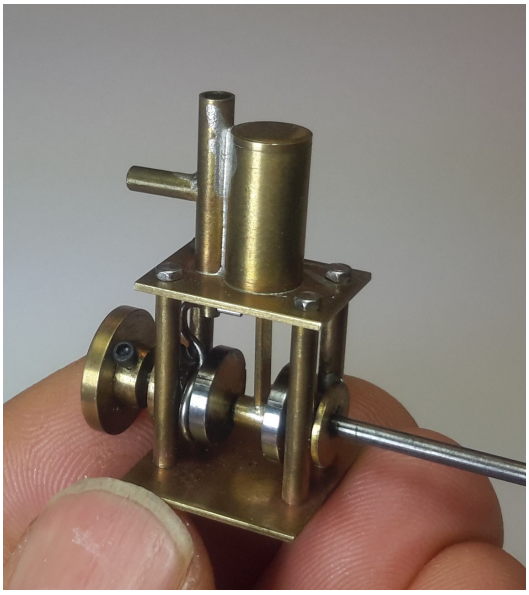
CONSTRUCTION NOTES FOR
ONE CYLINDER SINGLE ACTING STEAM ENGINE

Revised 5/9/16

By

Les Proper
lesproper@gmail.com

These construction notes accompany the attached plan and materials list for the one cylinder single acting steam engine. This engine is the simplest of a family of miniature brass steam engines designed by Leslie J. Proper. The plan is a sample from "THE MINIATURE STEAM BOAT BOOK" by Les Proper.



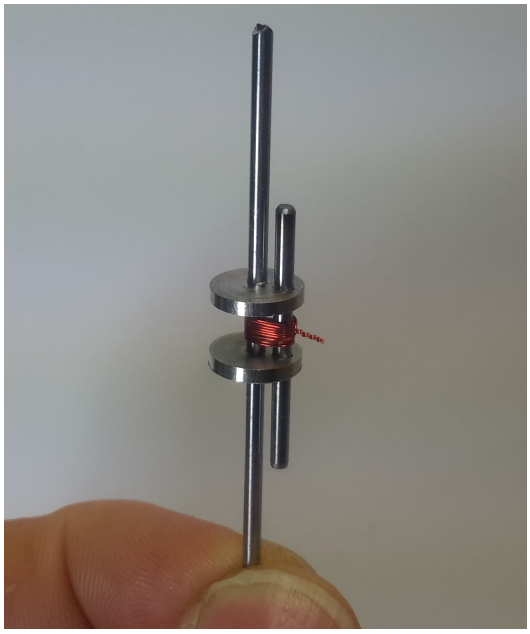
Start by making the engine frame, which consists of the brass top, base, and frame posts. The frame is held together with 0-80 machine screws, hex head on top and Phipps head on the bottom. The frame posts are drilled and tapped on the lathe.

Next remove the brass top from the engine frame and lay out and drill the holes for the cylinder and valve tube. The cylinder and valve tube are made from brass tubing manufactured by K&S Precision Metals. The part are joined together with soft soldered. Drill the steam port with a number 56 drill bit. Do not bend the cylinder and valve tubes out of round when putting them into the brass top or dent them with a center punch when drilling the steam port. The brass cylinder tube will easily distort out of round on the bottom if the brass top cylinder hole is out of round. Roughness in the cylinder and valve tube at the steam port can be reamed smooth with the correct size drill bit. Install stainless steel wire through the steam port connecting the cylinder and valve tube to align and prevent plugging with solder. Soft solder will not bond to stainless steel. Use fine copper wire and easy press fits into the brass top to hold the parts together for soldering. Make the brass cylinder head with an easy press fit into the cylinder. The cylinder head is soldered with the first soldering. Solder on the steam inlet pipe in a second soldering operation. Be careful to not melt the other parts apart. Drill the steam inlet pipe hole with a 1/16" drill bit. Drill the hole after the steam inlet pipe is soldered on.

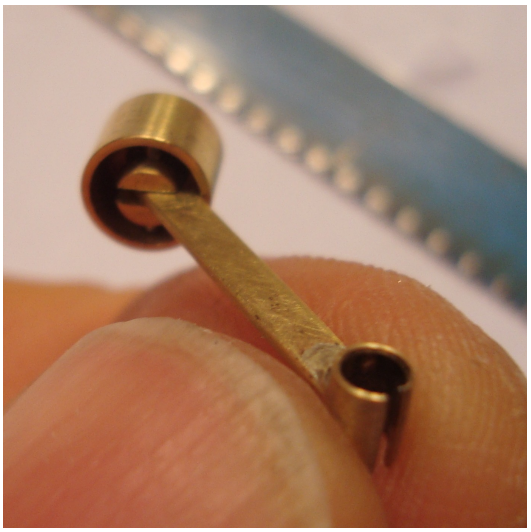
The main bearings are machined to fit snug between the engine frame posts. Hold the bearing in alignment with a piece of 5/64" drill rod and use spacer to hold to the correct height above the brass base. Solder the bearing onto the frame posts with soft solder.

The crankshaft is made from drill rod parts that are hard silver soldered together. Drill the holes in the 3/8" drill rod before cutting off the disks in the lathe. Cut the crank pin extra long so it extend beyond the disks and can be wired to the main shaft to hold the assembly for soldering. After soldering cut the center shaft out between the disks and trim the crank pin flush with the outsides of the disks. Face the outside surface of the front crank disk in the lathe with a very light facing cut for the brass eccentric.

The eccentric is made from free cutting brass and has a rounded groove to fit the valve rod which is bent to shape from 1/32” brass or stainless steel wire. The valve has a 0.10” travel, so the hole in the eccentric is 0.05” off center. The eccentric is soldered onto the crankshaft with it's top at the 3:00 o’clock position when the crank pin is in the 6:00 o’clock position. This will produce a clockwise turning engine (when viewed from the front of the engine). Soft solder the eccentric to the front face of the crankshaft by placing a tiny flattened piece of solder between the eccentric and crank disk and push it down while heating with the torch. This will prevent solder from getting into the eccentric groove.



The piston is machined to form a very close, but free sliding fit into the cylinder. Strive for about 0.001” smaller than the ID of the brass cylinder tube. The connecting rod is made by hard silver soldering a piece of 1/8” brass bar at a right angle to a piece of 1/8” brass tube. Use long pieces of bar stock and tube for soldering as they can be held and squared easier. Cut the connecting rod to size after soldering. The piston has a slotted hub that holds the connecting rod onto the piston. The part is assembled and soft soldered together. The bottom end of the connecting rod will have been softened during the hard silver soldering and is slit open across the bottom, spread open to fit over the crank pin, and bent closed on the crank pin. Cutting the slit with a piece of hacksaw blade with the set ground off will reduce the tube circumference to fit the crank pin perfectly.



The valve is machined to form a very close, but free sliding fit into the valve tube. Drill the valve rod hole in the valve with a number 66 drill bit in a drill press to make it square to the center line of the valve. The valve rod is bent, free hand, using a small needle nose pliers from 1/32 inch wire. The looped end is made by wrapping the wire around a number 2 drill bit. The valve rod should be about 0.36 inches from the center of the loop to the bent end that fits into the valve hole. Remove the front engine frame posts to install the valve rod on the eccentric and close it up with a tweezers. The valve rod must turn freely on the eccentric with as little free play as possible. Install the valve in the valve tube and insert the valve rod in the valve hole. The top of the valve should be even with the top of the valve tube at the top of it's rise. This is critical for a good running engine.

At all steps in the construction make sure all parts are turning and sliding freely without sticking before moving on. The tiniest amount of sticking will rob the engine of power and

result in poor performance. The engine should run at a nice speed on about 5 psi. A well made engine will run easily on just lung power.

PICTURED BELOW ARE THE STEAM BOATS INCLUDED IN
“THE MINIATURE STEAM BOAT BOOK”

This one cylinder single acting engine was used to power the 10” model of Lil' Toot, shown in the lower right.