An Unamplified Four-Foot Box Loop

by Shawn Axelrod

A129-4-1

For several years I have been using a three foot box loop that Don Homan put together for me. Although I have been more than happy with its performance, I have been wondering whether a four foot loop might produce either a better signal or deeper nulls. So I set out to build one, using the principle that the less metal inside the loop winding the better.

Parts

--one variable capacitor, 10-365 pF. I got mine from an old radio. (Fair Radio Sales, P.O. Box 1105, Lima, OH 45802, or Antique Electronic Supply, 6221 S. Maple Ave., Tempe, AZ 85263 can supply these as well if you're not interested in paying the new price.)

--one knob for the above. I used a vernier for finer tuning.

--175 feet of wire. I used enamelled 20 gauge wire.

--four end pieces (wire supports). Each is a 7" length of 2x2 finished lumber.

--two cross arms: 45 1/2" lengths of 2x2.

--two braces: 6" lengths of 1x2

--dowel: approximately 40", 1 1/2" diameter

--loop support: 4" length of 2x2

--a loop stand. I used a stand for an outdoor umbrella stand

--suitable length of coax to run from loop to receiver

--a connector for interfacing the loop pick-up winding to the coax; I used a screw-type terminal block

--two 3 1/2" bolts with nuts

--four flat head wood screws, approximately 2" long

I used cedar for the wood in my loop. Measurements may change for other types of finished lumber.

Preparation of the Various Parts

A. Cross Arms

First, drill holes (suitable to thread some of the wire through) 3 1/2" from each end of the 45 1/2" length. Measure 3/4" each side of the center of each length. Shade this area as in Figure C, then cut out the area to a depth of 3/4". The arms can now be fitted together in the same plane.

A129-4-2

B. End Pieces

Mark lines every 1/2" across the face of each piece as in Figure A. Cut about 1/8" deep on each line; these grooves will be for holding the loop windings in place. Their width should be just large enough to allow a press fit for the wire which you are using. On the opposite side of each end piece from the grooves, shade the area 3/4" each side of the center of piece as per Figure B, then cut the area to 1/4" depth. This notch should allow the end pieces to fit the ends of the cross arms. Next, drill a hole in the exact center of each end piece suitable for one of the wood screws, and drill an appropriate countersink.

C. Braces

Drill two holes on the flat side of each of 6" long pieces of 1x2. Each should be centered one inch from each end and be a suitable diameter for the bolts you'll be using.

D. Loop Support

Figure F shows the dowel and the 4" long piece of 2x2. Cut a 4" long 1/2 inch deep piece from one end of the dowel to form a notch that the 2x2 piece will sit in. Take the 2x2 and drill a hole through it about 1 to 1 1/2 inches from the top end. This hole's diameter should accomodate the 3 1/2 " bolt you will use.

Assembly

A. Loop Support

Take the 4" piece of 2x2 and fit it into the notch on the dowel. Once you are sure it will fit well, glue the two pieces together with a good wood glue. The other end of this dowel should fit into the outdoor umbrella stand and rotate with ease.

B. Mounting the End Pieces

Fit the two cross arms together to form a coplanar X; use wood glue to keep them together. For added strength, put a one inch screw through the center as well. Attach each of the four end pieces to the ends of the cross arms. Insure that they are placed so that you can wind the wire around the outside of the loop as per Figure G. Glue each end piece securely, and use the countersunk wood screws for added strength.

C. Tuning Capacitor Board

Take the 6 inch long piece of 1x2 as shown in Figure D and mount the wire connector one to two inches from the end of the board. Mount the variable capacitor on the underside of the board as shown in Figure D so as to allow the shaft to stick out far enough so that the knob can be attached.

D. Mounting the Tuning Capacitor Board.

Glue this board on the underside of any of the end pieces, i.e. on the opposite side from the grooves. One end will butt against the cross arm, while the end with the capacitor and connector on it will stick out from the end piece. This part of the frame will be the bottom of the loop as in Figure G.

E. Mounting the Braces

Take one of the 3 1/2 inch bolts and put it through a hole in one brace (Figure E), then through the piece of 2x2 attached to the dowel

A129-4-3

(Figure F), and finally through the second brace (Figure H). Secure the bolt using a wing nut to make it easier to adjust. Put the dowel into the stand and you now have a rotating and tilting mechanism for your loop. Before attaching the loop to the dowel, you'll likely need to weight the stand; sand worked well for me.

F. Mounting the Loop

Slide the bottom arm of the loop frame between the two braces (Figure G). Find where it will balance best for tilting, then drill a hole suitable for the second 3 1/2 inch bolt at that position. Slide this bolt through the brace, the loop arm and the other brace (Figure H) and secure it with a nut.

G. Pick-up Loop

Drill another hole in the bottom arm of the frame about 4 1/2" from the end piece. One end of the pick up loop wire is fed through this hole to the connector. The wire is then threaded through the holes in the other arms to get back to the bottom arm from where it will run to the other side of the connector. Make sure the pick-up loop is tight.

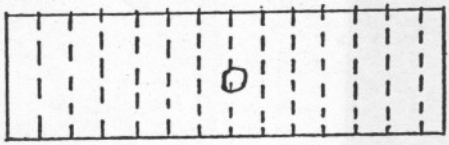


FIGURE A
End Piece Top View

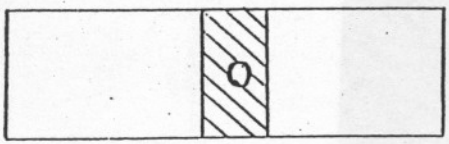


FIGURE B
End Piece Bottom View

Cross Arm Bottom View

FIGURE C

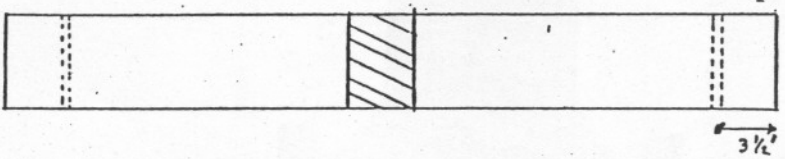
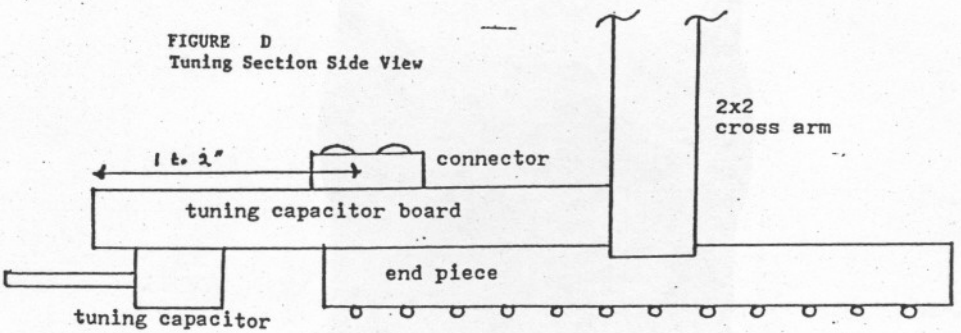
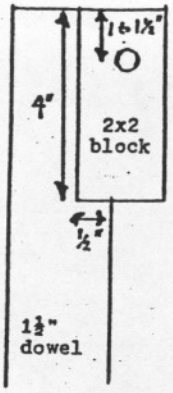


FIGURE D
Tuning Section Side View

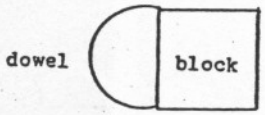


A129-4-4

FIGURE F
Dowel Side View



Dowel Top View



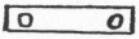


FIGURE E
Brace Side View

H. Winding the Loop

To wind the main coil of the loop, solder the end of the wire to the solder lug on the variable capacitor. Then wind the wire around the loop, pushing the wire into the grooves on the end pieces, keeping the wire taut as you do so. After you have completed the winding, solder the remaining end of the wire to the frame of the capacitor.

I. Attaching the Coax Feed Line

Simply put, one end of the pick up loop goes to the coax center conductor, the other end goes to the coax shield. I found that I got a better match to my receiver (an ICOM IC R-70) when I placed a 680 pF capacitor between the pick up winding and the coax center conductor.

Tuning up the Loop

Attach the coax to your radio using whatever connector is appropriate. Try peaking the loop tuning capacitor on a signal around 1000 kHz. Vary the receiver tuning and readjust the loop capacitor to discover its tuning range. If you cannot tune the top of the band, remove a winding or two. Eventually, you should be able to tune from about 520 to 1700 kHz on this loop..

Conclusions

I have been able to get nulls up to 40 dB on my S-meter by tilting and rotating this loop. In a nulling comparison using this loop I was able to hear WDGY-630 with local CKRC nulled, while Wayne McRae could not using a the 3' loop. We were both using ICOM IC-R70's at the time, and were spaced 7 to 10 feet apart. I was also able to hear Belize-830 using the four foot loop, but could not using the three foot loop. In general, it is the superior nulling ability of the four foot loop rather than its sensitivity that gives it the advantage.

FIGURE G

Antenna Side View

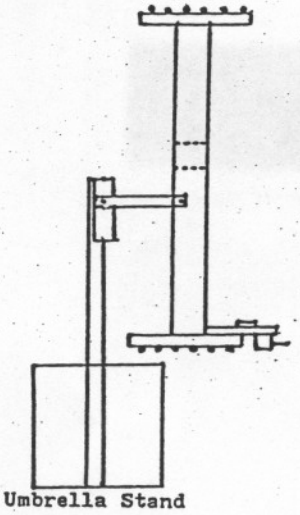


Figure H Braces Seen From Above