Mainly about Construction

BY "MEGOHM"

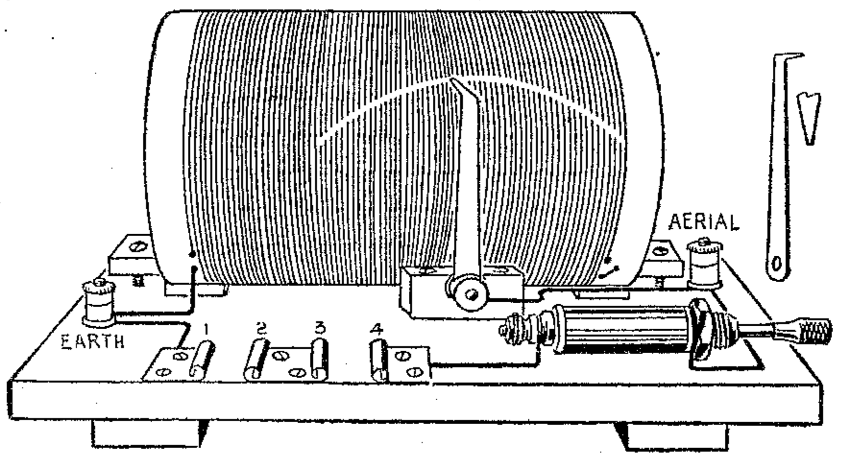
AN EFFICIENT CRYSTAL SET

CAN BE MADE BY ANYBODY

There is a simple crystal set for the beginner in construction. It is not intended to be a permanent set, but can be quickly constructed and put into use while the owner takes his leisure to construct a more pretentious set. All that is required in addition to the items given are a pair of headphones and an aerial.

Articles Required.—Cardboard former about 5in. long and 3in. diameter, 3 brass terminals, ¼lb. 20's enamelled wire, permanent crystal detector, piece of board about 9 x 5 inches, 1 dozen ⅜in. brass screws, sheet brass, etc.

As no condenser is to be used in tuning this set, it is necessary to provide a means of tapping the coil at the exact turn that tunes in the required station. Any means that will accomplish this will answer well, but the simplest and most convenient is a metal arm moving in an arc across the wires, the insulating material having been scraped away to give good metallic contact between the metal arm and the wire. The end of this arm that makes contact with the wire on the coil must have upon it a small flat which will rest upon one wire without touching the wire on either side of it. As a crystal set is generally used only on the local station, once the arm is set it will only require moving in the event of the station getting several metres off its usual wave-length. It is convenient, therefore, to fix the pivot of the arm in a suitable position below the few turns upon which contact is to be made. If two stations can be heard, then the pivot may be fixed half-way beween the two positions. The new Wellington station, 2YA, comes in best at about 80 turns on a three-inch former, with an 80 feet aerial, whilst about 100 turns should be provided to include 4YA if that happens to be the local station, and for 2YA 90 turns should be put on to leave a margin, and this same winding will suit for 1YA and 3YA, as they will tune in on fewer turns than 2YA as their wave-length is lower



The Coil.

Twenty's enamelled wire is to be used for the coil, and wound close together goes about 23 turns to the inch, 90 turns occupying about four inches, so that a former five inches long will give a good margin at the ends The diameter is to be three inches. Two holes are made near one end with a fine bradawl, the wire is passed in through one hole and out through the other, leaving about five inches of end. Winding is now proceeded with as described elsewhere on this page, and this method will be found good whether the former is bought or made at home. The ends of the coil can be supported on small blocks of wood, and the coil clamped down by a lath running through the bottom, a hole being drilled in each end of the lath through which screws may be passed to fasten the whole to the baseboard. The finish of the coil is fastened through two holes in the former, but cut off close as it does not connect to anything.

The Tuning Arm.

The brass for the tuning arm should be hard brass of 18's gauge, 2¼in. long, at least, but the length can best be determined after the coil is fixed in position. When straight up it should contact the wires well above the centre of the coil. The wide part of the arm is about ⅜in. across, drilled to fit over the terminal on the portion that usually holds a wire. Half an inch at the other end is turned over at right angles, the width at the bend being about ⅛in. The end is tapered nearly to a point, a small flat being filed at the extremity. The block should be thin enough to allow of the terminal projecting at the back through the hole drilled for it, so that a nut can be screwed on to keep it secure. The enamel coating is scraped off the end of a piece of wire, the end curled into a loop and secured between the base of the terminal and the block, or, better still, between the nut and the block. This wire is scraped clean where it is looped round the aerial terminal, and without cutting, continues to one end of the crystal, whatever type may be used as detector. The enamel must be carefully and thoroughly scraped off the wire for a distance of half an inch or more, wherever it is to connect to another part of the circuit. Even a small portion of enamel remaining will sometimes stop signals from coming through.

The Crystal.

The crystal shown in the drawing is a good type of semi-permanent crystal that will go for days without resetting, and will give good volume Some may prefer the carborundum type, which is put up in similar cartridge form, but has the additional advantage of never requiring setting, and always gives good and consistent volume and tone. It pays to buy a good crystal to ensure continued good reception, and it can always be used in a more pretentious-looking set that may be constructed later on. Of course, a cat's whisker and loose crystal can be used, but is not recommended for local reception.

'Phone Connectors.

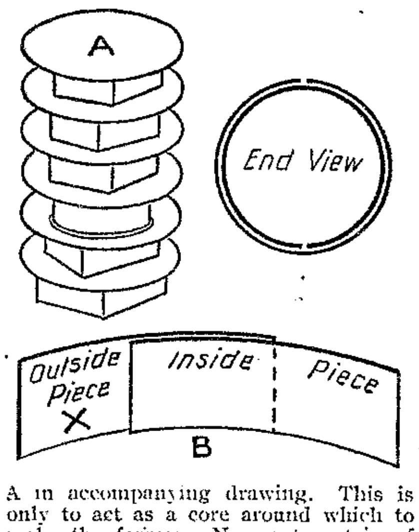
The 'phone connectors shown are made from 30's hard brass sheet, curled round a nail or drill shank ⅛in. in diameter. The brass for the two outside pieces measures 1⅛in. by ⅜in., and for the centre piece 1⅝in. by ⅜in. Holes ⅛in. diameter are drilled or punched as shown, and the connectors fixed to the board with ⅜in. No. 4 brass screws. The loose end of wire from the left-hand of the coil is now cleaned at the proper position, clamped under the earth terminal, and continues to clamp under the brass 'phone connection (1). These 'phone connectors will allow of two pairs of 'phones being used. If one pair is in use, plug the tags into 1 and 4; if two pairs, plug the first pair into 1 and 2, and the second into 3 and 4.

Final Remarks.

The baseboard may be finished with shellac, dissolved in methylated spirits, rubbed on with a rag, but this must be done before attaching any of the parts. The crystal is shown supported by the connecting wires, but a brass angle piece drilled ⅛in. on one face and drilled for two screws on the other, can be screwed to the board, the wire from aerial clamped underneath. The broad end of crystal mount will then slip through the ⅛in. hole and is secured by the nut provided, and stands in the same position as shown, but is more securely held. Provided that a reasonably good aerial is erected, this set will give all that can be desired in the way of crystal reception. Where the aerial used is short, extra turns should be put on the coil to compensate. The track of the tuning arm should be bare copper ⅛in. wide, the enamel being scraped off the wires with a sharp knife.

FORMERS FOR COILS

It is not always possible to purchase the particular size or diameter of coil former required, so here is given a simple and handy method of making a neat, true, and serviceable former of any exact dimensions. A sixteenth of an inch is usually sufficient thickness for the wall of an ordinary former. Two layers of the white card called by printers "8-sheet" will make up this thickness. If thinner card is used sufficient layers must be put on to make up one-sixteenth. The method will be best described by taking some particular size as an example, so we will suppose it is desired to make a former of three inches outside diameter and four inches long. From an old cardboard box cut six circles 2⅞in. diameter and pile them up with small blocks of wood or anything handy to separate them about ¾ inch as shown at



A in accompanying drawing. This is only to act as a core around which to make the former. Now cut a strip of the good card four inches wide and place round core, marking where it meets, and cut just short of meeting round. Now keeping this round the core, place another strip round the outside, marking the full distance round, and cutting off just short. Now glue about half of each together as shown at B, and when the glue is sufficiently set, glue all over portion marked X, place round core, work into position with both hands, wind two or three yards of twine round outside and leave to set. Seccotine used sparingly is a handy adhesive. A coat of thin shellac varnish will keep the damp out.

DON'T TWIDDLE

HANDS OFF THE DIALS.

Many listeners attempt to retune their set when one programme number gives way to another. They notice a decline in volume and assume that the set needs adjustment. If the dials are not turned, the volume control is adjusted, or perhaps both are tinkered with, on the assumption that this is necessary.

Nearly always there is no occasion for touching the set. The volume change is due entirely to conditions at the broadcasting station. Perhaps a soprano has just given way to a brass band. The operator in the control room of the station takes care of the volume by adjusting resistances connected with the speech amplifier—an audio channel used for regulating the amplification of everything broadcast. A different adjustment is needed for a band than for a soprano, and it may take a few moments before the transmitter is properly settled for the new conditions.

Therefore, when a station seems to be suffering from an odd form of fading at the time of programme change keep in mind the probable cause and let your receiver alone. No attempt should be made at readjustment until a few minutes have elapsed

RADIO BATTERIES

DRY AND WET CELLS

INTERESTING FACTS.

Between the storage battery and the dry battery are four outstanding differences in operating characteristics:

First, the storage cell is rechargeable. Following the change of lead peroxide and sponge lead to lead sulphate in the normal discharge of the cell, this lead sulphate may be converted again to the original condition of peroxide on the positives and sponge lead on the negatives by connection to a suitable source of charging current, the cell then being again ready for another period of service discharge.

In other words, the discharging process is reversable, and the succeeding operations of discharge as a source of electric power supply and charge to bring back the conditions under which the storage cell may again furnish electric current may be repeated indefinitely until the cell wears out in service.

Various Differences.

The primary or dry cell, however, may act but once, continuously or intermittently, as a source of electrical current. When discharged it is useless.

Second, the difference in voltage of the storage cell between the state of full charge and that of nearly complete discharge is relatively slight. The voltage is well maintained under given conditions of discharge rate for the larger portion of the discharge period, dropping down less rapidly at the start and holding well up until nearly at the end. With the dry cell the voltage drops in more or less of a straight line from beginning to end of discharge and over a considerable range.

Internal Resistance.

Third, the virtual internal resistance, that is, the resistance factor which produces variation in voltage with change in current rate, is extremely low in the storage cell. Both storage and dry cells increase in internal resistance as discharge progresses Not only is this increase in resistance less marked in the storage cell but the initial value of resistance is so low that this effect is practically nil The dry cell, however, gives a voltage somewhere near its initial voltage for only a small portion of its rated capacity in terms of rate and time and exhibits more and more as discharge progresses variation of this voltage with current change.

Fourth, the storage cell has to a marked extent the property of recovery. In intermittent operation, as usual in radio service, it gives at the beginning of any short discharge period a voltage higher than that given at the end of the previous discharge, and until the intermittent discharges have integrated nearly to the rated capacity, the storage cell gives under these conditions of intermittent use the voltage of a nearly charged condition.

Why Life is Shortened.

Reverting for a moment to the first outstanding characteristic of the storage cell, the type of plate used in both A and B radio batteries will give in laboratory practice from 400 to 600 cycles of charge and discharge before disintegration. This would indicate a service life in radio of many years. Actually, this service life is greatly shortened, due to abuse, overcharging and overdischarging, idle periods in a discharged condition, lack of attention to the necessity of refilling to replenish evaporation and other causes. In farm lighting plants, where the same type of plate is used and the battery is given a more or less complete charge, usually weekly or twice a week, a service life of ten years is not unusual, and six to eight years something like the average. A good radio A battery should give dependable service over a period of at least four to six years.

In our second consideration, the open circuit voltage of the storage cell of the pasted plate type may be taken as 2.15 volts at full charge and initial operating voltage at low rates as 2.1. Radio batteries are usually of sufficient capacity for several weeks' intermittent operation. The final discharge voltage may be as low as 1.80.

Greatest Discharge.

By far the greater portion of the discharge at radio rates, whether continuous or intermittent, is between 2.05 and 1.95 volts. The final voltage is approached only as the cell nears complete discharge. This variation from 2.05 to 1.95 represents only 5 per cent. lowering in voltage over most of the discharge period. In comparison, the initial voltage of the dry cell, 1.5, drops down from the start, going to about 1.13 at the practical end of its useful service life, a variation of 25 per cent. Now, again, if partially charged at more frequent intervals than would be represented by the full discharge period, or installed with a so-called trickle charger, the available voltage of the storage cell may be considered as constant at or near the 2.1 voltage or full charge, whereas the continual loss in voltage of the dry cell is unavoidable.

Making Wet Batteries.

Storage batteries for radio service are almost universally in the lead-acid type of the so-called Faure plates. These are made with grids or lattice frameworks of lead antimony alloy, on which by special machine processes are pasted mixes of lead oxides, constituting the active material.

After pasting, the plates are converted respectively into positives and negatives in the forming process, that is, by continued charging. They are then in A battery manufacture, assembled into groups by lead burning the plate lugs to so-called post straps, then assembled with the separators, usually of wood, Port Oxford cedar, in compartment type rubber or glass containers.

Cells are joined together by lead links, integrally lead burned to the posts of the positive and negative groups, and to gas and acid tight lead bushings moulded in the rubber covers. When finished, the batteries are shipped either with the acid, charged and ready for use, or more often in what is called the add-acid type In this form the batteries are without acid, but completely charged and ready for service upon the addition of the necessary acid electrolyte.

Sizes of Batteries.

Radio A batteries range in size from 18 ampere hours capacity at four volts for some types of super-heterodyne receiving sets, and 35 ampere hours at six volts for so-called trickle charge batteries, up to the larger A sizes of 75, 93½, 105 and higher ampere hour capacities. B batteries are usually in two plate types, in glass jars, of capacities 2500 to 4500 milliampere hours and in assemblies of 12, 24 and 40 cells, giving nominally 24, 48 and 80 volts, and covering the voltage range of standard 22½, 45 and multiples of these figures in dry batteries. Both the A and B types find application in broadcasting stations as well as for home receiving sets and amateur transmission.

PLUS OR MINUS?

TO ASCERTAIN WHICH IS WHICH.

Difficulty in ascertaining which is a positive or negative wire connected to a battery is frequently experienced by radio fans. This applies particularly to loudspeaker cords. Connecting the loudspeaker with the wrong polarity causes weakening of the magnet within it

The simplest method of testing the polarity of wires leading from storage batteries of small voltage is by grasping any pipe or ground wire with one hand and touching the wire you desire to test to your tongue. The positive wire will give you a slight sensation or a sort of sour taste; the negative will have no effect Do not attempt this, however, with alternating current, or, in fact, any current of high voltage. With any voltage up to 110, you can determine the polarity by touching with a fingertip. If an alternating current, touch very quickly If it is a positive wire you will get a slight shock; if negative, there will be no effect. Direct current (used in radio receivers) will cause a slight tangling feeling, whereas alternating current will produce a shock. There is no danger in making these tests on ordinary battery power in connection with radio. If, however, you prefer a different means, place a little common salt in a glass of water and insert the ends of both wires in the solution. There will be a bubbling around the negative wire, while the positive will apparently produce no effect on the water.

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