

CW Resonant Speaker

By Bill Sepulveda, K5LN

Since I'm an avid CW operator, and spend lots of my retired time on the air in the narrow mode operation called CW. Yea, I know, CW is supposed to be dead and going away! Well, to tell the truth, I have no problem in finding CW Ops during any time of the day or night from anywhere around the world. However, and as you should know, it has a lot to do with band conditions, right! ☺

Since I've added a new radio to my operating table there was something still missing when I listened to CW signals. Lots of noise, the signal was not crisp and clear, and just not the good experience I remembered. I was having trouble hearing the stations clearly, and I wound up turning up the volume pretty high, and when I did, I noticed the door between the shack and the house would quietly close. Oh, and I recently found out from my doctor that my hearing isn't what it used to be. It must be one of those retirement Perks. ☺

Not being happy with the situation, I was reminded that I had one of those CW-1 SkyTec speakers which were available in the late 60's. For some, they will remember the speaker, and others will question what they are.

Now to use another retirement perk, where did I put it? After a day's search of the junk box and much to my surprise; I found it! So I hooked it up and WOW, the CW signal jumped right out of the speaker and I had to lower the receiver volume as well as my Side Tone monitor level because the signal was so loud! The signal 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 in being able to easily copy the signal at a reduced volume. Oh what a relief it is!

After using this great speaker and experiencing how well it worked, I started thinking I need to look around the internet to see if other's were suffering from the same situation, and if anyone had ventured into making a new configuration of the CW Resonant Speaker? It's been a long time since the late 60's; surely someone has made a better mouse trap? I was able to find a few articles and YouTube videos on the internet; however they were missing lots of details on how to make one. Plus I wanted something that was small and didn't look like a kludge.

So, with all the information I could muster, I started playing around with building some. It took a Lot of trial and error and different configurations to nail it down. I finally wound up with the repeatable configuration that would peak a signal at approximately 700 Hz and increase the volume of the signal quite a bit. Sorry I don't have the test equipment to show you how much louder it is, but you'll be pleasantly surprised once you hear it! Also adding a sleeve in the open end of the Elbow will help move the center frequency down to about 550Hz. Oh, by the way the door between the shack and house doesn't close any more. ☺

How does it work?

When using a specific **Speaker Size with a Baffle**, a matching **Size** and **Depth** of a **Speaker Cavity**, and a matching **Size** and **Length** of a **Resonator Tube**; the audio from the speaker will be amplified at a specific audio frequency and band width. Just like a filter in the radio, but it's in the audio output of the Speaker.

So here it is broken down to a simple Bill of Material, where the parts may be found, followed by step-by-step instructions on how to make each part, and how to assemble them. Sometimes I get mired in the details as you'll see; but better more information than not enough. ☺

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How to make a CW Resonant Speaker:

Bill of Material:

- 1 – **One inch** long piece of **Two inch IPC Schedule 40 PVC pipe**; available at hardware stores (Home Depot / Lowe's)
- 1 – **Two inch, 45 degree PVC Street Elbow**; available at most hardware stores (Home Depot / Lowe's)
- 1 – Clear **CD Disk Cover**; available at any Electronic store that sells CD holders.
- 1 – **2-¼ inch speaker Philmore #TS21 - 8 ohm, 0.2 Watt**; available at Altex Electronics, or on the internet.
- 1 – Tube of **Loctite "GO2" clear glue**; available at the local hardware store (Home Depot / Lowe's)
- 2 – **RCA jacks**; available from Fry's, the internet, or Altex Electronics.
- 1 – **SPDT On – On miniature toggle switch, Philmore #30-10002**; available from any electronics supplier
- 6 – One inch diameter **Cotton Balls**; you'll have to ask the XYL for help with this one.
- 2 – **Jumper Cables** with **RCA** connectors on each end. You need to determine the length for your application.
 - Some 24 or 26 gauge hook up wire.

Tools:

- Solder
- Soldering Iron
- Basic hand tools (Cutters, pliers, and wire strippers)
- 100 Grit sand paper
- Coarse sand paper
- Dremel Tool
- A Saw to cut the PVC Pipe

Assembly Procedure:

Creating the "Speaker Cavity":

- 1 – Cut a **Two inch diameter schedule 40 PVC pipe** to **one inch long**. See figure 3.
- 2 – **Sand and Clean** the inside and outside edges of the pipe. It's important to have the cut square and straight.
- 3 – **Drill a 1 /4 inch hole, at 3/8 inches** from one edge of the tube. See Figure 3.
- 4 – On the **opposite side** of the tube, and **on the same edge, make a mark** that lines up with the center of the 1/4" hole; **measure 3/8 inches from that mark to the right and left**. Drill a **1 /4 inch hole** at each location, also at **3/8 inches** from the edge of the tube. See Figure 3.
- 5 – **Deburr and clean** both sides of the three holes.
- 6 – Set the **"Speaker Cavity"** aside.

Creating two Cover disks (Baffle):

- 1 – Using a **clear CD disk cover**, draw a 2- 3/16 inch circle. Then draw a 2-3/8 inch circle and cut the circles out of the cover. I'll leave how you cut the disks up to you. **No cracks in the Plastic please!** I used a Dremel Tool to cut mine. Then finished the edge with a small grinding wheel. See Figures 1 & 2.
- 2 – **Drill a 1/8 inch hole** in the center of the **2-3/16 inch disks**. Clean and deburr the hole. See Figure 1.
- 3 – The **2-3/8 inch Cover** should fit nicely on the bottom of the **"Speaker Cavity"** tube. It's important the **"Speaker Cavity"** tube is closed and sealed.
- 4 – Put Disks aside.

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Install Cover Disk to Speaker: (Refer to figure 6 & 7A for details)

- 1 – Prior to assembly, make sure the 1/8 inch hole in the **2-3/16 inch Cover Disk** (3) is in the center of the speaker and the outer edge of the disk is within the speaker metal frame. If not, make it so! It's **IMPORTANT!**
- 1 – Place a **small bead of Glue** (1) around the top ridge of the **Speaker**. See figure 6.
- 2 – 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**. Applying a small weight the size of the speaker will help hold the pieces flat.
- 3 – **Allow the glue to completely dry.**

Assembly of the Speaker Cavity:

- 1 – 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 so the speaker contacts are on the right side as shown in **figure 5 and 7B**.
- 2 – Set the **“Speaker Cavity”** tube down on a flat surface so the holes for the **Switch** and **RCA Jacks** are closest to the flat surface.
- 2 – Apply a bead of **glue** (4) around the top edge of the **“Speaker Cavity”** tube. See Figure 7A.
- 4 – Turn the tube over (glued side facing down) and orientate the **“Speaker Cavity”** tube (5) as shown in **figure 5 and 7B**. 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.”** See figure 5 and 7A&B.
- 5 – Let this assembly sit until the glue is dry.
- 6 – **After the glue has dried, make sure to remove any excess glue which might overlap the outside edge of the “Speaker Cavity”.** **The outside surface of the “Speaker Cavity” MUST be clear of any glue!**

Switch, RCA Jack installation, and wiring:

- 1 – Install the **Switch** (6) and two **RCA Jacks** (7) into the **“Speaker Cavity”** (5). Remove **ALL** the hardware from the **Switch** and only use the **Lock Washer** between the **Switch Body** and **Cavity** and only one nut to secure the **Switch Horizontally** in place. When installing the **RCA Jacks**, tighten them in place to where the two **Ground Lugs** are **touching each other** so they can be soldered together. See Figure 7B.
- 2 – Using **Figure 8**, wire the **switch, speaker, and two RCA jacks**. See figure 7B for part orientation. When viewing the **“Speaker Cavity”** from the bottom the **Left RCA Jack** is the **“Audio In”**, and with the **Switch Lever** oriented to the right, will be the CW Speakers **“On”** position. The other switch direction will be the **“Bypass”** position.
- 3 – Now **stuff the cotton balls** (8) in and around the speaker edges and bottom of the Speaker. Do not over stuff to where it will create a bulge in the bottom cover when it's applied. See figure 7A.
- 4 – 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. See Figure 7A.
- 5 – Place the **2-3/8 inch Cover Disk** (11) to the bottom edge of the **“Speaker Cavity”**. See Figure 7A.

Street Elbow modification (Resonator):

- 1 – To the **Street Elbow**, add **clearance notches** for the **Switch** and **RCA Jacks**. Add enough depth to the notches so there's about 3/16 to a 1/8 of an inch of the **“Speaker Cavity”** exposed at the bottom of the Elbow. I did it by using a **Dremel Tool** with a small circular sanding wheel (not a disk). Set it aside for the moment. See figure 4.

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Final Assembly:

- 1 – On the “**Speaker Cavity**”, attach an **RCA Jumper Cable** to the CW Speaker “**Audio In**” Jack, and the other end of the same cable to the **radio speaker “Audio Output” jack** (you may need to make up a cable to work if the radio doesn’t have an RCA jack for the external speaker output jack).
- 2 – Connect the other **RCA Jumper Cable** from the **CW Speaker “Audio Out” Jack** to the **External Speakers “Audio In”** connection.
- 3 – Set the “**Speaker Cavity**” on the operating table so the disk with the 1/8 inch hole is facing up.
- 4 – Set the CW Speaker switch to the “**Bypass**” position (switch lever to the right).
- 5 – Turn on the radio, and set the Side Tone of the radio to 700 Hz.
- 6 – Tune in a CW station to where the audio is at 700 Hz.
- 7 – Switch the CW Speaker to the “**On**” position. Audio will be very low until the Elbow is installed.
- 8 – Place the **45 Degree Street Elbow** on top of the “**Speaker Cavity**” so the **Switch** and **RCA Jack Notches** are lined up to clear the Switch and RCA Jacks.
- 9 – Slowly press the **Elbow** down over the “**Speaker Cavity**” and listen for the **loudest signal Peak** from the CW Speaker. **Caution:** make sure your hand is **NOT** over the opening in the Elbow! ☺ This may take a few tries to find where the loudest point is. You may have to re-install the Elbow to make sure the sweet spot or loudest point is found. 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. Set the CW Speaker to the “**On**” position, and adjust the volume control on the radio to where the signal is at a comfortable listening level, which should now be at a lower point than without the CW Speaker. This is where you want to be. If not! Check for **good glue joints** around the speaker frame to the “**Speaker Cavity**”.

Congratulations, you have just made a great CW tool. The more you use it, the more you’ll realize that the signals are clear and crisp, and using a regular speaker for CW is no longer acceptable.

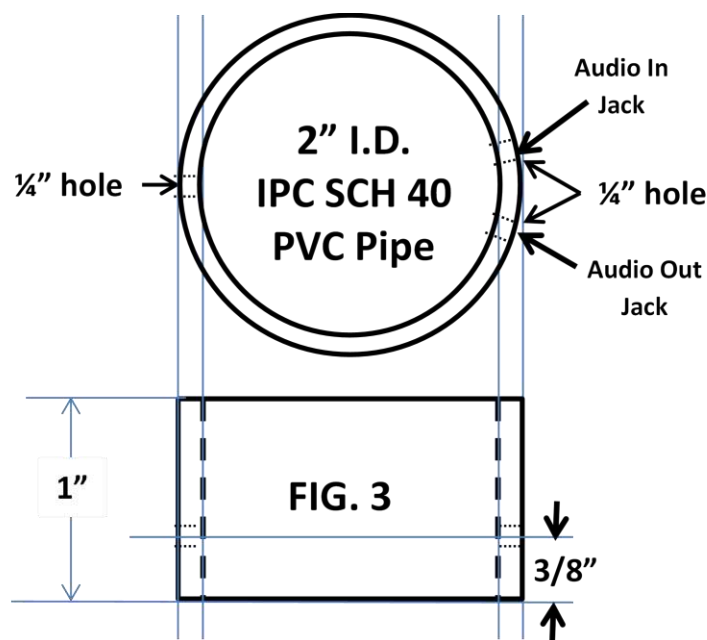
Views to help in assembly:



FIG. 1



FIG. 2



"Speaker Cavity"

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Speaker Orientation

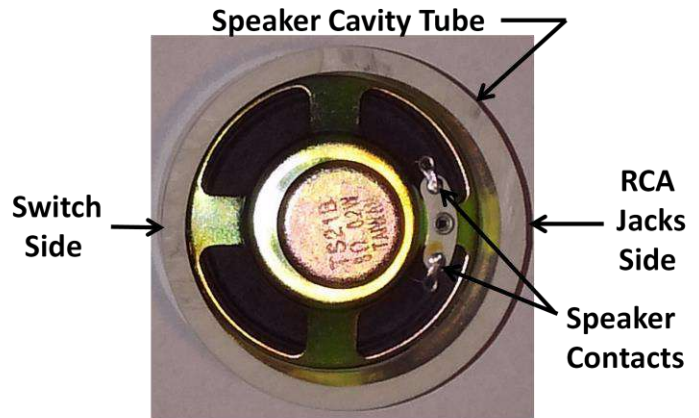


FIG. 5

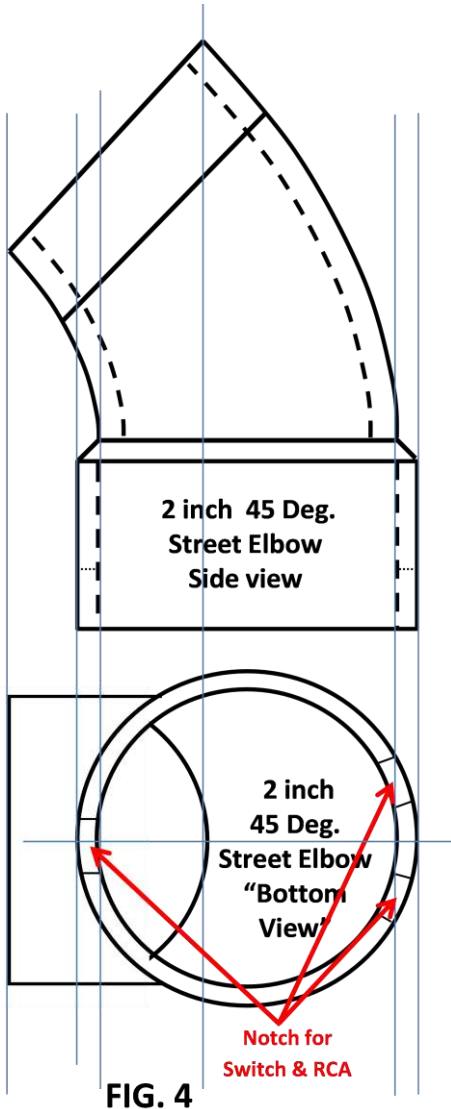


FIG. 4

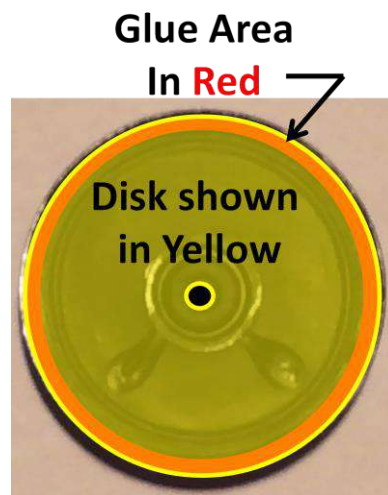


FIG. 6

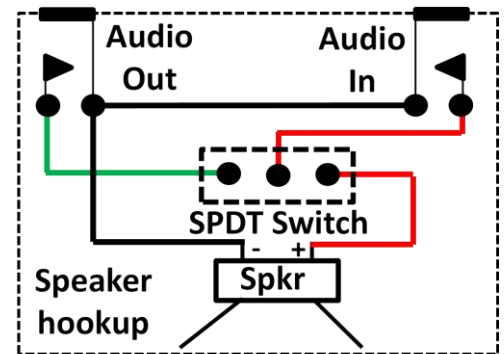


Fig. 8

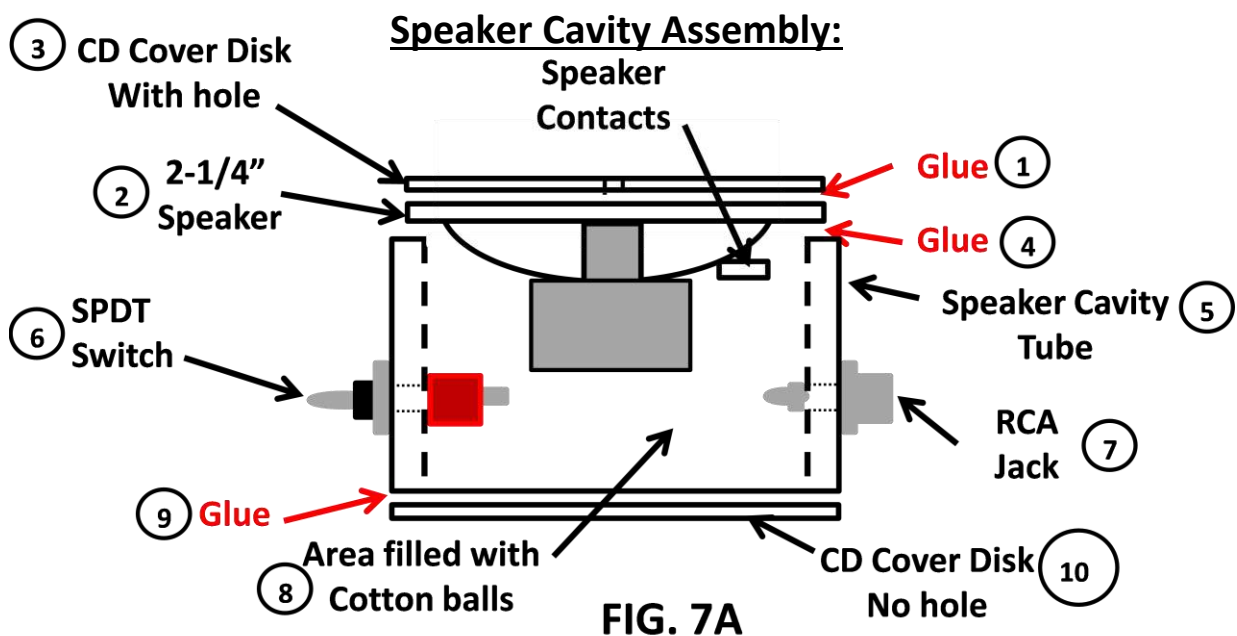


FIG. 7A

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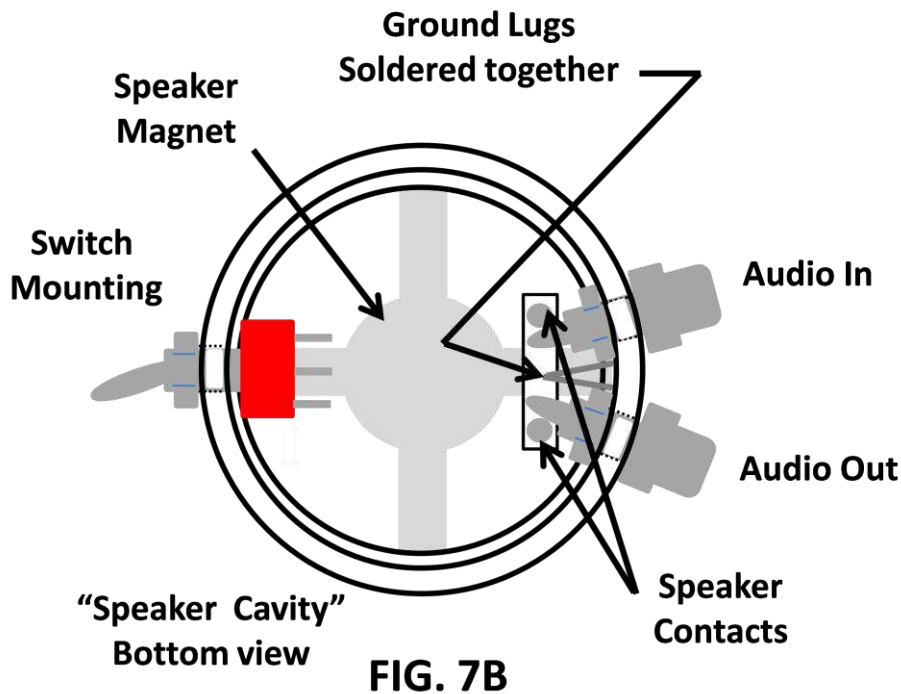


Photo of finished CW Speakers:

I'll leave it up to you how you finish the details on your speaker. I use my method of making Labeling using Microsoft "**PowerPoint**". See the article in my QRZ Page, or in the 2002 December Issue of QST called "**Panel Layout with Microsoft PowerPoint**".



Well that's it; best wishes and share this with your CW friends so they can also enjoy the clear and crisp CW signals.

73,
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