one side are bent on to the top piece of paper, and the other four are bent on to the bottom piece of paper. The length of the projecting pieces should be a little over half an inch.

Two pieces of waxed cardboard are cut to the same size as the paper to act as a kind of cover. Connection has yet to be made to the plates, and this is best done as follows: Two short lengths of copper wire are soldered to two small pieces of copper foil. These are placed one against each of the bent pieces of tinfoil, being slipped between the top and bottom pieces of paper and the cardboard. This should be quite clear from the diagram. To ensure an efficient contact the condenser is pressed well together, and it is then firmly bound round with some tough brown paper which is secured with a little gum. To serve as a protection against damp, the finished condenser is painted with hot wax, great care being taken to cover the parts where the copper foil emerges from the paper. If desired, the condenser may be placed in a box, when the wires would be brought to two terminals mounted on a piece of ebonite on the top.

Connecting the Apparatus

Fig. 3 is divided into two parts. One part shows how the apparatus appears when it is connected up, and the other part shows the standard way of indicating the various components. It will be noticed that a switch has been included between the telephones and the detector. It is so arranged that either of two detectors may be used at will. This is a very convenient method of working, as should one detector suddenly become insensitive in the middle of an important signal it is only necessary to put the switch in the other position, thereby connecting up the second detector. As soon as the signal has finished we can immediately readjust the faulty detector. The switch is also very useful for comparing two different types of detectors, since it is possible to change from one to the other without disconnecting any of the apparatus.

The tuning coil previously described was designed to receive wave-lengths up to about 600 metres. However, if it is desired to receive longer waves all that is necessary is to insert two terminals in the position marked X in Fig. 3. When receiving on the small tuning coil these are connected together with a piece of wire, but when it is wished to listen to longer wave stations simply disconnect the wire and insert another coil in its place. This coil can be made exactly similar to the other, but there is no need to fix a sliding contact since all the fine tuning can be accomplished with the original coil. It is only necessary to tap the coil at varying intervals, bringing the tappings to a multi-point switch.

A coil of this description is usually called a loading coil, since it loads the aerial to the required wave-length. PAUL D. TYERS.

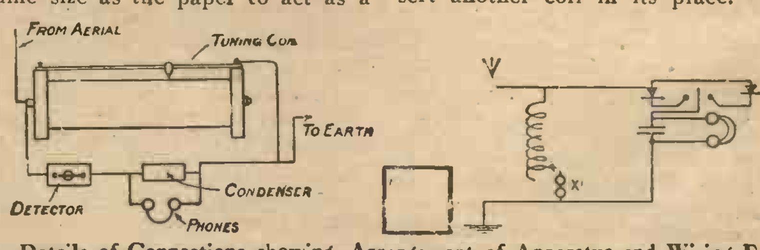


Fig. 3.—Details of Connections showing Arrangement of Apparatus and Wiring Diagram.

Protecting the Aerial from Lightning

WHEN you arrive at the momentous decision to dabble in wireless, above all things do not make a start in construction or erection until you have schemed out

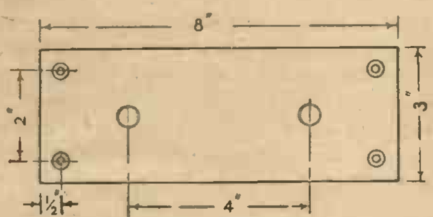


Fig. 1.—Drilled Ebonite Baseplate.

completely what you want and how you propose to set about it. You will no doubt enlarge and extend as you go on, but it is well to have something basic to work on at the outset. Having thus made your decision, be very sure that you include an efficient means of protection against lightning.

With the aerial erected and the leading-in wires brought to a suitable position, it is advisable to have a protective device installed outside in order to avoid directly bringing into the house the aerial leading-in wires with no protection. A suitable and convenient method, and one which serves a dual purpose, is to fix a well-insulated spark-gap type of lightning arrester into a suitable housing on the outside wall, and connecting the aerial through it direct to earth, thus avoiding any possibility of damage.

This spark-gap arrester can easily be

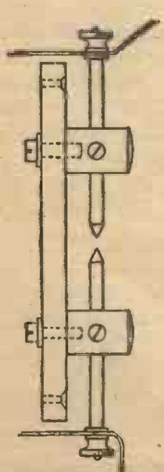


Fig. 4.—Assembly of Arrester.

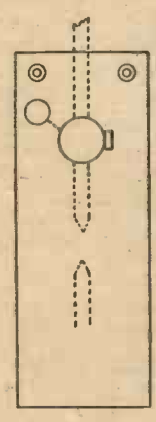


Fig. 6.—Additional Earth Terminal.

made as follows: Obtain a piece of ebonite about ½ in. thick and 8 in. in length by 3 in. wide. Clean off all the polish from both sides and edges and leave a matt surface. When satisfactory drill as shown in Fig. 1. Now get a piece of brass rod 1 in. in diameter and 3 in. long, cut it in half, round off the top, and drill each piece as shown in Fig. 2.

A piece of steel rod should next be obtained ⅜ in. in diameter and 9 in. long. Cut it in half and make a nice clean point at one end and turn down and screw the other end of each piece as shown in Fig. 3.

The arrester can now be assembled. Fig. 4 is self-explanatory. The two pieces (Fig. 2) are fixed on to the ebonite base by means of 0 B.A. screws with a washer at the back. The two points (Fig. 3) are slid through these supports and clamped with 2 B.A. screws through the sides of the supports, three washers and a thumb (terminal) nut being used at the screwed end of each to clamp the aerial leading-in and earth leading-in wires in each case.

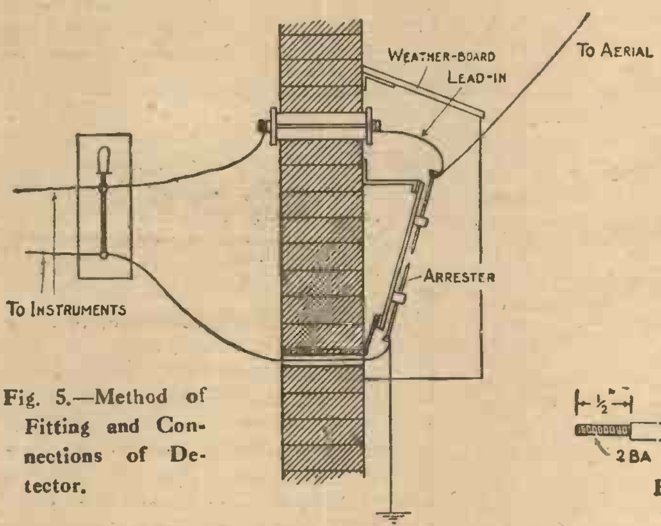


Fig. 5.—Method of Fitting and Connections of Detector.

The method of attaching the arrester to the side of the house (building, shed, etc.) is shown in Fig. 5. The method can be varied to suit the conditions of the particular case and the material at hand.

The chief point about this method of fixing is that it is weatherproof. The arrester is supported by means of suitably bent-up pieces of mild steel strip arranged at an inclination outwards from the wall, with roof and sides. The inclination prevents rain from lodging, and in most cases even touching the arrester points and the small roof and sides effectively stops side and top splashing.

The connection of the aerial leading-in wires and the earth connection should be brought directly to the terminals on the pointed rods of the arrester, as shown in Fig. 5, and connection made from these points to the short-circuiting switch, which, of course, should be provided inside with the receiver. A 20-ampere lighting switch is very suitable. The provision of this switch is essential, both as an extra safeguard and in order entirely to cut off the delicate apparatus from the aerial and earth when not in use.

The further advantage alluded to with this method of protection is that by a suitable adjustment of the gap almost complete elimination of those annoying static discharges, or X's as they are called, may be achieved.

If it is found difficult to adjust the gap, which, by the way, should be about half a millimetre, a modification can be made to the arrester, which will render close adjustment more simple.

Instead of fixing the earth wires directly on to one of the pointed rods, provide a terminal as shown in Fig. 6, and make the earth leading-in connection to this, con-

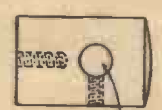


Fig. 2.—Holder for Electrodes

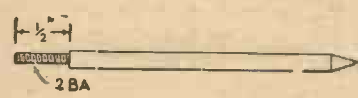


Fig. 3.—Electrode.

necting this terminal by a piece of stiff wire placed under the washer to the support post, as shown by the dotted line. This relieves the pointed rod of the wires and makes it easier to adjust. Further, if it is desired a suitable screw thread can be run up the rod, and the hole in the support post similarly tapped, giving an even finer adjustment.

With regard to maintenance, paint the iron brackets and wooden housings, and occasionally polish up the steel points. If a piece of rustless steel can be obtained, use it by all means; if not, well polish the steel rods with fine emery and oil.

This arrester, of course, cannot be left in circuit when transmitting, but a simple switching arrangement would overcome this small difficulty. E. ALEXANDER.

THE Handbook on Wireless is acknowledged to be "Wireless Telegraphy and Telephony," one of the famous "Work" series of handbooks published at the offices of this journal. The price is 1s. 6d. net.

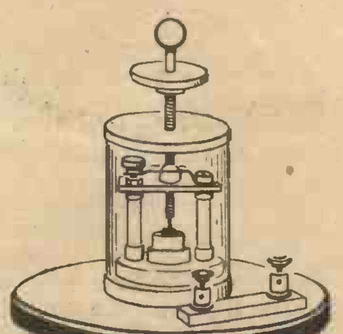
Photographic Illustrations show a Collection of the Best-known

Silicon

Galena and Special Galena

Bornite

Radiocite



Enclosed Detector

ALL ABOUT

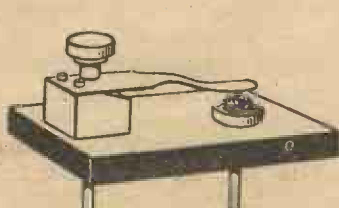
WIRELESS signals are transmitted in the form of waves created in the ether which, striking the receiver aerial, cause small alternating currents to travel up and down it. As these currents are of a very high frequency, the ordinary wireless telephone receiver cannot detect them. It is necessary, therefore, to rectify them, or, in other words, change them into unidirectional currents, before passing them through the telephones. The rectified currents produce a movement of the telephone diaphragms and thus the signals are made audible.

Certain kinds of crystals, such as carborundum, zincite, bornite, silicon, galena, molybdenite and iron pyrites, have the peculiar property of being able to rectify small alternating currents. We must explain how they do this.

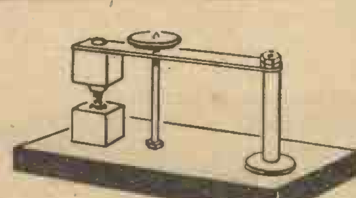
A crystal rectifies because it allows current to flow through it in one direction and does not, to any appreciable extent, allow current to flow through it in the opposite direction. It is practically a uni-directional conductor. The ratio of currents flowing in opposite directions through a good crystal should be about 40:1. It will be understood that the crystal acts electrically, very much in the same manner as a ratchet-wheel acts mechanically.

Carborundum is probably the best crystal for all-round use. It is not affected by mechanical vibration nor by fairly heavy electrical discharges across it, and it is very sensitive. This crystal has to be used in conjunction with a 4-volt battery and potentiometer, because it requires a small initial potential or voltage to be applied across it to bring it to its most sensitive point. Carborundum is used with a flat steel surface, the rectification taking place at the point of contact. This crystal is manufactured by fusing carbon and silicon together in an electric furnace. In practice three kinds of carborundum crystal are met with: (*a*) a hard dark variety, having great metallic lustre which has poor rectifying properties; (*b*) a soft crystal of a pale green colour, a colour due to the presence of copper and iron salts (this type of crystal is a very poor rectifier); (*c*) a dark grey crystal which will be found to give the best results as regards sensitivity and stability of action.

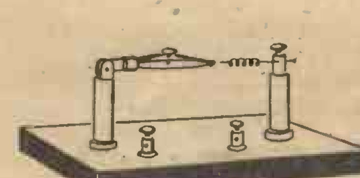
The most popular crystal detector is without doubt the perikon detector. This is a combination of either zincite and



Carborundum-steel Detector



Perikon Detector



"Drawing-pen" Detector

Wireless Crystals Enlarged to About Three Times Normal Size.

Carborundum

Copper Pyrites

Zincite

CRYSTALS

bornite or else zincite and tellurium. The latter combination is usually found to give the better results. Zincite, or oxide of zinc, is dark red in colour; bornite is a compound of copper and iron sulphides, being bluish grey in appearance and fairly heavy. Tellurium is a light-coloured metal. The perikon detector does not require a potentiometer because the voltage of the incoming signal is sufficient to bring it to its sensitive point. It has the advantage of being fairly easy to adjust. Also when a crystal becomes slightly insensitive it can be scratched with a knife and a new surface used. To obtain the best results it is usually found that the crystals must make a light contact with each other. This detector is more sensitive in action than the carborundum type, but not so robust.

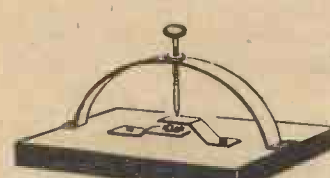
Silicon, galena, molybdenite and iron pyrites, whilst being serviceable for experimental work, do not give such satisfactory general results as either carborundum or the perikon detector. All these crystals are minerals. Silicon is light grey in colour and has not many sensitive points. Galena is very sensitive for long ranges, but strong signals destroy its sensitivity. It is bluish black in colour, has a metallic lustre, and is heavy. When using this crystal it is usual to have a graphite contact in conjunction with it. Molybdenite is dark in appearance and is suitable for the reception of strong signals; it is convenient for use in portable sets. Iron pyrites is a cubical crystal, being very metallic and heavy. It possesses many of the properties of carborundum but is not so sensitive.

The only sure way to obtain a good crystal is to search for sensitive points amongst several specimens. It is wise to remember that sensitivity is not everything; a good crystal should have the qualities of being constant in action and of not being affected by atmospheric disturbances. Such crystals as "Radiocite" and "Permanite" are usually sensitised forms of galena. They are very sensitive but not constant; a fine copper wire contact is used in conjunction with them.

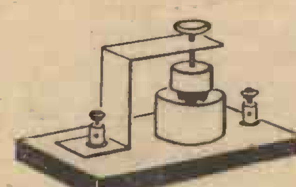
There is plenty of instruction and amusement to be had with a good crystal set. The range of a crystal set is about 300 miles for ordinary ship stations and 20 or 30 miles for high-power telephony. Several experts prophesy the return of the crystal and its ultimate triumph over the valve.

G. H. L. N.

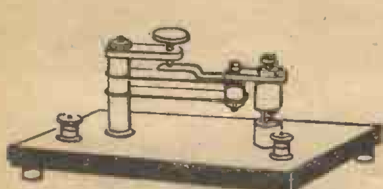
Permanite



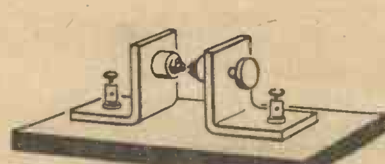
Improvised Detector



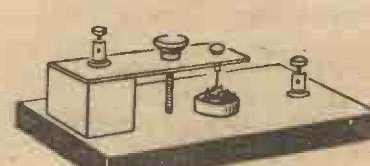
Mercury-cup Detector



Spring-adjusted Detector



Another Double-crystal Detector



Simple One-crystal Detector

Practical Working with Valves.—II HINTS AND USEFUL NOTES

THE grid leak and condenser can, with advantage, be shielded with metal foil, which should be connected to the positive terminal of the plate battery. This tends to prevent the grid of the rectifying valve from being affected by the necessary movements of the hand when making adjustments.

Sliding Contacts

A fixed condenser, having a value of from one-third to one microfarad, should be connected between the slider of the potentiometer and the negative end of the battery. This will act as a by-pass for radio-frequency currents which otherwise might have to pass through one-half a potentiometer having a resistance of perhaps four or five hundred ohms. Great care should be taken to see that the sliding contacts are good, otherwise noise may result. It is surprising how many people, including many skilled electricians, there are who take great pains to keep all oil and grease away from moving contacts. This is totally wrong, as a sliding contact if kept covered with a film of oil cannot oxidise; such a contact is also self-cleaning, due to the abrasive action of the very fine dust which forms (when absorbed in oil) a very good metal polish.

High-tension Battery

The plate-circuit battery generally consists of a group of from thirty to sixty dry cells. It is fairly satisfactory provided care is taken not to short-circuit the cells, or to attempt to discharge at a high rate. If the discharge becomes heavy the battery becomes more or less polarised, with the result that not only does the battery electromotive force fall, but considerable noise is heard due to intermittent discharge. Dry cells are cheap to renew, and after about six months—if used, say, an hour a day—are generally ready for renewal. The writer always suspects the plate-circuit battery when noises occur in the 'phones, and experience has proved that many noises are due to this cause. The battery should always be shunted with a condenser of not less than one microfarad capacity.

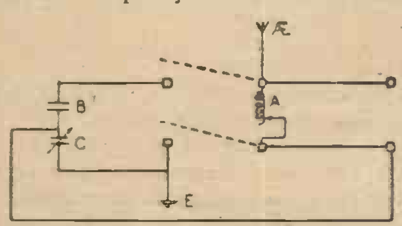
Filament Battery

A source of trouble often quite unsuspected is the filament battery. Some accumulators, if discharged at any value approaching the rated safe discharge rate, tend to give off gas, and it is often noticed that when this gas is rising noise results. On returning several cells to the manufacturers for this reason, the makers stated that had they known the cells were for wireless work they would have made them in such a way as to overcome this trouble to a large extent. They recommended that an accumulator of at least 100 actual ampere-hour capacity should be used for a discharge rate of 5 amperes.

Care should be taken that all connections are soldered, as a bad contact is often the cause of noises in the 'phones.

Dust between the plates of the variable condensers is another fruitful source of noise, but fortunately the remedy is obvious and simple.

A great many experimenters, in an endeavour to obtain a large range with a given inductance, use a comparatively large condenser in parallel. This is very bad practice, as a parallel condenser should never exceed .0005 microfarad capacity, and is even better if smaller, say .0003 microfarads. A very suitable arrangement is to use a series-parallel switch, wired in such a way that when in series with the aerial the effective capacity is the maximum, and when in parallel the maximum capacity is a much smaller



Arrangement of Series-parallel Switch.

amount. This result is obtained by having a fixed condenser in series with the movable condenser. The wiring for this arrangement is as shown in the illustration.

The reference letters in this figure are as follows: A, inductance; B, fixed condenser, say .0005 mfd.; C, moving condenser, say .0015 mfd.; switch to right when in series.

A small switch can conveniently be placed in circuit to short-circuit the fixed condenser (B) if a maximum capacity in parallel is wanted. A further advantage of this arrangement is that the minimum capacity of the condenser is reduced.

Transferring Power

It is very difficult to decide which is the best arrangement to adopt for transferring the power from one valve to the next when dealing with radio-frequency currents. Three common methods of doing so are: (1) Radio-frequency transformers; (2) reactance capacity; (3) resistance capacity.

In the first case the power is probably transferred to the next valve by a combination of transformer effect and reactance capacity, and whilst very suitable for all wave-lengths is more applicable to those of from 200 to 2,000 metres, as above this the transformers become comparatively costly owing to the cost of the wire necessary for winding.

The reactance-capacity method has been found to be very good, and is somewhat cheaper and easier in construction; the windings are simple, and the question of coupling is easily controlled. The windings generally consist of slab, pancake or, better still, duolateral coils. Above 2,000 metres the simplest, and probably the best, method is resistance capacity, although it has the disadvantages that a higher voltage plate battery is required and the amplification is not so great.

A Triple-purpose Amplifier

The writer is now building an amplifier in which advantage can, and will, be taken of all three methods. It is a simple matter to arrange if four-point plugs are used to accommodate the transformers, etc. The necessary grid leaks and condensers can either be mounted on the panel with suitable switching arrangements or, as an alternative, a separate fixed condenser and leak can be provided for each coil and mounted on the same plug. The latter method is perhaps the best, as the condensers and grid leaks can be adjusted to suit requirements of the coil in question.

The writer hopes that the set he is at present constructing will be more satisfactory than the previous experiment, which had four radio-frequency tapped transformers giving a range of 300 to 15,000 metres. He also hopes that these few notes will be of assistance to earnest experimenters with more patience than money, and who prefer to make mistakes and apparatus rather than buy finished apparatus and settle down into a round of "listening in."

A. F. C.

MARCONI PATENTS AND THE AMATEUR

THE Marconi Company officially announce that, far from wishing to take advantage of their patent rights to hamper and discourage amateurs, they desire to assist, rather than hinder, them in following the hobby. They state that they have no intention of taking any action against amateurs who construct for their own use wireless apparatus embodying any of the patents owned by the Marconi Company, provided that such apparatus is not offered for sale and is used only for amateur purposes. In this particular connection "construction" is intended to signify the actual manufacture, wholly or in part, of a wireless set, and not the mere connecting up of purchased instruments. On the other hand, the company intend to protect their rights when unauthorised use is made of their patents in the manufacture of apparatus for sale publicly or privately.

Radiograms

ARRANGEMENTS have been made for the American wireless station at Arlington to collect particulars of the weather conditions every morning from a number of American stations and wireless them to the Eiffel Tower. They will then be broadcast from the Eiffel Tower half an hour after noon.

■ ■ ■ ■ ■

An international organisation of the world's wireless operators has been formed. The federation is to have its headquarters in London.

■ ■ ■ ■ ■

The Middlesbrough Chief Constable has been authorised to obtain an estimate of the cost of purchasing a transmitting and receiving set and to submit the same to the next meeting of the Watch Committee of the Middlesbrough Town Council.

■ ■ ■ ■ ■

No official information is forthcoming as to whether either Glasgow or Edinburgh will be the selected spot for a broadcasting station. There are rumours that each city is to be permitted one.

■ ■ ■ ■ ■

Broadcasting is already well established in Canada.

■ ■ ■ ■ ■

A system is now being perfected on the Continent by which finger prints can be wirelessed.

■ ■ ■ ■ ■

The synoptic weather reports and general inferences hitherto issued daily on 1,400 metres C.W. at 6 a.m., 8 a.m., 2 p.m., 7 p.m., and also at 9.15 a.m., and 8 p.m. (all hours are Greenwich mean time), in future will be transmitted on 4,100 metres C.W. The synoptic report at 2 a.m. will continue on 1,400 metres. The 8.30 a.m. report will cease. In cases of breakdown or other delay, should transmission on 4,100 metres not have begun within ten minutes of the scheduled time, the message will immediately be issued on 1,400 metres.

■ ■ ■ ■ ■

Wireless is to be used as a means of bringing schools lying in outside districts into touch with university life. Hitherto there has been some difficulty in inducing professors, lecturers and others to go out to them.

■ ■ ■ ■ ■

Authorities are of the opinion that the wireless business as it is now developing is going to be greater than the gramophone industry.

Swansea Education Committee recently passed a supplementary estimate for £50 for the purchase of apparatus to enable a start to be made in teaching the principles and practice of wireless telegraphy and telephony at the Technical College.

■ ■ ■ ■ ■

The more progressive newspapers in the States are already broadcasting special talks to readers, market reports, stock quotations and sporting news, in addition to complete musical programmes.

■ ■ ■ ■ ■

The South African Government has approved of the establishment of broadcasting wireless telephone services. As in this country the circulation of advertising matter and commercial traffic is, however, not permitted.

■ ■ ■ ■ ■

In the House of Commons on Wednesday last Mr. Pike Pease said the conditions for the issue of wireless broadcasting licences had not yet been settled. He hoped to make a statement on the subject soon.

■ ■ ■ ■ ■

A wireless theatre has been established in Southport. Sixty 'phones have been installed, and patrons will be able to hear concerts from London, The Hague, Eiffel Tower, and many other stations, general news, weather reports, lectures, etc. There is one central receiving instrument to which the sixty 'phones are connected. The theatre will be open daily from 10 a.m. to 10 p.m., the charge for admission being one shilling.

■ ■ ■ ■ ■

Receivers are to be installed in every village of any size throughout France. On the receipt of the official weather forecast from the Eiffel Tower it will be communicated to the inhabitants by the ringing of the parish church bell according to a prearranged code.

■ ■ ■ ■ ■

A wireless telephone health bulletin service has been inaugurated by the United States Public Health Service. A message of advice on how the average man and woman may ensure continued good health is broadcast twice a week.

FORTHCOMING EVENTS

Derby Wireless Club. July 20, 7.30 p.m. At "The Court," Alvaston, Derby. Lecture on "Detecting Devices," by Mr. E. V. R. Martin.

Nottingham and District Radio Experimental Association. July 27. Meeting.

Derby Wireless Club. July 27, 7.30 p.m. At "The Court," Alvaston, Derby. Lecture on "Practical Construction of a Single Valve Receiver Set," by Mr. A. T. Lee.

TELEPHONY TRANSMISSIONS

Eiffel Tower (F L). 2,600 metres. Each afternoon (Saturdays and Sundays excepted).

Marconi House (2 L O). July 20, 8 to 9 p.m. Transmission tests.

The Hague, Holland (P C G G). 1,070 metres. July 23, 3 to 5 p.m.

Writtle (2 M T). 400 metres. July 25, 8 p.m.

Broadcasting and the Public

THE newspapers tell us that the Postmaster-General and the committee of broadcasting firms are on the point of reaching an agreement, and that in this agreement two facts stand out prominently—the Government will share the licence fees with the broadcasting companies, and will, in due course, introduce legislation with a view of ensuring that only British-made apparatus shall be used in the transmitting and receiving of the broadcast messages. At the time of writing this agreement is not a fact accomplished, and we should like all concerned to look closely and anxiously into the matter before a hard-and-fast agreement on these lines is cemented.

We have long seen the very great difficulty the broadcasting firms must be in. The public calls upon them to provide amusement, and if the public calls the tune the public must also pay. There can be no two ways about that. The difficulty has been in finding a just way of making the public pay. In the United States the public has paid in one way only, that is, by purchasing the goods the broadcasting firms manufacture and sell, and a very good way, too. In this country the broadcasting firms have hesitated to start amusing the wireless public until they could be sure of their return, and that is the very core of the difficulty, but to allow a conference of broadcasting firms to settle it in secret conclave with the Postmaster-General was not ideal. The public interest was not sufficiently represented. The Postmaster-General represented, first and foremost, the official interest—the interest of a great public department in whose hands are the exclusive rights of telegraphy and telephony in this country. The broadcasting firms represented themselves. There was needed an equal representation of the public interest, a few good men of affairs who could have put the case for the people who will have to do the paying. If the suggested agreement goes through, not only will the broadcasters be given a close monopoly, but, in addition, they will be drawing a fee from every member of the public who owns a receiving set. The present nominal licence fee will have to be considerably increased—perhaps multiplied by four—and that in itself is not fair in view of the fact that the broadcasters are shutting out foreign competition, as a result of which their profits from the sales of apparatus and parts must, in due course, assume enormous dimensions. We strongly dislike the idea of a monopoly. Every true Englishman does, but if, in the special circumstances, it is agreed that a monopoly is desirable in this instance, let that be enough. Don't seek to make the public pay at both ends of its hobby—more for its licence and inevitably more for its apparatus.

Thousands of amateurs are not interested in broadcasting. They are more or less serious experimenters to whom broadcasting as such has very little attraction. Theirs will be a very real hardship when they have to pay for something they do not want and will not have. Sooner or later the whole question of the licence and fee must be raised. Many amateurs fail completely to find any reason why the State should take a fee and do absolutely nothing for it.

CORRESPONDENCE

Can any Reader Explain?

SIR,—There are two points your correspondent should fully appreciate—firstly, that light waves are electro-magnetic in nature, differing only in linear dimensions from the disturbances which are created by oscillating electric currents, etc.; secondly, that it is of vital importance that the dielectric (in this case porcelain) should be completely taken into account and studied thoroughly, because it is the "refractive index" of the dielectric which decides whether the waves are capable of passing or not. G. B. is aware that wireless waves, also X-rays, are capable of passing, but fails to see why light waves cannot if they use ether as their medium.

If, for the sake of explanation, we say the dielectric's electrons are vibrating ten units and the light wave is vibrating at ten also, on impact the two would cancel and the light waves would not pass.

I think this is sufficient to show that it is not the ether that is responsible for the light not passing, but the electrons in the porcelain.—A. P. (Southsea).

SIR,—G. B.'s letter in your issue of the 8th inst. raises some interesting points. I think it is hardly safe to deduce any theory from the behaviour of an electric bell enclosed within a porcelain or other non-conducting receiver.

In the last paragraph but one G. B. refers to the waves of light from the sun as not travelling all around the earth's surface, while "the electro-magnetic waves, as is well known, follow the earth's surface." Is this last statement unquestionably established, or may it not be that the waves travel in straight lines through the earth to the several receiving stations? I shall be very much interested to know other reader's views.—E. W. W. (Coventry).

[We are obliged by great pressure on our space to hold over many other letters in answer to G. B. Further correspondence on the subject is not invited.—ED.].

Testing 'Phones

SIR,—Regarding the short article on testing 'phones, there is a much simpler test which I have always found to give trustworthy results, which is as follows: Place one end of one 'phone lead in the mouth, hold the other by the insulation, and touch the blade of a pocket knife with the bare end. If the 'phones are in a sensitive condition a distinct click is heard each time the contact is made.—W. B.

"Listening-in" To Be Dearer

SIR,—Under the above heading one of the daily papers published a statement of which the following is an extract:

"The cost of the broadcasting programme, estimated at £20,000 a year for each of the eight stations, has surprised those anxious to listen-in, and many have written suggesting that the price of the Government's listening-in licence, now fixed at 10s. 6d., should be increased, and the sum charged over and above the original figure placed to a common fund, out of which the programme could be provided. It is understood that a proposal on these lines has been placed before the Post Office authorities, and it is probable that a considerable increase in the licence fee will be authorised."

To the hundreds of wireless enthusiasts with money to spare for expensive valve sets the threatened increase will make little or no difference. To the real amateurs, however, who have built up their sets step by step, using home-made apparatus and inventive genius, the additional burden added to their already bowed shoulders, may, and probably will, cause the closing down of their stations.

The country has nothing to gain scientifically by thousands of "condenser wanglers" making the ether hideous with the howling of their valves; it has everything to lose by suppressing the top-attic man. Which of these two distinct sections will supply our country with wireless operators in the event of another war?

Certainly not the arm-chair enthusiasts.—J. F. G. C.

CLUB DOINGS

Proposed Central London Wireless Society

Hon. Sec.—(pro tem.).—HORACE E. HOBBS, 15, Rydon Crescent, London, E.C.1.

APPLICATIONS for membership are invited.

Proposed Clapham Park and District Amateur Wireless Club

CORRESPONDENCE is invited by Mr. J. C. Elvy, A.M.I.E.E., M.I.E.S. It is proposed that the club should include Streatham, Balham and Tooting.

The Mid West Herts Wireless Club

Hon. Sec.—MR. J. R. FRANCIS, "Ivy Cottage," Redbourn, Herts.

THE Secretary invites correspondence from all willing to assist in the holding of meetings in St. Albans, Harpenden, Hemel Hempstead and Berkhamsted.

Radio Rendezvous

709, The Broadway, Manor Park, E.12.

AMATEURS in the districts of East Ham, Manor Park, Ilford, Wanstead, Forest Gate and Barking are invited to become members of the above club. Club rooms are open every night until 10 p.m., Sundays excepted.

Birmingham Experimental Wireless Club

(*Affiliated with the Wireless Society of London*).

Hon. Sec.—FRANK S. ADAMS, 110, Ivor Road, Sparkhill, Birmingham.

A CONFERENCE of Midland Wireless Clubs is being promoted by this Club, with a view to discussing the interchange of lecturers, and other matters of mutual interest.

It is proposed that the conference shall be held in Birmingham, as early as possible in September. All Midland Clubs are invited to send delegates, and the secretary will be glad if secretaries of the wireless organizations will communicate at the earliest possible date.

Stoke-on-Trent Wireless and Experimental Society

(*Affiliated with the Wireless Society of London*).

Hon. Sec.—F. T. JONES, 360, Cobridge Road, HANLEY.

AT a meeting of the above society on Thursday, July 6th, some buzzer practice for the benefit of the new members was followed by a lecture on "A Short Wave Tuner," by Mr. A. H. Wilson.

(*Continued on page* 136)

OUR INFORMATION BUREAU

Expert Replies to Readers' Questions. Hundreds of Replies are sent by Post.

TO ENSURE A PROMPT REPLY PLEASE OBSERVE THE FOLLOWING RULES

Write distinctly, give all necessary details and keep to the point. Ask one Question at a time—never more than two. Send a Stamped and Addressed Envelope. Send the Coupon cut from page 134.

Valve Panel for Mark III Receiver

Q.—I wish to make a valve panel for use in conjunction with a Mark III receiver, and should be glad of advice. – E.E.C.C. (15)

A.—The usual type of valve panel is well adapted for this purpose, and may be constructed in accordance with detailed instructions given in Chapter IX of the new handbook, "Wireless Telegraphy and Telephony" (Cassell & Co., Ltd., price 1s. 6d.). The usual terminals as fitted will be required as follows: (1) Valve terminals on Mark III. set to be connected to aerial and earth terminals of valve panel, that is to say, to the grid (via condenser and leak) and filament of valve, which may always be regarded as the "input" circuit. (2) Telephones will require to be removed from Mark III. set and connected to telephone terminals of panel. (3) L.T. and H.T. batteries are to be connected to respective terminals on the panel. (4) Reactance terminals on panel will require to be short-circufted by means of a piece of stout copper wire, unless of course a reactance coil is made and suitably coupled to the secondary circuit of the Mark III. tuner. Though not strictly necessary for reception of spark or telephony, a reactance coil affords a means of obtaining great magnification, but the coupling should not be such that self-oscillation of the set occurs, as this distorts received speech, etc., and may cause considerable interference to adjacent receiving stations. Self-oscillation is necessary for reception of continuous-wave signals, unless a piece of apparatus known as a separate heterodyne is employed. The proposed arrangement should prove very useful, though for radio-phone reception from stations within a radius of, say, 50 to 70 miles the Mark III. set, plus one valve functioning as a low-frequency amplifier, should certainly be tried as an alternative arrangement.—CAPACITY.

CLUB DOINGS (*Continued from page 134*)

The lecturer, after outlining points which if neglected would greatly reduce the efficiency of any tuner, dealt with the construction of a short-wave tuner on which telephony from local amateur stations, and the wireless concert sent out from the Marconi station in Essex, could be received.

A home-made tuner of the variometer type constructed by the lecturer, other tuners, and a large number of tuning coils were exhibited and handed round for examination.

Walthamstow Amateur Radio Club

Hon. Sec.—R. COOK, Ulverstone Road, Walthamstow, E.17.

AT a meeting of the above club held at the Y.M.C.A., on Wednesday, July 12th, Mr. Butler gave a very interesting and instructive lecture, accompanied by diagrams on the blackboard, on "How to Construct a Crystal Set." Next week he is taking for the subject of his lecture "A One-valve Set."

The club are giving a Public Demonstration at the Y.M.C.A. on Tuesday, July 25th, when they hope to initiate a proportion of the public of Walthamstow into the mysteries and pleasures of Wireless.

All applications for membership should be addressed to the Hon. Sec.

The Hackney and District Radio Society

Hon. Sec.—MR. E. R. WALKER, 48, Dagmar Road, South Hackney, E.9.

THE above society held meetings open to the public at 111, Chatsworth Road, Clapton, on the evenings of July 6th and 7th.

The lecture given at the opening by Mr. E. R. Walker, was on "First Principles in

(*Continued on page 138.*)

THE PETOPHONE CRYSTAL SET

£3 15s. 0d.

COMPLETE WITH 4,000 OHM HEADPHONES

Comprises Double Slide Tuning Coil, 8 in. × 4 in.; Crystal Detector, Condenser, High-class Sensitive 4,000 ohm Headphones. Set Mounted on Polished Mahogany Board. Carriage paid 75/-. Delivery in 48 hours. Satisfaction or money returned

BUILD THIS VALVE PANEL

Price 15/9 Set of Parts

Price 15/9 Set of Parts

Full Set of Parts contain Ebonite Panel, drilled and lapped, Grid Leak (Sphinx Tubular Type, guaranteed 12 months), Grid Condenser, Telephone Condenser, Systoflex, Wire, All Terminals, Set of Engraved Ebonite Tablets, Valve Sockets, Blue Print. 15/9, Post 9d. We can supply a Polished Cabinet to fit at 3/6 extra.

Get our Catalogue A. 6d. Stamp brings it to your door.

WE HAVE SETS OF PARTS FOR ALL OTHER TYPES OF RECEIVERS & TUNERS

Don't forget our NEW address:

PETO SCOTT (The Condenser King),
FEATHERSTONE HOUSE, 64 HIGH HOLBORN, LONDON, W.C.1
Also at 17, FROME ROAD, WOOD GREEN.

BROADCASTING and GENERAL RECEPTION

Single Valve Set

THE COMPLETE INSTRUMENT. Highest quality throughout. Supplied with Set of Tuning Coils, 170-2,500 metres less Valve Phones and Batteries.

£7 0 0

THE WIRELESS INSTRUMENT CO.
328, CITY ROAD, E.C.

CONDENSERS

.0015 Set of Parts	25/-,	Assembled	30/-
.001 „	„ 19/-,	„	24/-
.0005 „	„ 12/6,	„	15/-
Vernier ..	..	„	4/6

Large Stock of Headphones (4000 ohms) **£2 10 0**

Filament Resistance 4/6, Valve Holders 1/6, H.T. Batteries 3/6, 15 v. Switch Studs 1/6 doz., Arms 2/-.

B. L. HOUSTOUN, 65, ENDELL ST., LONDON, W.C.2. 'PHONE: REGENT 4911.

WE DON'T WASTE YOUR TIME.

We hold good stocks of everything Wireless, and make it our boast that every letter has attention WITHIN 24 HOURS.

Complete Lists two stamps.

ELECTRICAL SUPPLY STORES,
5, Albert Terrace, King Cross, HALIFAX.

No. 1 of a New Wireless Magazine for Amateurs

EXCLUSIVE FEATURES of No. 1

- HOME CONSTRUCTION MADE EASY
- THE MAN BEHIND THE VOICE
  Photographs of London stations and their operators (monthly feature)
- THE BROADCASTER BUREAU
  Expert Advice Free
- AERIAL HINTS
- WIRELESS SOCIETIES OF GREAT BRITAIN
- "HOW I DID IT!" By A Novice

and many other splendid features

Here is a 64-page Wireless Monthly Magazine which does full justice to a wonderful subject. Here are splendidly illustrated and fascinating articles by eminent authorities, written in plain simple language to enable the amateur to dip into wireless to his heart's content. The BROADCASTER is the first English Monthly Wireless Magazine for Amateurs. To keep abreast of the times you MUST read "THE BROADCASTER."

DON'T MISS THE EXCLUSIVE INTERVIEW WITH GODFREY ISAACS ON BROADCASTING

The Broadcaster

THE RADIOPHONE MONTHLY FOR LISTENERS-IN

One Shilling

CLUB DOINGS (*continued from page* 136)

Wireless Telegraphy," Mr. Walker explained how the aerial became charged so that it produced waves. After this the second lecturer, Mr. D. R. Ison, gave an explicit explanation of reception of the waves, with the aid of a Marconi 31A tuner. On both evenings various items of telephony were received. Any persons wishing to join the society should apply on Thursday evenings at the above address, or write to the Hon. Sec.

Printed and Published in England by CASSELL & COMPANY, LIMITED, Ludgate Hill, London, E.C.4. Sole Agent for South Africa, CENTRAL NEWS AGENCY, LIMITED. Saturday, July 22, 1922.