Facing and Boring with 4-Jaw Chuck

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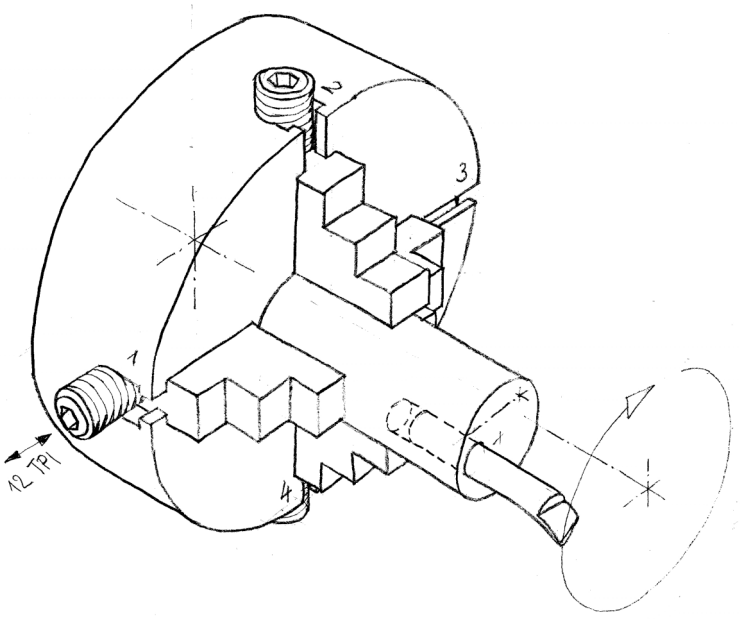
A 4-jaw chuck accepts rectangular and circular and odd shaped parts. And the 4 jaws can be adjusted individually. That allows many tricks or inventions.

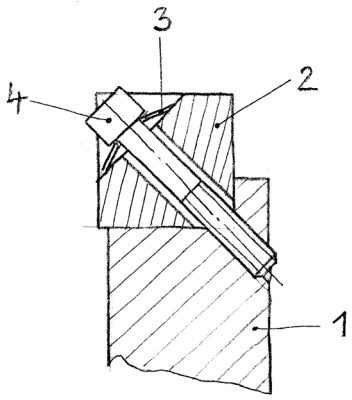
One day I needed a fly cutter, so I clamped some round stock with a small boring bar to the 4-jaw chuck. The high inertia of the heavy chuck made for a smooth rotation - even with interrupted cuts. The boring bar can be set to a wide range of diameters. As the jaw screws have a coarse 12 threads per inch, it is very difficult to use this set up for precision boring. But a fly cutter is intended for facing and this setup gives very pleasant surfaces.

Start with slow revolutions.



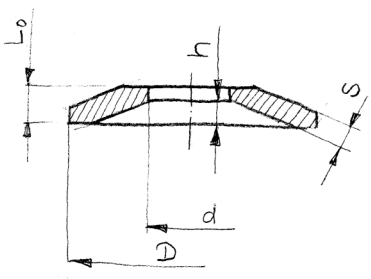
The boring problem haunted me.

I looked for nice boring tools in Homemadetools. Very nicely and admiringly made. But I mistrusted the dovetails because I didn't know how to measure them. (Yes, I know the dowel pin method.)
As the cutting forces of a small tool in a small lathe are small, I resorted to a kind of poor man's dovetail - hold in place by a screw and a disc spring.



The dovetail is: A square bar sitting in a milled corner. The square bar has a slot of 10 mm (3/4") to be adjustable. The screw ensures that it stays there. But a lonely screw would be too difficult to adjust.

So a disc spring exerts gentle force: The spring force can be set high enough to withstand the cutting forces yet low enough to permit a smooth adjustment of the slide. There is no need for lubrication.You can play with different arrangements of the disc springs to get a stiffer or weaker fit in the corner. (Disc springs a very handy for many purposes, so I keep some different sizes in stock)

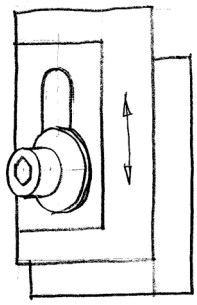


features exaggerated

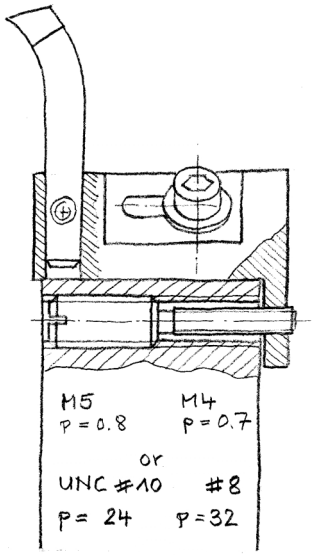
specification:
D x d x S [mm]

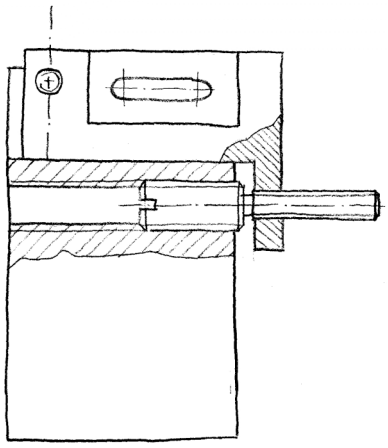
eg. 12 x 5,2 x 0,6
(h = 0,4)

compressed by 0,3 mm
resulting Force 600 N
(137 lbf)



(european projection)





A set of 2 different threads permits a very fine adjustment of the slide. It uses the principle of the difference of 2 thread pitches. In this case a M5 with a pitch of 0.8mm and M4 with a pitch of 0.7mm.
One turn of the difference screw (*) advances the slide by 0.8 - 0.7 = 0.1 mm. (4/1000th inch)
You may combine any threads you like or need.

The unexpected disadvantage of a difference screw is that it uses a lot of space: 20 turns of 0.1mm gives you a total of 2mm adjustable travel. But then the screw moves 20 turns of 0.8 = 16mm

The difference screw works with american threads too:
1-turn-travel =
25.4 x(1/24-1/32) = 25.4 x (4/96 - 3/96) = 25.4 / 96 = 0.265 mm
equivalent to (roughly) 10/1000th inch

* I would avoid the expression ‚differential' because this is used in the context of derivatives of functions. Or even more frightening: Differential equations.

Clamp the slide mechanism with the 4 jaws. This gives you a wide range for the circle described by the tip of the boring bar.

Then (given the metric screws) a **quarter** turn of the difference screw moves the boring bar by 1/1000th of an inch outwards or inwards; that makes 2/1000th in diameter.

An **eighth** of one turn varies the **diameter** of a bore by 1/1000th (0.025mm) which is sensible enough to produce a fit of 1/2000th (0.01mm).

Use the lowest rpm of the spindle because we expect quite an unbalance.