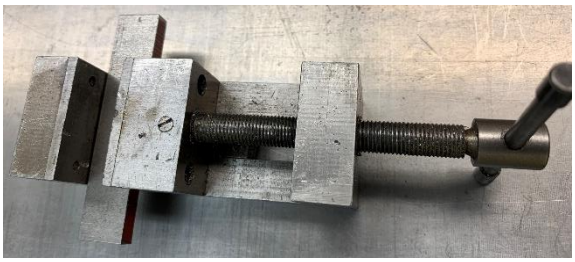
Drilling A Hole At an Angle, Version 2.0

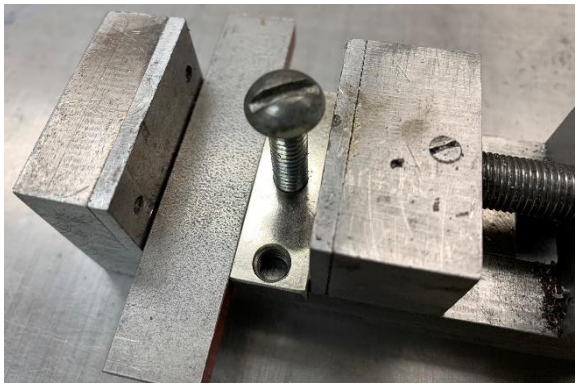
By R. G. Sparber

Drilling a hole at an angle is easy… if you have an angle plate. Even if you do have one, do you really want to drag it out?



For small parts, I like to use my home made machinist vise. It gets clamped into my larger vise which, in turn, is clamped to the drill press table.

In order to drill an angled hole, I want to be able to tilt this little vise to a precise angle and then secure it in the larger vise.



Start with a piece of scrap steel that has been drilled and tapped ¼ - 20. Then thread in a screw. I place the assembly next to my stock and tighten the vise.

With my digital angle gauge on top of the vise and the vise sitting on my reference plate, I zero the gauge.

Then I turn the screw until the needed angle has been achieved. I can then transfer the vise with support leg to my larger vise and secure it.

If you try to just drill down on a sloped surface, the drill point will deflect and you will at least miss your mark. At worst, you will tear up the part ***and*** break the drill. What to do?

One of my favorite sayings in engineering is

"If you can't solve the problem, change the problem".

I know how to drill into stock that is perpendicular to the center of rotation but I don't know how to drill at an angle. OK, then drill perpendicular.

Before clamping the part in my tilted vise, I center punched the hole's location. After clamping, I used my spud to align the punch mark with my center of rotation. Since the punch mark is very shallow, little shift in location is introduced by tilting the stock.

The small vise has already been clamped into my larger drill press vise. To prevent any movement, I clamp the larger vise to my table.

Next, I installed an end mill into the chuck that is at least as large in diameter as the hole I want to drill. Here you see a 1/8th -inch diameter end mill. It easily deflects as it cuts on the sloped surface but, if you go slow, it will return to true. No such problem with ¼-inch end mills.

When the end mill cut a full circle, I was done. See the surface, directly under the center of rotation? It is parallel to the drill press table.

Using the end mill first transformed the problem from trying to drill on an angled surface to the trivial one of drilling on a flat surface.

I replaced the end mill with my 1/8th-inch drill and finished the job.

So how did it work?

Installing my 1/8th-inch diameter spud, I lowered the quill and noted any deflection.

The spud went straight down the hole. This proves that the hole location did not shift during drilling.

A 1/8th-inch dowel pin smoothly fits into the hole.

I welcome your comments and questions.

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