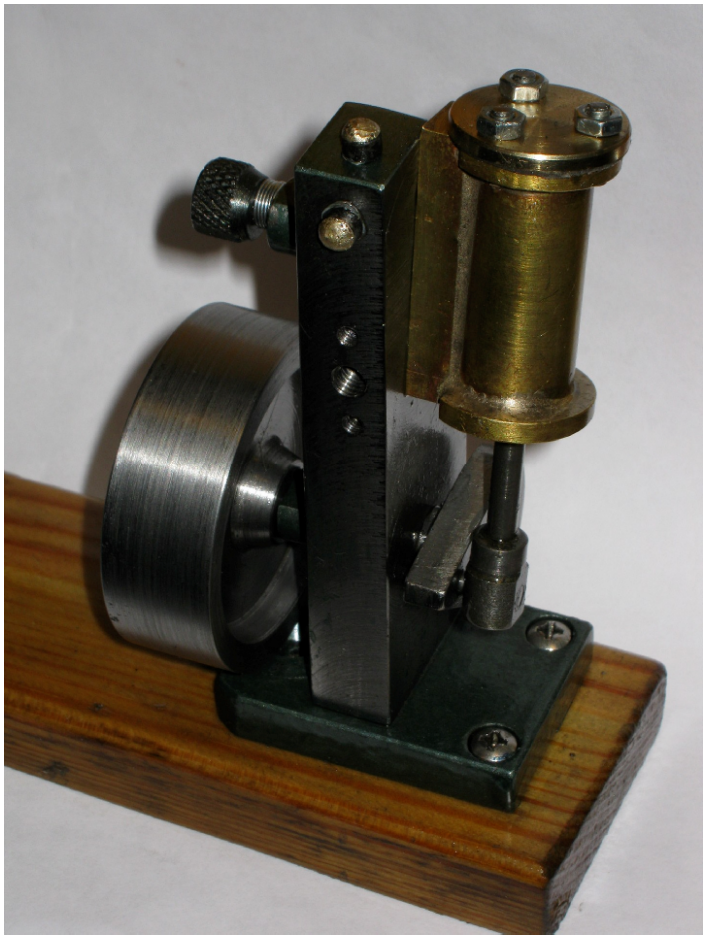
Building a Single Acting Oscillator from barstock

I had a few pieces of brass in my pile of off-cuts and decided to make a small single acting oscillating steam engine. The brass pieces consisted of a short 15mm diameter rod and some brass flats. The top cylinder cover was turned and parted off from a 25mm diameter brass bar. The flywheel, crank and crankshaft and column and base are made from mild steel. The piston and piston rod are made from free-cutting stainless steel (303). If you run the engine on steam a stainless column might be preferable, but I wasn't able to find any suitable pieces.

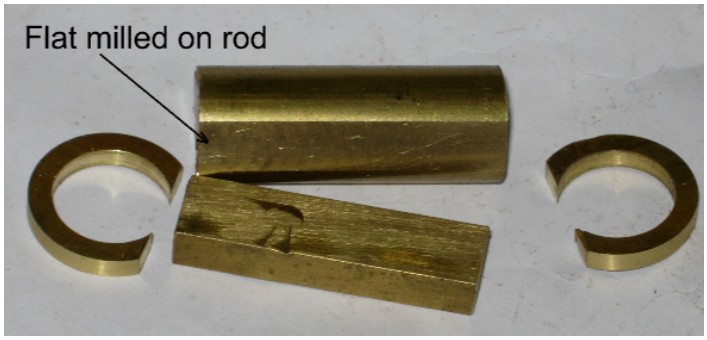


The cylinder was fabricated from the brass pieces and silver soldered together, then the cylinder bore was drilled and reamed.

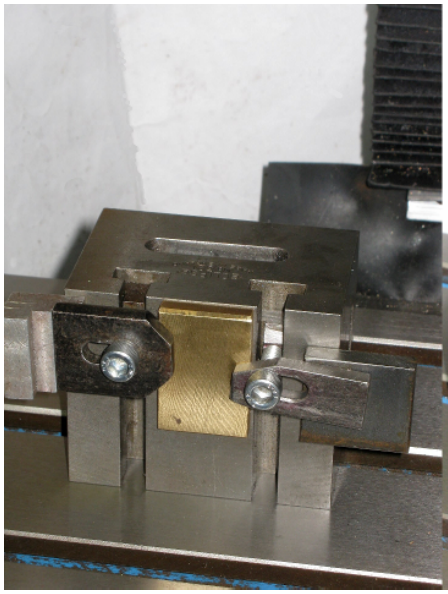
The engine is partly based on Elmer Verburg's #36 Vertical Reversing Wobbler without the reversing gear. The drill jig I used for this single acting oscillator is the same as I used for a double acting oscillator I made (Elmer's #36 without the reversing gear).

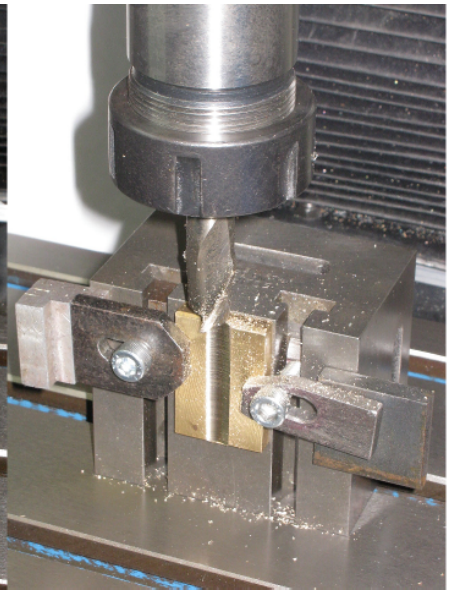
Fabricating the cylinder

Since the single acting oscillator doesn't have the trunk guide I made the cylinder slightly longer so I could make a longer piston to take the side forces. The part of the cylinder where the steam ports are was made from a 6 x 12mm brass flat. I milled a flat along the 15mm diameter brass rod and turned two rings from 25 x 3 mm brass flat, the end of the rings were cut off so they would fit not only around the 15mm rod but also just touch the 6 x 12 mm brass flat. The pieces was then cleaned, fluxed and silver soldered. After silver soldering the cylinder was pickled in citric acid.



Unfortunately during silver soldering the cylinder block moved slightly with respect to the brass flat that would make the cylinder port. When you reach brazing temperature flux and silver solder is fluid and the "wind" from the propane torch moved the 15mm diameter brass rod floating on top of the brass flat.



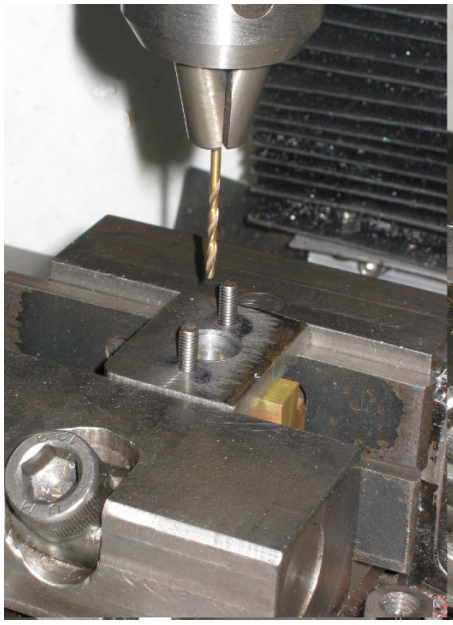


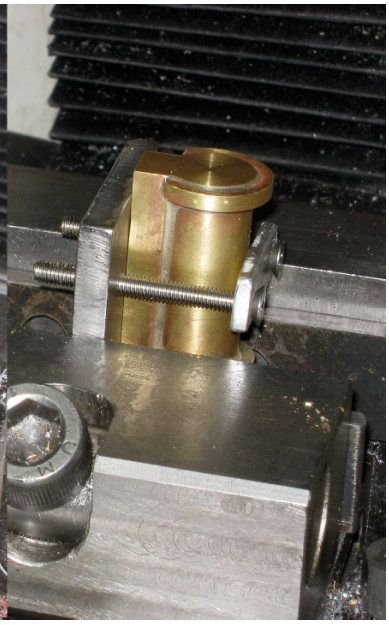
The plan was to make the cylinder with a 12mm bore (since I had a 12mm reamer), now I had to reduce the bore to 10mm.

Since I had more 15mm diameter brass rod available I got hold of another piece of brass flat and fabricated another cylinder using a slightly different approach. Instead of milling a flat on the 15mm diameter brass rod, I milled a concave depression in the brass flat. I used a T-slotted box angle plate to clamp the brass flat and a 15mm diameter slot drill to mill a groove around 1mm deep. This approach gave much better results during silver soldering.

Drill jig for drilling and tapping for the pivot pin

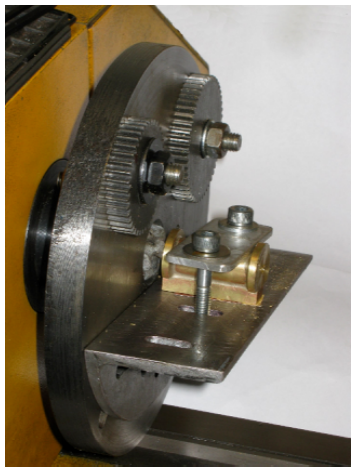
The port face of the cylinder was flattened by rubbing it with emery paper on a flat surface, and the position of the pivot pin and ports was then marked out.





If the cylinder is a rectangular block it is easy to square it up and drill and tap the hole for the pivot pin square to the cylinder port face. That is what I did when making my version of Elmer's #36.

That would not work very well for this single acting engine so I decided to make a very simple jig to hold the cylinder while drilling and tapping for the pivot pin. The main part of the jig is just a rectangular piece of mild steel with a countersunk hole in the middle with M4 tapped holes on each side. The jig was milled on each side to make both sides flat and parallel. This way I could clamp the cylinder port face to the jig and place the jig on parallels in the vice and drill for the pivot pin and tap the hole M4.



Boring the cylinder

I clamped to cylinder to an angle plate clamped to the lathe faceplate to drill and ream the cylinder. A couple of change-wheels were used as counterweights.

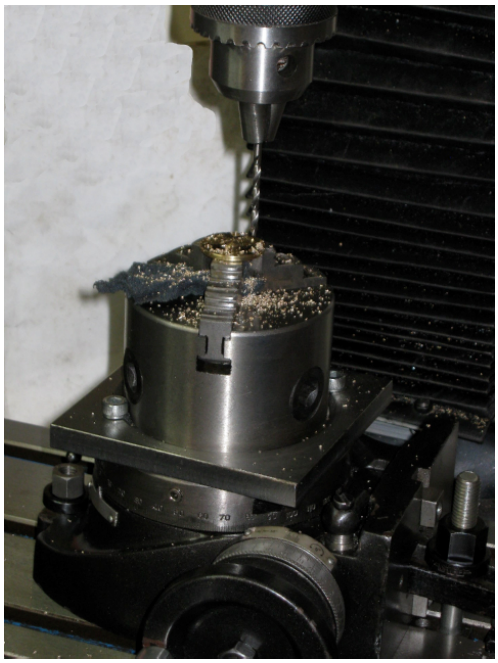
The two portholes were drilled 2mm to a depth of around half the distance between the cylinder bore and the port-face. The cylinder was held at an angle in the vice and the steam passages were drilled from the edge of the cylinder end into the 2mm hole drilled from the portface. Before drilling I used a small slot drill to mill a small flat for the drill to start from.

Pivot Pin

The pivot pin was made from a piece of 4mm diameter free-cutting stainless steel. The M4 thread was cut in the lathe. To hold the pivot pin while screwcutting I used the ER-16 collet holder I use in my milling machine.
The 4mm rod was reversed in the collet and screwcut M4 on the other end for the nut holding the spring.

Piston

The piston was turned from a piece of stainless steel a little over 12mm diameter to a sliding fit in the cylinder. A couple of oil grooves were turned as well. A 3.3mm hole was drilled to a depth of a bit over 12mm, then the first 6mm of the hole was opened up to 4mm and the bottom of the hole tapped M4. The piston was parted off to a length of 12mm.
The piston rod was screwcut M4 in the lathe the same way as the pivot pin, and a piece of cast iron from the scrap box used for the big end.



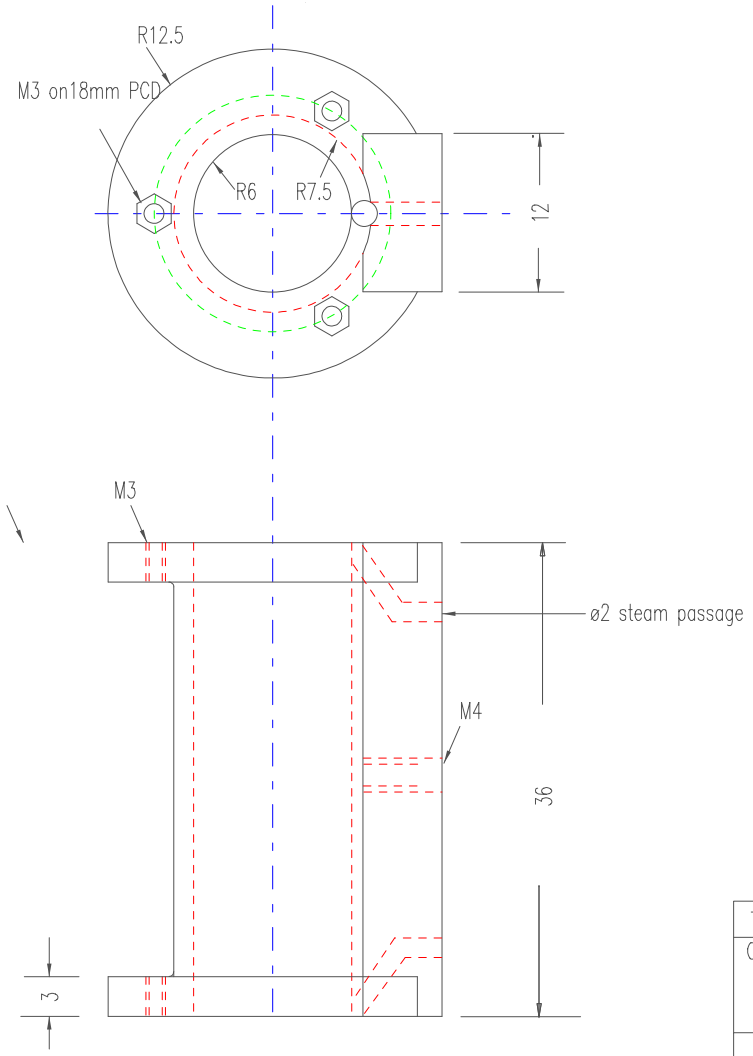
Cylinder Cover

The cylinder cover was turned from a piece of 25mm diameter brass rod. A spigot protruding a little over 1mm was turned to just fit into the cylinder bore. Then the cover was parted off and transferred to a self-centring chuck on the rotary table to drill three 3mm holes 120° apart on a 18mm PCD. I used the holes in the cover to spot the three holes in the cylinder flange, and drill them 2.5mm and tap M3. I used pieces from M3 threaded rod to make simple studs and M3 nuts to attach the cover to the cylinder with a paper gasket in between.

The flywheel, crankshaft, crank and crankpin was made the same way as for Elmer's #36 I made. The column was made similar to the one I made for Elmer's #36, except I only needed to drill the upper steam passages in the column.

The little engine run well both on compressed air and steam.

Single-acting oscillating Steam engine12mm bore, 19mm stroke



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CylinderSingle-acting oscillating Steam engine12mm bore, 19

Material, brass