



## CRYSTAL RADIO KIT



### (A) List of Parts provided in the CRYSTAL RADIO SET

1. 8 Brass furniture thumbtacks
2. 70' of Copper magnet wire #30
3. 1 Large paper clip
4. 1 - 470 pF disc capacitor
5. 1 - 0.01  $\mu$ F disc capacitor
6. 1 - Germanium diode
7. 1 - Crystal earphone with wires
8. 2 - Alligator clips with wires
9. 1 - PLMCRS1 instructions

#### **Parts you need to obtain:**

1 cardboard tube (toilet papertube)  
1 board (wood, 7 1/2" x 5")  
sticky tape (to hold coil you make)  
quick drying varnish, nail polish, or clear radio cement

#### **Tools Needed:**

needlenose pliers  
a small hammer  
wire cutters

### (B) Project Description

*The complete **CRYSTAL RADIO SET KIT #8893** includes everything you need except for the wood baseboard, the cardboard tube from a toilet paper roll and varnish, nail polish, or clear radio cement to paint the coil.*

*This little project is a sure interest grabber with students of electronics of any age! It does not require a great amount of skill, but a little application will produce a good basic radio receiver. Construction is fairly simple. **This radio DOES NOT require batteries** to operate, using simple electrical principles to power itself.*

*This circuit is for the simplest radio receiver that can be practically constructed - yet it is the basic building block of more highly sophisticated and complex units.*

### (C) SAFETY FIRST

***DO NOT** attempt to use an electrical wall outlet, or connect to any electrical appliance to ground your radio. Use a cold water tap, or "ground stake".*

***DO NOT** mount your antenna near to, or over the top of, electrical power lines of any type. If your antenna wire should break it could contact the live power and a severe **ELECTRICAL SHOCK** and possibly **DEATH** could occur.*

***DO NOT** leave your antenna coupled to the radio when it is not used, as it is an attraction to **LIGHTING STRIKES** and/or violent electrical **STATIC DISCHARGE**. Place the free end of the antenna **OUTSIDE** and clear of the building or connect it direct to earth.*

***DO NOT** operate the radio during the approach of, or during an electrical storm .*

## (D) Operating instructions

In order for the radio set to work you will have to connect it to an **ANTENNA** and a **GROUND**. In some locations an antenna may not be necessary, but a good ground connection is very important. A cold water pipe is usually the best to use, or you can put down an "earth stake" and connect to it.

The best antenna for this radio can simply be a really long wire, mounted as high as possible. Good results can also be produced by using metal bed spring frames or a fence. Be creative!

Crystal radios are not very selective, nor very sensitive. Several stations may be heard at once, many of them equally as strong as the others. A long antenna (30+ meters) will improve the strength of some stations, helping you tune them in a little more easily.

Operation is that simple.

## (E) Theory of Operation

The crystal radio works by creating an oscillator with the coil and C1. The placement of the wiper along the coil varies the amount of inductance in parallel with the capacitor. This tunes our radio by determining the oscillating frequency. The signal is then rectified by the diode and smoothed out by C2. The resulting signal causes a thin ceramic crystal in the earphone to vibrate creating the sound that we hear.

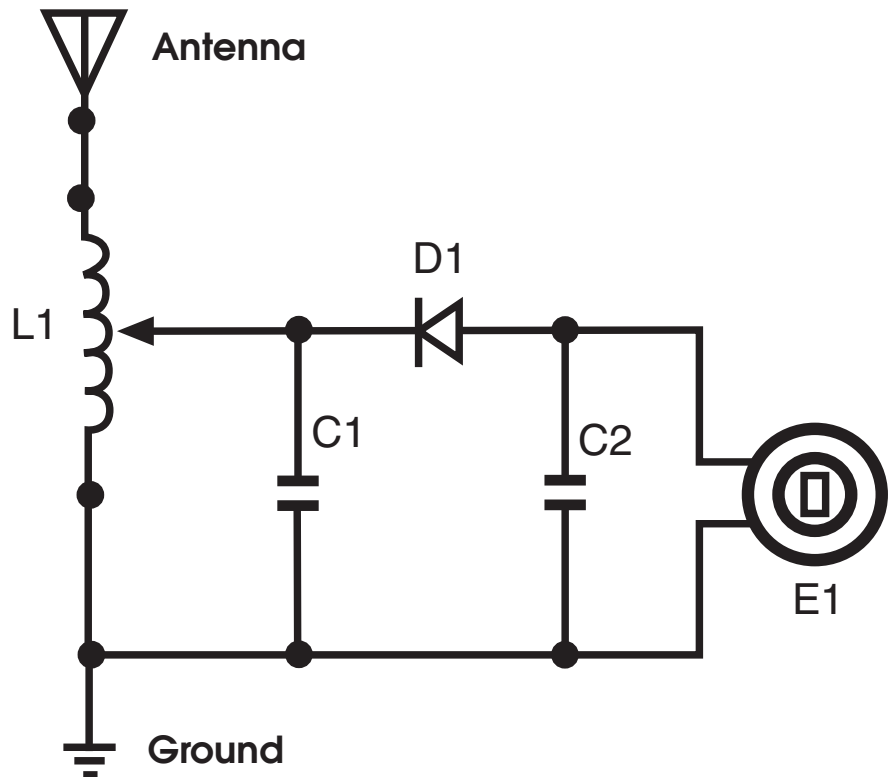
## (F) Reading Comprehension

1. The wiper varies the amount of \_\_\_\_\_ in parallel with the capacitor.
2. The signal is \_\_\_\_\_ by the diode.
3. The crystal \_\_\_\_\_ vibrates to create sound.

## (G) Complete Parts List

- A (9cm x 13cm) or (7.5in. x 5in.) block of Pine wood, or chipboard.(not included in kit)
- 8 BRASS flathead thumb tacks.
- 2 Alligator Clips, one for antenna, one for ground.
- A discarded cardboard roll from a toilet paper roll.(not included in kit)
- L1 - 70' of 30 Gauge Magnet wire for approximately 145 turns around the cardboard roll.
- A large wire paper clip.
- 300mm length bare copper.
- C1 - A 470 PicoFarad ceramic disc capacitor.
- C2 - A 0.01 Microfarad ceramic disc Capacitor.
- D1 - A Germanium Point Contact Diode Type OA90.
- E1 - A CRYSTAL earphone

## (H) Schematic Diagram



# (I) Assembly Instructions

## Tools needed:

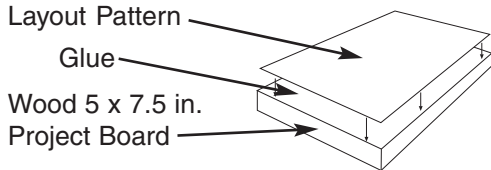
A small hammer, a pair of wire cutters and a pair of needlenose pliers are all the tools required. A roll of household sticky tape is handy for holding wire in place as you wind the coil.

### Step 1 (Wood Project Board)

Cut a piece of wood to 5" x 7 1/2" x 1/2"

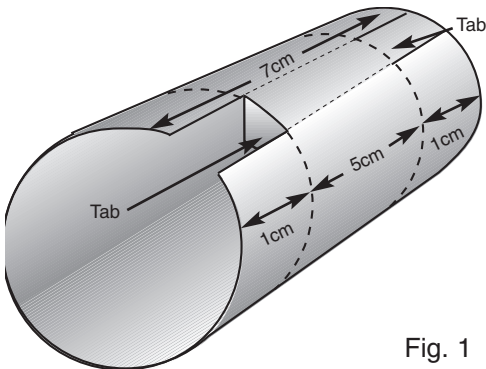
### Step 2 (Layout Pattern)

Cut out the Layout Pattern and glue it to the wood.



### Step 3 (Coil)

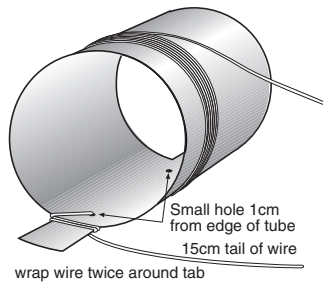
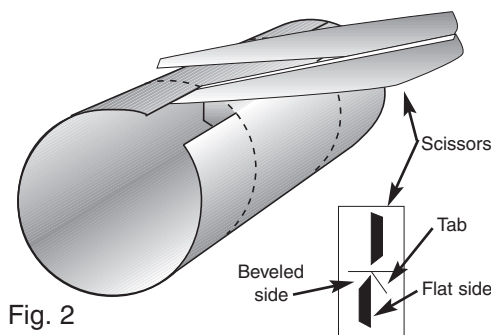
Prepare the tube to wind the coil. Measure and cut a 7cm length of the tube. Draw a line all the way around the tube to use as a guide while cutting. Draw two more lines 1cm in from each end. Cut tabs on both ends exactly across from each other then fold them in, out of the way for cutting off the extra tube length. (See Fig. 1)



### Step 4 (Coil)

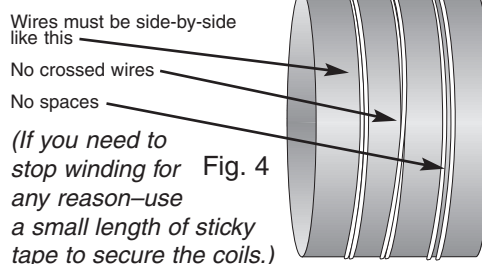
Using scissors, cut the extra length from the tube. Do not cut the tabs off as they will be used to hold the tube to your wood project board.

The easiest way to cut the tube straight is by placing the flat of the scissors against the folded tab and following your line around as shown in Fig. 2.

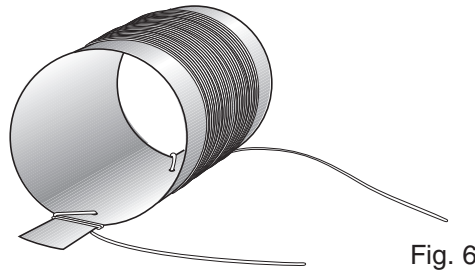


### Step 5 (Coil) (See Fig. 3)

Make a small hole with a tack, 1cm in from both ends of the tube. Push 15cm of the wire through from the outside of the tube to the inside and wrap the wire tail twice around the tab at one end, this prevents the wire from slipping as you wind. Starting 1cm from the edge of the tube firmly wind on as many turns as will fit between the two holes (approximately 145 turns,) ensuring each turn is straight and tight together **no gaps!**



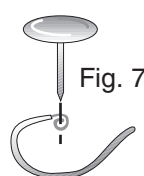
When you reach tab #2, trim off the wire to 15cm and wrap it twice around the tab. A coat of quick drying varnish or nail polish will secure the coil loops permanently. Coat the cardboard tube at the same time and place the assembly aside to dry.



### Step 6

Straighten out a paper clip with pliers and a hammer. In one end make an open loop 5mm in diameter. This paper clip will be used as a wiper on the coil. (See the Pictorial Diagram page 4). All the components and wires are secured with furniture tacks no soldering is required.

For a better connection to the tacks make small loops at the ends of the wire leads on the capacitors and diode and the copper wire which joins the various parts of the circuit together.



### Step 7 (Coil)

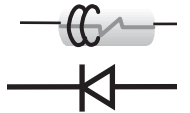
Attach the Coil you just made to the board as indicated by the pattern, placing the tacks through the tabs of the tube. (You may need a small hammer to tap the tacks down tightly.) **Do Not** hammer any other tacks down into the board until **all** the other parts have been properly positioned.

### Step 8 (Wiper)

Place the wiper in position on the board and rest it against the coil. From this you can see where the coil will need to be scraped free of insulation. (This area on the coil is shown as a white stripe on the Pictorial Diagram page 4.) The enamel insulation and varnish you coated the coil with can be removed using a fine cut file or fine grit emery paper—taking care **not to displace or break any of the coil turns**. Make bare an area about 10-15 mm wide, across the face of the coil. The coating also needs to be removed from the leads, then they can be wrapped around the appropriate tacks "A" and "F".

### Step 9

With the straightened paper clip acting as a **WIPER**, the coil will be a **VARIABLE INDUCTOR** (See the Pictorial Diagram page 4). The free end of the wiper is bent at an angle so that it will wipe along the bare wires of the inductor when secured in place on the baseboard.



### Step 10

Identify the Diode (D1) with the black stripes at the end corresponding to the line shown on the schematic symbol. Place it as shown in the schematic on the board in the correct position between tacks "B" and "C".

### Step 11

Identify the capacitors (C1, C2) and place them in position. C1 goes between tacks "B" and "D", and C2 goes between "C" and "E".

### Step 12

Take one of the alligator clip leads and wrap the end of the wire around tack "A". Wrap the end of the other alligator clip lead around tack "F". Make sure that you hammer these tacks down securely to prevent the alligator clip wires from pulling away from the tack causing loss of contact.

### Step 13

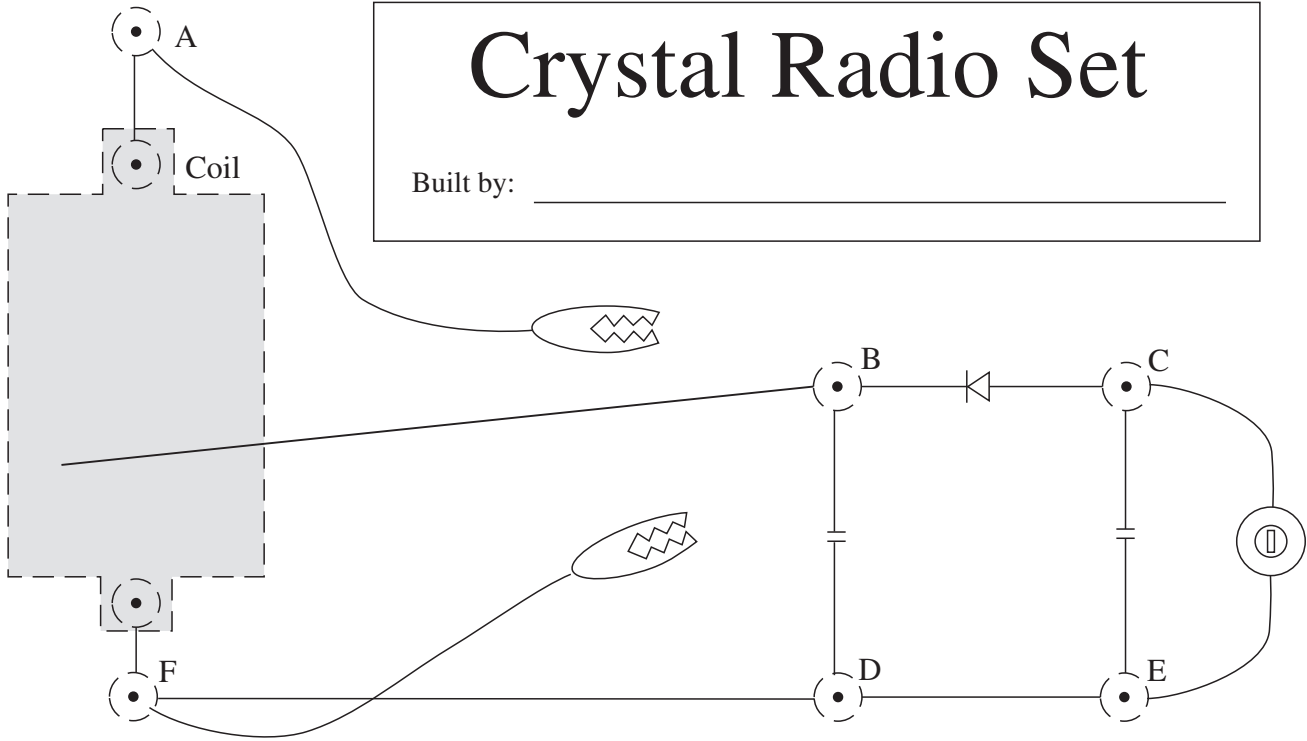
Take bare copper wire and connect tacks "D", "E", and "F".

### Step 14

When all of the components are arranged as desired, the tacks can be hammered into place. Now your radio is complete. Happy Listening!

# Crystal Radio Set

Built by: \_\_\_\_\_



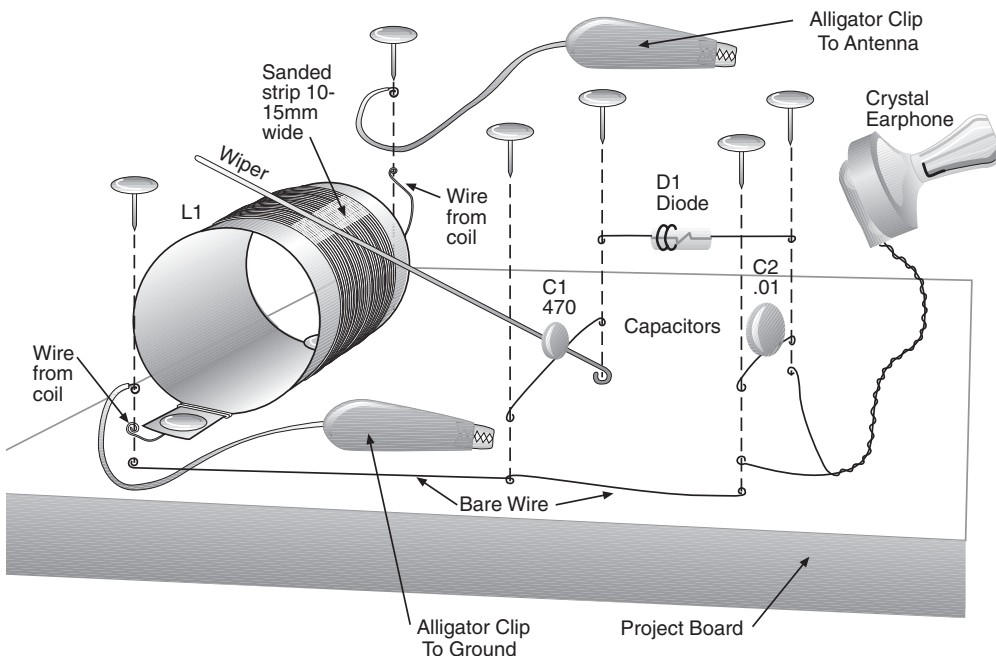
**(J) Layout Pattern** (above, exact size)

Cut on dotted line.

Cut out the layout pattern and place it on your board. Build your radio on top of it.

(●) = Thumb Tacks

**(K) Pictorial Diagram**



**(L) Web Address**

This and other Kits are available on the internet at :  
<http://www.shopsite.com/kits>

