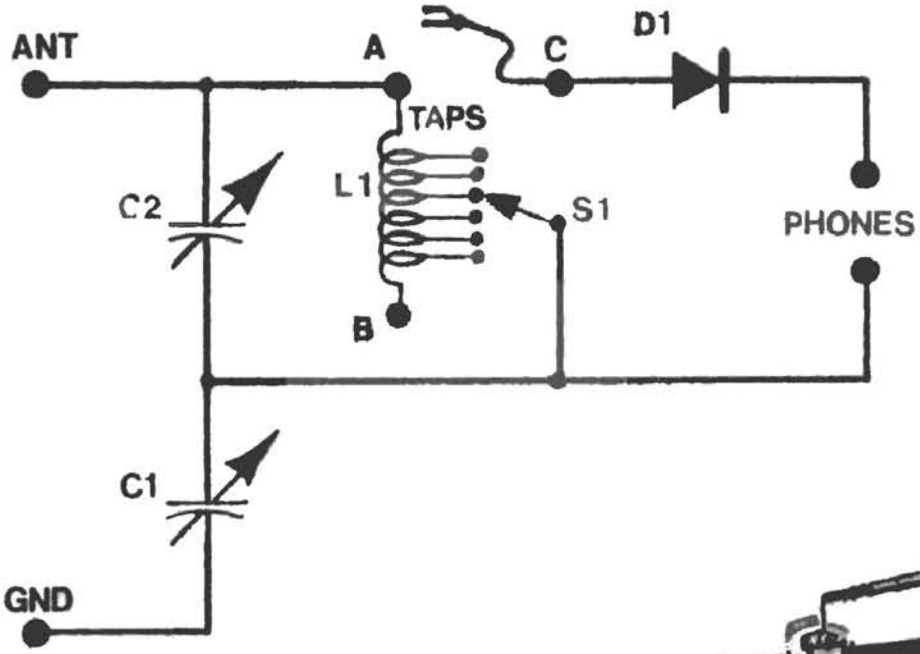
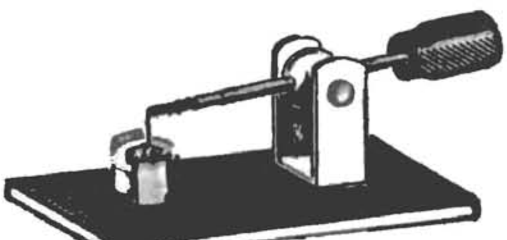
all about
CRYSTAL SETS

by
Charles Green





How-To-Build Simple Crystal Set Radios

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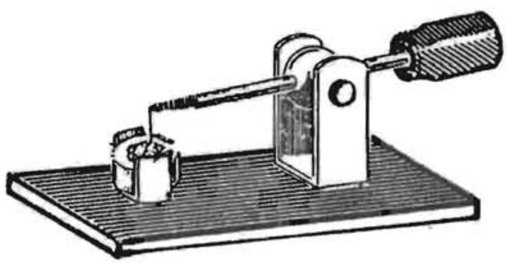

How - To - Build Simple Crystal Set Radios

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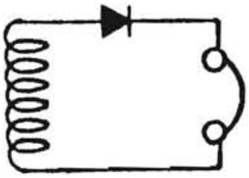
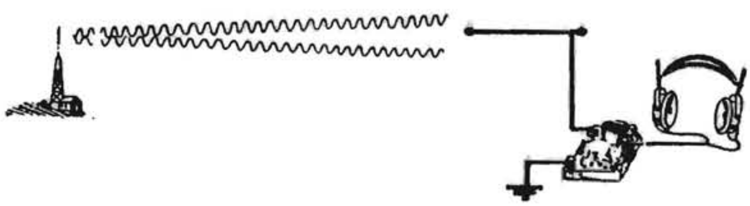


PREFACE

In the beginning of this century, when radio was called "Wireless", most of the early experimenters used a crystal set to receive radio signals.

The crystal set is still the simplest type of radio receiver. A catwhisker (made from a thin wire) touching a sensitive spot on a piece of galena or silicon mineral crystal and a tuning coil, form the basic parts of this radio.



Radio signals from a nearby station are picked up via antenna and ground connections to the crystal set. The galena or silicon crystal detects the signals and the resultant audio is heard with headphones. No battery or electrical power is required.

This book tells you about crystal sets and shows you how to build them.

Charles Green

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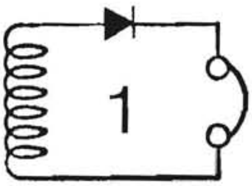
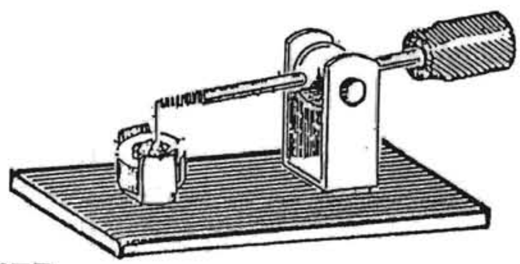


THE CRYSTAL DETECTOR

A crystal detector of radio waves can be either a traditional catwhisker and natural mineral crystal, or a modern semiconductor diode.

SEMICONDUCTOR DIODE



CATWHISKER DETECTOR

Certain natural minerals such as galena (lead sulphide) and silicon have electrically sensitive surface spots. In the beginning of this century, experimenters discovered that electrical current would flow into the sensitive spot on a mineral crystal from a catwhisker, but would not pass readily (high resistance) from the crystal to the catwhisker. This unique feature was used to detect (rectify) radio waves and extract the audio modulation.

HOW-IT-WORKS

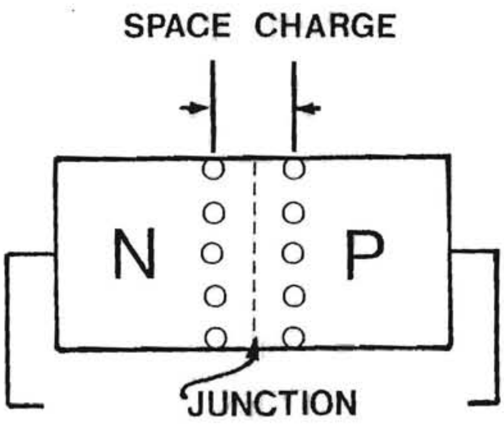
There are two general types of crystal detctors;

- . Point contact diode
- . Junction diode

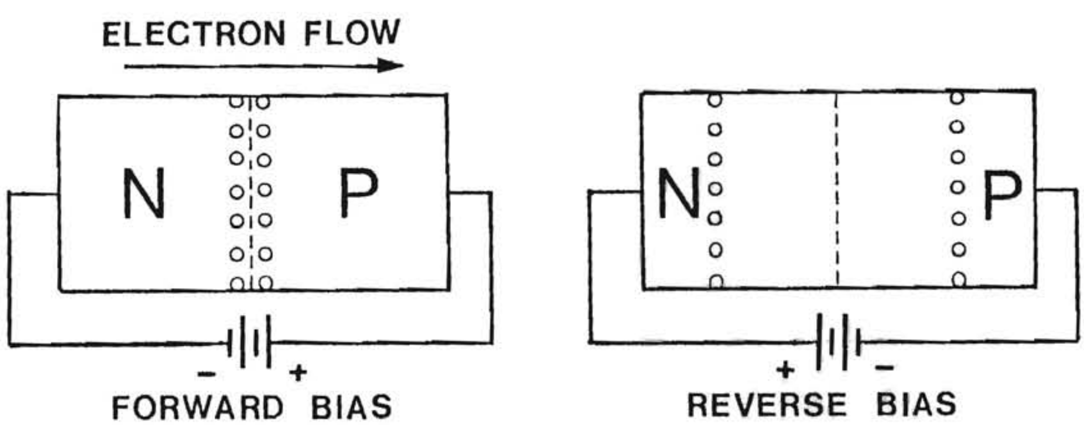
Both types use semiconductor material such as silicon, germanium, or galena. The basic semiconductor junction diode is made of two portions of the material "doped" in manufacturing by adding controlled amounts of chemicals. The doped portions have opposite electrical properties:

"P" TYPE, with an excess of positive electrical charges (holes).
"N" TYPE, with an excess of negative electrical charges (electrons).

Junction Diode



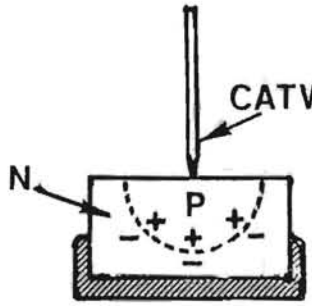
The boundary between the two doped portions is called a PN junction. The area on both sides of the PN junction is called the space charge region. When a positive voltage is applied to the "P" material (and negative voltage to the "N" material), the space charge region becomes narrow and electron current flows through the PN junction.



When the voltage polarities are reversed, negative to "P" and positive to "N", the space charge region widens (increasing the effective resistance of the PN junction) and the electron flow is very small (back current). If an ac voltage is applied to the PN junction, it will act as a rectifier (or radio wave detector).

Point Contact Diode

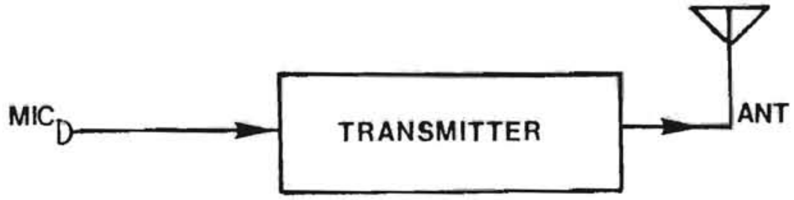
The point contact diode uses a "catwhisker" of thin wire contacting the surface of doped "N" semiconductor material. The pointed end of the wire produces a high intensity electric field in the area of the semiconductor surrounding the wire. When an electric current flows from the wire to the semiconductor material, a small region of "P" material forms around the area of the point contact. Thus a PN junction is formed which operates in the same way as the junction diode.

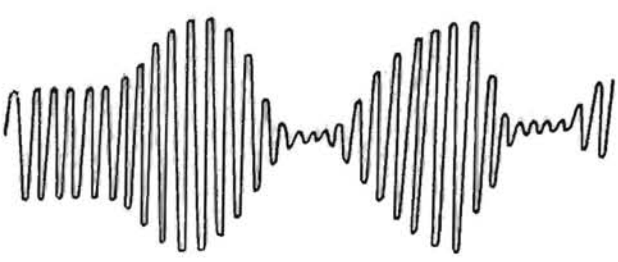


The sensitive spots of galena and silicon crystals used in traditional catwhisker detectors have naturally doped areas of semiconductor material, and operate in the same way as the point contact detector.

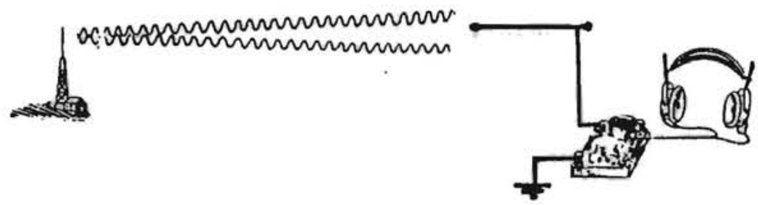
DETECTION OF RADIO WAVES

At the transmitting radio station, a microphone converts sound waves into electrical audio signals. The audio signals then modulate the transmitted radio waves.





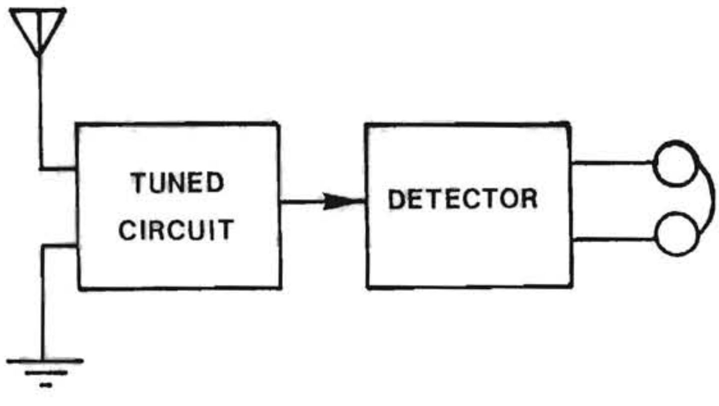
The transmitted radio waves are intercepted by the receiving antenna and small rf currents are induced in the antenna wire. The rf currents (high frequency ac) flow through the detector to ground. As previously explained, the crystal detector will pass current in only one direction, therefore, pulsating dc voltages (detected audio signals) are developed by the crystal equivalent to the audio modulation of the transmitted radio waves.



The detected audio signals flow through the headphone coils and affect the intensity of a magnetic field. This causes the steel discs of the headphones to vibrate and produce audible sound waves.

TUNING THE CRYSTAL SET

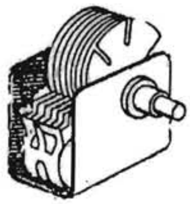
The antenna intercepts all radio waves in the area, and the signals will be heard jumbled up in the earphones. A nearby radio station may be received with the other stations heard in the background.



In order to receive a radio station properly, the crystal set must be tuned to the frequency of the transmitter. A tuned circuit composed of an rf coil (inductance) and a capacitor, is connected between the antenna/ground circuit and the detector.

Capacitor

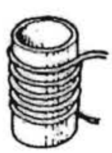
The modern capacitor is evolved from the old Leyden jar. It consists of two or more metal sections separated by a dielectric (air, paper, or plastic). The capacitor stores energy in the form of an electrostatic charge in its dielectric. A variable capacitor (used in a tuned circuit) has movable metal sections that adjust the amount of capacity.



A capacitor will allow pulsating dc current or ac current to flow through it, but will block steady dc current. A capacitor has an oppositon or "reactance" to ac that varies with frequency. The higher the frequency, the lower the reactance of a given value of capacity. Capacity is measured in micro-farads (uF) or micro-micro-farads (picofarads) (uuF or pF).

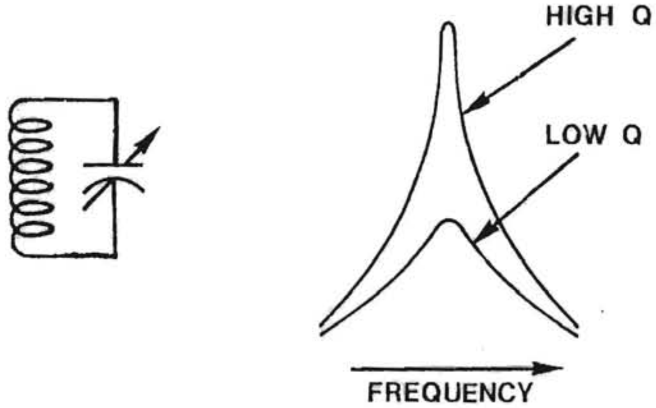
RF Coil

An rf coil is made of insulated copper wire wound on a plastic or cardboard tube. When electric current flows through the coil, a magnetic field is created. This magnetic field resists any change in electric current flow. This opposition or "reactance" to ac varies with frequency. The higher the frequency, the higher the reactance of a given value of rf coil inductance. Inductance is measured in millihenrys (mH) and microhenrys (uH).

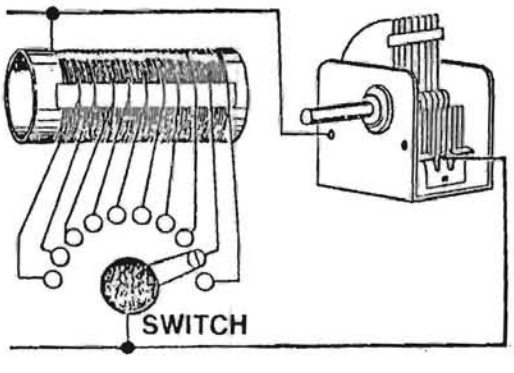


Tuned Circuit

A tuned circuit is composed of a capacitor and an rf coil. As previously described, the reactances of a capacitor and an rf coil change with frequency (but in opposite ways). At a particular frequency, the two reactances will cancel each other out. This condition is called "resonance". The impedance of a parallel tuned circuit is at its highest at resonance. Radio signals at the resonant frequency will be greatly magnified, while signals at other frequencies will be shunted to ground (rejected).

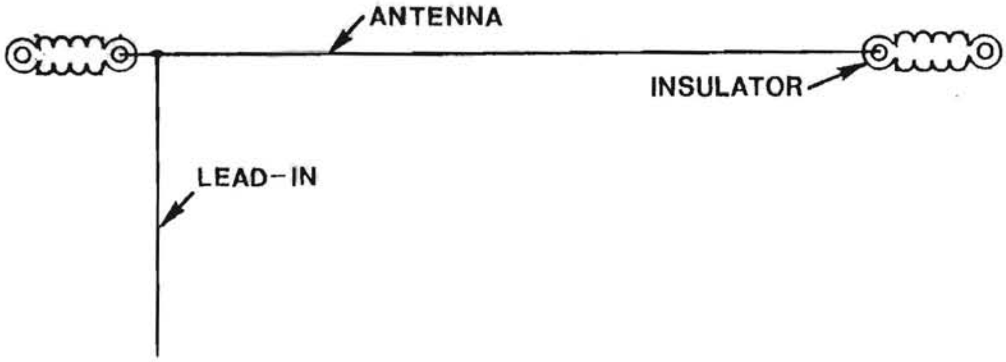


The resonant frequency of a tuned circuit can be changed by adjusting the capacitance (using a variable capacitor), or by varying the inductance (using a slider or taps on the rf coil). A ferrite core can also be used to change the inductance of a coil. The selectivity of a tuned circuit is dependent upon the quality (Q) of the components and the inductance /capacity ratio (L/C ratio). A high-Q tuned circuit is more selective than a low-Q circuit. A tuned circuit with a high L/C ratio (large inductance and small capacity) is more selective than a low L/C ratio circuit.



ANTENNA AND GROUND

A simple crystal set depends upon the strength of the radio waves received by the antenna to produce audio in the earphones. If you live in a strong signal area (a nearby radio transmitter), a crystal set can produce loud audio in earphones with only an inside antenna. But in lower signal areas, a good outside antenna with a ground connection is required.



If you are fortunate enough to be able to put up an outside antenna, the basic rule of thumb is the higher, the better reception. Check your local electronics store for an antenna kit. You can construct an antenna using a glass or plastic insulator at each end of a length of copper wire (insulated or bare). Make the antenna as long as possible. It does not have to be in a straight line to work.

CAUTION

ANTENNA INSTALLATION
NEAR ELECTRICAL POWER
LINES IS DANGEROUS.

Make sure that your antenna
is far enough away from any
power line, so that it will
not touch a wire if it falls.

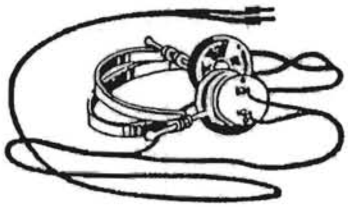
Connect a length of insulated wire between the end of the antenna and your crystal set antenna terminal. This antenna lead-in wire can be fed into your house through a window.

If you can not erect an outside antenna, run a length of insulated wire as long and high as possible through your house or apartment. It will work, but not as well as an outside antenna because of the shielding affect of the house walls.

Connect a ground lead to a cold water pipe. Make sure that it is a metal pipe. Or, you can buy a ground rod from your local electrical supply store and drive it into the ground near your house. Then connect your crystal set ground lead to the rod. For safety install a lightening arrestor between the antenna lead and ground (see the instructions with the device).

HEADPHONES

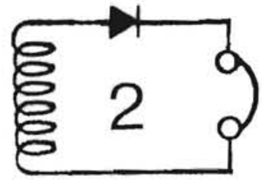
Headphones (also called earphones, or headset) are required to hear the received audio from a crystal set. The standard headphones are made with dual coils of fine wire connected in series in each phone. Horseshoe magnets are built into each phone case to provide a magnetic field. A disk of thin sheet iron (diaphragm) is mounted near the top of the coils. The phones are connected in series with a set of flexible leads terminated in metal "phone tips".



Detected audio signals flow through the coils and affect the intensity of the magnetic field from the horseshoe magnet. This changes the magnetic attraction of the diaphragm, and causes it to vibrate and produce audible sounds.

The total resistance of the series headphone coils is used as a measure of audio sensitivity. A resistance of 2000 ohms is sufficient. More sensitive headphones have a resistance of over 5000 ohms and are used to hear very weak signals.

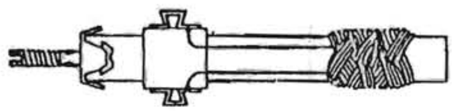
The 2000 ohm headphones can be obtained at electronic parts mail order houses.



SIMPLE RECEIVER PROJECTS

SIMPLE CRYSTAL SET

Look at the schematic diagram. The crystal set uses a tunable ferrite coil L1, and a crystal diode D1. This type of tuning coil is called a "loopstick". The ferrite core is screwed into the coil form and increases the inductance of L1, thus tuning the receiver to a lower frequency.



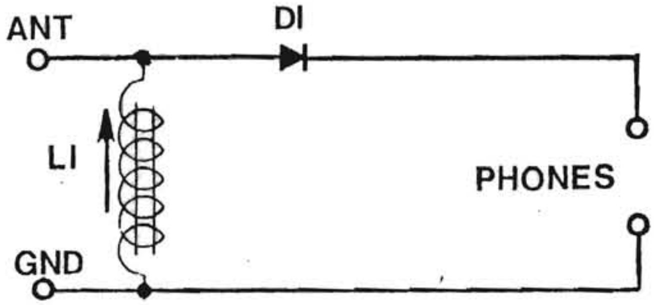
CONSTRUCTION

As shown in the illustration, the crystal set components are mounted on a 5 1/2-inch by 2 1/2-inch by 3/4-inch wood base. Layout and install the crystal set parts in the locations shown. The loopstick L1, is mounted with a metal strip supplied with it. Push the snap-in end of L1 into the large hole of the metal strip. Then bend 1/2-inch of the other end of the strip to form a bracket and mount it on the base with a wood screw. If the metal strip is not available, make one out of sheet metal approximately 2-inches long by 1/2-inch wide. Then drill a hole to fit L1 at one end, and a small hole to fit a wood screw at the other end.

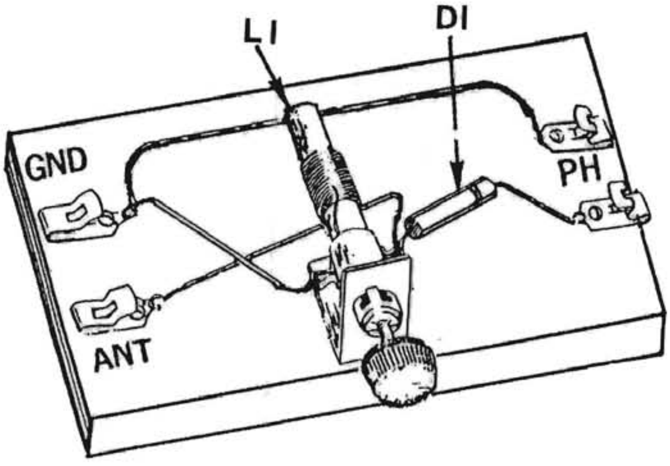
Mount the four fahnestock clips and solder lugs with wood screws in the locations shown in the illustration.

WIRING

Use hookup wire to connect the crystal set components as shown in the schematic and illustration. The loopstick L1 may have three terminals. One of the terminals is a tap, which is not used in this circuit. Make sure that you connect only to the terminals at the start and end of the loopstick coil.



SIMPLE CRYSTAL SET



List of Materials

D1 - Germanium diode
    (1N34A or equiv.)
L1 - Loopstick
    (see text)
4 - Fahnestock clips
BASE - 5 1/2 X 2 1/2 X
    3/4-inch wood section
PHONES - 2000-ohm headphones
MISC. - Solder lugs, wood screws,
knob and bracket to fit L1,
hook-up wire.

Install a small knob on the end of the L1 adjustment screw. Make sure that the screw turns freely with the knob. Position the 1N34A diode as shown before soldering the leads.

Experiment 1

Connect the antenna, ground, and 2000-ohm headphones to the crystal set terminals. Rotate the L1 knob counter-clockwise as far as it will go. Do not turn past this point, or you may break the ferrite rod inside the coil form. The ferrite is now outside of the coil winding. This is the highest frequency point of the tuning range of L1.

Slowly turn the L1 knob clockwise and listen for received radio stations. When the L1 knob is turned fully clockwise, the ferrite will be completly inside the coil (increasing the inductance) and it will be at the lowest frequency point of the tuning range.

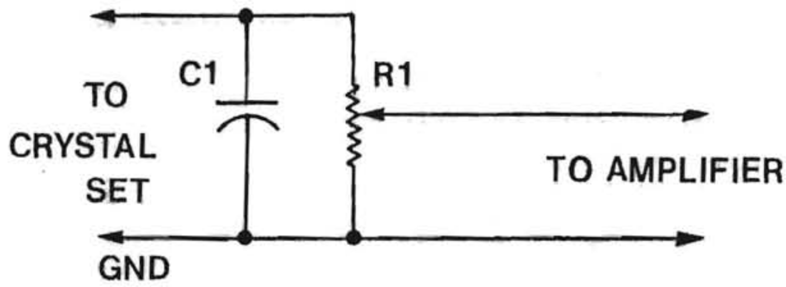
Experiment 2

Connect capacitors, with values from 50 mmf to 300 mmf, in parallel with L1. Then tune L1 and note how the frequency range has changed.

AMPLIFIER CONNECTION

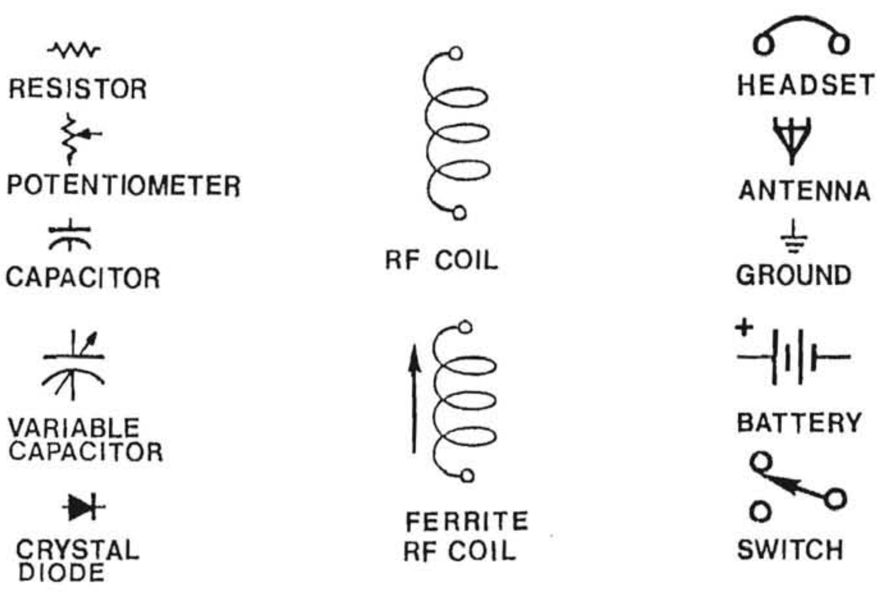
The simple Crystal Set (and the other receiver projects) can be connected to an amplifier in place of earphones. This amplifier can be a single channel input of your home stereo.

Parts values are not critical; C1 is approximately .005 mfd, and the volume control R1 can be any value from 1000 ohms to 10,000 ohms. Use shielded wire between R1 and the amplifier input jack.



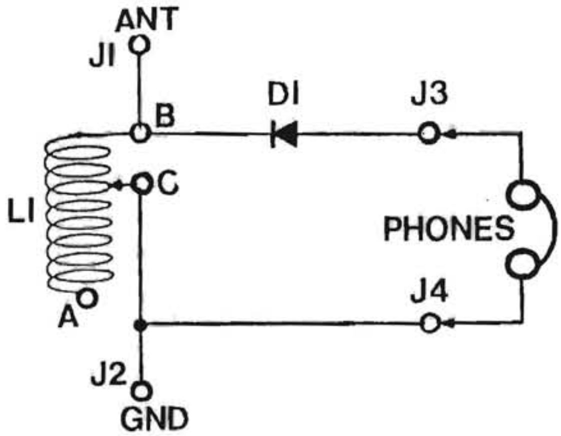
Amplifier Connection

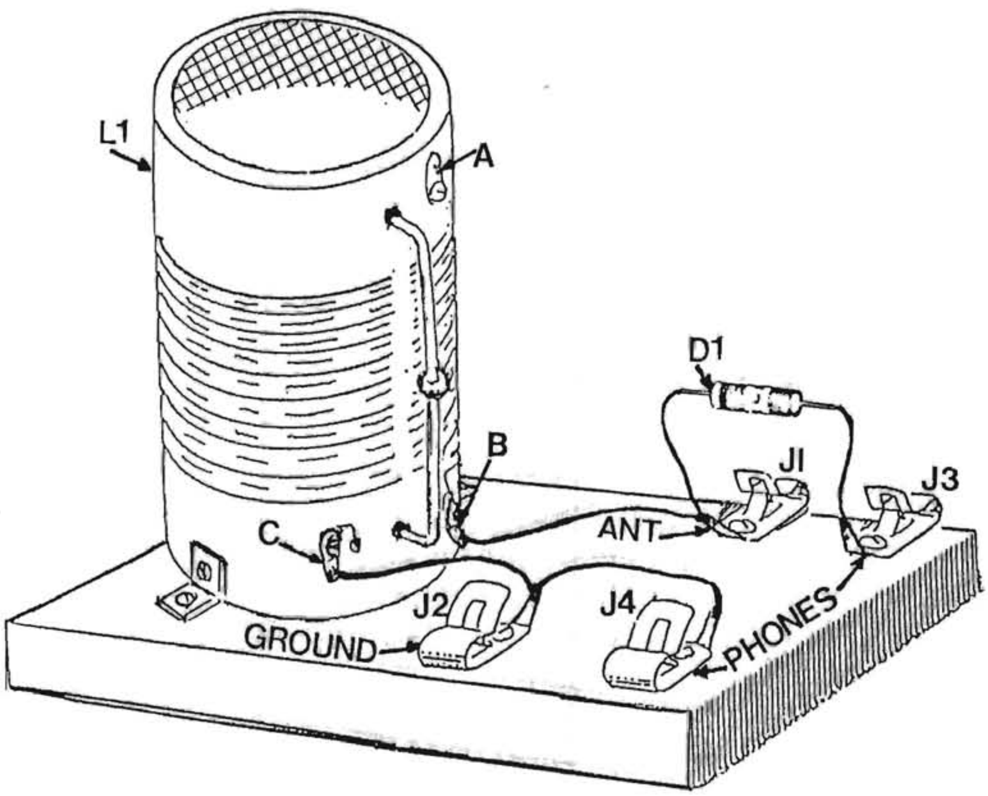
Schematic Symbols



List of Materials

D1 - Germanium diode, type 1N34A, 1N60, 1N82A, or equiv.
L1 - Slider-tuned coil (see text)
4 - Fahnestock clips (terminals)
BASE - 6 x 3 x 1/2-inch section of wood (see text)
PHONES - 2000 ohms headphones
MISC. - Coil form (see text), No. 24 enameled copper wire, 3/32 inch dia. brass rod, brass ball slider (see text), solder lugs, two small brackets, hook-up wire, wood screws, machine screws and nuts.

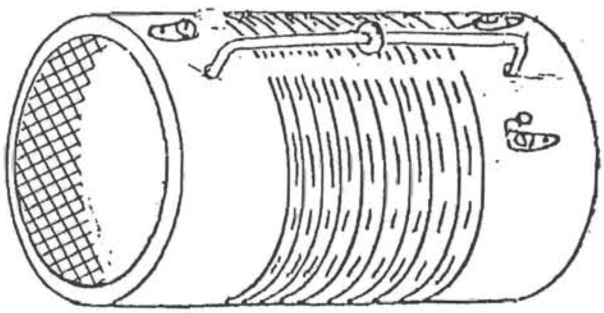




SLIDER TUNED CRYSTAL SET

SLIDER TUNED CRYSTAL SET

In the early days of radio, slider tuned coils were used in crystal sets. This method of tuning the inductance uses an adjustable metal contact (slider) that moves over the coil. The slider makes contact with individual coil wires to tune in the radio stations.

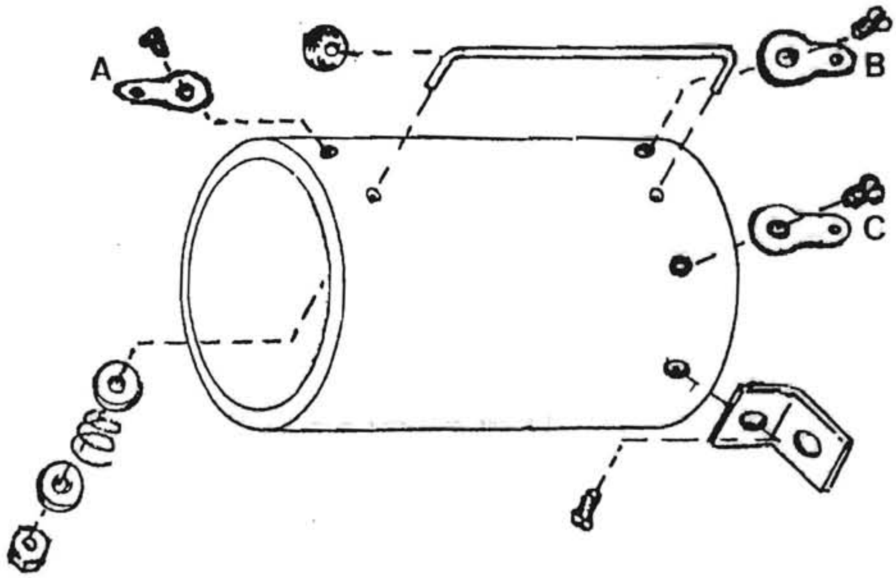


The enamel insulation of the coil wires in the slider path is removed for good electrical contact.

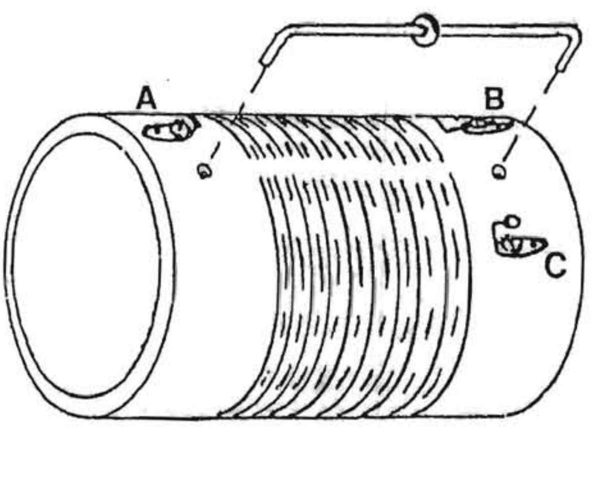
You can experiment with a slider tuned coil by building this crystal set. As shown in the illustration, the coil is mounted upright on a 6-inch by 3 1/2-inch by 1/2-inch wood base. A semiconductor diode is used for a detector.

TUNING COIL CONSTRUCTION

Look at the drawing of the tuning coil L1 construction details on the next page. The tuning coil is wound on a cardboard or plastic mailing tube section, 2 5/8-inches in diameter and 5-inches long. Make sure that you select a rigid, thick-walled tube for a coil form. The tube used in our model has a 3/16-inch wall. The coil form must be rigid to hold the slider ball and rod assembly.

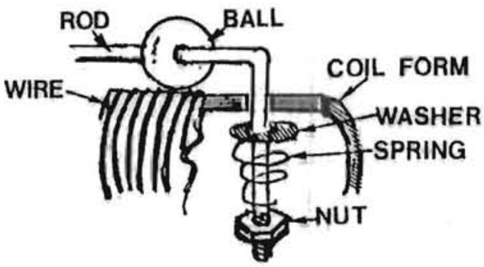


Before winding the coil, drill all the holes in the form as shown in the drawing, and then install the solder lugs. Position the solder lug ends toward the coil form edges.



The coil is wound with No. 24 enameled copper wire. Remove the enamel from the wire end with sandpaper and then solder the wire to the lug. Start winding the coil, keeping the turns as tight and close together as possible. Wind the wire to the front of the bottom solder lug B. Remove the enamel and solder the wire end to the lug.

A brass ball approximately 3/8-inches in diameter is used as the moving contact slider. This brass ball can be found at your local electrical supply store. It is a type of ball that is used as a top nut for small table lamps. Drill a hole through the ball so that it will slide over a length of 3/32-inch diameter brass rod. Bend the brass rod at each end (after placing the ball in the center of the rod), to fit through the holes in the coil form as shown in the drawing. Cut the rod 1-inch down from the bend at each end.



Insert the brass rod with the slider ball into the coil form holes. Then place a small washer and spring on one end of the rod (inside the coil form). Solder a nut on the end of the rod to hold the spring in place. Do the same to the other end of the rod. After soldering, slide the ball over the wires and check that it slides smoothly. Use sandpaper to remove the enamel insulation of the wires in the path of the ball slider. Connect a wire between the soldered nut on the bottom end of the brass rod and the solder lug near the rod.

BASEBOARD

All of the crystal set components are mounted on a wood baseboard as shown in the drawings. Cut the baseboard to size; a 6-inch by 3 1/2-inch section of 1/2-inch thick wood (maple is used in our model). Sand the edges after cutting. It is not necessary to paint or stain the baseboard.

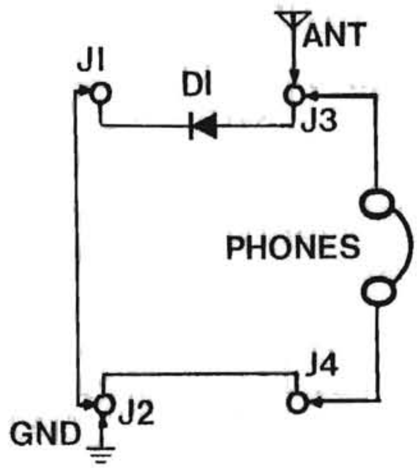
Mount the four terminals and solder lugs as shown in the drawing. Label the four terminals with either rub-on lettering or cemented paper tags. Install two brackets on opposite sides of the bottom of the coil, and mount it on the baseboard with the lugs toward the terminals.

WIRING

Bare No.22 wire was used to wire our model, but any kind of hookup wire can be used. Connect the wires between the solder lugs as shown in the drawing, except do not connect the antenna terminal lug wire to the coil terminal at this time. Connect the crystal diode between the solder lugs as shown.

Experiment 1

This experiment will show how an untuned crystal detector functions.



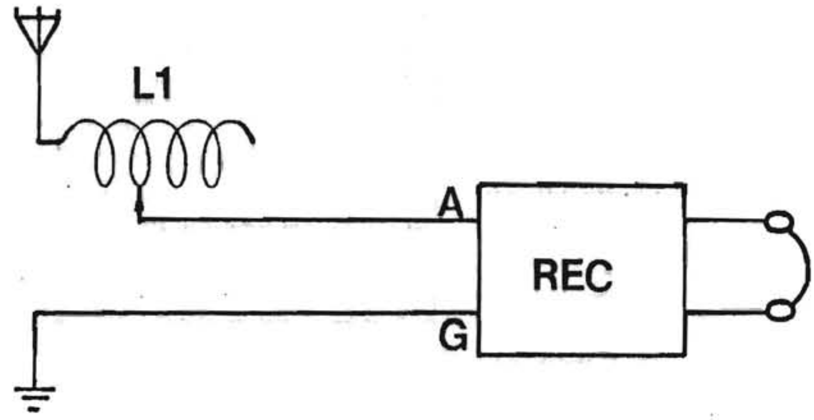
Connect the untuned detector circuit as shown in the drawing, and then hook-up your antenna and ground leads. Connect 2000-ohm headphones to the circuit and listen to the detected radio waves.

You will probably hear a strong local radio station, with other, weaker radio station transmissions all jumbled together.

Experiment 2

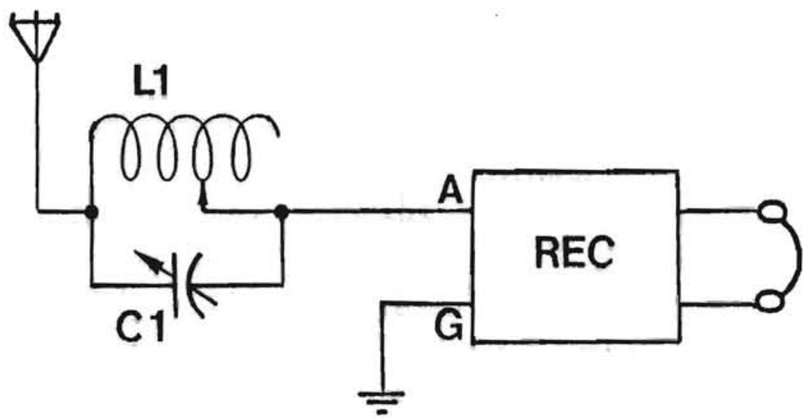
Reconnect the baseboard wires to the circuit of the Slider-Tuned Crystal Set as shown in the drawing. Listen to the detected radio waves as you tune the coil by sliding the brass ball over the sanded wire path. You should be able to receive the radio stations much better than the untuned detector circuit of Experiment 1.

LOADING COIL

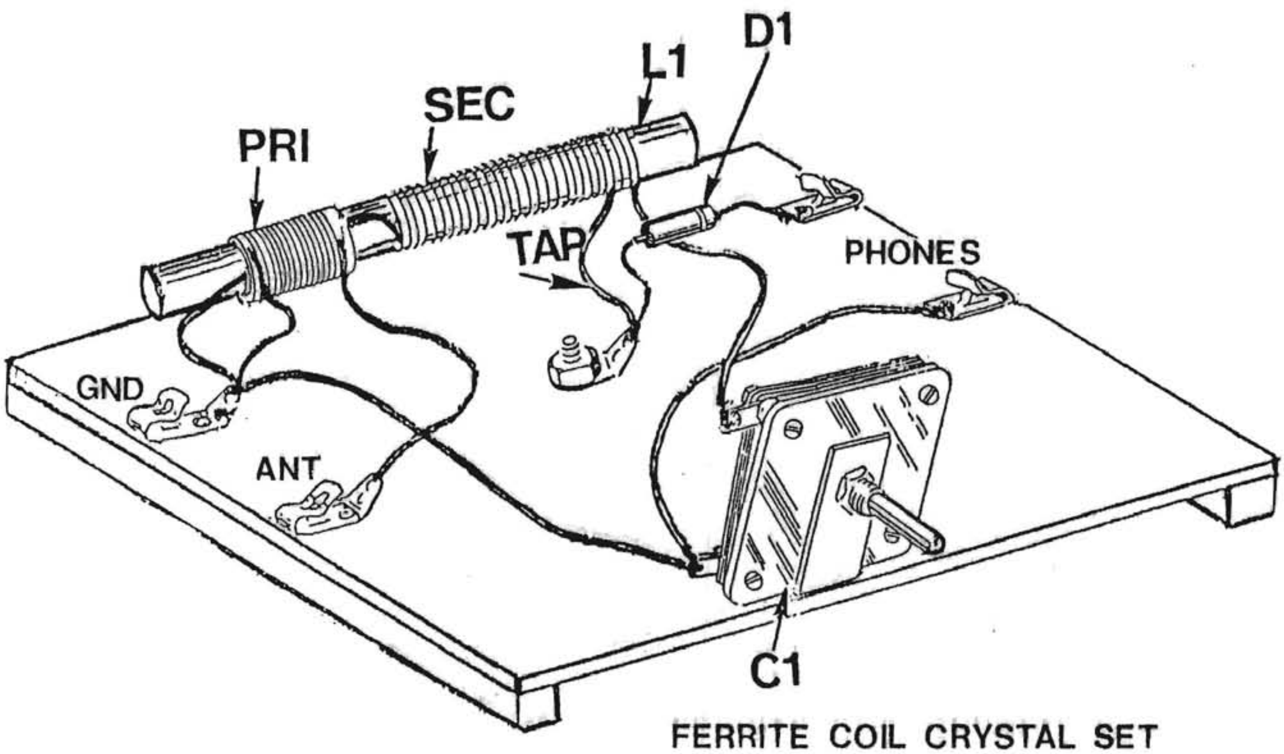


An additional slider tuned coil, L1, can be used as a Loading Coil to increase the electrical length of your antenna. This may allow better reception of the lower broadcast band frequencies. Connect L1 in series with the antenna lead to the receiver, and tune it for best reception.

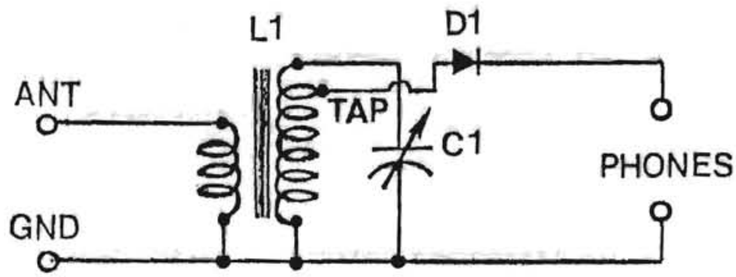
WAVE TRAP



L1 can also be used in a Wave Trap circuit to tune out a strong local signal, and allow easier tuning of weaker stations. C1 is a 365 mmf variable capacitor connected in parallel with L1. Adjust L1 and C1 so that the interfering station is at minimum.



FERRITE COIL CRYSTAL SET

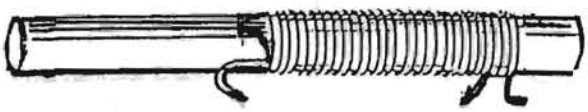


List of Materials

C1 - 365 mmf variable capacitor.
D1 - Germanium diode (1N34A or equiv.).
L1 - Ferrite coil (see text).
4 - Fahnestock clips.
2 - wood sections; 6 X 1/2-inch square (see text).
BASE - 8 1/2 X 6-inch sheet plastic (see text).
PHONES - 2000-ohm headphones
MISC. - plastic tube section for L1 primary winding (see text), solder lugs, machine screws and nuts, wood screws, bracket for C1 (see text), knob for C1, hookup wire.

FERRITE COIL CRYSTAL SET

This crystal set has a large ferrite core coil L1 of a type that is normally used for a built-in antenna in portable radios. This type of coil has a very high "Q" and may be more selective than an air-core coil. As you can see in the schematic, a primary coil is wound around the ferrite coil. The original winding is used as the secondary.



The primary coil (connected to the antenna and ground) can be moved close to, or away from, the secondary (original winding connected to D1). This variable coupling is used to control the selectivity of the crystal set.

PRIMARY COIL

The primary coil is wound on a 1-inch section of plastic tube that can fit loosely over the ferrite rod. A 1/2-inch diameter plastic tube is used on the receiver shown in the illustration. Wind 12-turns of hookup wire evenly over the tube and twist the ends together to prevent movement. Leave 4-inch leads from the primary coil winding. Slide the primary coil over the center of L1.

BASEBOARD

The crystal set components are mounted on a 8 1/2-inch by 6-inch section of sheet plastic. The thickness of the plastic is not critical, but it must be rigid enough to hold the parts without bending. A 6-inch long 1/2-inch square wood section is installed under each end of the baseboard. A section of wood can be used for the baseboard with wood screws to mount the parts, in place of machine screws and nuts.

The model shown uses a plastic variable tuning capacitor, but an air type capacitor can be used for C1 instead. Make a metal bracket approximately 1-inch wide by 1 1/4-inch high and a 1/2-inch right angle mounting foot from sheet aluminum. Drill a hole in the top of the bracket to fit C1 and two holes in the mounting foot to fit small machine screws. Locate the components on the baseboard as shown in the illustration and then drill mounting holes. If you have a cardboard or plastic mounting supplied with ferrite coil L1, you can mount it on the baseboard. If not, L1 can be taped loosely on top of the baseboard. Th ferrite coil L1 in our crystal set was obtained from an old radio. Install the components on the board with solder lugs, machine screws, and nuts.

WIRING

Connect the parts with hookup wire as shown in the illustration. Use the schematic diagram as a guide. Make sure that the ground lead from L1 secondary passes inside the primary coil. Also check that the primary coil slides freely over the L1 winding. Install a knob on the C1 shaft, and mark the terminal designations on the baseboard.

Experiment 1

Hookup the antenna, ground and 2000-ohm headphones to the crystal set terminals. Slide the primary coil over the center of the L1 winding. Tune C1 for radio stations. Then slide the primary coil towards the ground end of L1 while tuning C1. Note the difference in selectivity.

Experiment 2

Change the number of turns of the primary winding and repeat Experiment 1.

Operating Tips

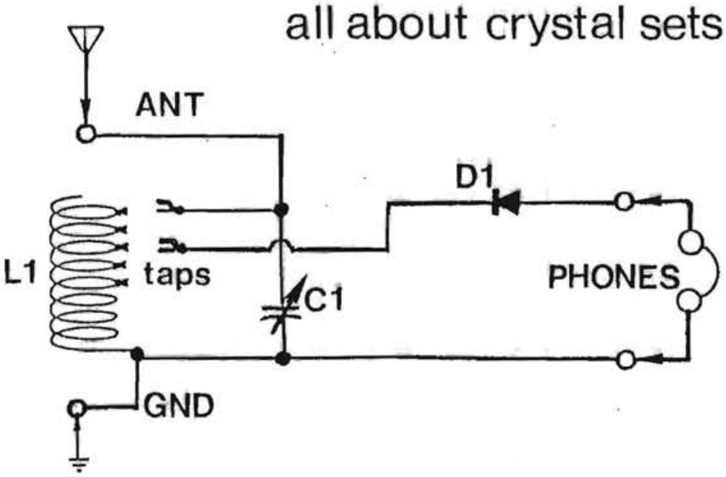
After operating a crystal set for some time, you may notice a difference between day, evening, and night reception of radio stations. This is due to the two ways that radio signals travel between the transmitting antenna and a receiving antenna.

(a) The ground wave; which moves along the surface of the earth.
(b) The sky wave; which travels upward and is reflected by the ionosphere.

The reception of broadcast stations is dependent upon the time of day. During daylight hours, stations are received primarily by ground wave transmission. At night, the broadcast stations will be received via sky wave transmission. Also, some radio stations change to a lower power at night. Reception in the evening may be more difficult as the fading ground wave is interfered with by reflected waves. But later, it may be possible to hear far-away stations transmitted by sky wave.

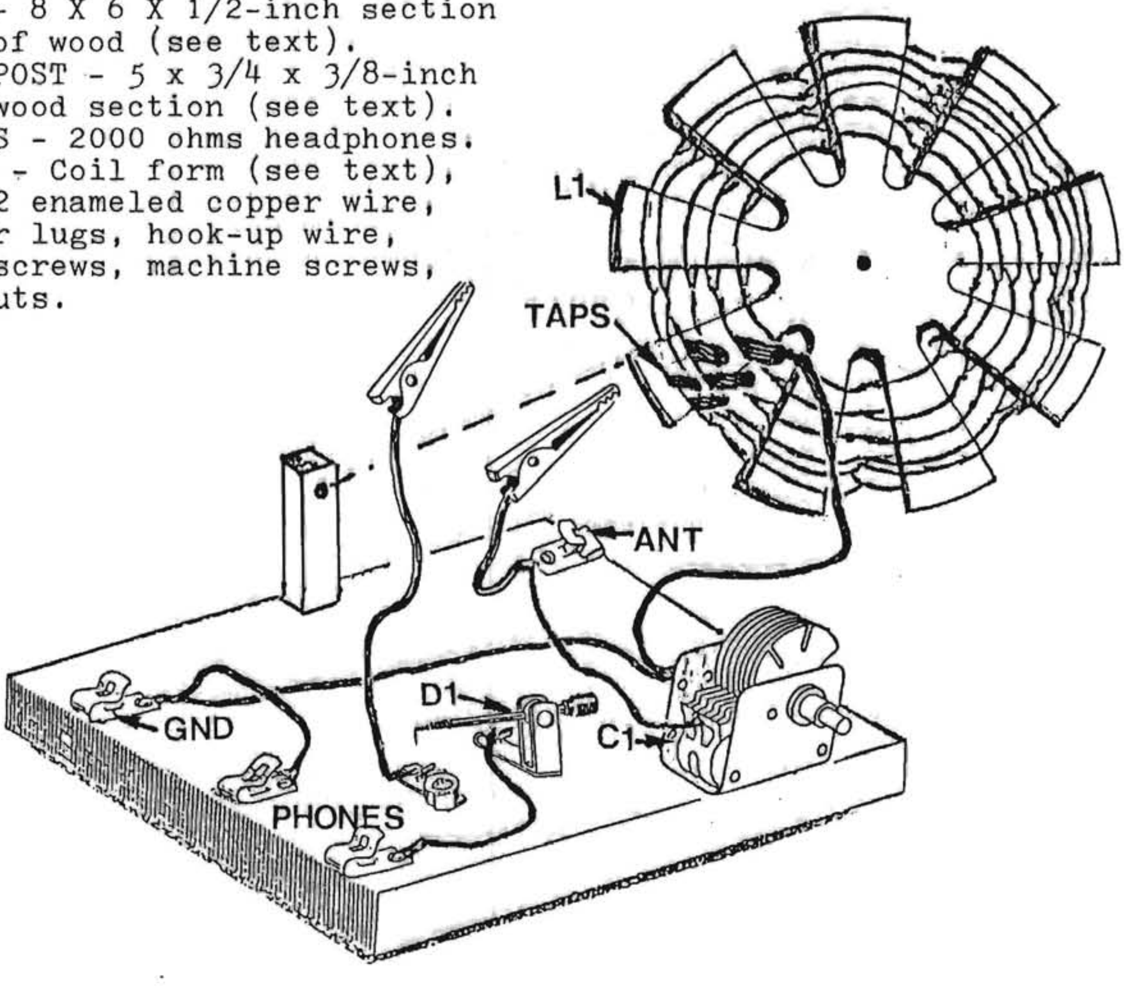
Your geographical location to radio stations is very important for reception, as a crystal set receiver does not amplifiy signals. It is entirely dependent upon the strength of the radio waves. If you are in a deep valley surrounded by high mountains, reception will be difficult. If you live in a flat plain, with no obstacles to radio transmission, reception may be very good.

An outside antenna is necessary for for best reception. If possible, try erecting an extra antenna at a right angle to the original one, and switch it in to provide a directional effect for increased signal strength. Keeping a log of received stations for a week may be helpful in determining the radio reception conditions in your area.



List of Materials

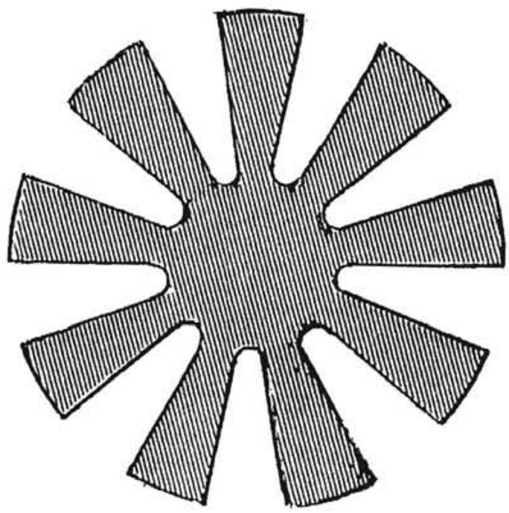
C1 - 365 mmf variable capacitor.
D1 - Catwhisker crystal detector (or 1N34A or equiv. diode).
L1 - Spiderweb coil (see text).
4 - Fahnestock clips.
2 - small alligator clips
BASE - 8 X 6 X 1/2-inch section of wood (see text).
MTG. POST - 5 x 3/4 x 3/8-inch wood section (see text).
PHONES - 2000 ohms headphones.
MISC. - Coil form (see text), No. 22 enameled copper wire, solder lugs, hook-up wire, wood screws, machine screws, and nuts.



SPIDERWEB COIL CRYSTAL SET

SPIDERWEB COIL CRYSTAL SET

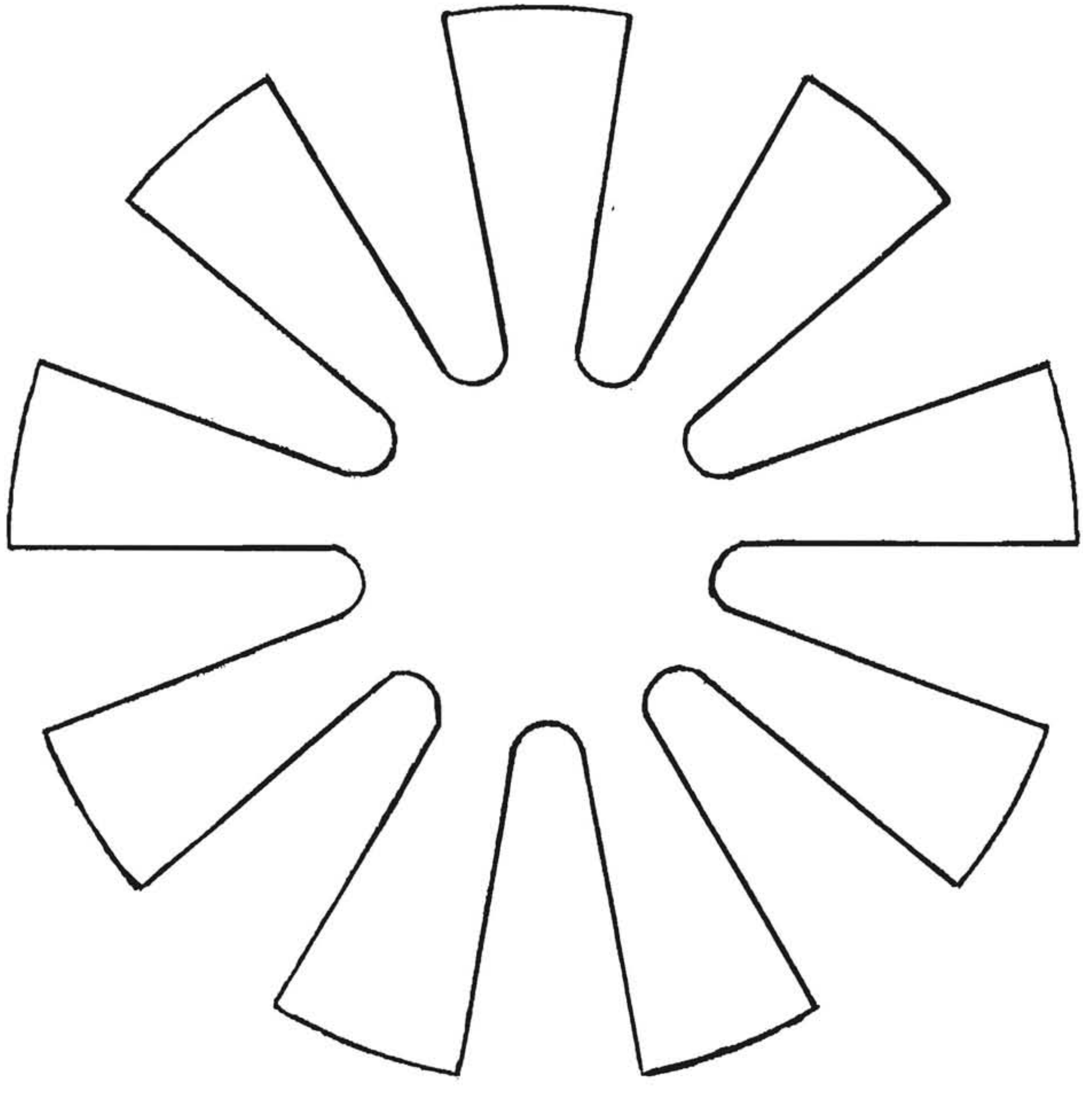
The spiderweb coil is a tuning coil that is wound on a flat wheel form that has an uneven amount of spokes. This type of coil was also used as a loop antenna in early radios.



Our receiver uses a tapped spiderweb coil that is tuned by a variable capacitor. As shown in the illustration, the spiderweb coil is mounted at the rear of a 8-inch by 6-inch by 3/4-inch wood base. A catwhisker crystal detector and a variable capacitor are mounted near the front of the wood base.

SPIDERWEB

The spiderweb coil is wound on a 6-inch diameter flat form that has nine vanes. Make a tracing of the spiderweb coil form template on the next page. Then use carbon paper to transfer the tracing to a section of 1/8-inch fibreboard or sheet plastic. Cut the coil form out with a jeweler's saw, and drill a center hole to fit a small wood screw.



Spiderweb Coil Form Template

Wind the coil with No. 22 enameled copper wire, starting from the center and winding outward. Leave about 5-inches of the starting end of the wire free. It will be used as a connecting lead. Feed the wire behind a vane and over the front of the next vane as you wind. Wind the wire closely and evenly on the form. It is not necessary to count the turns. Wind the wire to about 1/4-inch from the end of a form vane. Then drill a small hole near the vane end, and bend a solder lug through it. Solder the wire end to the lug.

On one of the vanes, count down five wires and then carefully lift it outward. Remove about 1/4-inch of the enamel with a section of sandpaper and then bend the end of a solder lug aound the bared wire. Solder the lug to the wire, then cut off remaining portion of the lug (away from the bentover end). Repeat this every five turns until you have a total of six lug taps on the coil. Stagger the lugs away from each other to keep them from shorting.

BASEBOARD

As shown in the illustration, the Spiderweb Coil Crystal Set parts are mounted on a wood baseboard. Cut the 8-inch by 6-inch baseboard from a section of 1/2-inch thick wood. White pine was used in our model. Sand the surface of the wood after cutting.

Make the spiderweb coil mounting post by cutting out a 5-inch by 3/4-inch by 3/8-inch wood section. Then cut a notch in the center of the rear of the baseboard to fit the wood section. Install the wood section in the notch with small wood screws.

Mount the parts on the baseboard as shown in the illustration with small wood screws. If the mounting holes of the tuning capacitor C1 are on the bottom, drill matching holes in the baseboard and use flathead machine screws to hold the capacitor.

Install solder lugs with the four terminals, and mount the spiderweb coil to the mounting post with a wood screw through a center hole in the coil form. The coil should be positioned with the lugs facing forward (on the left side of the coil form).

WIRING

Connect the crystal set components with hookup wire as shown in the illustration. Use 6-inch lengths of insulated stranded wire to the two small alligator clips.

Experiment 1

Connect antenna, ground, and 2000-ohm headphones to the crystal set. Then connect the D1 alligater clip lead to the antenna terminal. Set the tuning capacitor C1 to minimum capacity (rotor blades all the way out). Connect the antenna clip lead to the tap on L1 near the center of the form.

Adjust the crystal detector D1 catwhisker to a sensitive spot and tune C1 for a radio station. It may be easier to tune for stations if you temporarily connect a crystal diode (1N34A or equiv.) in place of the catwhisker crystal detector.

After a station is heard, you can disconnect the diode and probe for a sensistive spot on the crystal with the catwhisker. Change the antenna clip lead to other L1 taps and continue tuning C1 for radio stations.

Experiment 2

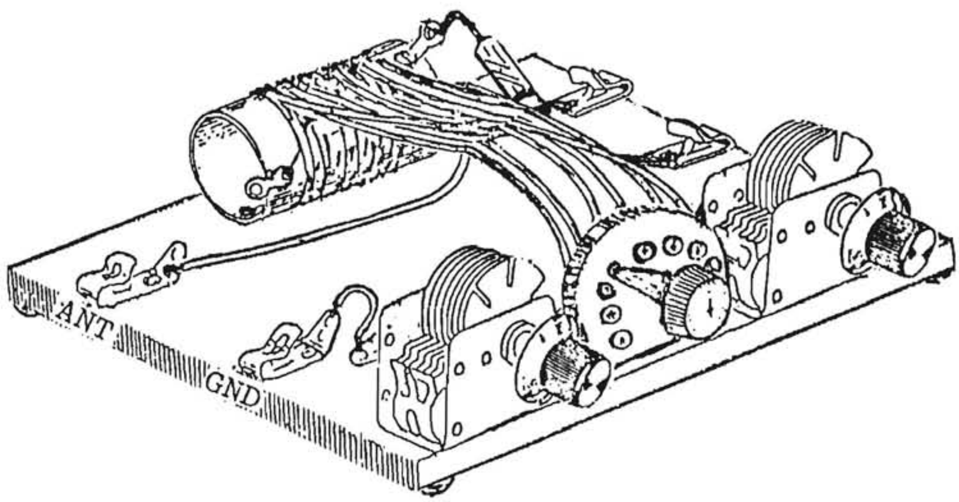
Disconnect the D1 clip lead and reconnect it to a tap on L1 close to the center of the coil. This will load L1 more lightly than if the detector was connected to the top of the coil. Repeat the tuning procedure of Experiment 1 and note the difference in selectivity and volume of the received radio stations. Then tune in a radio station and move the D1 clip lead to other taps on L1. There will be a particular tap point for optimum selectivity and volume for each received station.

STATION LOG

DATE	TIME	DIAL	STATION	NOTES

3 ADVANCED RECEIVER PROJECTS

DUAL TUNED CRYSTAL SET

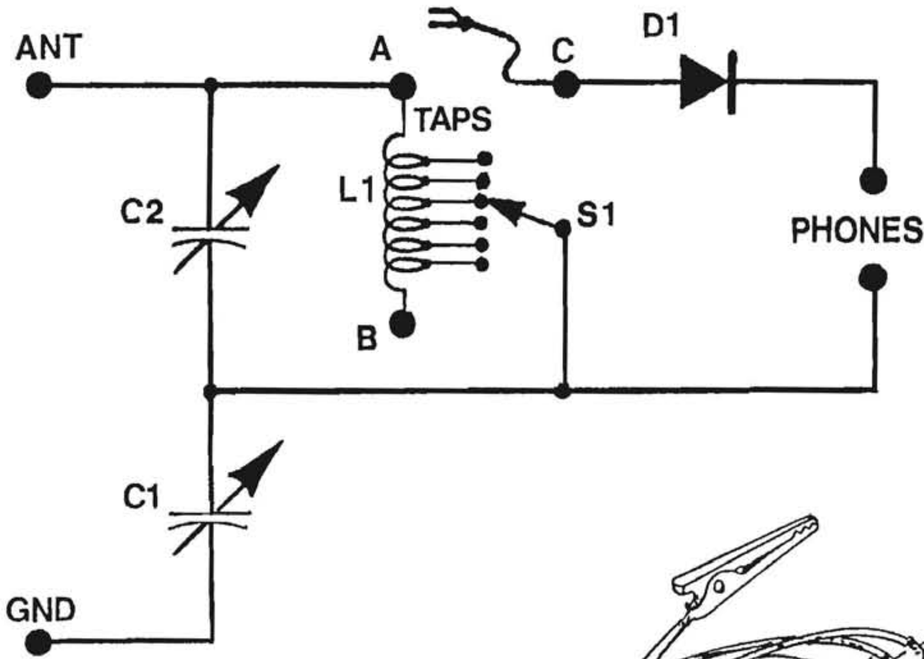


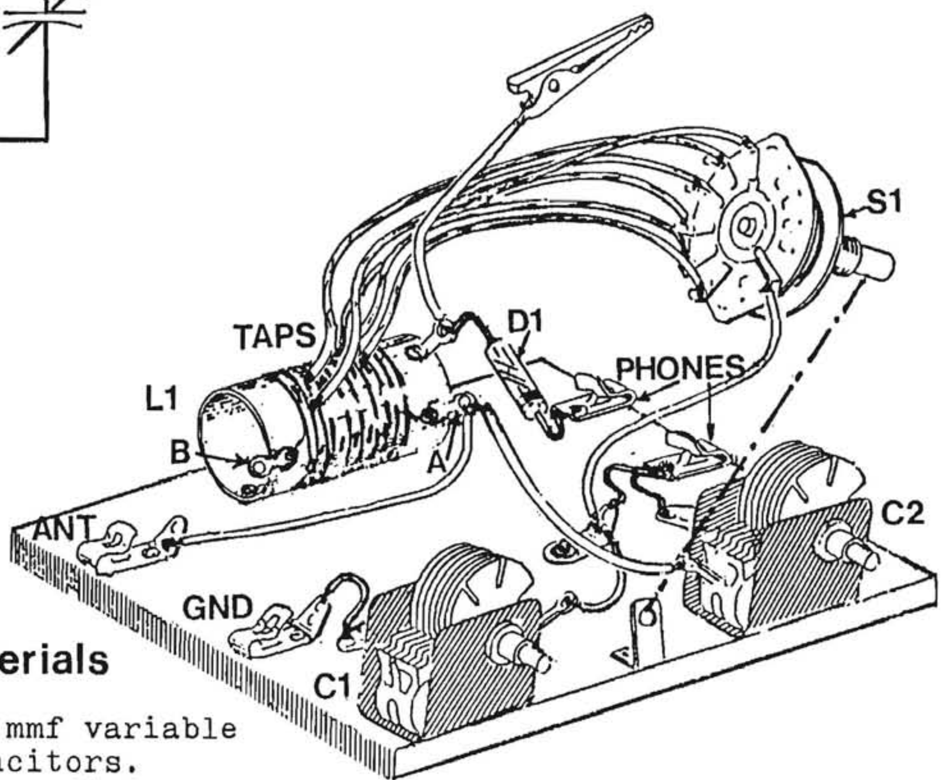
This crystal set circuit uses two variable capacitors C1 and C2. As you can see in the schematic drawing, C1 tunes the ground circuit, and C2 tunes a tapped coil L1. The taps of L1 are connected via the rotary switch S1.

TUNING COIL

Look at the drawing of the coil form construction details on page 34. The tuning coil L1 is wound on a section of 1/8-inch wall plastic tube, 2-inches in diameter, and approximately 4-inches long.

Drill holes in the form and install three solder lugs with machine screws and nuts. Position the solder lug ends towards the coil form ends as shown.





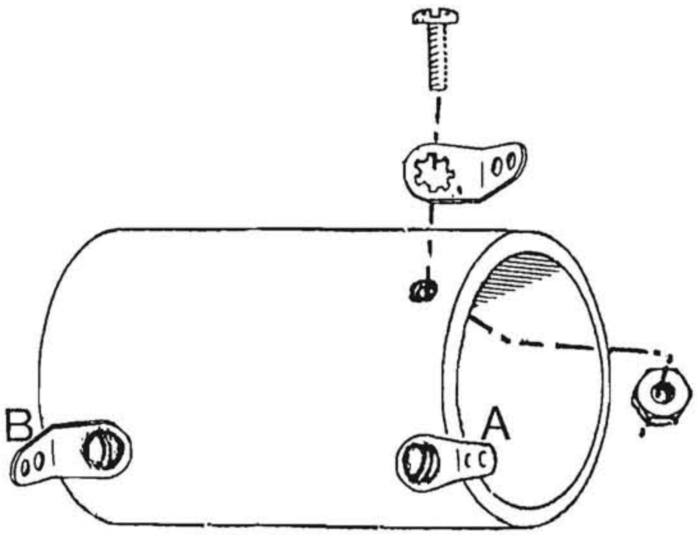
List of Materials

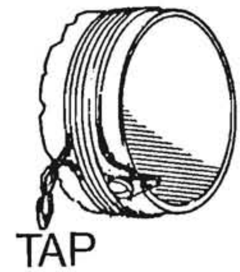
C1,C2 - 365 mmf variable capacitors.
D1 - Germanium diode (1N34A or equiv.).
L1 - Tuning coil (see text).
S1 - 1-pole, 10-position rotary switch (see text).
4 - Fahnestock clips.
1 - Small alligator clip.
BASEBOARD - 5 x 8 x 3/8-inch wood section (see text).
PHONES - 2000-ohm headphones.
MISC. - Coil form (see text), No. 24 enameled copper wire, solder lugs, hook-up wire, wood screws and nuts, knobs, bracket for S1.

DUAL TUNED CRYSTAL SET

The coil L1 is wound with No. 24 enameled copper wire, and is tapped every five turns for a total winding of 75 turns.

Drill a small hole in the coil form approximately 1 1/4-inch from the "A" lug. Remove the enamel from the end of the No. 24 wire and then feed the wire end through the hole. Solder the wire to lug "A".





Wind five closely spaced tight turns around the coil form. Then bend back and twist together 1/2-inch of the wire to make a tap. Position the tap outward and then continue winding the coil, keeping the turns as tight and close together as possible. Make a tap every five turns and then drill a small hole in the coil form after the 75th turn. Feed the wire through the hole, remove enamel, and solder the end to lug "B".

BASEBOARD

The Dual-Tuned Crystal Set is built on a wood baseboard as shown in the illustration. Cut the 5-inch by 8-inch baseboard from a section of 1/4-inch thick plywood. Sand the edges and surface of the baseboard to remove any splinters. Drill holes in the baseboard and install the parts with small machine screws and nuts in the locations shown in the illustration. Drill mounting holes at each end of the tuning coil L1 and position it on the rear of the baseboard with the coil taps toward the front. The illustration shows a commercial rotary switch, but a wooden rotary switch can be used for S1 instead. (See page 53 for construction details.)

Install the four fahnestock clips (used as antenna, ground and headphone terminals) with solder lugs. Mount an additional solder lug on the baseboard midway between S1 and L1.

WIRING

Connect the crystal set parts with hookup wire as shown in the pictorial illustration and the schematic diagram. Use the center solder lug as a junction point for leads from C1, C2 and S1 as shown in the illustration. Connect the leads from S1 to the taps on L1 in numerical sequence; every 5 turns for 7 taps. Then connect the last three leads every 10 taps. Insert the lead ends into the taps and hold them with a drop of solder. This will make it easier to move leads to other L1 taps. Use a 5-inch length of stranded hookup wire for the alligator clip lead connected to D1 at solder lug C.

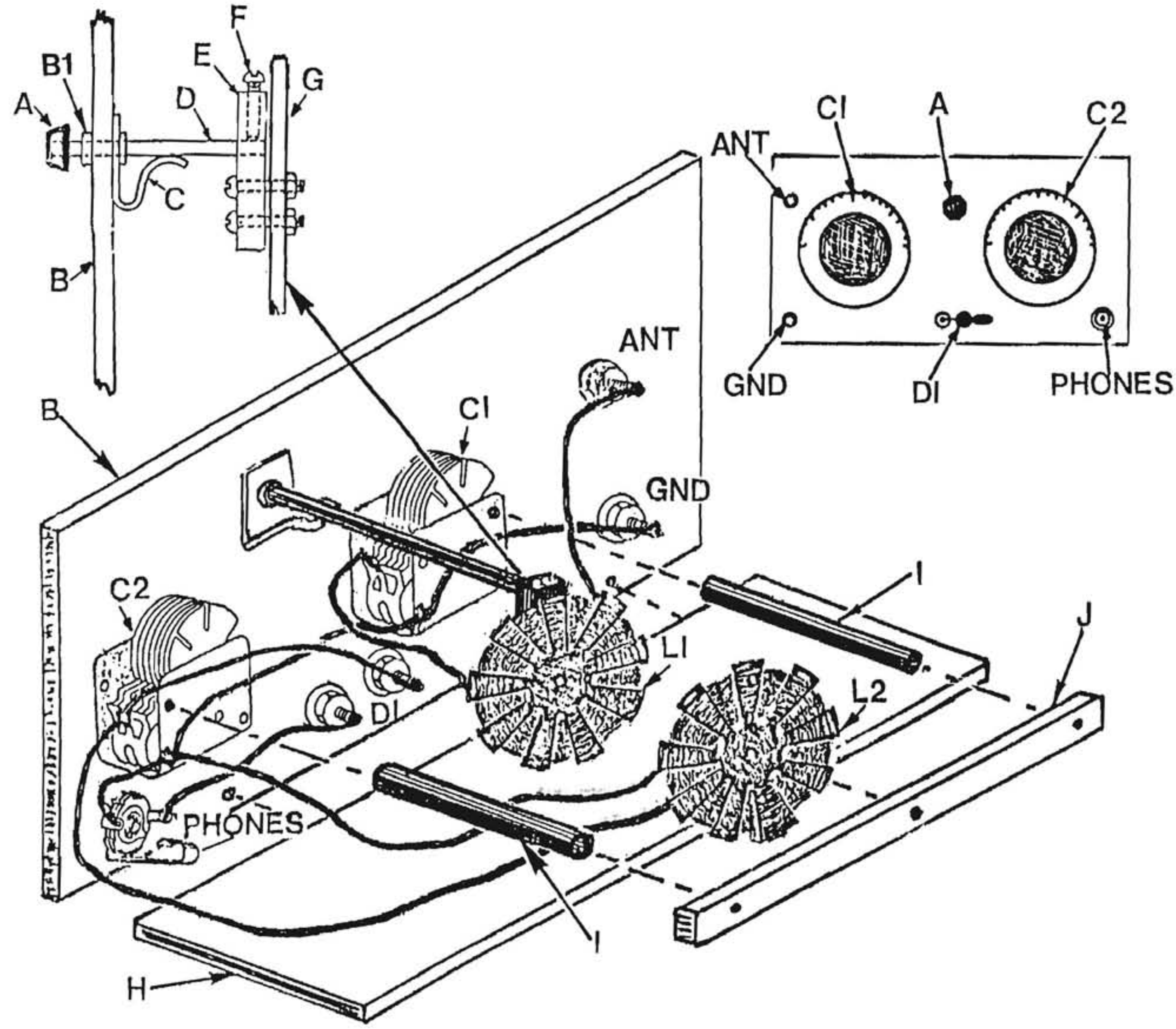
Experiment 1

Connect 2000-ohm headphones, antenna and ground leads, to the crystal set terminals. Then connect the D1 clip lead to the L1 "A" solder lug.

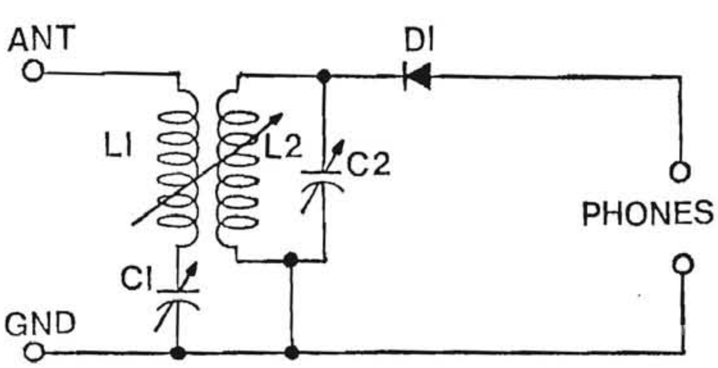
Set S1 to each tap position in turn and tune C1 and C2 for received radio stations. If all of the local stations can not be heard, experiment with different connections to the L1 taps. More turns may have to be added to L1 (with additional five-turn taps) to receive stations at the lower frequency end of the broadcast band.

Experiment 2

Remove the D1 clip lead from "A" and then connect it to the "B" solder lug on L1. Repeat the tuning method of Experiment 1 and note if the crystal set is more selective. This is possible, because L1 is now connected as an rf transformer. You can also connect the D1 clip lead to each of the S1 taps and note if there has been any improvement in reception.



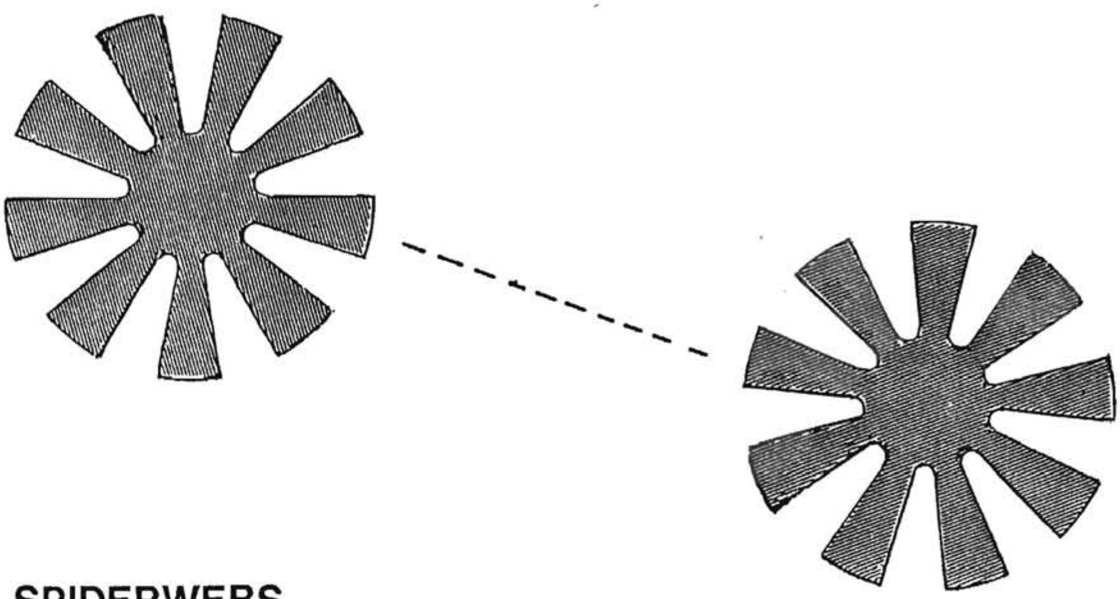
SELECTIVE CRYSTAL SET



SELECTIVE CRYSTAL SET

This receiver uses two spiderweb coils in a two-circuit tuner for good selectivity and sensitivity. As you can see in the schematic diagram, the antenna-ground rf input circuit is tuned by L1-C1 for maximum signal gain. L1 acts as the primary winding of an rf transformer, with L2-C2 as the tuned secondary. Coupling between L1 and L2 is variable for best selectivity. L2 is connected to a catwhisker crystal detector and the audio signals are fed through the phone jack to 2000-ohm headphones.

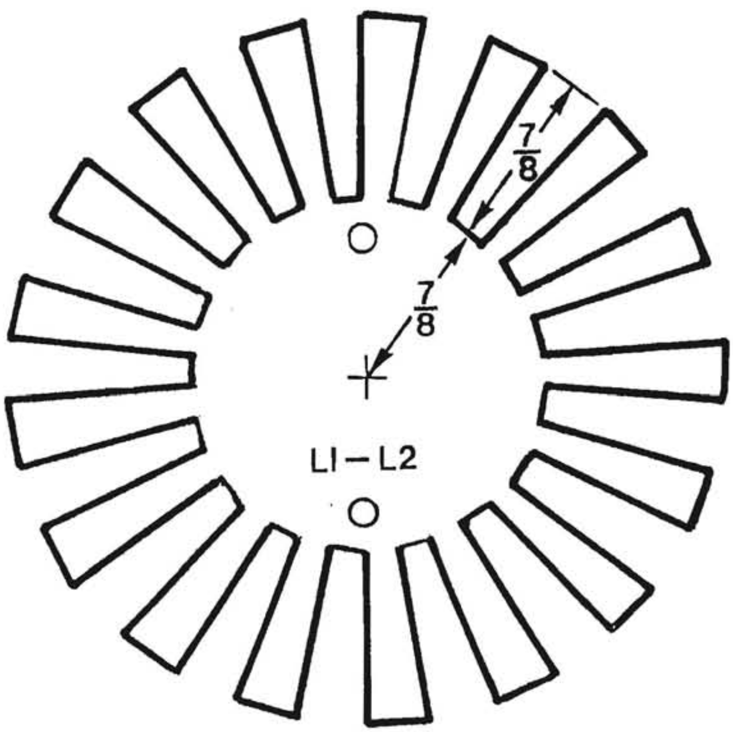
As shown in the illustration, the crystal set parts are mounted on the rear of a black plastic panel. This type of layout is similar to the type of construction of the old-time crystal sets.



SPIDERWEBS

Both L1 and L2 spiderweb coils are made exactly the same way. L1 and L2 are wound on 17-vane coil forms 3 5/8-inches in diameter. The coil forms in our receiver are made from 1/16-inch sheet plastic of the same type used for printed circuit boards (but without the copper foil). Any kind of rigid sheet plastic should be suitable for the coil forms.

Make a tracing of the spiderweb coil template. Then use carbon paper to transfer the tracing on a section of 1/16-inch thick sheet plastic. Cut out the vanes with a jeweler's saw. Drill two holes as shown, and install the two solder lugs.



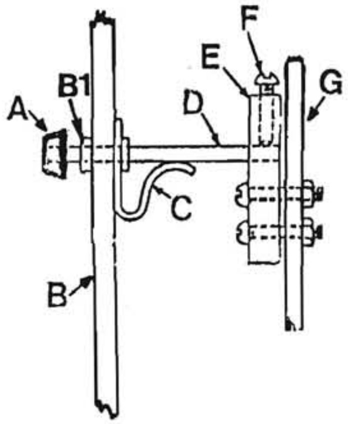
COIL FORM TEMPLATE FOR L1–L2

Wind as much No.22 enameled wire as possible on each coil form. Solder the wire to a solder lug before winding a coil. Then wind the wire over a vane and under the next vane. Wind the wire closely and evenly on the form. It is not necessary to count the turns. Solder the wire end to the remaining solder lug

CONSTRUCTION

The panel used in our receiver is a 7 3/4-inch by 4 1/2-inch section of 1/4-inch thick black acrylic plastic. The size is not critical, but it should be large enough to mount all of the parts as shown in the illustration.

Layout and drill the mounting holes of the components on the panel. Make sure that C1 and C2 are positioned so that the edges of the tuning knob dials are more than 1/2-inch apart. Install the catwhisker crystal detector assembly, antenna and ground terminals, and the phone jack in the locations shown.



As you can see in the illustration, L1 is installed on the end of a variable coupling metal rod. This 1/4-inch diameter rod is 3-inches long with a flat side. Drill and tap a small hole close to the end of the rod. The rod used in our model came from a discarded volume control. Cut a 2-inch long by 1/2-inch wide by 3/8-inch thick wood section and drill holes to fit the rod, two mounting screws, and a hole for the rod set screw. Locate and mount the wood section in the center of a spiderweb coil L1 so that the rod will be 3/4-inch down from the edge of the top vane.

Hold L1 behind the panel and using the free end of the rod, locate the panel hole. Position L1 midway between C1 and C2, and make sure that the top edge of the coil is below the top of the panel. Drill a hole to fit the rod bushing in the panel hole location. The panel bushing in our model was removed from a discarded volume control.

Drill a hole to fit the bushing in one end of a 2-inch by 1/2-inch section of sheet aluminum. Bend the other end of the section to fit against the flat side of the rod. Install the metal section and the bushing in the panel hole.

Insert the rod into the bushing and make sure that the metal section end fits close to the flat side to prevent rotation of the rod. Install a knob on the rod end and make sure that the rod can be pushed in and out easily. If necessary, put a small amount of grease on the flat side of the rod.

Install the remaining spiderweb coil L2 on a wood section that is mounted on the rear of the panel with two spacers. The spacers should be long enough for L2 to be located 1/4-inch behind L1 with the rod pushed all the way in. The 5 1/2-inch by 1-inch by 1/4-inch wood section in our model is supported with screws installed through 1 1/2-inch metal spacers into tapped holes in the rear of C1 and C2. The screws and bushings can be made longer and mount into panel holes in your receiver.

Install a wood section on the bottom rear of the panel to keep the receiver upright. A 5-inch by 3-inch section of 1/4-inch thick wood is used in our receiver.

SET WIRING

Connect the receiver components with hookup wire as shown in the illustration and schematic diagram. Use flexible stranded wire for connections to L1. Make sure that the L1 leads do not touch any component as the variable coupling rod is moved in and out.

Install knobs on C1, C2, and the variable coupling rod. Then place the crystal in the detector assembly.

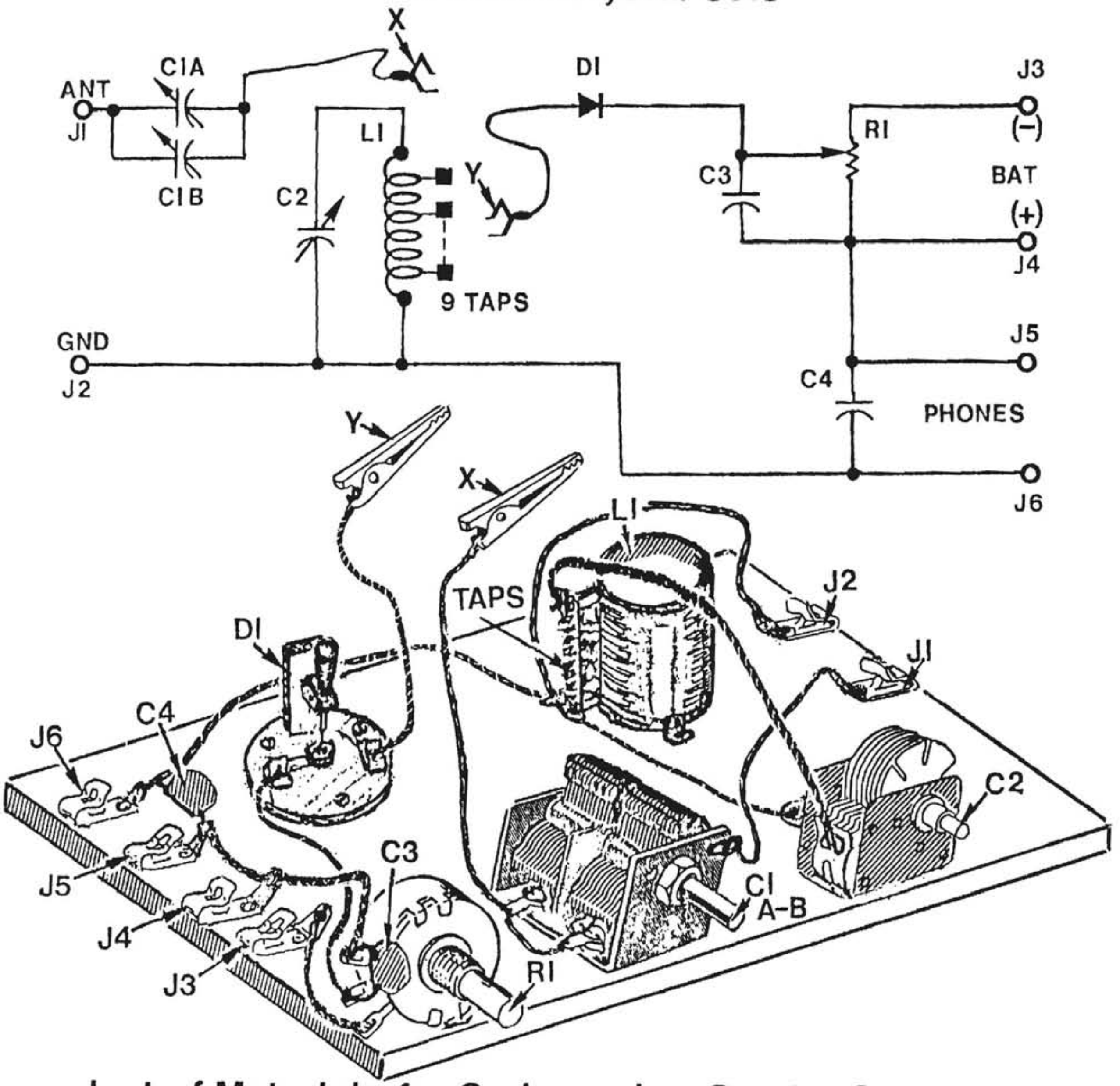
OPERATION

Connect antenna and ground leads to the receiver terminals. Plug in a set of 2000-ohm headphones into the panel phone jack. For easier initial operation of the receiver, temporarily connect a germanium diode (1N34A or equivalent) across the D1 connecting lugs. Make sure that the catwhisker is not touching the crystal at this time.

Push the variable coupling rod half way in and tune C1 and C2 for a station. Adjust the variable coupling rod and retune C1-C2 for best reception. Check operation over the entire broadcast band. It may be necessary to add or subtract turns of wire on L1-L2 for complete coverage. After checking operation with the germanium diode, remove it and try using the catwhisker crystal detector.

List of Materials

C1,C2 - 365 mmf variable capacitor.
D1 - Catwhisker crystal detector assembly.
L1,L2 - Spiderweb coils (see text).
2 - Terminals.
1 - Phone jack.
PHONES - 2000-ohm headphones.
MISC.- Plastic sheet for spiderweb coils, solder lugs, machine screws and nuts, wood screws, hookup wire.
CONSTRUCTION MATERIALS (See Text).
A - knob
B - Panel
B1- Bushing
C - Aluminum section
D - Rod
E - Wood section
F - Setscrew
G - L1 coil form
H - Wood section
I - Spacers (2)
J - Wood section



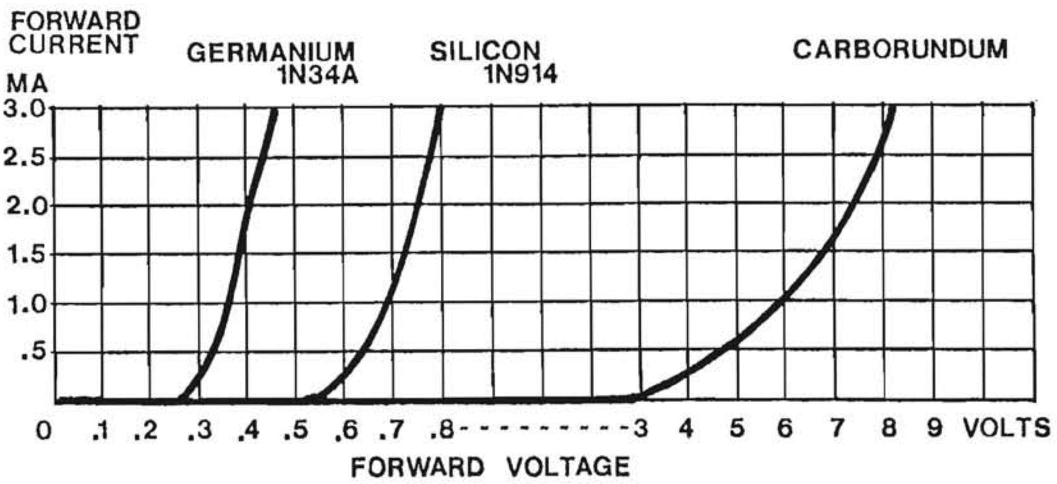
List of Materials for Carborundum Crystal Set

C1A-C1B - Dual 365 mmf variable capacitor.
C2 - 365 mmf variable capacitor.
C3 - 0.1 mf capacitor.
C4 - 1000 mmf capacitor.
D1 - Carborundum crystal and catwhisker detector assembly (see text).
J1 to J6 - Fahnestock clips.
L1 - Tuning coil (see text).
R1 - 5,000-ohm potentiometer (linear taper).
BAT - 6-volt battery
PHONES - 2000-ohm headphones.
MISC. Coil form (see text), No.24 enameled copper wire, 1/2-inch long spacers, perfboard strip (see text), push-in clips, solder lugs, knobs, hook-up wire, 1N34A diode (or equiv.), wood for base and D1 detector assembly (see text), wood screws, machine screws and nuts, alligator clips X-Y, brackets for L1 and R1.

CARBORUNDUM CRYSTAL SET

Materials other than galena, silicon or germanium have the property of detection. In the beginning of radio, carborundum (the name given to a compound of silicon carbide) was also used as a detector. The required heavy catwhisker pressure made it suitable for the early radio stations on ships, as it did not fall out of adjustment. It would also handle the strong signal energy from nearby spark transmitters without burning out. But what makes this type of crystal detector different, is the necessity for a bias battery.

A crystal detector has a high current flow with voltage applied so that it conducts in the forward direction (catwhisker to crystal), and a very low current flow in the reverse direction. The amount of current flow in the forward direction depends upon the characteristics of the crystal material and the applied forward voltage.

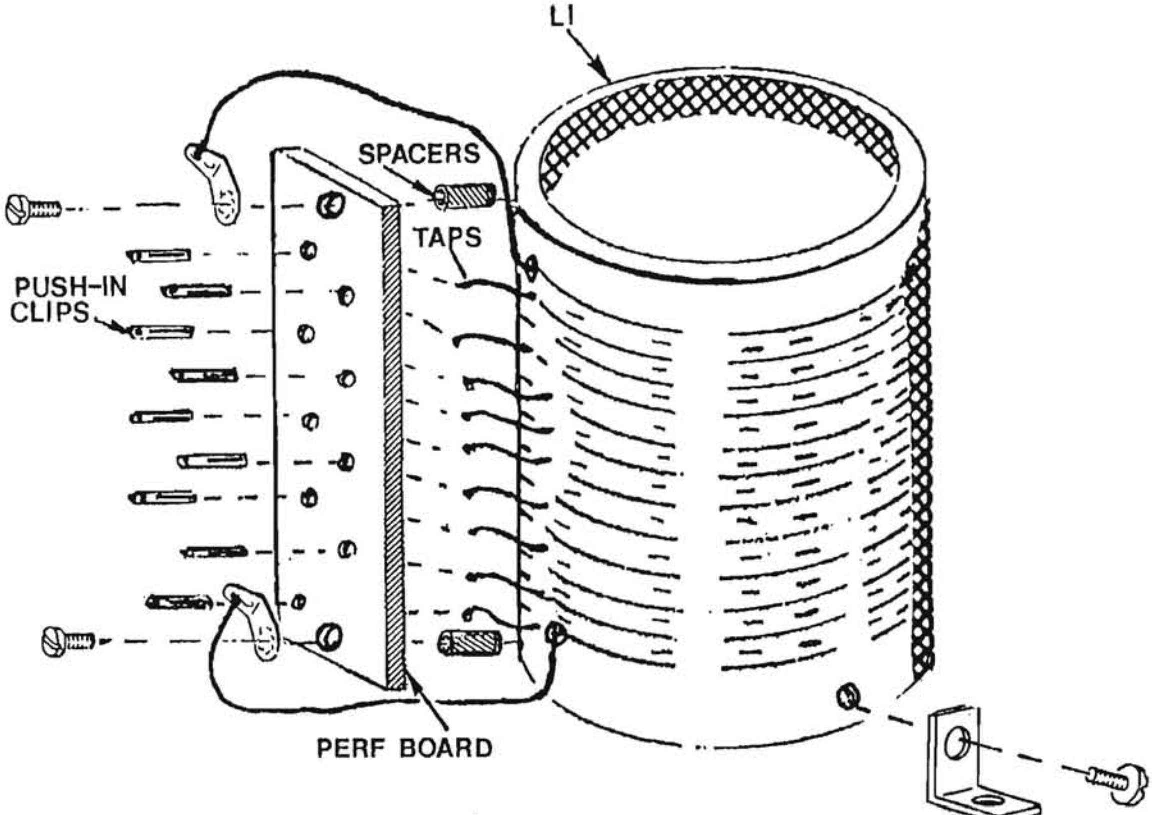


TYPICAL CRYSTAL DIODE CURRENT

The graph compares carborundum with germanium and silicon crystal detectors. Germanium minimum conduction voltage is about 0.3 V. Silicon is 0.6 V, and carborundum is 3 V. The high carborundum minimum conduction voltage is the reason a bias battery is used to move the threshold down so that weak radio signal voltages can be detected.

TUNING COIL

As shown in the illustration, the tuning coil L1 is wound on a cardboard (or plastic) mailing tube section 2-inches in diameter and 2 3/4-inches long.



TUNING COIL ASSEMBLY

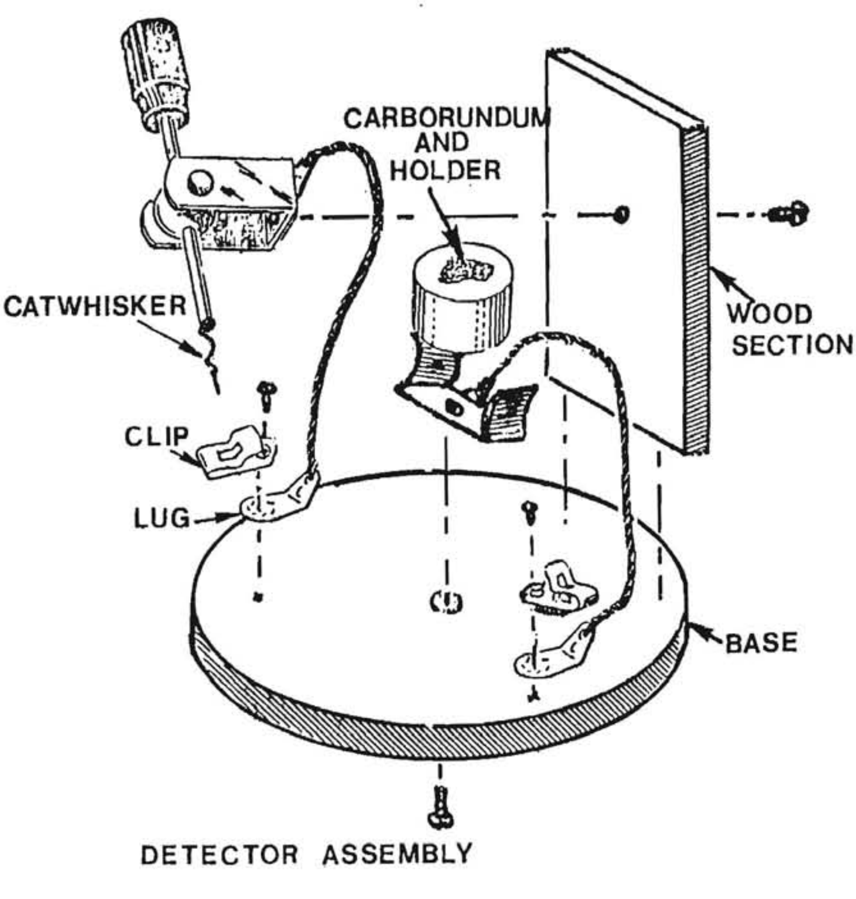
Locate and drill a hole 1/4-inch from each coil form end for machine screws to fit the two spacers. Also drill holes for two mounting brackets at one end. Then drill a small hole near each spacer hole to feed the wire on the form before you start winding.

Wind the coil with No. 24 enameled copper wire. Tap the coil every 10 turns for a total of 9 taps. An easy way to make the taps is to twist the wire together for a half inch and position the free end out. Make all the coil taps in the area between the two spacer holes. Thread the free end of the wire through the small hole at the end of the form near the spacer hole. Make sure that all of the turns are tightly wound and close together. Use a section of sandpaper to remove the enamel from the tap wire ends. Then tin the ends.

Mount 9 push-in clips in a 1/2-inch by 2 1/4-inch perf board section. Locate and drill holes on the board and install it on the coil form with two solder lugs, 1/2-inch spacers, machine screws, and nuts. Solder the coil taps to the ends of the push-in clips. Connect the coil leads to the solder lugs and mount the two 1/2-inch brackets on the coil form.

DETECTOR

The crystal detector assembly is vertical, (as shown in the illustration) instead of horizontal as in most catwhisker detectors. Begin construction by cutting the 2 1/2-inch diameter base and 2-inch by 4-inch vertical section from 1/4-inch thick wood.



DETECTOR ASSEMBLY

Locate and install the two fahnestock clips on the base with solder lugs and small wood screws. Mount the vertical section on the edge of the base with wood screws (or cement). Locate and install the catwhisker holder with a solder lug, machine screw and nut near the top of the vertical section.

Temporarily position the crystal holder on the base so that the catwhisker will touch the center of the crystal. Locate and mount the crystal holder in this position with a solder lug and machine screw and nut. Connect the detector assembly with hookup wire as shown in the illustration. Solder a short section of coiled steel spring wire to the end of the positioning rod to serve as a catwhisker. Cut the end of the wire diagonally to give it a sharp point.

BASEBOARD

The receiver parts are installed on a 8-inch by 7-inch by 3/4-inch wood base. Wherever poossible, small wood screws are used to hold the components on the base.

Begin construction by laying out and installing the parts in the positions shown in the illustration. It will be necessary to make a metal mounting bracket to fit R1. C1A-B and C2 are mounted with machine screws in the tuning capacitor frames through countersunk holes in the base. Install solder lugs in the rear frame of both tuning capacitors. Also mount solder lugs with all of the terminals. Install knobs on the tuning capacitors and R1.

WIRING

Use hookup wire to connect the crystal set parts as shown in the schematic and illustration. Connect 5-inch leads of flexible stranded insulated wire to each alligator clip. Solder one lead to the stator lugs of C1A-B and connect the other lead to D1. Connect C3 and C4 as shown and keep their leads as short and direct as possible.

Experiment 1

Connect your antenna to J1, ground to J2, and 2000-ohm headphones to J5 and J6. Temporarily connect a germanium diode (1N34A or equiv.) in place of the carborundum crystal detector D1. The diode will make it easier to check out the receiver.

Do not attach the battery to J3-J4 at this time, or the diode may be damaged.

Connect **X** C1A-B clip lead to the top tap of L1, and **Y** D1 clip lead to the second tap from the top. Tune in a radio station with C2 and then adjust C1A-B for best volume. Change the position of the clip leads and retune C1A-B and C2 for best reception. Check operation of the receiver over the entire broadcast band.

Experiment 2

Tune the receiver to a radio station and then disconnect the germanium diode. Do not disturb the receiver tuning. Install a carborundum crystal into the D1 assembly. Set R1 to mid range, and connect a 6-volt battery to the receiver; negative lead to J3, positive lead to J4.

Adjust the D1 catwhisker for a sensitive spot on the carborundum crystal. Then set R1 for best volume of received signal. Retune C1A-B and C2 and change the clip leads on the L1 taps as necessary for reception of radio stations.

Note

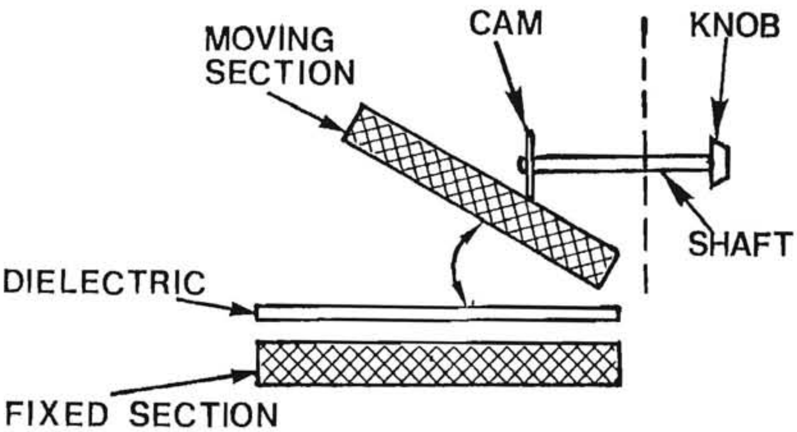
Carborundum that will work as a detector may be hard to find. Grinding wheels are not suitable as a source, because the carborundum is usually in fine particles mixed with other material. Best bet is to contact collectors of antique radio parts. But you can use this receiver to experiment with minerals for semiconductor operation. See the Workshop Section for information on mounting mineral sections for detector experiments.

4 COMPONENT PROJECTS

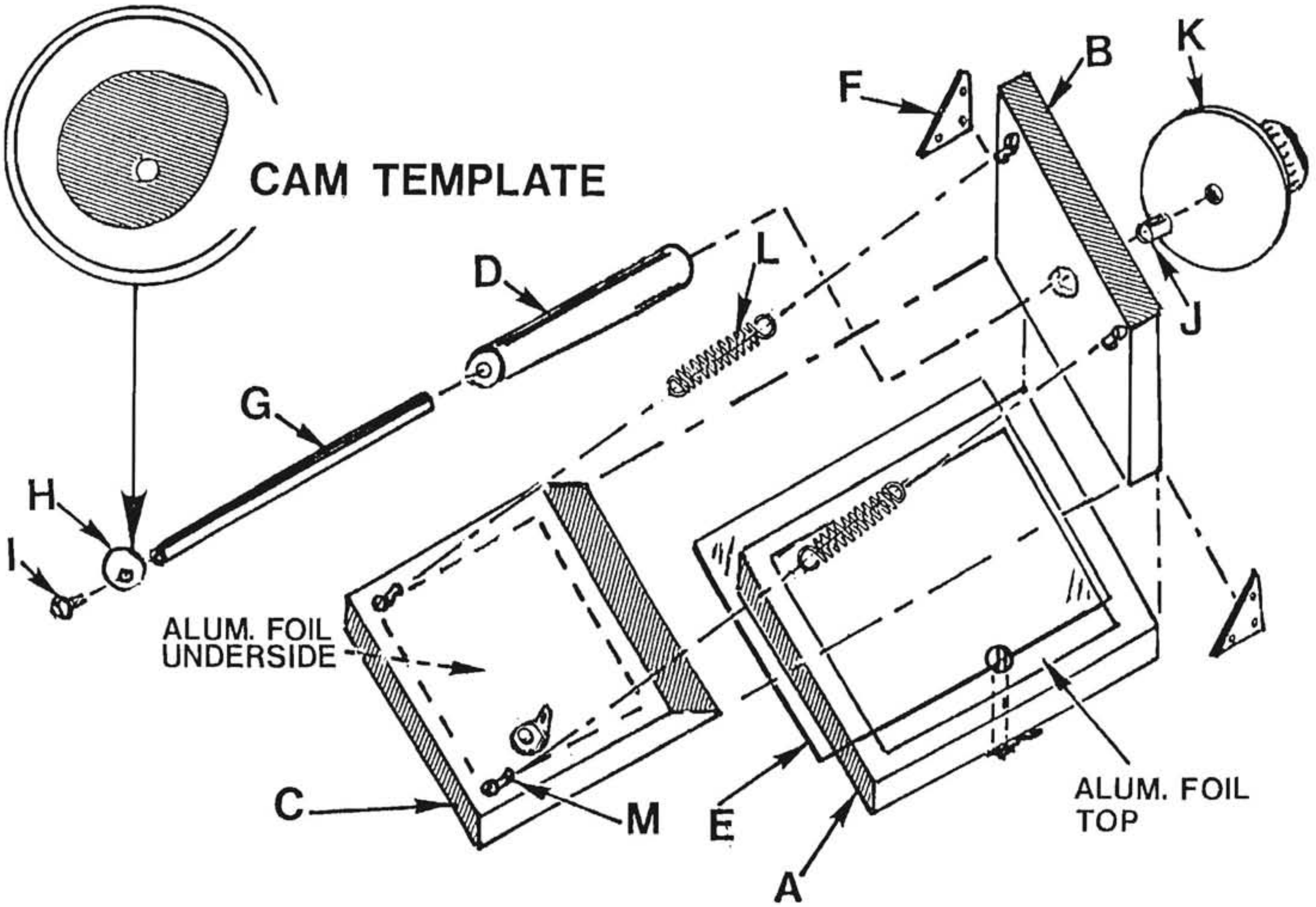
BOOK TUNING CAPACITOR

During the roaring 20's,the Crosly Radio Corporation used a type of tuning capacitor that had two plates hinged together on one edge. The dielectric was a sheet of mica between the two plates. This type of tuning capacitor was called a Book Condenser.

The tuning capacitor shown in the illustration is similar to the Crosly Book Condenser. It uses aluminum foil plates cemented to fixed and movable wood sections, and a plastic sheet dielectric (cut from thin transparent plastic notebook protector material).



Adjusting the tuning knob causes a metal cam to rotate and control the movement of a spring loaded wood section. This varies the capacity between the two foil plates. As the plates are brought closer together, the capacity increases. As they are separated, the capacity decreases.



BOOK TUNING CAPACITOR

List of Materials

A - 3 x 3 1/2 X 3/8-inch wood section
B - 3 x 1 3/4 x 3/8-inch wood section
C - 3 x 3 1/8 x 3/8-inch wood section (one end beveled 45 degrees - see text).
D - 3/4 - inch diameter wood dowel, 2 1/4 inches long.
E - 3 1/2 x 3 -inch sheet plastic (See text).
F - 2 triangular 1-inch metal sections
G - 1/4-inch metal rod, 3 -inches long.
H - Metal cam (see text).
I - Machine screw (see text)
J - Bushing 3/8-inch long (to fit rod G).
K - Tuning knob (to fit rod G).
L - 2 springs 1/4-inch diameter by 1 1/4-inch long.
M - 4 solder lugs.
MISC. Small wood screws, nails, aluminum foil, machine screws, nuts, solder lugs and washers.

CONSTRUCTION

Start construction by cutting the wood sections from 3/8-thick wood to the sizes shown in the drawing. Section C has a 45 degree bevel at one end. This acts as a pivot point for the movable section. Drill and countersink a hole to fit a flathead machine screw in the places shown on sections A and C. Do not install the screws at this time.

Cement aluminum foil on the top of section A and on the bottom of section C. Then cut and remove a 1/2-inch strip of foil from the front edge of section A. Cut a 1/8-inch strip from the remaining edges. Also cut away a 1/8-inch strip from all the edges of the foil on section C.

Carefully slit the foil on top of the machine screw hole on section A and press the foil gently inside the hole. Install the flathead machine screw into the hole, making sure that it is in contact with the foil. Fasten the screw with a washer and nut. Make sure that the screw does not turn and rip the foil. Install a solder lug and nut on the free end of the screw. Repeat this operation with section C.

Cut the sheet plastic E to size and place it on top of section A. Then place section B on top of the plastic sheet and install it on the end of section A with wood screws. Install the two metal sections F with small nails.

Saw the metal rod G to size and tap one end to fit a machine screw. Cut the dowel D to size and center drill it to fit the rod G. Cut a flat on one side of the dowel.

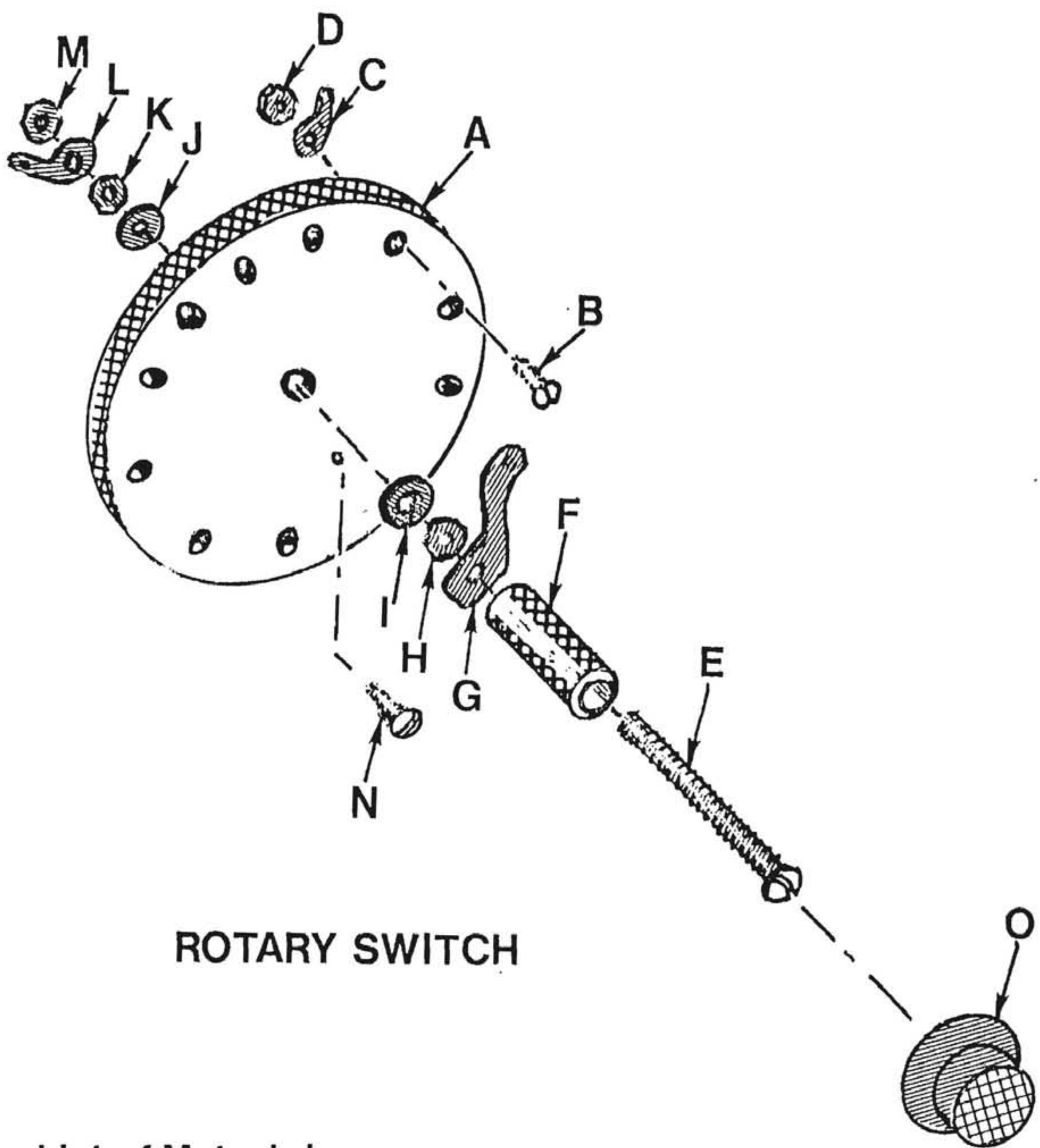
Make a tracing of the cam H template and cement it on a section of heavy gauge sheet aluminumm. Cut the cam to size and drill a hole to fit the rod machine screw in the location shown. Install the cam with a lock washer on rod G. Insert the free end of the rod into dowel D. Place section C on top of the plastic sheet E on section A. Then temporarily position dowel D with rod G in the center of section B. Rotate the cam so that its long end touches the top of section C. Mark the placement of the dowel on section B. Drill a hole in section B to fit dowel D. Cement the dowel in place.

Locate and install solder lugs with wood screws on sections A and C as shown in the drawing. Bend over the ends of the solder lugs and install two springs L in the lugs.

Mount tuning knob K and bushing J on the free end of rod G. Adjust the knob and check that section C moves in and out with the cam rotation, changing the capacity between the foil plates.

You may have to experiment with the cam diameter for best operation of section C. File the cam edges in small increments only and recheck the operation often. Use very light springs to keep section C from pressing against the cam and moving it.

Reverse the cam on rod G to alter the direction of capacity (clockwise or counterclockwise). The capacitor can be installed vertically on a receiver project with a small metal bracket mounted on the bottom side of section A.



ROTARY SWITCH

List of Materials

A - 2 1/4 diameter x 3/8-inch wood section.
B - Flat head machine screws.
C,L - Solder lugs.
D - Nuts to fit B.
E - Machine screw 1 1/4-inches long.
F - 1/4 diameter x 1/2-inch long bushing (to fit E).
G - Switch arm 1 x 1/4-inch (sheet brass, see text).
H,K,M - Nuts to fit E.
I,J - Washers to fit B.
N - Small woodscrew.

ROTARY SWITCH

In the early days, radio experimenters could not buy parts that are readily available today. They had to build their radio components from wood sections and common hardware.The rotary switch ilustrated is similar to a type constructed for use with tapped coils of crystal sets.

The rotary switch shown uses flat head screws for contact points that are mounted on a wood section. The switch arm is cut from sheet brass and is installed on a machine screw.

CONSTRUCTION

Refer to the drawing of the rotary switch. Begin construction by cutting the 2 1/4-inch diameter section A from 3/8-inch thick wood. Locate, drill,and countersink the holes for the flathead machine screws B. The rotary switch shown has 10 machine screws, but you can space the hole locations for the number of switch contact points desired. Allow a space between the starting and ending contact points for the woodscrew N. This woodscrew is used as a stop for the rotary arm G. Locate and drill a center hole for the machine screw E. Install the screws B in section A with solder lugs C and nuts D. Install the woodscrew N.

Measure and cut the rotary arm G from a section of sheet brass. The arm should be long enough to reach the contacts. Make sure that it is not too wide, or it may short out to a nearby contact. Make a dent or "dimple" on the contact end, and drill a hole for screw E on the other end. Bend the rotary arm as shown in the drawing. Install screw E into bushing F, and arm G, and tighten the assembly with nut H. Place washer I on the screw and install screw E into the center hole of A. loosely fasten the screw with washer J and nut K. Then rotate the bushing F and arm G. Adjust the tightness of nut K as required to allow rotation of G with only a slight "drag". Install solder lug L on screw E with nut M, and bend the lug towards the screw end. Install knob O on bushing F, and recheck operation of the arm G. It should touch all of the contacts B and stop at screw N.

The rotary switch is used as shown in the Dual-Tuned Crystal Set Construction Project. Make sure that extra lead length is allowed for connection to the solder lug L. Bend the lead into a "pig-tail," so that it will not break as the solder lug L is rotated.

5 WORKSHOP

The construction projects in this book can be built with common hand tools found in an average home workshop.

Useful Hand Tools

Safety glasses or face shield
Steel rule
Square
Hack saw
Wood saw
Screwdrivers
Pliers
Wirecutters
Tin snips
Center punch
Files
Hammer
Soldering Iron

Wear safety glasses or face shield while working. Observe common sense safety precautions.

SOLDERING

Make sure that the part to be soldered is clean. Use only rosin core solder. Prepare the soldering iron tip as follows:

File each surface of the tip to remove oxidation. Plug in the iron and let it heat until you can melt solder on the tip (before the copper tip turns blue or bronze color). Melt enough solder until all sides of the tip are coated. Then wipe off excess solder with a damp sponge or cloth.

Make sure that the bare wire lead to be soldered is free of oxide. It is best to tin it first by melting a bit of rosin core solder on the lead end. Crimp the lead in the part hole to keep it from moving during soldering. Hold the iron tip under the part until it is hot enough to melt solder. Apply only enough rosin core solder to cover the surface of the part. Remove the iron. Do not move the part or wire while it is cooling.

PROJECT CONSTRUCTION TIPS

Tape a sheet of graph paper over a project wood section. Mark locations of the parts on the paper. Center punch mounting hole centers through the paper. Use a compass to draw circles the same size as the holes. Then drill holes through the paper.

Lettering on the projects can be done with a labelmaker that prints on strips of adhesive coated plastic. You can also use decals or dry transfer lettering sheets.

Small metal brackets can be made from heavy gauge sheet aluminum. Layout and drill the mounting holes and then cut it to size with a tin snips. Form the bracket by using a heavy mallet and a vise.

Tuning Capacitors, Knobs, and Dials

Old radios are a good source of components. The radios generally use two tuning capacitor sections ganged together. The receivers previously described will operate with one of the capacitor sections (365 mmf). You can cut out cardboard discs and cement them to radio knobs and use them as dials with the tuning capacitors. Mark the dials with dry transfer lettering, or black drawing ink.

Panels and Cabinets

The layout and construction of crystal sets is not critical. They can be fitted into many different types of wood cabinets. You can use almost any type of non-metallic box, but metal boxes are not recommended as sheet metal close to the tuning coil may lower its "Q". Black sheet plastic used for the front panel with white dry transfer lettering will give your receiver project an antique look.

MOUNTING MINERALS FOR CRYSTAL DETECTORS

Minerals (galena, etc) for experimentation as crystal detectors, will work best when mounted in a metallic base. For temporary mounting (while testing), wrap aluminum foil tightly around the sides and bottom of the mineral. Then place it into a sheet metal ring or cup that will fit into the detector assembly.

After testing, the mineral can be permanently mounted in a metal slug. Drill a shallow hole of a diameter equal to the detector assembly crystal in a block of wood. Fill the hole with melted solder. While the solder is still molten, carefully place your mineral section into the center. Hold the mineral in place with tweezers or long nose pliers until the solder cools. Then pry the metal slug out of the wood. Be sure that the top of the mineral section is free of solder.

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About the Author

Charles Green has been involved in the design and construction of electronic equipment for industry and the U.S. Government for 30 years. Much of his experience has been as a technical writer preparing operation and maintenance manuals. His continuing interest is in constructing radios and he has had over a hundred articles published in hobbyist magazines over the past two decades.