Another Shay Steam Brake Valve

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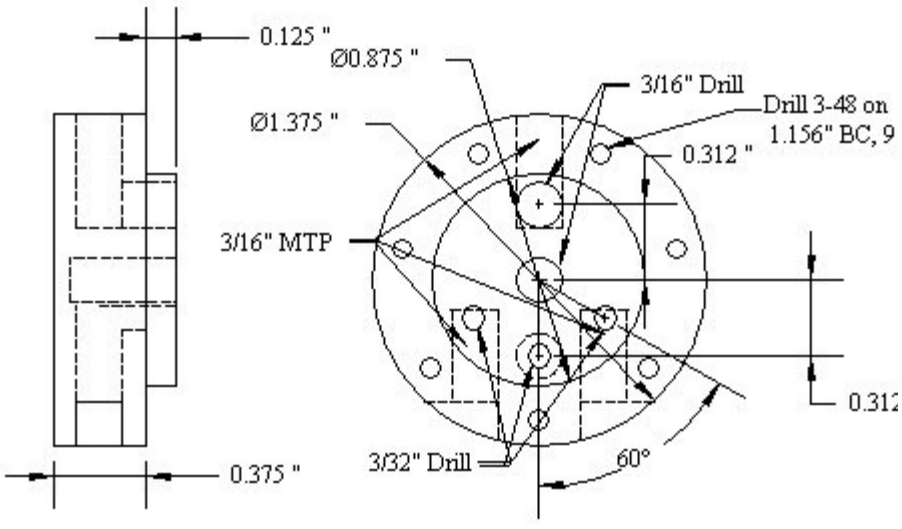
I was not happy with the valve described in the brake valve section Shay Steam Brake Valve because th passages were too small. The valve worked OK on compressed air but sometimes would not pass steam, especially under lower pressure such as less than 50 psi. I modified the the valve by drilling the passage larger. This fixed the blockage problem but the clearances were reduced with the larger passages and the developed a small leak. One solution was to make a new valve designed with larger passages. A valve 3/32" passages would be satisfactory and this size passage could probably be achieved reliably with a 3/8 plug.

I had recently finished building an air compressor/pump that used O-Ring seals and was very happy with Rings. I had also made a blowdown valve using an O-Ring seal and was happy with that design. With t successes I decided to try to make a brake valve using O-Rings. The O-rings will seal against a rotating just like the blowdown valve. Recall that the valve must make two connections at once: the steam input end of the cylinder and the other end of the cylinder to the exhaust. The passages connecting the betwe valve inputs and outputs will be within the rotating disk. (This was the view in January 2004).

Update 2/26/2006: I made the O-Ring valve and it worked fine for a few weeks and then started to leak one of the O-Rings tore on the disk. I replaced the O-Ring and then another tore in a week or so. It turn this design didn't work very well. After two summers with seldom working brakes I decided to design a valve using a rotating disk on a thin sheet of Teflon. The disk is spring loaded and the entire valve is pressurized and sealed. This valve uses some of the concepts of a brake valve sold by LocoParts. The LocoParts valve is an excellent value and I recommend it. Unfortunately that valve controls only one en brake cylinder and is not applicable to the double ended cylinders used on the early Shays. I deleted the description of the O-Ring based valve from this page and replaced it with the description of the disk-Tefl valve which really works.

Brake Valve Base: The drawing on right shows the valve base. The base is made of 1.375" diameter brass rod. The nine outer holes tapped 3-48 are for attaching the top to the base. I drilled the holes in the top first and then used the top as a pattern to drill the holes in the base. Steam enters the base through the 3/16" MTP hole in the back and then up through a tension pin forced into the 3/16" vertical hole. The center 3/16" hole is for the shaft. The three 3/32 holes near the front are the steam ports. The middle port is for exhaust and goes out the bottom. The other two ports intersect 3/16" MTP holes out the front that go to each end of the brake cylinder.



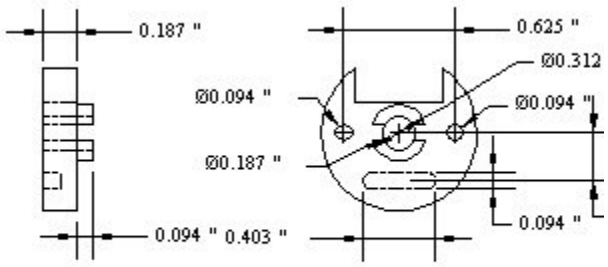
Brake Valve Base

This shows the top of the base with the two output pipes connected. The black plate out the back is from the previous valve and is used to attach the valve to the shelf above the rear engine cylinder. The stub of the tension pin near the rear of the top is hollow which allows the steam to flow into the valve. The pin together with a slot in the disk limits the rotation of the disk. (The stainless steel tension pins were trimmed to the proper length with a Dremel cutoff disk.)

This is the under side of the base. A recess (not shown on the drawing) was milled in the base for the attachment plate. The plate is screwed to the base with a pair of 4-40 FH screws. The tension pin out the bottom is to carry the exhaust through the shelf. The lower part of the exhaust port is enlarged to 3/16" to accept the short expansion pin.

Teflon Seal: This photo shows the 0.015" thick Teflon seal in position on the base. The Teflon is available from McMaster-Carr. The Teflon was cut with an hobby knife. The seal is held in place by the tension pin and the shaft.

Valve Disk: The drawing shows the valve disk that is turned from 7/8" diameter brass rod. The shaft runs through the hole in the disk center and into the center hole of the base. The slot in the back fits around the the the tension pin that sticks up from the base. The slots limits the disk rotation to 30 degrees each side of the center. When the disk is centered. the slot is over the exhaust port (the middle port). When the disk is rotated 30 degrees, the slot is over both the exhaust port and one of the ports leading to the brake cylinder allowing that end to exhaust. One of the holes though the disk is over the port leading to the other end of the brake cylinder allowing the steam to flow from above the disk through the hole to the port and on to the brake cylinder. When the shaft is rotated to the other extreme the opposite ends of the cylinder are powered and exhausted.



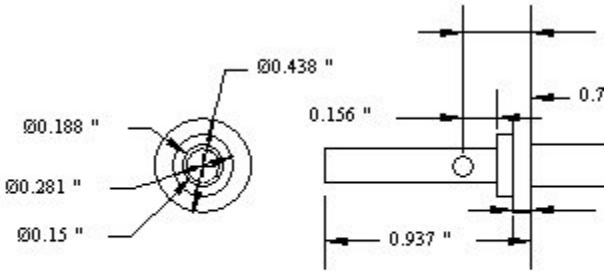
Brake Valve Disk

This is the top view of the disk. I didn't make the slot in

the back quite like the drawing. Instead, I drilled 3/16" holes at a 5/16" radius from the center and 30 degrees each side of the center line. I then opened up the slot with a saw and filed the edges such that the disk rotated freely. The slot in the shoulder on the top is 3/32" wide to accept the pin through the shaft.

I had the disk in the rotary table so I milled a curved slot rather than the straight slot shown on the drawing. The slot is 3/32" wide at a 5/16" radius from the center and covers a 30 degree rotation each side of center.

Valve Shaft: The shaft is 3/16" stainless steel rod. The washer was turned from 1/2" stainless steel rod and silver soldered on the the shaft. The hole is for a 3/32" tension pin that fits in the slot in the to of the disk.

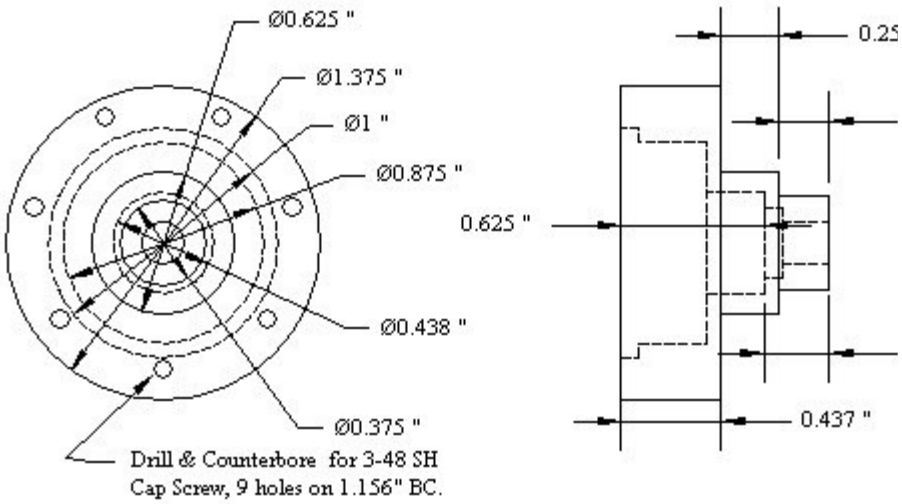


Brake Valve Shaft

Valve Shaft & Spring: Photo shaft the valve shaft & Spring. The spring is 9/16" long cut from, a 7/8" long, 0.42" OD, 0.047" wire diameter stainless spring (McMaster-Carr #9435K93).

This photo shows the shaft, spring, disk & base positioned for the placement of the top. Not that the disk is held against the Teflon by both the spring and steam pressure.

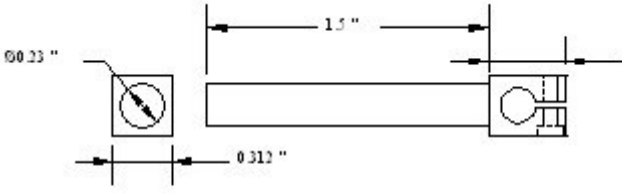
Valve Top: The valve top is turned from the same 1.375" diameter brass rod as was the base. The recess on the bottom edge is for a 7/8" ID - 1" OD (#020) Viton O-Ring seal. The recess near the top is for a 3/16" ID - 5/16" OD (#008) Viton O-Ring seal.



Brake Valve Top

This shows the underside of the finished top. The O-Ring looks bigger that the 1/16" thick ring specified on the drawing. It is in fact a 3/32" cross section O-Ring that I ordered by mistake. I made the recess deeper to accommodate the thicker cross section.

Valve Handle: Valve Handle: The valve handle is turned from 5/16" square brass. After the handle was turned I remembered how hot the handle on the old valve got so I changed the design. I turned the end of the handle part down to 3/16" and threaded it 10-32. I then tapped the end of a piece of 1/4" plastic rod (I think it was Delrin) 10-32 and threaded it on the brass.



Brake Valve Handle

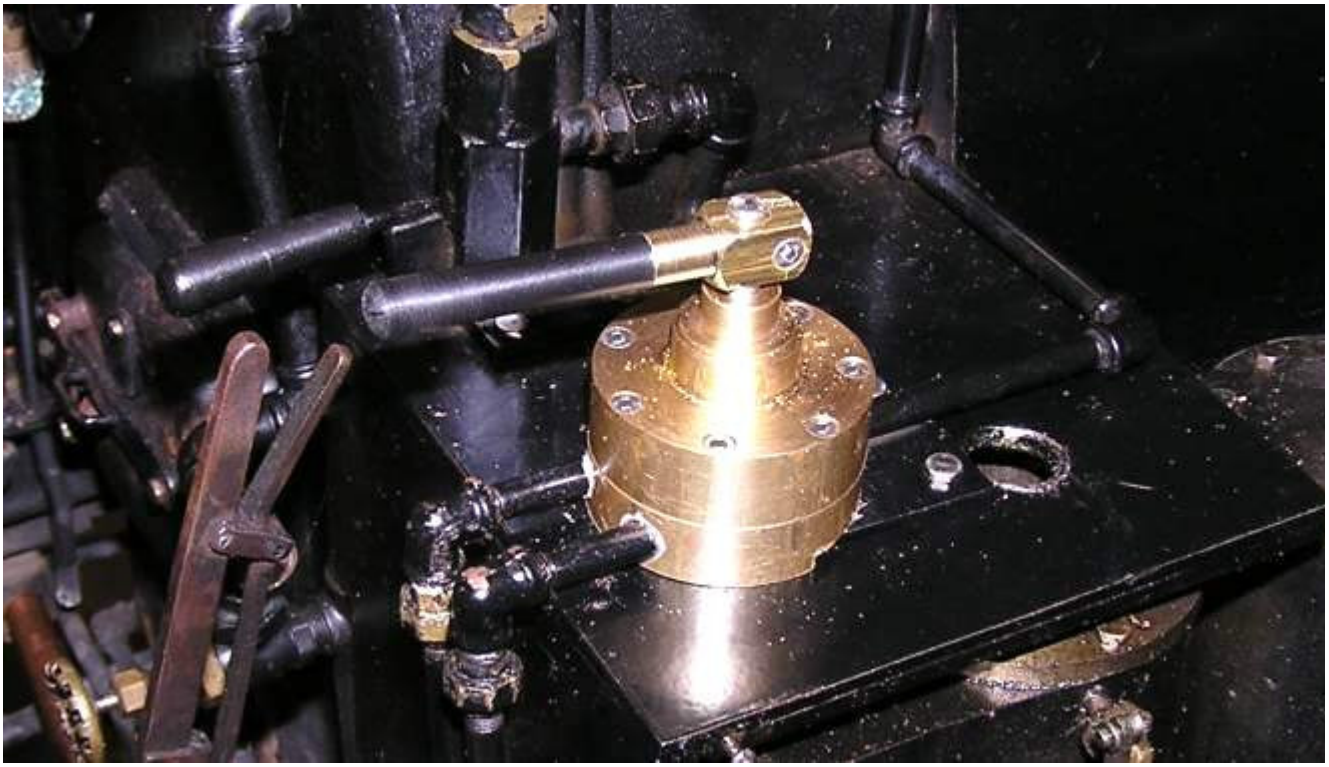


Photo above shows the finished valve installed on the shelf over the rear cylinder. The cab was off when photo was taken.

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