

LAYING OUT AND CUTTING CONTROL PANELS

Gary Wolf

YES, SOME STILL USE steam gauges but these days it is getting harder to justify the choice when I-Pads and glass panels are taking over. However if you are Old School or your plane does not have a generator, mechanical gauges are the choice.

The most useful material for a panel is 1/16" aluminum, either 6061 or 2024. They are stiff enough that even the narrow webs between tightly packed gauges provide good stiffness. The problem is how to cut the 3-1/8" or 2-1/4" holes and to lay out the four holes for the mounting screws.

PROTECT IT

Before doing any layout or cutting, protect the finish of your panel blank with wide masking tape to cover its face, and maybe the back too if you are ADHD. This is a lot less work than polishing the scratches out later.



Above, The Spruce gauge template and the ATS panel punch

LAYOUT

The standard gauge has a mounting surface 3.25 x 3.25 with a 3-1/8" diameter gauge face and four mounting holes in a square pattern on a 3.5" circle.

Typically adjacent gauges have the edges of the case no closer than 1/4" from the neighbour, leaving a half inch spacing between faces. Aircraft Spruce sells a handy layout template that works for both 3-1/8" and 2-1/4" gauges. It comes with a 1/8" transfer punch and a caution to use the punch instead of drilling through the template. You could alternatively dig out your Grade 11 geometry book and your dividers and swing arcs to lay out your own template.

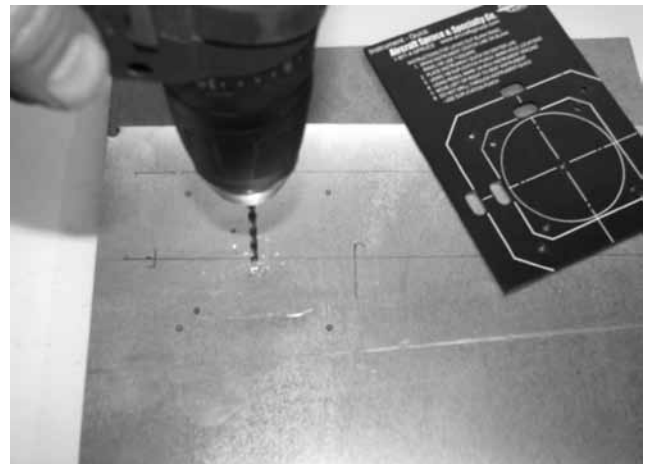
Draw a horizontal line on the panel and put a mark at the centre of each future instrument, then write above each layout which size the gauge will be. Drill the centre mark for 1/8" and cleco the template in place. Clock it to be level, clamp it in place, and transfer punch the corners. Remove the template and drill the corner holes and you can proceed to the difficult part – cutting the gauge hole.

ATS PANEL PUNCH

The class act for cutting gauge holes in an aluminum panel is the ATS panel punch that will quickly cut either 3-1/8 or 2-1/4" holes. A 5/8" bolt draws the punch and die together



Top: The Spruce gauge template and the ATS panel punch. Left, the transfer punch is used to lay out the hole centres. Right, do not drill through the template or you will lose its accuracy. Left, test panel with template and tools.



so you will need to enlarge the centre hole. A step drill works well but you must work carefully to keep it on centre. Most step drills have a pilot of $\frac{1}{4}$ " diameter so drill the centre hole to that size. Use a drill press to upsize to $\frac{5}{8}$ " and deburr, and you are ready for the punch.

It takes a lot of force to cut a 3-1/8" hole in 1/16" aluminum so you will not be doing this with a 3/8" ratchet. A long pattern 15/16" box wrench is the minimum. I used

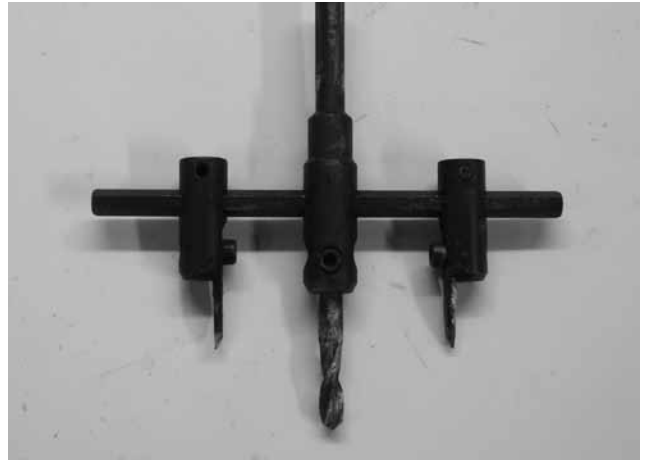
a socket on the air hammer that I use for changing snow tires and it breezed through. The slug will be trapped in the die but it has a knockout hole so you can remove the slug with a punch and hammer.

Fit your gauge to check if the mounting holes are still on centre with the gauge face. If you worked carefully they will be.

HOLESAW

A holesaw will do an effective job of

cutting the gauge hole if you use a good one like Morse or Milwaukee. Make certain that you use the drive pins of the arbor to drive the holesaw so that it can self centre. Holesaws are rarely perfectly on centre and the cheap ones will sweep a wide line, and the resulting hole can be as much as .030" oversized. Do a test cut in scrap before committing to the panel. It is possible to drive the holesaw with a hand drill but it works a lot better in a drill press. Back the aluminum up



Left, Updrill to 5/8 with a step drill and use the ATS punch for the panel hole. A pneumatic wrench makes this easy. Right, try to avoid anything that looks like this

with a piece of MDF and clamp them together.

A sharp holesaw can be used dry but when it wears a spray of WD 40 will help clear the chips. Do not use oil for aluminum as it encourages clogging of the teeth. My Morse holesaw cut only .010" oversized.

FLYCUTTER

If someone suggests using a flycutter, that person is not your friend. The only way to have any success is when it is in a drill press, the table has been leveled, and the feed is very gentle. The sheet must be well clamped to a board and you had better do some test pieces to get the diameter right. Make certain that if it catches and throws the part across the shop there is nothing valuable that could be damaged. If you try to use a flycutter in a hand drill there is little chance of doing anything but damage.

THE KOLLSMAN CUTOUT

Altimeters will need a cutout for the Kollsman adjuster and no two manufacturers seem to use the same location or size. I have measured many and the outside radius seems to be 3/8" larger than the gauge face. Measure yours with a vernier. The ends of the cutout are frequently 1/4" radius and the width vary from 7/8" to 1-1/8" depending on the manufacturer.

I made a template from .020" aluminum and tried to cleco it to my gauge. Of course the adjuster knob prevented this but it looked as if it was on the same centre as where the mounting hole would have been for that corner. I drilled it for 3/8" and found that it slipped over the knob. Then I scribed the outline on the backside of the template and gradually filed the cutout to fit the adjuster lump. This template was then clecoed to the panel blank, the line was

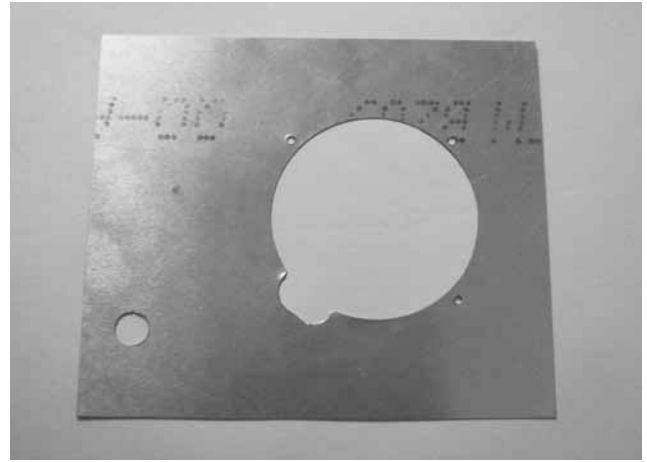
scribed, and I filed the cutout.

GAUGE AS TEMPLATE

Instead of using the Spruce or a shop made template, a gauge can be used for this purpose. Lay out and cut the 3-1/8" holes and place a gauge to be square. Using a transfer punch in one corner you can centre punch the first hole. Drill it and cleco the gauge in place and you can punch the other three holes and then drill them. A dead gauge is better for this and if you are determined you can remove the faceplate to become your template without having to work around the case.

OTHER HOLES

Holesaws and step drills do an effective job for the small gauges and the switches. The mag switch hole has a little tongue to keep the switch from rotating but most builders just tighten the switch down.



Left, A good holesaw does an effective job if the panel is backed up and clamped Right, a shop made template will aid in laying out the Kollsman adjuster hole

Rocker switches are a frequently a pain because they do not use round holes. To cut a small square hole drill the corners, staying inside the line. Then drill the bulk of the cutout and file to finish. Snips have no place here. This is all a bother but no one makes rectangular drills. A large square cutout can have a start hole step drilled to about 3/4" and a little air saw or a jig saw with a fine blade will handle the edges. Stay inside the line and file to the finished dimension. Pull the masking tape back for the filing so that you can see the aluminum. Nobody said you had to buy

square switches; toggles are round.

ALTERNATIVES

There are companies that have CNC laser or water jet cutters and if you can supply a cutting file they will hand you back a finished part and it can even include the tongue for the mag switch. Spruce sells a software package to design your own, or if you are building a popular plane like an RV-7 there are companies that are set up with their own software to make your panel for you. Check with your kit manufacturer and the type support groups to see what is available.

In some cases it might be faster and less expensive than doing it the Old School way. For 51% purposes writing a cheque counts the same as cutting and filing your own panel, but for some the pride of accomplishment is more important. ♣

ATS panel punch (ATS #123C) ACS #12-02743	\$220.00
Gauge template, Aircraft Spruce #140....	28.00
Milwaukee 3-1/8 holesaw, Aircraft Spruce #49-56-3120.....	22.00
Milwaukee 2-1/4 holesaw, Aircraft Spruce #49-56-2250.....	22.00

Aviation Definitions

HOLDING PATTERN: The term applied to the dogfight in progress over any radio facility serving a terminal airport.

BI-PLANE: What you'll say to your bird if flying costs keep going up

WALKAROUND: What you do when waiting for weather to clear.

LANDING FLAP: A 4000' roll out on a 3000' runway.

CRITICAL ENGINE: That part of your airplane which used to be under the cowl, but is now in intensive care at the maintenance shop.