Building a Solar Air Heating Collector from Soda-Pop Cans

Greg West

This solar air heating collector uses recycled aluminum soda pop cans for the absorber. The pop cans have the tops and bottoms drilled out, and are assembled into vertical columns that the air passes through. The black painted soda pop cans are heated by the sun. The solar heat is transferred to the air passing up through the columns of can.

A manifold at the bottom supplies room air to all the can columns, and a similar manifold at the top of the collector collects the heated air for distribution back to the room.

The combination of uniform air distribution to the whole collector and the large amount of heat transfer area from the cans to the air makes for an efficient collector. My collector also uses Twinwall polycarbonate glazing -- this is a type of double glazing that reduces heat loss and increases the efficiency of the collector.

So let's start from the beginning. I want to first thank a guy that goes by my2cents0

on YouTube for directing me to the Hungarian website that led me to an engineer whom I only know as Zoli. He actually speaks better French than Hungarian ☺. I want thank Zoli for his upmost patience with me on this project, I bugged him to death back and forth for nearly three months to make sure I was doing everything right.

Overview

These are my cans siliconized together with the top manifold on and the bottom manifold you see on the table. My panel core, is 17 cans wide and 17 cans tall -- this was all I could fit into a four by eight foot insulated box made from Polyisocyanurate insulation board (polyiso). The outside of the collector measures 4 ft by 8 ft. The header caps are 44 ½" with ½" bends on all ends.

I drilled the manifold holes at 54mm dia. and spaced at 66mm on center and came to find out the can columns would "just fit". Maybe 67mm O/C might work better just so things won't be too tight. Using 67 mm spacing will make the space between holes 11 to 12 mm which, I think, will work fine. On the next collector I will use the 67 mm spacing between hole centers. Start 10mm from the header cap end before you start laying out and drilling. I drilled the bottom holes in the cans out at 44mm and the top ones at 51mm. You need to be very careful with the tops, because the hole saw will just fit, no room to mess up ☺.

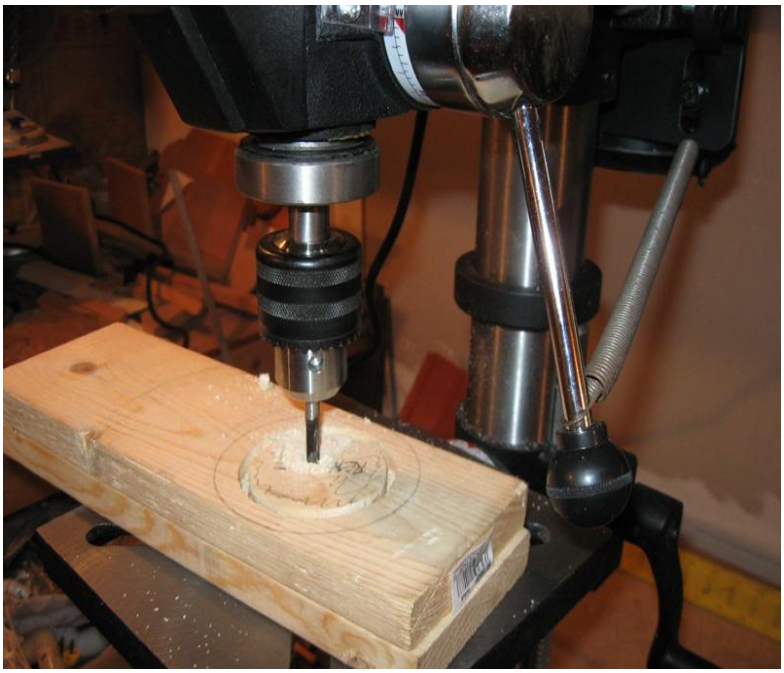
When cutting the cans with the hole saws I used in a drill press which was a learning experience in itself. It took a little while and several near miss flying

objects to get the hang of it. You would be amazed how fast a hole saw can take something right out of your hand. So, **safety first.** Wear safety glasses and leather gloves that some cotton jersey gloves will fit into. The cans will heat up rapidly while cutting the tops and bottoms out.

Building the Can Columns

At first, I made some wooden jigs to hold the cans while cutting on the drill press.

I used a small rotary saw to start a hole for the diameter of the end of can I was working on. Then, believe it or not, I took a small straight cut router bit in my drill press and cut out the rest of the hole.



If you have a steady hand, set the depth on your drill press this is pretty easy to do. Notice my extra hand, a screen door spring holding the router bit to it's depth. Oh my, necessity really is the mother of invention. I made the jigs out of large stock of two 1" x 4" blocks of wood glued together, then cut them down to a size that was easy to handle.

This jig is for the can tops. I marked the inside shoulder to be more plain and cut to a depth just enough for the cans neck to fit into. I made a similar holder for the can bottoms.

After all this trouble, I actually found out it was easier to drill the can tops and bottoms out by just putting the can in a cozy holder as shown in the picture, and doing the drilling free hand. This is where the leather cloves and cotton jersey ones come in. As I said before, the 51mm hole saw will just fit the can inside the can rim. You have to be very careful here -- most times this is where you going to mess up ☺. I ran my drill press at it's medium speed and used Lenox hole saws -- they cut pretty well. Let the can spin a little if it wants to. Hold the can near the top with one finger on the can top close to the saw, and the rest of your fingers resting around the cozy. The can will get hot fast.

Cut out the bottoms of the cans using the 44mm hole saw. This is a breeze after the first few cans. Just remember to let the can spin a little as you cut it if it wants to. If you try and hold the can to tight the hole saw will twist the can inside the cozy -- if this happens, the can will be scrap because it will cause the can to wrinkle and although you may not see the very minute crack in the can it will be there, I sprayed primer on one can here as an example.

The ring you see around the can will become a leak down the road if you use it because of the expansion and contraction from heat over time. Soda cans are only 10 microns thick, so it won't take long to develop a leak.

Notice the bricks at the lower right of the photo, these are what I used to keep pressure on the cans after the silicone was applied. Some cans with the tops and bottoms cut out.

I used a 3” PVC pipe cut in half to hold my can tubes while the silicone cured. One note, buy an end cap for the pipe, it will make things a little easier. I’ll do that next time. Cut the end cap in half and glue it to your pipe. 1”x 4” boards nailed together will work just as good I think but I have not tried that yet.

Here’s the photos of the can tube construction, I just put silicone around the small end of the can, pressed them together while in the PVC tube and while using one finger to smooth the silicone joint I used my other hand to turn the tube as I went along.

You can see at the left one tube already complete in its PVC holder.

Let your hand rest gently on the left can while turning the assembly with your other hand, thumb and fore finger.

There's that brick again, I was doing this in my living room floor because it was to cold to do it out in my shop. If incline the tube a little the brick will have enough pressure to keep everything in place until the silicone sets. I did this until I had a stack 17 cans tall and 17 wide to fit the 44.5" wide manifold plates I had drilled out for them. Ok, you have your tube stacks made. If your collector is not 4 ft by 8 ft, you will have to work out the number and length of can columns for the size you are building.

Building the Manifolds

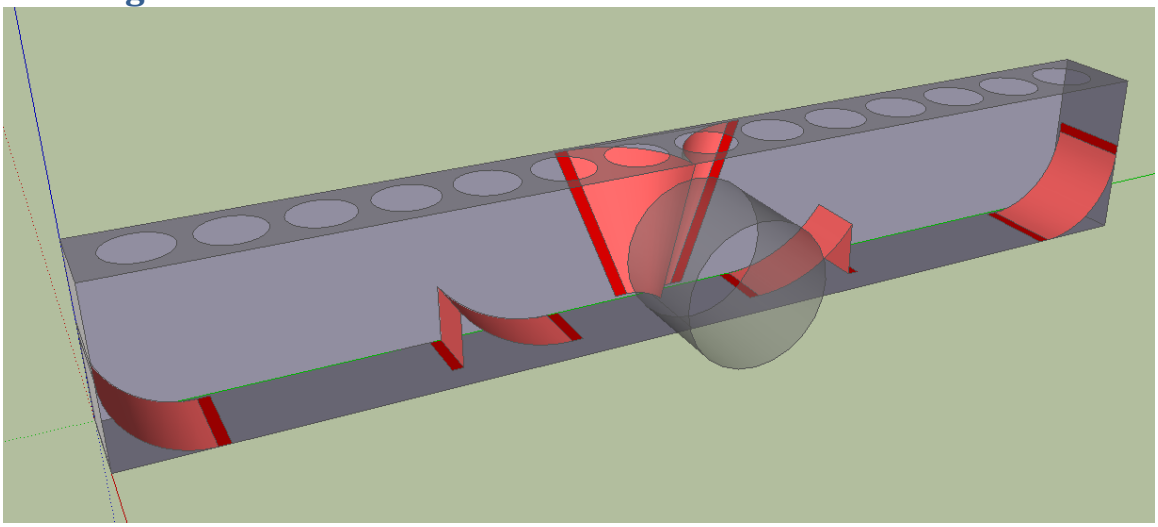
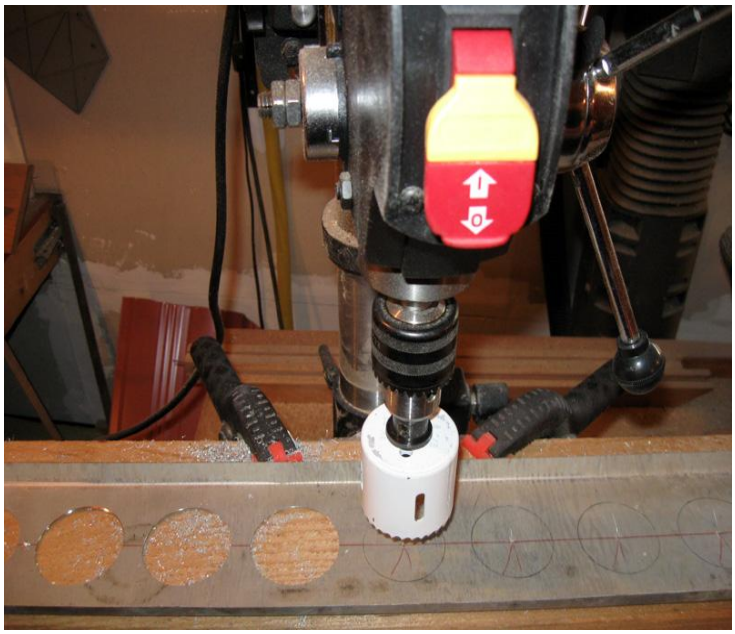


Figure 1 Manifold distributes air evenly to the can columns (drawing from Zoli)

First I took a 1” x 4” and measured out the dimensions given to me by Zoli from his SketchUp drawing and drilled a test manifold to make sure everything would fit. It was tight. Since everything over in the UK etc. is metric that is what I used. The closest hole saw I could come up with for the cans was a 54mm. The plans called for 55mm holes spaced 66mm on center. I started 10mm from the edge of the manifold and did my layout. I think that spacing the holes 67mm on center would not hurt on the manifold layout, as there sufficient room to do this.



I just clamped a scrap of 1 x 4 under the manifold plate while drilling free hand. This worked out well for me. Here’s a photo of drilling the cans free hand. Be very careful.

After I had done all this I fitted the can tubes into the top and bottom manifold plates and used silicone to seal them in place.

Don't be afraid to use plenty of silicone here, but don't block the air way. After this measure what you have. Then cut aluminum flat plates to that make up the front, back and bottom of the manifold. Size them so that the whole can and manifold assembly fits snugly into the 4' x 8' Polyiso housing. The manifold box ends up

being approx 6.75" tall by 3.5” deep 44.5” wide.

The photo above is of the new style manifold with air disrupters installed and end caps which I had to make myself.

I made these out of aluminum house trim coil and had to cut the radius on the ends to make them fit on each end of the manifolds.

Making the end caps

I did this on top of my saw table just using some clamps and straight edge. Just bend the sheet up with your hands then tap along the edge with a hammer and you will come out with a nice edge.

Painting and Final Assembly

Here's a photo of the painted pane core. Do the painting outside of your shop or house.

You want the core housing to be reflective so that any sun that passes by the core will be bounced back onto the core.

Photo of the intake with cover I made from aluminum and mounted a 6" duct fitting to it, I did the same for the outlet.

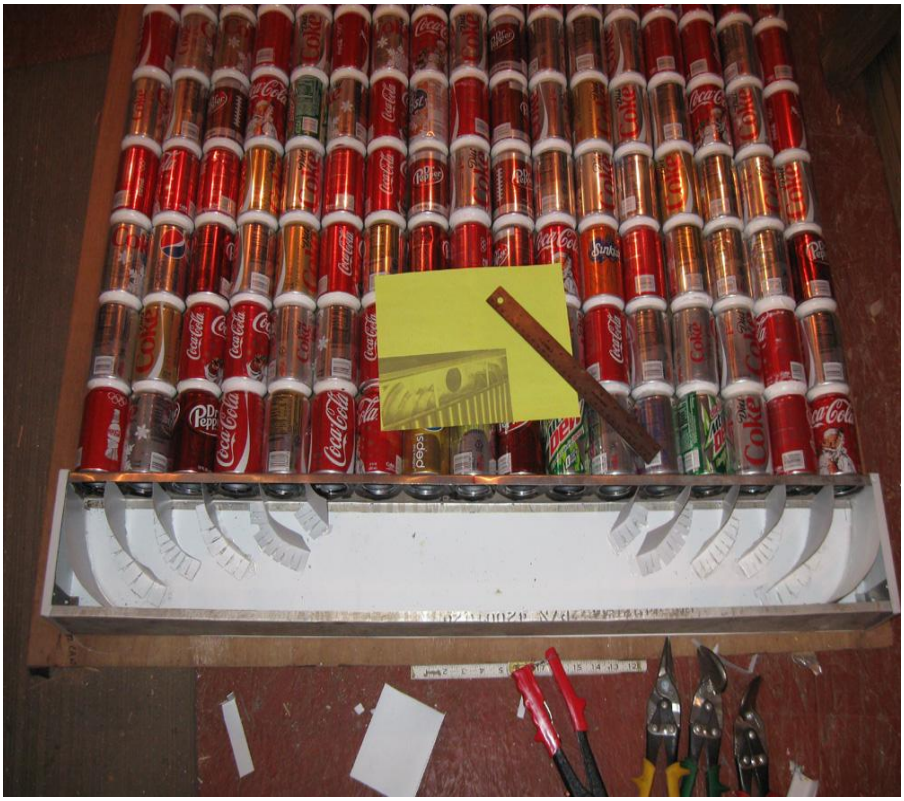
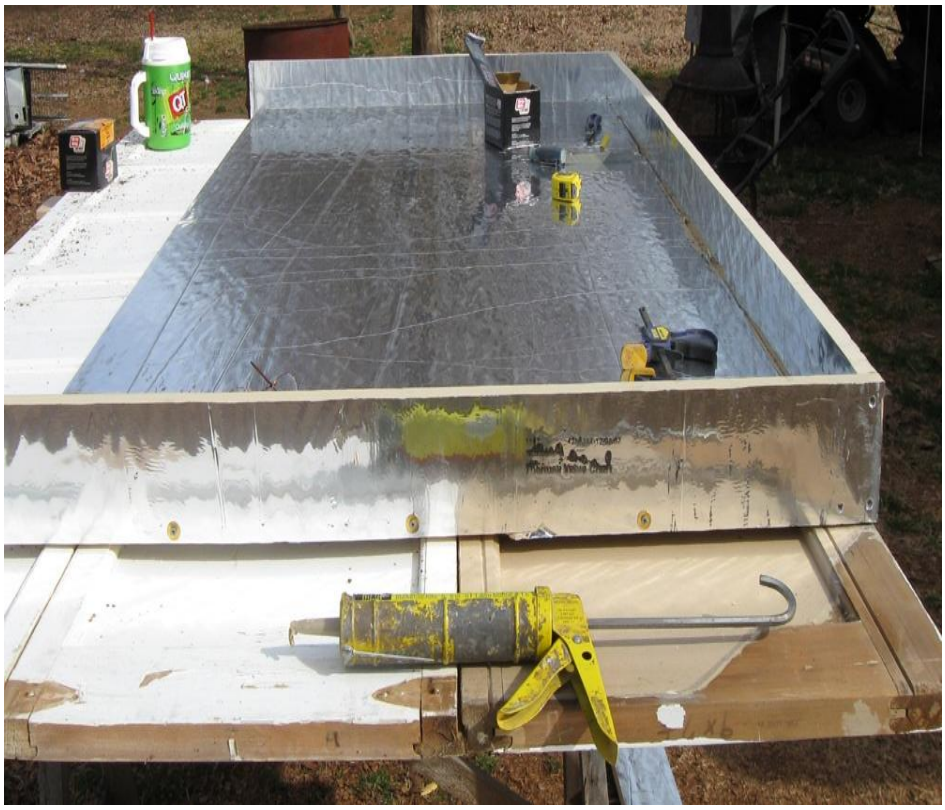


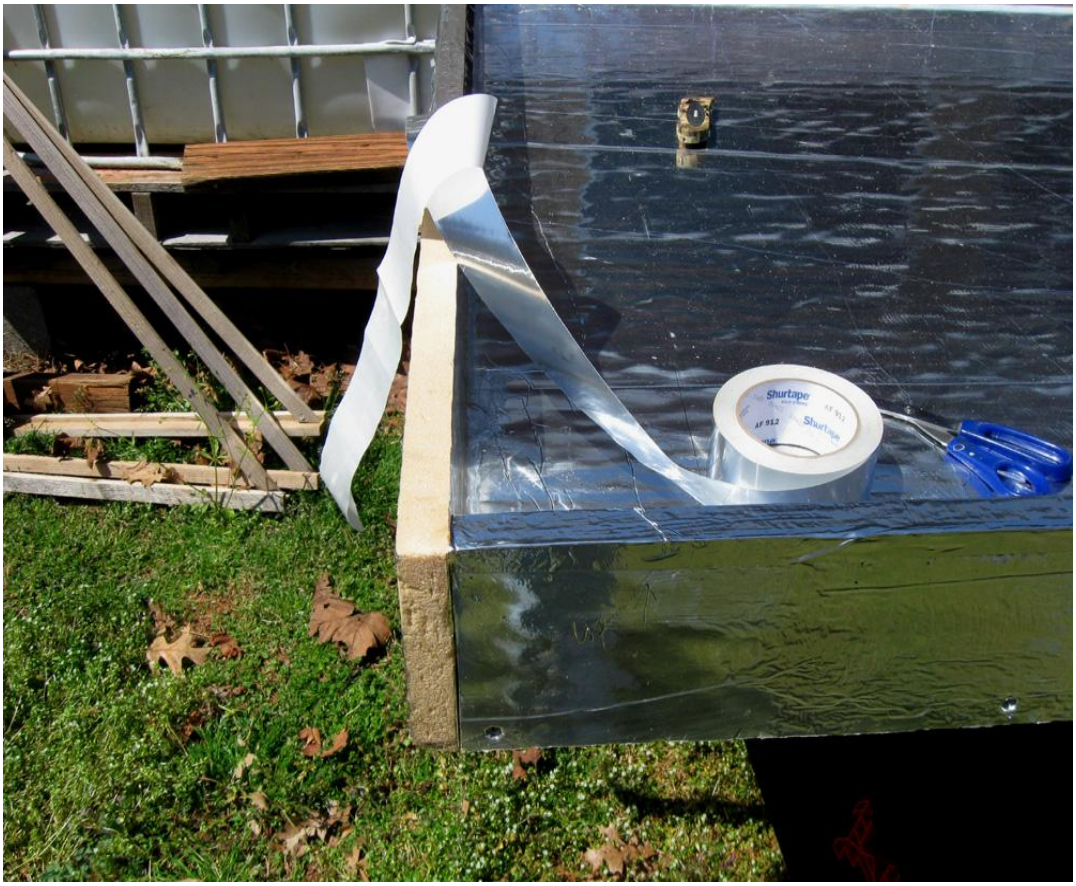
Photo of outlet as you can see I only had a picture to go by, just simple air deflectors. Zoli said it looked good to him ☺

Photo of the core, 3” pipe and cans

Some photos of housing.



I protected all exposed polyiso board with Aluminum tape, the inside corners also.



I then used silicone on all inside edges of the tape just to make sure they didn't work loose over time as I've found out can happen.

The outside surfaces of the Polyiso are protected from the weather by aluminum trim pieces.

Photo of collector in it's housing. You can see the reflection from the back of the housing here.

And this photo of collector on it's side in my shop.

And the finished collector below. The strip you see in the center is to keep the panel from expanding over four feet wide which it would do when heated up. I also have 3/8ths inch aluminum rods in place to help support the twin walled polycarbonate panel and to keep it from bowing as it heats up.

This collector can also be mounted vertical or horizontal on the south side of your home and it will work fine.

The only test I have run so far with Gary's help was with the collector laying on it's back on saw horses with the glazing just held on with some quick clamps. The test was promising with the collector running at 91cfm at a 60 F degree temperature rise. I would like to see it run at 100cfm at around a 50 to 55 F degree temp rise but that means a more powerful and louder fan which would require a muffler of some sort.

One more note on the polycarbonate panel. The people at Tex Supply told me to be sure and cut the panel one half inch shorter than the collector frame all the way around because it would expand when heating up and they were right, it did -- a lot. To seal the glazing to the panel I used polyurethane foam in case anything were to go wrong down the road I can get into the panel easy.

Not a bad looking panel for my first one, can't wait to build another ☺

Greg
September 5, 2010

You can email Greg questions at: gwest77 AT comcast DOT net (type @ for AT and a period for DOT)

Can Collector Resources:

Zoli's website... (in Hungarian -- use Google Translate for English)

Gary's collection of pop-can collector links..