

## Dave's Sheet Metal Bending Brake



I started building a Zenith CH601XL from plans in mid January 2006. After several failed attempts to bend the rudder spar I ended up going to a local sheet metal shop for help. The problem with that is that their equipment is not set up for the 1/8 inch radius bend specified in the plans. I saw right away that some type of bending brake was going to be needed throughout the project. So, I started looking for an affordable solution. I found commercial brakes to be too expensive and most of the plans-built brakes on the internet to be either made of wood (too flimsy) or ones that required extensive welding. I don't know how to weld. I came up with the plan for this brake at 3 AM during a sleepless night. It's simple, inexpensive, and requires no welding whatsoever. I built it in a single afternoon and was bending parts the next day. It worked so well I felt I should share the plans with other homebuilders who needed a brake of their own. It's not a commercial brake costing hundreds or even thousands of dollars so, don't expect it to perform like one on the longer bends. However, it does most bends extremely well. Some bends require a little creative thinking. If you're smart enough to build and fly an airplane, you should be able to figure it out.

Remembering my trials and tribulations as a new builder attempting to make a rudder spar, I decided this would be a good test for my brake. The spar is 1360mm long with 20mm flanges. Back in January I spent hours on this one part. Using my Olfa P800 knife and new bending brake, it took 10 minutes from layout to bending to make a perfect spar. Not too shabby for a brake that cost about \$100. I am currently building a **Sonex** from plans. I have bent all of my control surface skins as well as all of the channel pieces. Being able to bend my own parts has resulted in substantial savings on this project.

# Parts List



The steel angle and square tubing can be found at most metal suppliers or recyclers. **Check your Yellow Pages for a local supplier.**

- 3 pieces of 3x3x $\frac{1}{4}$  inch angle to desired length (8feet will bend the flaps)
- 8 feet of 1.25 inch square steel tubing for the handle
- Full length stainless steel piano hinge (got mine from Airparts, Inc.)
- CCP-46 stainless steel cherry pop rivets to attach the hinge (60mm spacing)
- 4 bolts  $\frac{1}{4}$  x 2 inches, 8 flat washers, and 4 stop nuts
- 2 bolts  $\frac{1}{4}$  x 3 inches, 4 flat washers, and 2 stop nuts
- 4 to 6 bolts  $\frac{3}{8}$  x 3 inches, 2 flat washers and 1 nut for each bolt
- 1 board 1 x 4 inches by length of your table to reinforce the edge
- Countersunk wood screws to attach the board and the bottom plate to your table.

# Building Instructions

Start by attaching the 1x4 reinforcement board under the edge of your table with glue and wood screws. This will make the edge much stronger.

Attach the bottom plate over the edge of your table using countersunk wood screws. I used one size drill bit for the screw holes and a larger bit to countersink the screw heads. You don't want the heads to be above the bottom plate surface or they will scratch your sheet metal. I only used 6 screws for this.

Set the top plate on top of the bottom plate and clamp in place with C clamps. The top plate front edge should be set back about 1/8 inch from the edge of the bottom plate (see photo).

Drill 4 holes for the 3/8 inch bolts through the top and bottom plates, the table, and the 1x4 board. High quality sharp bits will stop the cursing!! Make the 2 end holes about an inch and one half from the ends and the other two evenly spaced along the length of the plates.

Remove the top plate and round off the front edge to achieve a nice clean radiused bend.

Find and mark the centerline of the hinge and the bend plate. Attach the hinge to the bend plate with stainless steel pop rivets using about 60mm spacing between rivets. The top of the hinge should be just level with the top surface of the bending plate.

Remove the hinge pin and attach the other side of the hinge to the bottom plate making sure the hinge is facing the right direction. Make sure to center it correctly so the 2 sides of the hinge will line up correctly. Also be sure to line up the top of the hinge with the top surface of the bottom plate.

Put the bottom plate and the bend plate together to reinsert the hinge pin. This requires 2 people and can be a little tricky. I found it easier to cut the pin in half and go in from either end of the hinge until the 2 halves meet in the middle. A little 3 in 1 oil also helped.

Cut the square tubing to make the handle. I made 2 eighteen inch pieces for the ends and used what was left as the middle. Please see the photos for how this should look.

Drill the holes for the  $\frac{1}{4}$  bolts to attach the end pieces of the handle to the center piece. Attach the parts using the bolts, washers, and nuts. Don't tighten them really tight just yet. The end pieces should be at about a 60 degree angle to the center piece. This doesn't have to be exact.

Have someone help you hold the handle up against the bend plate and mark where it will go. You can clamp the 2 together. Drill the holes for the  $\frac{1}{4}$  inch bolts to attach the handles to the bend plate (2 each end). Attach the handle with the  $\frac{1}{4}$  inch bolts.

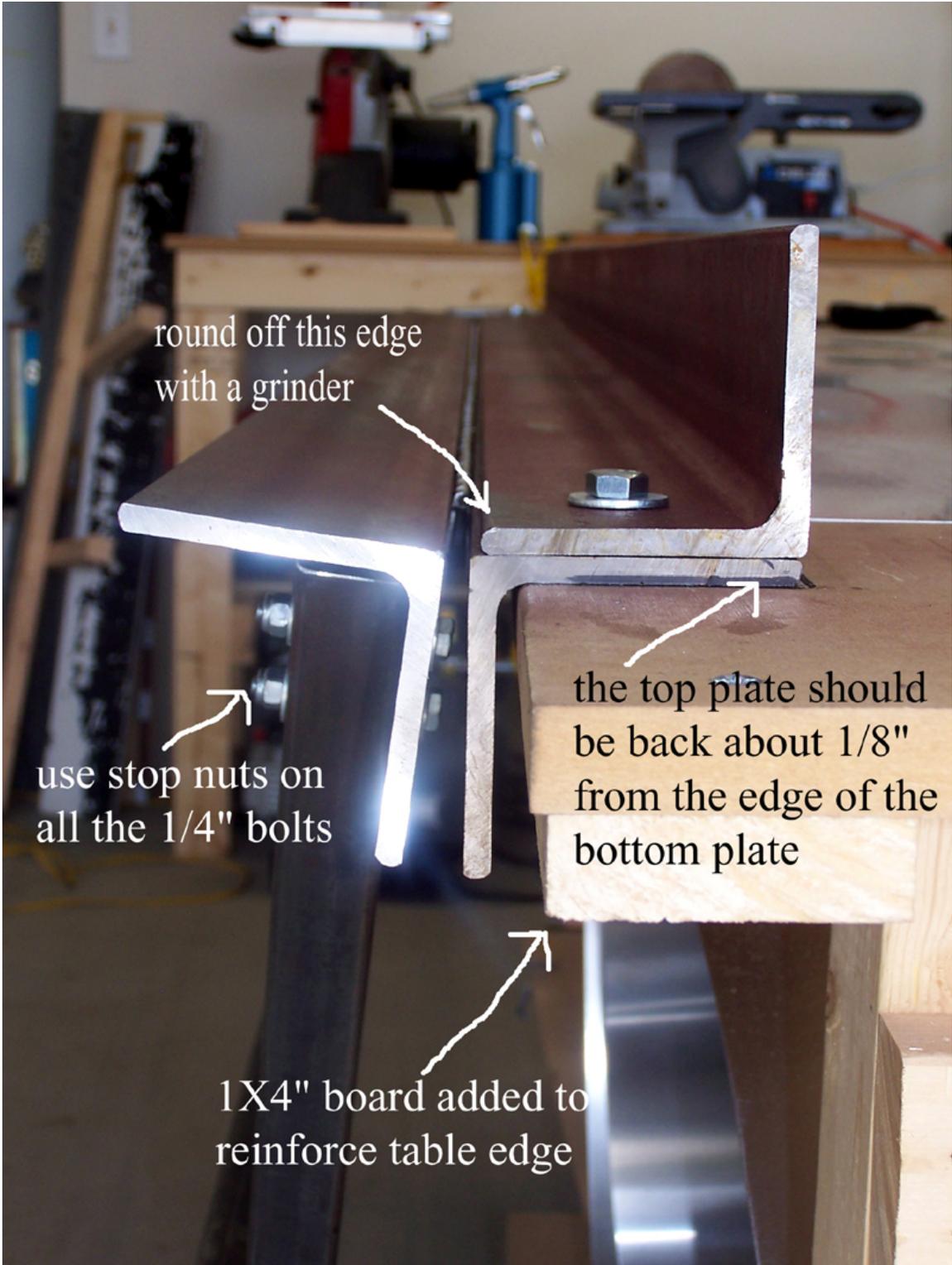
Tighten all the handle bolts snugly.

Insert the  $\frac{3}{8}$  inch bolts through the top plate and push them all the way through. Use one flat washer on the top, and one flat washer and nut on the bottom and hand tighten.

If confused by these instructions study the photos.

You're done!





round off this edge  
with a grinder

use stop nuts on  
all the 1/4" bolts

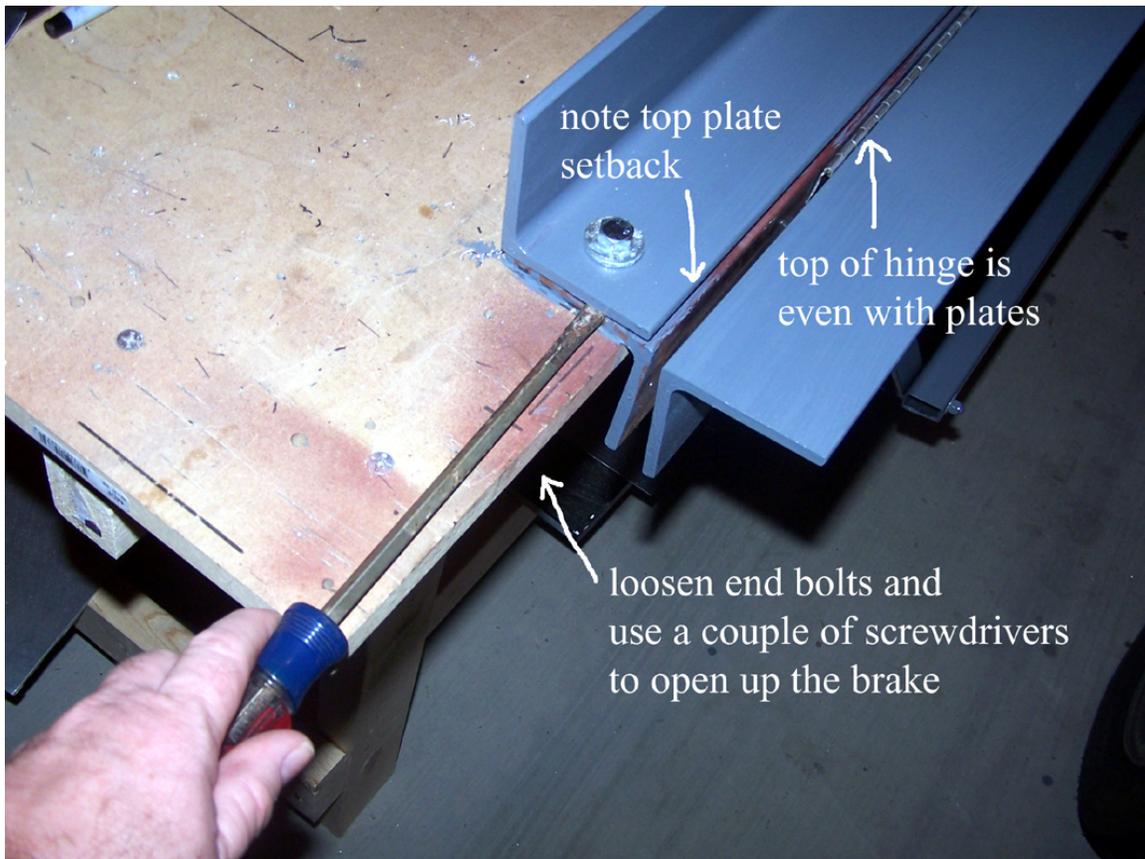
the top plate should  
be back about 1/8"  
from the edge of the  
bottom plate

1X4" board added to  
reinforce table edge

# Using the Brake

The number of 3/8 bolts you use will depend on the bending job. For long narrow bends such as channel flanges use all of the bolts. For parts like control surface skins, remove as many bolts as needed. I have found that for most smaller parts I only need to hand tighten the bolts. For long flanges tighten the bolts with a socket wrench.

To open the brake first loosen the bolts then insert a large screwdriver between the top and bottom plate at either end. I'm sure some bright person out there will probably come up with a more elegant way to do this.



Next insert your sheet metal lining up the bend line with the edge of the top plate.

Remove the screwdrivers, tighten the bolts, and bend away.

# The Test



Step 1: insert part and tighten the bolts.



Step 2: raise the handle to make the bend.



Lining up for the second bend.



Our beautiful spokes model, Jan, showing off the formed rudder spar.

# Bending Sonex Control Surface Skins



Cutting skins with the Olfa P800 knife



Bending sequence



Using a piece of angle clamped to the brake to bend past 90 degrees



Finished aileron skins

# Bending Tips

When bending long parts made of .032 and thicker aluminum, use the following method to avoid a bowed part:

1. Cut the blank with the flanges wider than the plans specify. At least 100mm wide will do.
2. Bend as usual.
3. Trim the flanges to specs.

If you need to bend a part past 90 degrees bend as far as you can, then clamp a 1X2 board or a piece of angle to the bending plate and bend again to the desired angle.

## The Bottom Line

Hey folks, I am not an engineer or any type of professional designer. I'm a working-class guy trying to build an airplane. I am always looking for better or easier ways to accomplish this goal. This brake works for me. I hope it does for you, as well. I am sharing this design free of charge. There have been other homebuilders who have helped me with advice and encouragement. I want to do the same for others. People from all over the planet (no exaggeration) have built this brake and used it with success. Feel free to modify the design to suit your needs.

Use some common sense when building and using this brake. By building it you are accepting personal responsibility for your own safety. If somehow you get injured, don't blame me. I am not some big corporation with deep pockets. Isn't it a shame I have to include this statement?

If you have any questions or comment feel free to contact me at [dclaytx2@hotmail.com](mailto:dclaytx2@hotmail.com)

Happy Building  
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