How to Build
A More Selective Crystal Receiver

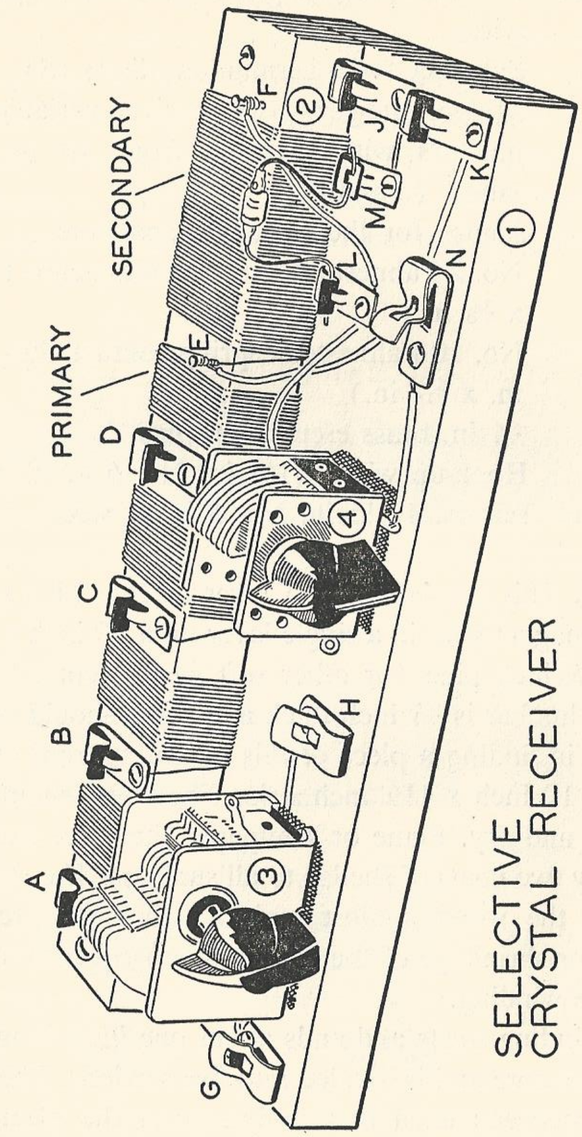
The crystal receiver described in the last chapter is popular because all the parts can be purchased ready-made. It is used in many high schools to demonstrate elementary principles of a radio receiver.

Unfortunately, the advantage of being able to assemble quickly a working receiver sacrifices sensitivity and selectivity. You can build a much better receiver if you wind a special coil to be used in place of a standard antenna coil which, after all, was not originally designed for use in a crystal receiver.

The following parts and materials are required:

1 Shellacked wood base, 10 in. x 4 in. x ¾ in. **(1)**

1 Shellacked pine coil form 10 in. x 1½ in. x ¾ in. **(2)**



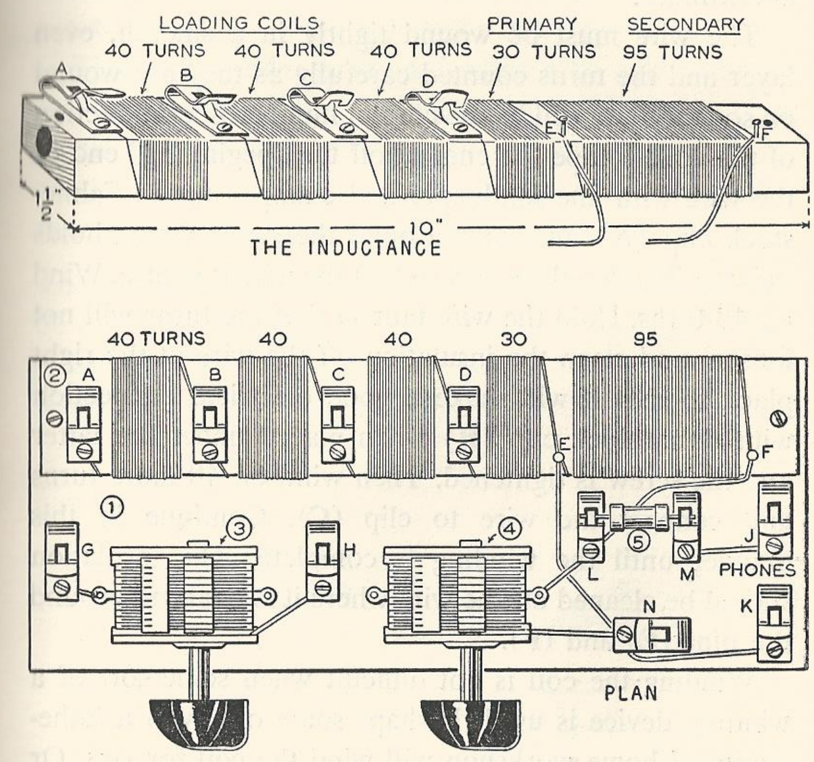
A MORE SELECTIVE CRYSTAL RECEIVER

100	feet No. 24 B.S. gauge enamelled magnet wire
1	Sylvania 1N34 germanium diode (**5**)
2	Midget one-gang TRF receiver variable capacitors with capacity from **10 to 365** mmfd. (**3** and **4**)
2	Knobs for the variable capacitors
9	No. 2 Fahnestock spring contact clips (1 in. x ⅜ in.)
2	No. 10 Fahnestock spring contact clips (¾ in. x 5⁄16 in.)
2	¾ in. brass escutcheon pins
	Hook-up wire, 2-1¼-in. No. 6 R. H. wood screws, 11-½-in. No. 5 R. H. wood screws

The Coil. This consists of 245 turns of No. 24 B.S. enamelled magnet wire in a single layer on a 10 inch x 1½ inch x ¾ inch pine (or other soft wood) core. Much common lumber is ¾ inch thick and there should be no difficulty in finding a piece of this thickness from which to saw a 10 inch x 1½ inch strip. The wood should be seasoned and dry. Plane or sandpaper the piece smooth and apply two coats of shellac to all surfaces. The shellac will seal the wood against moisture, help to prevent swelling or shrinkage of the core and consequent loosening of the winding.

The winding starts and ends about one inch from the ends of the core and is divided into five sections. There is a space between each section but from the electrical standpoint the winding is continuous. There is no break in the wire between sections. The spaces between the

sections and at the ends of the core provide the room for "taps." Four of the taps are No. 2 Fahnestock connector clips so that a wire can be easily and quickly connected to any one of them and disconnected with equal facility. Two of the taps are brass escutcheon pins. Escutcheon pins are round headed brass nails obtainable at a hardware store and used for fastening small name



PLAN OF THE CRYSTAL RECEIVER AND DETAILS OF THE TUNING INDUCTANCE

Note the letters identifying each contact clip and the two pins. These letters also appear in the circuit diagram.

plates. The connections made to the brass pins are permanently soldered. The Fahnestock clips are fastened to the wood core with ½-inch No. 5 round head wood screws. The escutcheon pins are driven into the core.

The first three sections of the winding each contain 40 turns of wire and comprise the ANTENNA LOADING COIL. The fourth section consists of 30 turns and is the PRIMARY. The last section contains 95 turns and is the SECONDARY.

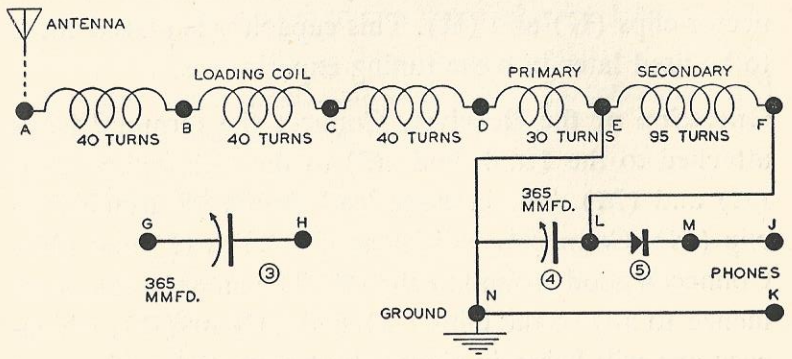
The wire must be wound tightly in a smooth, even layer and the turns counted carefully as they are wound on so that there will be the correct number in each section of the coil. Scrape the enamel off the "beginning" end of the wire with fine sandpaper and clamp it under Fahnestock clip (**A**) and once around the screw which holds the clip. Tighten the screw so that the wire is secure. Wind on 40 turns. Hold the wire taut so that the turns will not loosen, and clean the insulation off the wire at the right place so that it will make a good electrical connection with Fahnestock clip (**B**) when placed under the latter and the screw is tightened. Then wind on 40 more turns and connect the wire to clip (**C**). Continue in this manner until the winding is complete. The insulation should be cleaned off the wire where it is wrapped around the pins (**E**) and (**F**).

Winding the coil is not difficult when some sort of a winding device is used. Perhaps some one with a lathe-equipped home workshop will wind the coil for you. Or perhaps you can do this yourself on a lathe in the shop at your school. If a metal-turning lathe is used, one end of the wood core is placed in a four-jaw chuck on the

headstock of the lathe. The other end is supported on the center in the tailstock. The lathe should be turned slowly by hand by pulling on the belt. If a wood-turning lathe is used, the wood core is mounted between the head and tail centers as if it were a piece of wood to be turned. Turn the lathe by hand by pulling on the belt. Do not use power. Those who are not fortunate enough to have a lathe available should build the winding machine described at the end of this chapter. It will not require much time to make and the machine will make winding the coil easy.

When the winder is in use it should be held firmly to the top of work bench or table with a C clamp. Coil forms of various lengths can be wound with this same winder by moving the uprights so that the distance between them is $\frac{1}{16}$ inch longer than the coil form.

The Variable Capacitors. Both variable capacitors should be the type which can be mounted on a base and be provided with two threaded holes in the bottom of the capacitor frame for that purpose. If the threaded holes are



CIRCUIT DIAGRAM OF THE CRYSTAL RECEIVER

in the front of the frame, the capacitor is designed for panel mounting. In that case it will be necessary to attach a small plywood panel (6 in. x 3 in. x ¼ in.) to the front edge of the wood base and mount the capacitors on the back of the panel.

Fixed Capacitor. You may notice that an 0.001 mfd. fixed capacitor to be connected across the headset is not included in the list of parts. Such a capacitor is usually shown in circuit diagrams of crystal receivers. If a standard radio headset is connected to the receiver the 0.001 mfd. capacitor is not necessary. The purpose of the capacitor is to provide a path for radio-frequency currents around the headset. There is sufficient capacitance in the windings and connecting cord of a standard radio headset to provide such a path.

Assembling. Assemble the parts on the base according to the plan in one of the illustrations. To connect the parts, consult the wiring diagram. Notice that the variable capacitor (**3**) to the left on the base is not included in the circuit but is connected only to two Fahnestock connector clips (**G**) and (**H**). This capacitor is placed there to be used later in some tuning experiments.

Operation of the Receiver. Connect the terminal leads attached to the 1N34 diode (**5**) to the Fahnestock clips (**L**) and (**M**). The cathode lead should be attached to clip (**M**). Connect a radio headset to clips (**J**) and (**K**). Connect a good ground to clip (**K**). The antenna can be attached to any of the clips (**A**) (**B**) (**C**) or (**D**), whichever one will bring in signals best from the station you wish to listen to. For instructions regarding the antenna

and ground connection consult the chapter devoted to those subjects. Adjusting the variable capacitor (**4**) will tune the secondary winding and enable you to tune out unwanted signals.

With this receiver you should be able to hear more stations and get louder signals without interference than is possible with the simple receiver described in the previous chapter. The primary of the antenna coil used with that receiver does not contain enough turns to tune in signals efficiently over the entire broadcast band when used with a crystal detector. The coils (**A**) (**B**) (**C**) and (**D**) provided in the more selective receiver are loading coils. They enable you to tune or adjust the antenna circuit to suit the length of the waves which produce the signals you wish to listen to.

Perhaps you will understand how the loading coil improves the receiver after you have read the next chapter.

HOW TO BUILD A WINDING MACHINE FOR WINDING THE TUNING INDUCTANCE

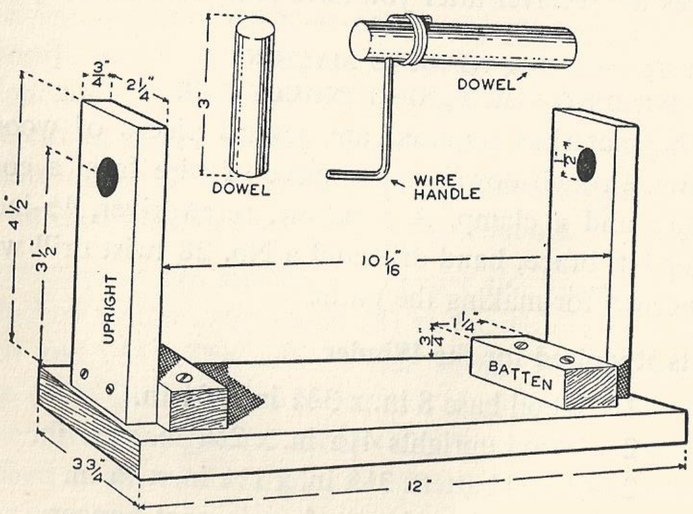
The materials required are several pieces of wood, screws, ½-inch dowel rod, a piece of wire from a coat hanger and a clamp. A handsaw, screwdriver, ½-inch auger bit, brace, hand drill and a No. 28 twist drill will be needed for making the parts.

Parts Required for the Winder

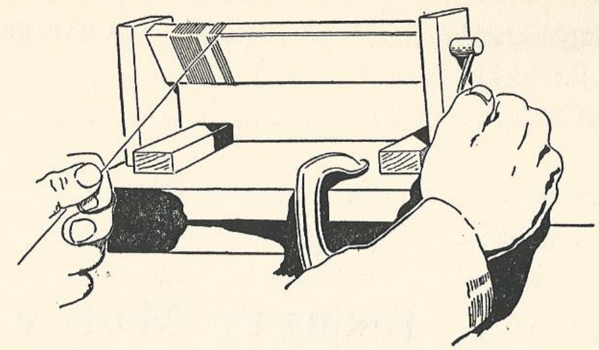
- 1 Wood base 8 in. x 3¾ in. x ¾ in.
- 2 Wood uprights 4½ in. x 2¼ in. x ¾ in.
- 2 Wood battens 3½ in. x 1¼ in. x ¾ in.
- 1 Piece of steel wire from a coat hanger
- 8 No. 6 wood screws 1¼ in. long

Cut the wooden parts to the dimensions shown in the illustration. Give them one or two coats of shellac or varnish. Bore a ½-inch diameter hole through both uprights on their center line and 3½ inches from the lower end.

Bore two holes in each upright with a No. 28 twist drill. The holes should be ⅜ inch from the end, and at the end opposite the ½-inch hole. Slip a No. 6 wood screw through each of the small holes in the uprights and fasten each upright to a batten. Fasten each batten to the base, using two screws. The battens should be located so that the distance between the uprights is $\frac{1}{16}$ inch longer than the wood core of the inductance. The ½-inch holes in the uprights are bearings and must be in line so that a piece of ½-inch diameter dowel will pass through both



PARTS FOR THE COIL WINDER


WINDING THE TUNING INDUCTANCE

holes and turn without binding. To align the holes, first fasten one upright and batten to the base. Then slip a long piece of ½-inch dowel through the bearing holes in both uprights, and fasten the second batten and upright to the base at the proper distance. Assembling the winder with a long dowel in the bearing holes should bring the holes in alignment.

Two pieces of ½-inch dowel 3 inches long are used as a shaft for the wood core which is to be wound. Bore a ½-inch diameter hole in each end of the core along its axis. Make the holes 1½ inches deep. A piece of steel wire (from a coat hanger) is slipped through a hole near the end of one of the 3-inch dowels and bent to form a crank. This wire handle is used to turn the core when winding it. The two pieces of dowel used as a shaft should fit tightly into the holes in the end of the core. It may be necessary to wrap them with a layer or two of paper to make a snug fit. The dowel shafts must turn freely in the bearing holes in the uprights. If they are too tight in the bearing holes, free them by sandpapering the dowels to make them slightly smaller.