

The Xtal Set Society Newsletter

In this issue (#67) July 1, 2002

*This is an excerpt from our July 2002 issue

The Quaker Oats Box Crystal Radio Set

If we put this set on the *NET*, would it create Oatmeal “Cookies”?

The “Peebles Choice” part 1 of 2

By: Mike Peebles

Last time I said I was going to do a series on basic crystal radio design and construction and this project is the beginning of that series. I am actually putting “the cart before the horse” here, but we get so many questions on building this project (it appears on the XSS website), we decided it needed to be rewritten for the true beginner. Our plan is to rework these directions until anyone can build the oatbox radio – and it will continue to appear as free plans on the Society’s website.

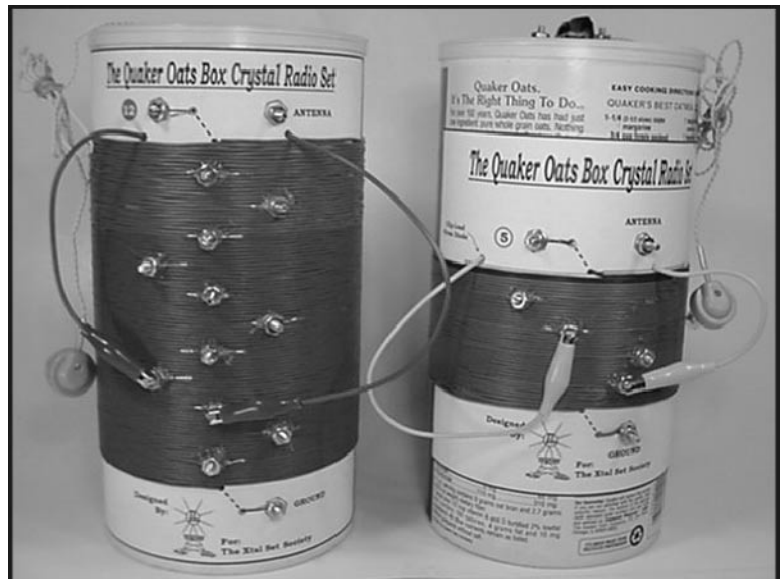
In building the first prototype, I was highly disappointed in its performance, so I decided to describe two versions: 1) *Basic Version* and 2) *Advanced Version*. While the *Basic Version* is functional, quite simple, inexpensive and does bring in a station or two, it came to my attention that some beginners might want a little more than that. The *Advanced Version* will tune the entire broadcast band, and is quite selective and sensitive for its design simplicity. These two versions are targeted for the beginner, Cub Scout groups, schoolteachers and parents.

In this issue I will describe the construction and operation of the *Basic Version*. Locate all the parts needed from the attached *parts list*, and look at the associated diagrams and drawings familiarizing yourself with the scope of the project.

Tools and extras you will need: 1-Large Oatmeal Box (5” diameter), Hot glue gun, with glue sticks, Paper glue sticks, or some type of similar glue, Masking tape, Awl or ice pick, #2 Philips screwdriver, Needle nose pliers, Slip-Joint Pliers, Wire cutters, Sharp knife and/or Wire strippers, Sharp scissors, and a Screw driver with a 1/8” blade.

Construction of *Basic Version*:

- 1) Cut-out and *paste* the *Basic Version* template, in the middle of the back-side of the oatmeal box. Make certain the template is square and centered on the box.
- 2) Cut-out and *paste* the *Basic Version* lid template in the center/outside of the lid.
- 3) Using an *awl* or *ice pick*, punch holes at (A) *Ground*, (D) *Terminal “12”*, (E) *Antenna*, *Phones* and *Diode*. These holes want to be about 1/8” in diameter. Punch a small hole at *Clip lead from diode*, *Clip lead from antenna*, and small holes located at *Start & Finish* of the coil’s windings. These should be just the size for a *wire* to pass through.
- 4) Make certain your hot glue gun is hot and loaded with glue stick, and have a 2” strip of masking tape handy. The glue will be used to attach your screw tap terminals on top of the coil winding.
- 5) Locate the 22 gauge wire, cut-off a 12” piece and strip about 1/2” of the insulation from both ends. Shape the bare-stripped ends like a fishhook and proceed to next step.
- 6) Strip about 3/4” of insulation from the end of the supply of 22 gauge wire, pass this wire through the *Start Winding*



Left, **Basic Version** Right, **Advanced Version**

hole, located at the bottom of the template, then back-through the hole just below and leave about 1-1/2" of wire, including the stripped, bare-end.

7) Locate a 1/2" Screw, 2-Flat Washers, and a Hex Nut. See the drawing named: *Basic Version, Coil and Terminals Detail* and find the detail marked (A) *Ground Terminal*. Wrap one end of the 12" wire around the head-end of the 1/2" screw and place a washer on the screw. Push the screw through the wall of the oats box, at the hole for *Ground Terminal (A)*, from the inside and make certain the wire is still wrapped around the screw, securely. Place a washer on the screw that is protruding through the outside wall of the oats box, then wrap the *Start Winding Wire* around the screw and secure with a *Hex Nut*, as shown in the diagram. Hold the screws head, on the inside with needle nose pliers and tighten the nut with slip-joint pliers on the outside. Make certain both wires are secure and the screw/nut is tight. The 12" wire on the inside of the box will be dealt with a little later.

8) Note: (A), (B) and (C) on the *Basic Version, Coil and Terminals Detail*: Locate eleven 1/4" Screws and eleven *Hex Nuts*, and start the nuts on each screw, just enough to hold the nut on the screw. Following the pattern on the template, start winding the wire around the oats box. Make certain the windings are straight, tight and close together. Wind 8-turns and place a piece of masking tape across the windings, just prior to the #1 *Tap Terminal*, and cut the wire about 1/4" past the *Tap Terminal* designation. Strip the end of the wire about 1/2" and shape like a fishhook. Strip the end of the supply of wire, about 1/2" again, and shape like a fishhook, also. Wrap these two bare-stripped-ends around the head-end of a 1/4" screw and tighten nut, securely. These tap screws will sit on top of the windings and will not go through the box. Hold on to the screw head with needle nose pliers and tighten with slip-joint pliers. Proceed winding until you reach the next *Tap Terminal*. Make certain all the windings are close, tight, straight and even. The *Tap Terminal* should sit on top of windings and make certain it it's straight and snug against the windings. Carefully put a small amount of hot glue around the head of the screw, securing it to the windings. Repeat this procedure for the remainder of the windings, until you reach *Tap Terminal #12*. Remove masking tape and re-use for each *Tap Terminal*. When you reach the *Finish Winding* mark, then cut-off the wire about 2" longer than that mark. Push the wire through the hole and back-through the other (see detail (D) *Tap Terminal #12*) and strip the insulation about 3/4".

9) See Detail (D) *Tap Terminal #12*, and locate a 1/2" Screw, two Flat Washers, and a Hex Nut. Put a Flat Washer on the Screw and push through the hole from the inside,

install another *Flat Washer* on the *Screw*, outside and wind the stripped-end of the coil wire around the *Screw*. Install the *Hex Nut* and tighten as per former instructions on *Terminal (A)*.

10) See Detail (E) *Antenna Terminal*, and locate a 1/2" Screw, two Flat Washers, a Hex Nut, and one 6" to 8" wire with one *Clip-Lead* on the end. Strip 1/2" insulation from the end of the *Clip-Lead* and push through the hole at: *Clip Lead from Antenna*. Twist the bare wire on the end of the *Clip-Lead* and wind around the head-end of the *Screw*, put a *Flat Washer* on the *Screw* and insert this through the hole at (E) *Antenna Terminal*, install another *Flat Washer* on the *Screw*, outside and secure with a *Hex Nut* as in previous steps. This concludes the assembly of the COIL and TERMINALS on the outside of the oat box.

11) Let's go to the illustration marked *Basic Version, Lid Detail*, keeping the *Coil and Terminals* illustration handy, too. Locate: four 1/2" Screws, eight Flat Washers and four Hex Nuts, put a Flat washer on each of the four Screws and push through the backside of the Lid, putting another Flat Washer on each and a Hex-Nut, turning just enough to stay on the Screw.

12) See illustration marked (A) on both Detail drawings and twist the 12" wire from *Ground Terminal (A)*, on proper *Phones Terminal*. At this point we must determine which type of earphones to use, *Crystal* or *2,000 ohm Dynamic*? If you are using a *Crystal-Type Earphone*, then you will need the *47K Resistor*, but not needed for the *2,000 ohm Dynamic* sets. It is recommended to use the *Crystal Earphone* as it is less expensive and quite adequate for this type of receiver. Cut a 3" piece of 22 gauge wire and strip each end 1/2", the form the bare-ends like fishhooks. Wrap one end of the wire to the opposite *Phone Terminal Screw* head, from the one with the 12" wire. Locate the *0.001uf Capacitor* and the *47K Resistor* (if used), and wire to the top of the *Lid* as per illustrations at *Phone Terminal (A)* and the other *Phone Terminal*, and tighten *Hex Nuts* in the same manner as previously mentioned. The other end of the 3" wire is wrapped around the head of the *Screw* at one of the *Diode Terminals*, and secured with a *Hex Nut* as per illustration.

13) Locate another *Clip Lead* and prepare as before, pushing it through the hole at: *Clip Lead from Diode*. The bare end of this lead is wound around the head of the *Screw* at (F) *Diode Terminal*, and the *Screw* is secured with a *Hex Nut*, as before.

14) Locate two *Hex Nuts* and the *Diode*, and secure *Diode* to it's proper *Terminals* as per illustration. In this applica-

tion, the *Diode* does not need to be installed in any particular direction. Be careful with the *Diode* as it is made of glass and a little delicate “*handle with care*”.

15) Locate two *Hex Nuts* and the *Earphone* of choice. If you are using the recommended *Crystal Earphone*, then strip the insulation from the ends, about 1/2” and tightly twist all the wire strands together and secure each wire to each of the *Phone Terminals*, with the two *Hex Nuts*. If you are using *2,000 ohm Headphones*, then just tighten the *Hex Nuts* down on the *Phone Tip Plugs*. Place lid on top of oats box, as per normal positioning. This concludes the assembly of the *Set* and it is highly recommended that you re-check your work thoroughly before proceeding to the *Operation of Set* instructions.

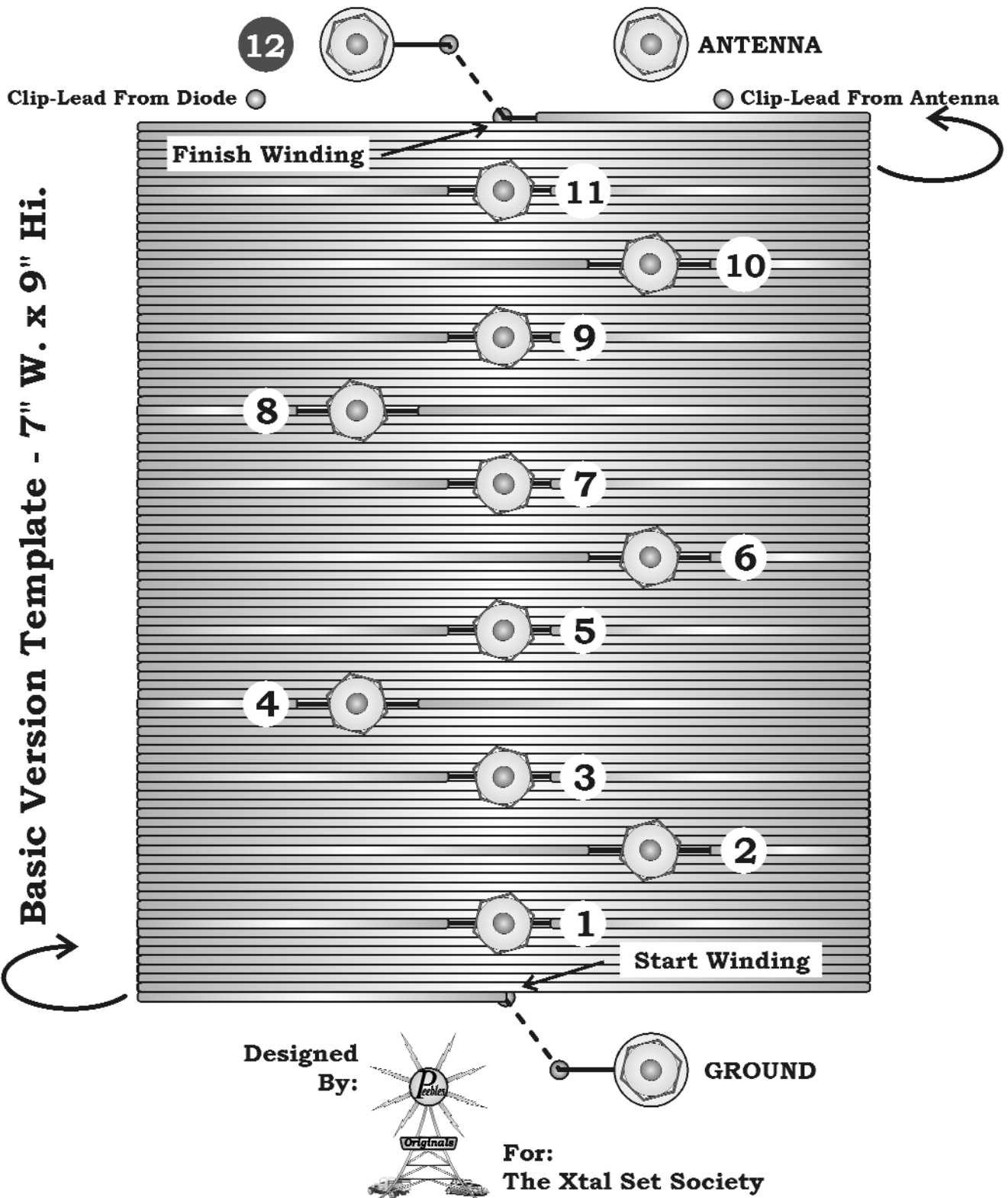
Operation of Set:

1) Connect *Ground* to the *Ground Terminal* and secure with a *Hex Nut*. Connect *Antenna* to *Antenna Terminal* and secure with a *Hex Nut*. Clip the *Antenna Clip Lead to Terminal (11)*, and the *Diode Clip Lead to Terminal (12)*. Place *Earphone* in ear(s) and listen. Do you hear a station? If so, is it loud, or very faint? Do you hear more than one station? Or, maybe no station at all? Note on a piece of paper what you experienced and proceed to change the *Taps* (1 thru 12) by clipping to them, noting what you are hearing at each combination. If you are experiencing no stations at all, then it is highly recommended to re-check all your work and make certain everything is as per instructions. When you are satisfied that your work is absolutely correct, then proceed with the above steps, noting your findings at each combination of *Taps*. There is no absolute correct way to adjust the *Taps*, but you will find that the stations at the lower-end of the *AM Broadcast Band* (530 to 1650 Kilohertz) will be at The *Taps* closer to (12) and the higher end will be closer to (1). The other thing you will experience is that the set will separate Stations, or become more *selective*, when the *Antenna Clip* is attached to *Taps* (1) thru (6), but the stations will not be as loud. With the *Antenna Clip Lead* on *Tap Terminals* (7) thru (12) you will note the stations getting louder, but harder to separate, thus the set is becoming more *sensitive*. This also will hold true with the *Diode Clip Lead*, and the trick is to find the proper combination, for your particular set, location and *antenna/ground* conditions. If your set seems to be completely overwhelmed with loud stations and no ability to tune any-one station, then try removing the *ground wire*, or you may try shorter, lower *antennas*, or maybe higher, longer *antennas*. Don't be afraid to experiment and keep a journal of all your findings as you make each change, this information will become valuable if you chose to move on to more radio experimenting, and especially if you intend to enter a science fair with this or another radio project. Hope you have

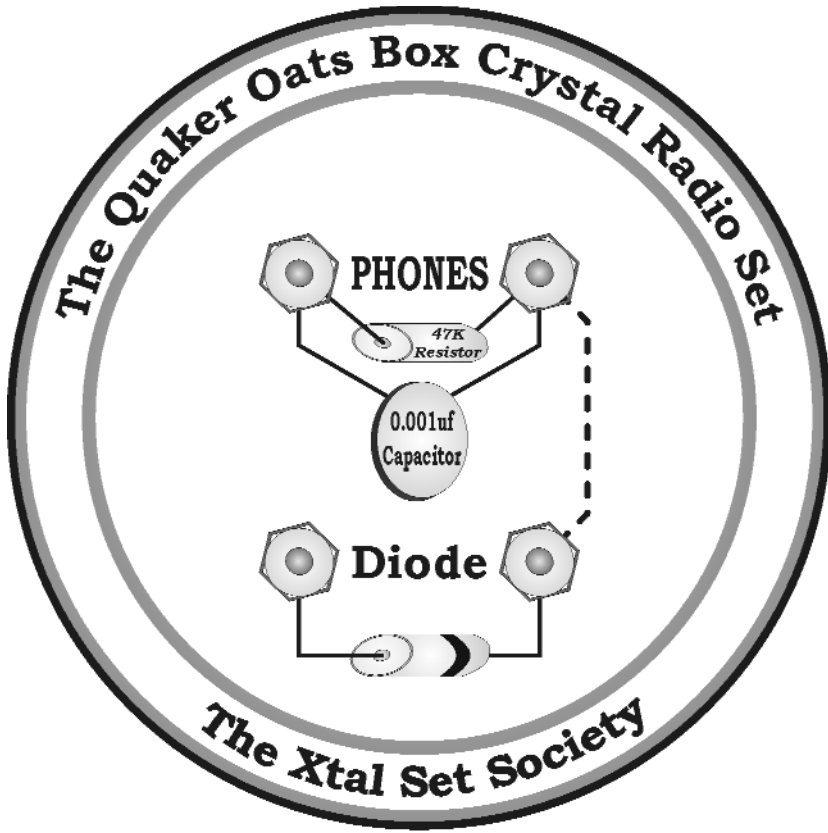
fun with this set and perhaps become “hooked” for a lifetime as I have since the age of 10, when I made my first radio for Cub Scouts. If you feel like continuing with radio, then get the book: *Radios That Work For Free or Crystal Set Projects* from www.midnightscience.com Have Fun!!

ALL PHOTOS and DIAGRAMS can be found below

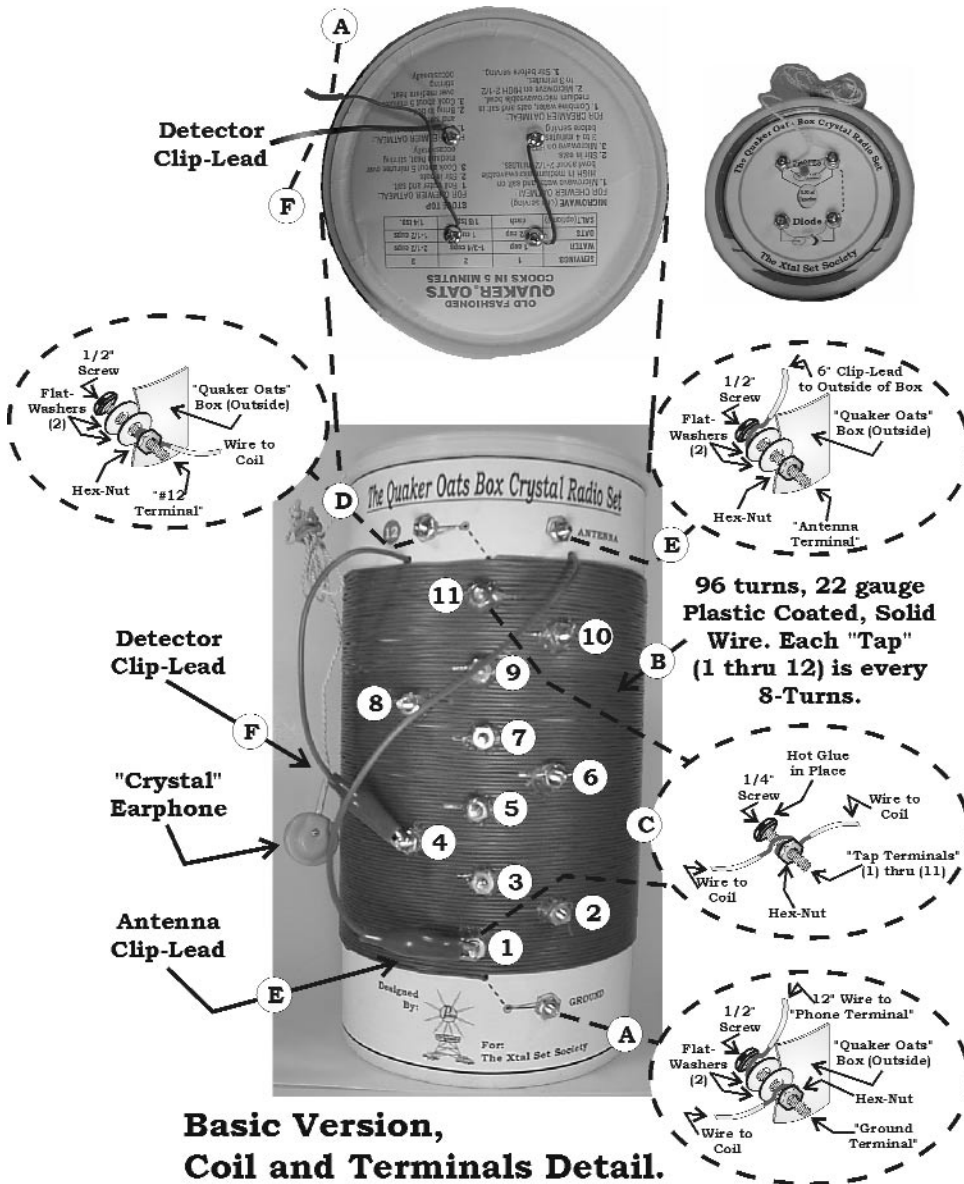
The Quaker Oats Box Crystal Radio Set

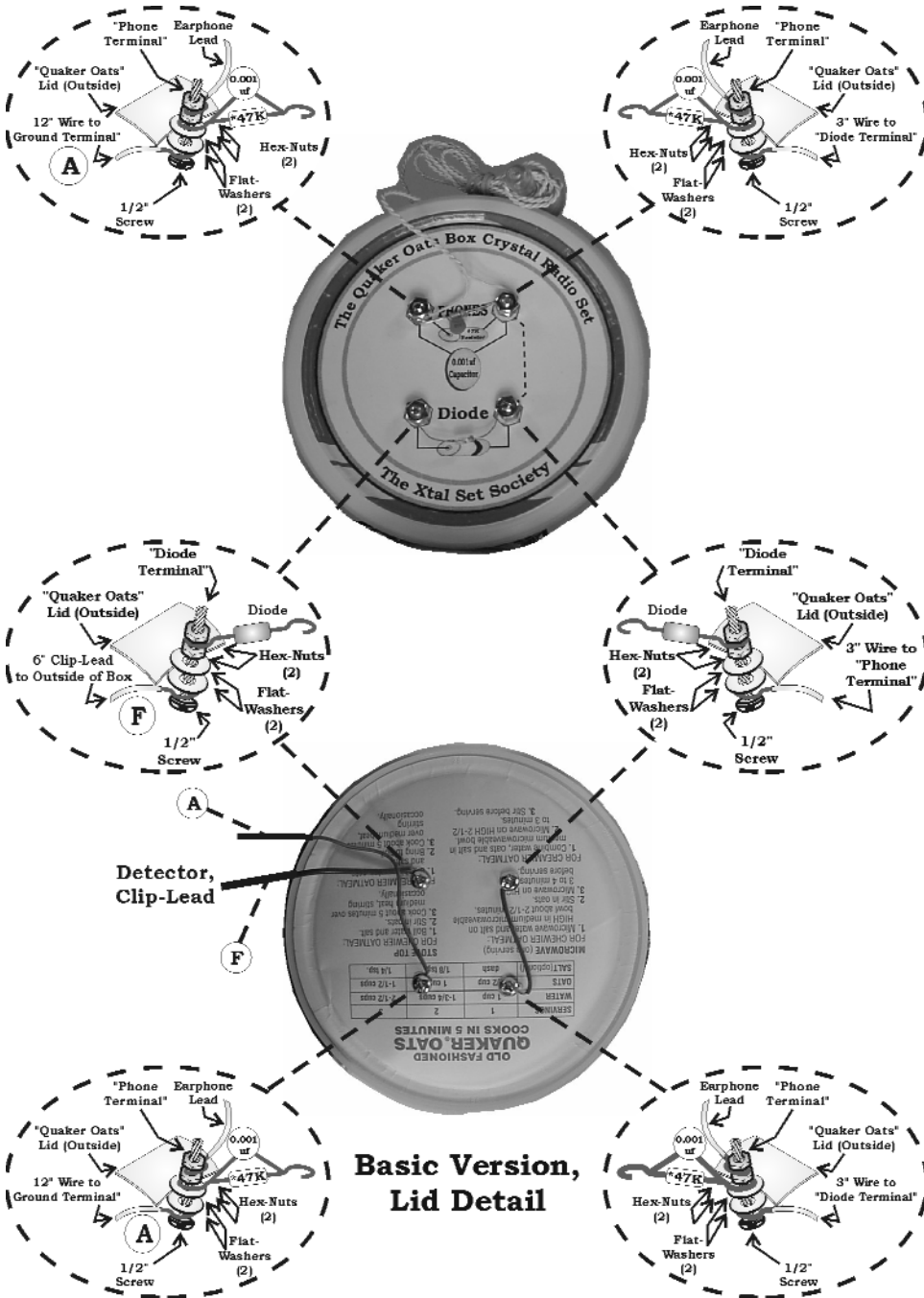


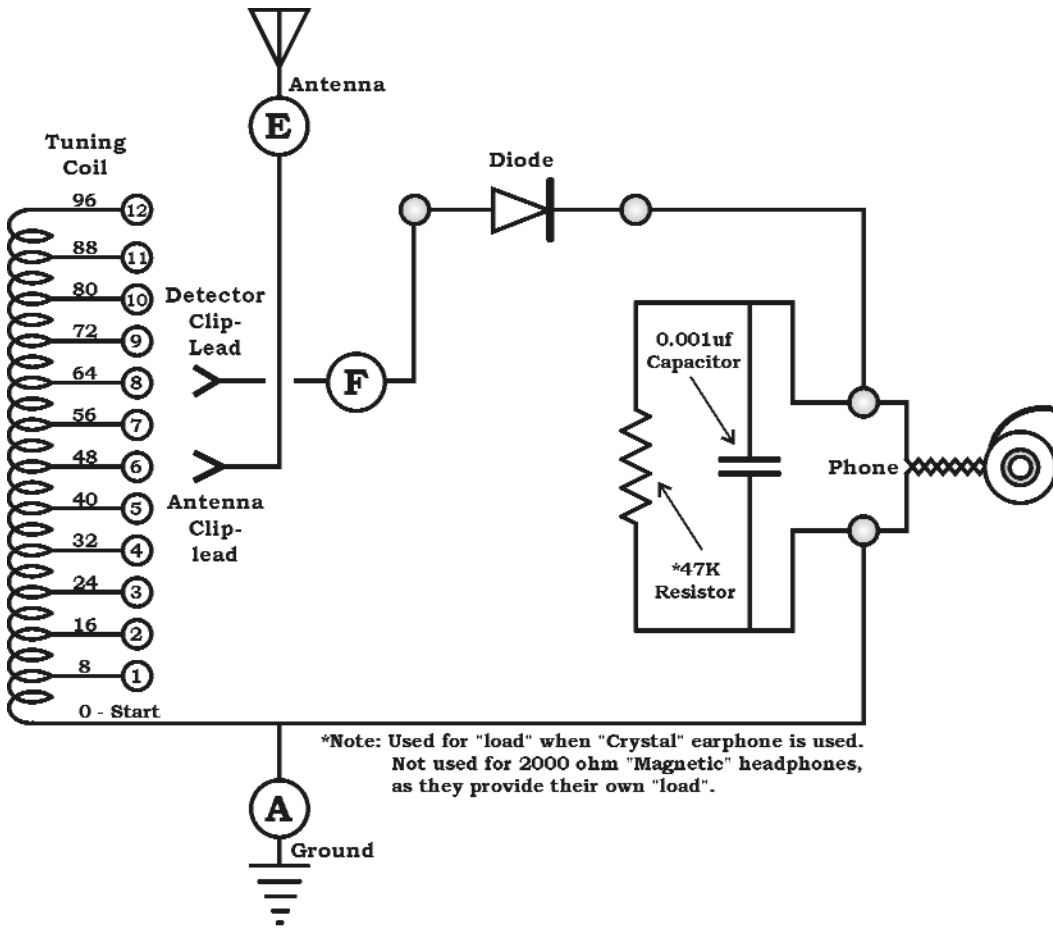
Basic Version, Template (Full Size)



**Basic Version,
Lid Template (Full Size)**







Basic Version, Schematic Diagram

THE QUAKER OATS BOX CRYSTAL RADIO SET, BASIC VERSION, PARTS LIST:

<u>Quantity</u>	<u>Description of Part</u>	<u>Radio Shack P/N</u>	<u>Other</u>
1	Quaker Oats Box, Large, 5" Diameter		You Provide
7	Machine Screws, 6-32 x 1/2"	64-3012	
11	Machine Screws, 6-32 x 1/4"	64-3012	
24	Hex Nuts, 6-32	64-3019	
14	Flat Washers, #6	64-3022	
180'	Wire, Hookup, 22 Gauge-Solid	278-1221 (2 packs-needed)	
1	Diode, Germanium, 1N34A-Type or any general purpose GERMANIUM	276-1123	Xtal Set Society
1	Capacitor, 0.001uf, Any Voltage	272-126	
1	Resistor, 47K, 1/2 or 1/4 Watt	271-1130 or 271-1342	
1	Headphone, Crystal (recommended) or 2,000 ohm Dynamic-type (47K resistor not needed with these)		Xtal Set Society
2	Clip-leads, 6" to 8", w/single clip	278-1156	
1	Antenna Kit, Recommended-Type, or similar wire, etc can be used	278-758	
1	Ground Wire, 18 Gauge, Stranded, or similar wire, etc can be used	278-1220	

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