

## Shay Throttle

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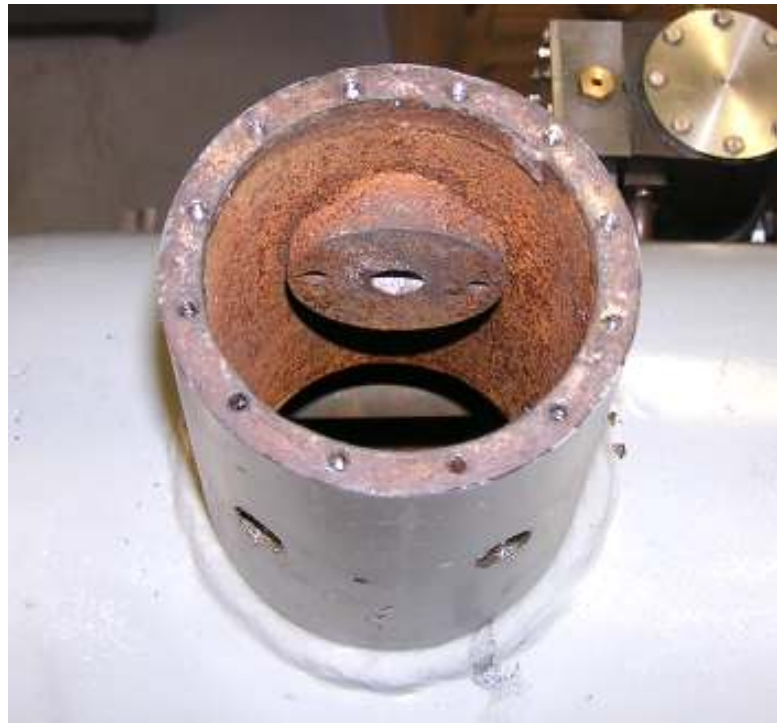
When I contacted for the boiler, the boiler maker said the throttle was very difficult to install and volunteered to install the throttle for an additional \$250. That of course was a challenge, and since the the parts cost about \$10, I decided to do it myself. One of the thoughts was that if I did it myself I would know how to get at it for any necessary maintenance. Turns out that it takes an hour or two to make the parts and a few minutes to install them if one doesn't do anything stupid. Of course, I did something stupid, so it took a bit longer.

The throttle is a common 1/4" pipe brass ball valve (brass body/stainless steel ball) located in the steam dome. The valve is controlled by a rod that connects between a lever on the valve and the throttle lever on the boiler backhead.

**Throttle Support:** The boiler maker installed the throttle support per Kenneth's specification. This photo shows the right side of the steam dome and the output side of the support. The flange connects to the steam supply pipe that carries the steam to the engine input steam header.



This photo shows the inside of the steam dome and the throttle support. The two holes in the support are threaded 10-32 for screws that secure the throttle assembly. The two holes in the lower part of the photo (left side of the steam dome) provide access for a hex wrench to install and remove the two screws. These holes are tapped 1/8" NPT and will be sealed with pipe plugs.



**Throttle Shaft Packing Gland:** This shows the hole in the backhead for the throttle packing gland. The hole is 1/4" NPT. The threads of this hole don't look very good; several small sections of threads are missing. Nothing seemed unusual when I tapped the hole. Will have to wait to see if the hole will seal.

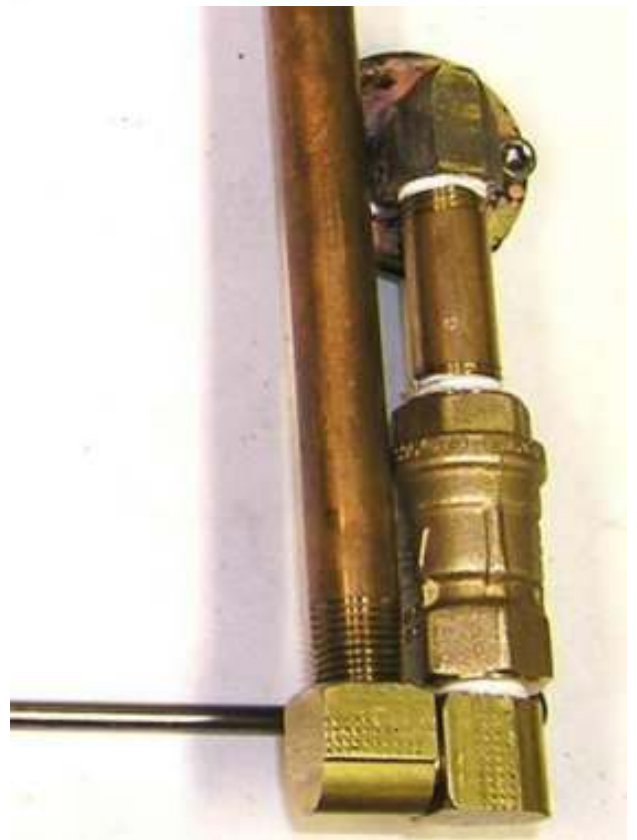
The fabrication of the packing gland and throttle lever are described on the backhead fittings page.



**Throttle Assembly:** This photo shows the right side of the throttle assembly. ( **Note : The rod is going the wrong direction in the photo ---- it's pointed to the front rather than the rear. Noticed this after the throttle was installed and wasn't about to take it back out to snap another photo.**) The pipe and fittings are 1/4" brass. The lever is made for 1/8" thick stainless steel bar. The green thing is a gasket between the assembly and the support. The long vertical pipe is the dry pipe that is cut to length later.



This is the left side of the throttle assembly. ( **Again, the rod is pointing toward the front rather than the rear of the boiler.**) That is Teflon sealing tape at the threaded joints. The round disk flange (under the gasket in previous photo) is made from 3/16" brass and silver soldered to the elbow.



**Cotter Pin:** A cotter pin is used in the end of the throttle rod. The pin is installed after the assemble is positioned in the steam dome and must be removable. The best choice might be a stainless hairpin type cotter. I didn't have one of an appropriate size and only non stainless pins are available locally. I ended up making the pin from 1/16" brass as shown on the right. The top loop is silver soldered. The hole in the shaft is 3/32 so the pin slides in easily. I used the hooked wire to drop the pin in place. A glop of Permatex sealer around the hook in the wire stiffened things up for the installation.



The throttle assembly was held by a loop of wire while the throttle rod was manipulated from the bulkhead end. The bent end of the rod slipped into the hole in the throttle valve lever without difficulty. This shows the assembly after the cotter pin was installed and the lower end bent over using a large hex wrench as a pushing tool. This whole operation only took a couple minutes. The throttle was installed without the dry pipe.



**Dumb! Dumb! Dumb!** At this point I felt pretty proud; installing the throttle is no big deal. I then tried to install the two screws --- very hard to turn and could only get them in a turn or two. Darn! Figured the holes on the throttle assembly weren't the same spacing as in the support causing the screws to bind. The holes in the assembly were slightly oversized, but maybe



not enough. No problem, take it back out. The cotter pin was pulled using a stiff wire with a hook on the end. The tip of a screw driver was then used to push the rod out of the lever. When doing this I thought that maybe the front of the rod should be secured so that it doesn't fall into the boiler. Less than a microsecond later the rod popped of the lever and slid into the bottom of the boiler. GRRRRRRR!

The lever is stainless so it could have been left in the boiler. However there is the pride factor. Getting it out looked impossible ---- the boiler is crossed with the tubes and there is a flat stay plate beside the hole in the backhead. And, the only way to get it out is through that hole in the backhead.

Turns out that it came out fairly easily --- this time I thought before acting. Turned the boiler upside down and found that the rod fell to the bottom --- on top the steam dome hole. I was able to loop a wire over the rod. Then turned the boiler right side and pushed the rod as far as it would go to the front --- the back end of the rod was at the rear side of the dome opening. I then slipped a length of 3/8" OD copper tubing into the gland hole in the backhead and then pushed it into the boiler and worked it over the end of the rod. The only problem with this was that the the tubing was restricted by the stay plates. However, a couple minutes later the end of the rod was in the tube. The tube was then pushed to the front of the boiler forcing the entire straight part of the rod in the tube. The tube was then withdrawn with the the rod inside.

I had mixed emotions about about including this whole episode --- however it might be useful as encouragement to other mechanically challenged steamers.

**Those screw holes:** Before enlarging the screw holes in the throttle assembly, screws were tried in the threaded holes in the throttle support. They would only go in a turn or two. The inside of the boiler is pretty rusted. The boiler was soaked in pickling solution before the silver soldering. This left a clear surface that oxidizes quickly ---- and the boiler had set around for months after it was made. So, it was likely rust in the threads ---- all the was needed was to run a tap through the holes. Fat chance --- no way could I get a tap in the steam dome. Then remembered that those black machine screws are really hard. Ground a couple tapered flats near the end of a screw making a poor-man's tap. A large T- handle hex wrench and and a few drops of tapping fluid cleaned the threads. Actually did it twice with two different screws to get them really clean.

**Insurance:** Before installing the throttle again I put an insurance washer and nut on the end of the throttle rod. The whole installation operation including making a new cotter pin took less than 10 minutes.



**Dry Tube:** This photo shows the completed throttle with the dry tube in position. The dry tube was cut to the correct length after the other parts were installed. The slots in the top of the tube are for a large screwdriver. A tight seal is not required at the bottom of the dry tube.



This photos shows the backhead with the throttle lever temporarily connected to the throttle rod. The throttle lever installation will be completed when the other parts are mounted to the backhead.



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