A Good Crystal Receiver with Amplifier

Full Details to Help Beginners

(By Megohm.)

THIS is a receiver that is easy to build, and that will give high quality signals. At short distances of a few miles from a main station, a small loudspeaker may be used, the voltage obtained being according to location dimensions of aerial, distance, and general efficiency of the receiver, which latter will be good if the directions are carefully followed. Good headphone strength for two or three pairs of headphones will be obtained at 100 miles, or more from a main station, depending upon the factors already mentioned, but no exact statement can be made as to the strength of signals in a given locality. The best way for intending crystal operators is to ascertain from crystal users in their own district, what stations may be considered within range, and how they are received. Radio enthusiasts are usually only too pleased to assist others with information when the request is made.

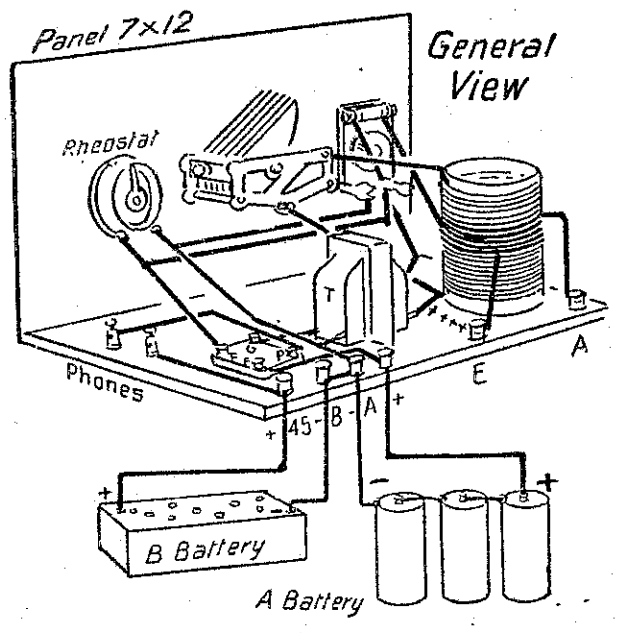
CARBORUNDUM UNIT RECOMMENDED.

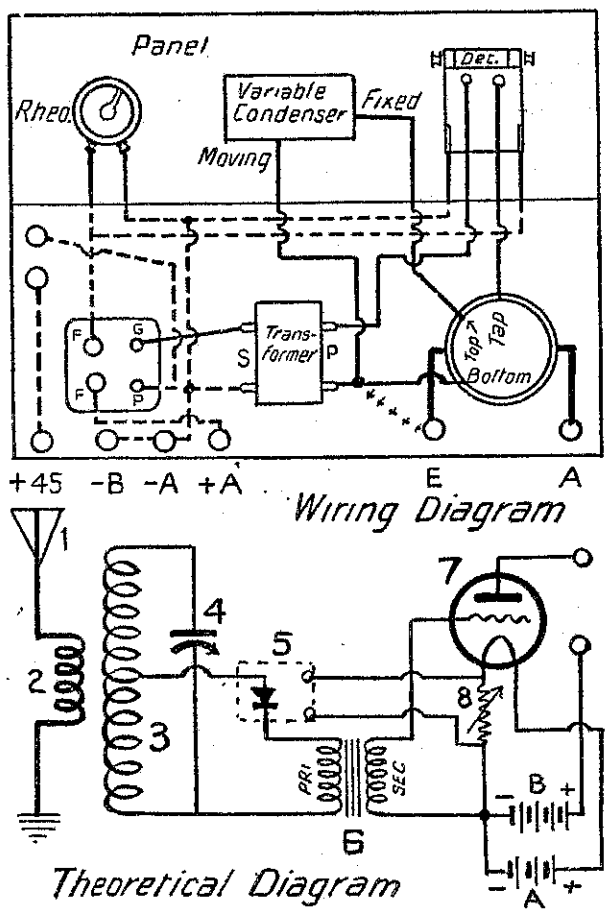
A CARBORUNDUM crystal unit is shown in the diagrams because it is recommended for this receiver. The writer is quite aware that many crystal users have purchased such a unit, and on account of expecting from it much more increase in volume than is possible, have been disappointed. The writer has experimented with one of these units, and with the small bias supplied from a single dry-cell, finds in operation that after a station is tuned in, the potentiometer control is moved until a definite point is reached where great clarity and slightly increased volume are noticed. This slight increase in volume is good at any time, but when it is to be amplified, it is greater, especially as finer clarity is also gained. The wording of a letter recently received from a correspondent showed that he expected the unit to give amplification equal to that gained by a valve. Some may wish to cut out the unit to save expense, in which case any kind of crystal may be put in its place. In such event, the two wires connected to the unit, and to each side of the rheostat would be dispensed with.

PANEL AND BASEBOARD.

THE panel may be of ebonite or three-ply. The former gives a smart appearance, but oregon three-ply finished with shellac varnish rubbed in, makes a neat, inexpensive panel. On the front of the panel, which measures 12 by 7 inches, there will be the condenser dial in the centre, to the left the crystal unit knob, and to the right the rheostat control. The panel is attached to the front edge of the baseboard by drilling three or four holes along the lower edge, and countersinking to take the heads of the brass screws used.

The baseboard should be of 3-8in. rimu, finished with shellac dissolved in methylated spirits and rubbed on with a cotton rag. Battens may be screwed underneath to prevent warping. Dimensions are 12in. long by 7 or 8 inches deep. The position of components as shown works out well, but need not be strictly adhered to. The main thing to avoid is having the connecting wires unnecessarily long where it can be avoided. Wires shown dotted in the wiring diagram are to pass through holes in the baseboard and run underneath, and on this account if battens are put under the board, it is best to place one at each extreme end. Wires under the board may be run close together where possible, but should be well insulated.





THE TUNING COIL.

THE tuning-coil or inductance is to be wound on a former 3 inches in diameter. This former may be purchased ready-made of bakelite, with ribs which keep the wire out of contact with the surface, making a "low-loss" coil. A colvern coil and base, costing 6s., would make a neat former, or a plain cardboard tube could be used, or a strip of celluloid cemented together on a former to make a tube of the desired diameter.

The wire to be used is 24's s.w.g. double cotton-covered, of which 56 turns must be put on, occupying a space of about two inches. At the centre of the coil, that is the 28th turn, a "tap" is to be led out. This is done either by scraping off the insulation and soldering on a 6in. length of the same wire, or by twisting a small loop in the wire whilst winding, afterwards cleaning off the insulation at the loop and soldering on the tap wire. Wind the wire tightly and evenly. This is best done with the spool on the floor and the coil on the knee, turning it and finding the wire with the hands. A pair of holes is made at each end of the winding, and through these the beginning and end of the wire are secured by merely passing through the two holes, in and out again. The former may be any length, but as the wire occupies only two inches, need not be longer than 3 inches. Having completed the 56 turns which is the secondary coil, we have the primary aperiodic or untuned aerial coil to provide. This consists of from ten to twenty turns of 28's s.w.g. double cotton-covered wire, found on top of the 24's, half the turns being on each side of the centre tap. Let the 28's rest in the hollows formed by the 24's. The fewer turns, the more selective, but with reduced volume. A good plan is to put on 20 turns with a tap at the 15th by means of a loop, then by actual trial the best position can be found, depending to some extent upon the distance from a main station.

The coil is fastened to the board by a strip of wood cut to fit the inside diameter, fastened to inside of former, and secured to the base by a screw through the centre of the strip.

THE WIRING DIAGRAM.

ALL connections are clearly shown on this diagram. The wires shown dotted are battery wires and are taken through holes in the board and pass underneath out of the way, giving the set a tidy appearance.

Starting at the rheostat, from one terminal a wire runs to filament of valve, from the other rheostat terminal under the board to A negative, and continues to B negative, a branch connecting to the transformer secondary marked C negative or A negative. The other secondary connection marked "grid" connects direct to G on valve-holder, which should be American UX type, as all makes of valves may be obtained with UX base.

From each rheostat connection at convenient points under the board, connections are soldered on to run to the two prongs on the carborundum unit. These prongs are intended to hold a single small dry-cell for bias, but instead we are getting the bias by the drop across the filament rheostat.

One 'phone terminal connects to the valve plate terminal and the other to the full B battery voltage terminal, 45 volts.

The moving plates of the variable condenser connect to the lower end of the 56-turn coil, and to one primary contact of the transformer in passing. The fixed plates of the condenser connect only to the top end of the tuning coil. The remaining primary contact of the transformer is connected to one side of the crystal and other side of crystal to the centre tap of the secondary coil. The remaining filament connection on valve-holder connects to A positive terminal.

Notice particularly that the 20 turns outside the coil connect to aerial and earth only, the top to aerial. There is no direct connection between this coil and the rest of the circuit, the energy being transferred by "induction." The 20-turn connections are shown by heavier lines in the diagram.

Connecting wires should be of 18's or 20's, preferably the former, underboard wires well insulated. Wires above board may be insulated, bare tinned, or square bus-bar wire.

Where terminals are not provided, wires should be soldered on rather than adopt any unreliable method of twisting on.

It should be noted that in the general view all wires are shown above the board in order to illustrate the connections as much as possible, but those indicated in wiring diagram should be put under the board.

BATTERY POWER.

NOTHING very extravagant is required in the way of batteries, and with an economical valve these should last several months.

A 45-volt B battery block is required, and the two extreme ends of this are connected to B positive and negative terminals, as shown. One of these connecting wires must be disconnected at either end when the set is not in use. A small switch could be included between the B positive terminal and 'phones.

Three ordinary cylindrical dry-cells giving 1½ volts each will constitute the A battery, to be connected exactly as shown. The central terminal of each cell is the positive, and connects to the negative of the next cell. A total of 4½ volts is thus available, when the cells are new, and as the suitable valves only require three volts on the filament, a good portion of the rheostat must be kept in the circuit. There is a certain point that can soon be found by experiment, beyond which the rheostat can be turned without any increase in amplification, and this point should on no account be exceeded. Excess of current shortens the life of a valve, but with care it should last well over a year. Great excess of current, say, a full volt over the rated maximum, may ruin a valve in a few moments, so nothing is to be gained by pushing valve filaments.

TWO AMPLIFYING STAGES.

SOME constructors will prefer to enlarge the baseboard, and add a second stage of amplification, which can easily be done, using the same batteries. The only extra parts required are a transformer, valve holder, and valve.

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