A Resonant Speaker for CW

This acoustic design makes listening a pleasure.

Bill Sepulveda, K5LN

I'm an avid CW operator and spend lots of my retired time on the air in that narrow-band mode. Since adding a new radio to my operating table, I noticed there was something missing when I listened to CW signals. There was lots of noise, the signal was not crisp and clear. I was having trouble hearing the stations clearly, and I would find myself turning the volume up pretty high.

I remembered that I had one of the Skytec CW-1 resonant speakers that were available several decades ago. I found the vintage speaker in my junk box, hooked it up, and wow — the CW signal jumped right out of the speaker! It was super clear, crisp, and loud. I had to reduce the volume on the radio, and I also noticed that the background was way down and I had no problem copying the signal at a reduced volume. What a relief.

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After using this great speaker and experiencing how well it worked, I started searching the Internet to see if others were suffering from the same situation, and if anyone had ventured into making a new configuration of the CW resonant speaker. A search revealed a few articles and videos, but they lacked construction details. Also, I wanted something that was small and attractive, so I built the resonant speaker shown in the lead photo.

How It Works

After considerable trial and error with different configurations, I figured it out. The audio from the speaker will be peaked at a specific audio frequency, with a narrow bandwidth, when the speaker size and acoustic cavity are tailored to specific dimensions. For example, using a specific speaker and baffle size, a specific depth of speaker cavity, and a matching size and length of a resonator tube, the device will act just like a filter in the radio. However, it will also enhance the audio volume.

I finally determined a repeatable configuration that would peak a signal at approximately 700 Hz and increase the volume of the signal by quite a bit. I don't have the test equipment to measure the loudness, but you'll be pleasantly surprised once you hear it. Also, adding a sleeve in the open end of the device will help move the center frequency down to about 550 Hz, if desired.

Here are step-by-step instructions on how to make the parts, and how to assemble them.

Making a CW Resonant Speaker

Table 1 shows the list of materials along with suggested sources. You can search the Internet or use the suggested sources. You will need solder, a soldering iron, and basic hand tools, such as cutters, pliers, and wire strippers. You will also need a Dremel® tool and a saw to cut PVC pipe, and some coarse as well as 100-grit sandpaper.

Make the Speaker Cavity

Cut a 2-inch diameter schedule 40 PVC pipe to a length of 1 inch. Make the cut square and straight. Sand and clean the inside and outside edges of the PVC pipe. Drill a ¼-inch hole, ⅜ inches from one edge of the tube. On the opposite side of the tube, and on the same edge, make a mark that lines up with the center of the ¼-inch hole. Measure ⅜ inches from that mark to the right and left. Drill a ¼-inch hole at each location, also at ⅜ inches from the edge of the tube. Deburr and clean both sides of the three holes. Set this speaker cavity aside for now.

Make Two Cover Disk Baffles

Using a clear plastic CD cover as source material, draw a 2 3/16-inch circle. Then draw a 2⅜-inch circle and cut the circles out of the plastic disc cover — be careful not to crack the plastic. I used a Dremel tool to cut mine. Then finish the edges with a small grinding wheel.

Next, carefully drill a ⅛-inch hole in the center of the 2 3/16-inch disks. Clean and deburr the hole. The 2⅜-inch plastic disc should fit nicely on the bottom of the speaker cavity tube. It's *important* that the speaker cavity tube is completely closed and well-sealed! Put the disks aside for now.

Install Cover Disk to the Speaker

Important: prior to assembly, make sure the ⅛-inch hole in the 2 3/16-inch cover disk (see Figure 1A) is in the center of the speaker, and the outer edge of the disk is within the speaker's metal frame. If not, make it so — this is important. Place a small bead of glue — at {1} in Figure 1A — around the top ridge of the speaker. Lay the 2 3/16-inch cover disk, {2}, on the top edge of the speaker, {3}, so the hole in the center of the cover disk is in the center of the speaker (*important*). Applying a small weight the size of the speaker will help hold the pieces flat. Allow the glue to completely dry.

Assemble the Speaker Cavity

After the glue on the speaker and cover disk is dry, place the speaker face-down on a flat surface so the magnet is up and the speaker contacts are on the right side, as shown in Figure 1B. Set the speaker cavity tube down on a flat surface so the holes for the switch and RCA phono jacks are closest to the flat surface. Apply a bead of glue, {4}, around the top edge of the speaker cavity tube.

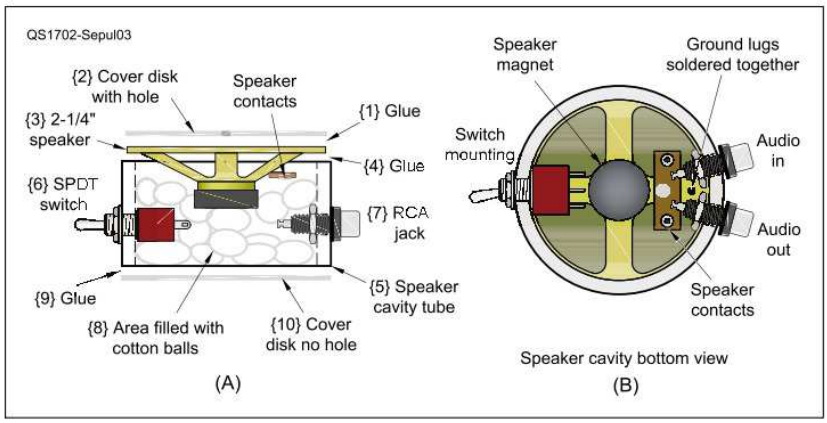

Figure 1 — Follow the assembly instructions {1} through {10} in (A), and component locations (B) in the speaker cavity.

Turn the tube over — glued side facing down — and orient the speaker cavity tube, {5} (Figure 1B). Lower the tube down onto the back of the speaker frame. Apply a small weight to the speaker cavity tube to apply pressure so the speaker self-aligns to the speaker cavity. Let this assembly sit until the glue is dry.

After the glue has dried, make sure to remove any excess glue that might overlap the outside edge of the speaker cavity. The outside surface of the speaker cavity must be clear of any glue.

Install Switch, RCA Phono Jack, and Wiring

Install the switch, {6}, and two RCA jacks, {7}, into the speaker cavity tube, {5}. Remove *all* the hardware from the switch and use only the lock washer between the switch body and cavity, then only one nut to secure the switch horizontally in place. When installing the RCA phono jacks, tighten them in place with the two ground lugs touching each other so they can be soldered together.

Wire the switch, speaker, and two RCA jacks according to the speaker hookup diagram seen in Figure 2. When viewing the speaker cavity from the bottom, the left RCA phono jack is the AUDIO IN, and with the switch lever oriented to the right, will be the CW speaker's ON position. The other switch direction will be the BYPASS position.

Now stuff the cotton balls, {8}, in and around the speaker edges and bottom

Table 1
List of Materials for the CW Resonant Speaker

Quantity	Item	Source
1	1-inch-long piece of 2-inch IPC Schedule 40 PVC pipe	Home improvement store
1	2-inch, 45-degree PVC street elbow	Home improvement store
1	Clear CD cover	An office supply outlet
1	2¼-inch speaker, Philmore #TS21 8 Ω, 0.2 W	Altex Electronics
1	Tube of Loctite "GO2" clear glue	Home improvement store
2	RCA jacks	Fry's or Altex Electronics
1	SPDT miniature toggle switch, Philmore #30-10002	Altex Electronics
6	1-inch diameter cotton balls	Pharmacy or supermarket
2	Cables with RCA connectors on each end, length to suit your need	–
–	Short lengths of #24 or #26 AWG hookup wire	–

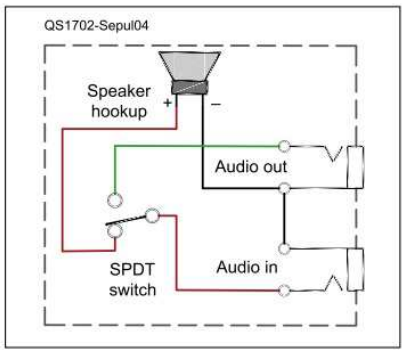

Figure 2 — Hook up the speaker, switch, and phono jacks according to this component diagram.

of the speaker. Do not overstuff to where it will create a bulge in the bottom cover. With the speaker cavity in the same position, apply a small bead of glue, {9}, around the bottom edge of the speaker cavity, which at this time should be facing up. Place the 2⅜-inch cover disk, {10}, to the bottom edge of the speaker cavity.

The audio from the speaker will be peaked at a specific audio frequency, with a narrow bandwidth, when the speaker size and acoustic cavity are tailored to specific dimensions.

PVC Street Elbow Modification (Resonator)

Use the finished speaker cavity as a guide to add clearance notches for the switch and RCA jacks to the PVC street elbow (see the lead photo). Add enough depth to the notches so there's about 3⁄16 to ⅛ of an inch of the speaker cavity exposed at the bottom of the elbow. I used a Dremel tool with a small circular sanding wheel (not a disk). Set this aside for the moment.

Final Assembly

Attach an RCA jumper cable to the CW speaker AUDIO IN jack on the speaker cavity. Attach the other end of the cable to the radio speaker AUDIO OUTPUT phono jack. Connect the other RCA jumper cable from the CW speaker AUDIO OUTPUT jack to the external speaker AUDIO IN connection.

Set the speaker cavity on the operating table so the disk with the ⅛-inch hole is facing up. Set the CW speaker switch to the BYPASS position — the switch lever to the right. Turn on the radio, and set the side tone of the radio to 700 Hz. Tune in a CW station to where the audio is at 700 Hz. Switch the CW speaker to the ON position. The audio will be very low until the elbow is installed.

Place the 45-degree PVC street elbow (see the lead photo) on top of the speaker cavity so the notches for the switch and RCA jack are lined up to clear the switch and RCA phono jacks. Slowly press the elbow down over the speaker cavity and listen for the loudest signal peak from the CW speaker. Make sure your hand is not covering the opening in the elbow. It may take a few tries to find the loudest point. You may have to re-install the elbow to make sure that you find the sweet spot or loudest point.

Now change the CW speaker to the BYPASS position, and listen to the signal, then change it back to the ON position. There should be a significant difference in volume between the two positions. Set the CW speaker to the ON position, and adjust the volume control on the radio to a comfortable listening level. This should now be at a lower volume point than without the CW speaker. If not, check for good glue joints around the speaker frame to the speaker cavity.

Conclusion

Congratulations, you have just made a great CW listening device. The more you use it, the more you'll appreciate the clear and crisp signals, and feel that using a regular speaker for CW is no longer acceptable. I'll leave it up to you how you finish the details and labeling on your speaker. I made labels using Microsoft *PowerPoint*®, as described in my article, "Panel Layout with Microsoft PowerPoint" in the December 2002 issue of *QST*.

Share this with your CW friends so they can also enjoy the clear and crisp CW signals.

Photos by the author.

Bill Sepulveda, K5LN, has been an active CW operator for over 53 years. Since retiring in 2010 from his career as a mechanical engineer in the electronics industry, he is now looking for ways to enhance the hobby. He produces front panel overlays on homebrew equipment and makes devices to aid CW reception. Bill also restores classic equipment and is an active mentor to the younger generation in his local area, where he teaches Morse code and CW operations. You can reach Bill by e-mail at **k5ln@austin.rr.com**.

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QST Congratulates...

Paul Wesling, KM6LH, who has posted several videos of his popular ARRL Centennial Convention talk, "The Origins of Silicon Valley: Roots in Ham Radio," on YouTube. Paul traces early tube development by San Francisco Bay area amateurs starting in the year 1907, and describes their contributions that would eventually build what is now Silicon Valley. You can watch the entire video series by going to the YouTube playlist page at **goo.gl/LAL1AT**.