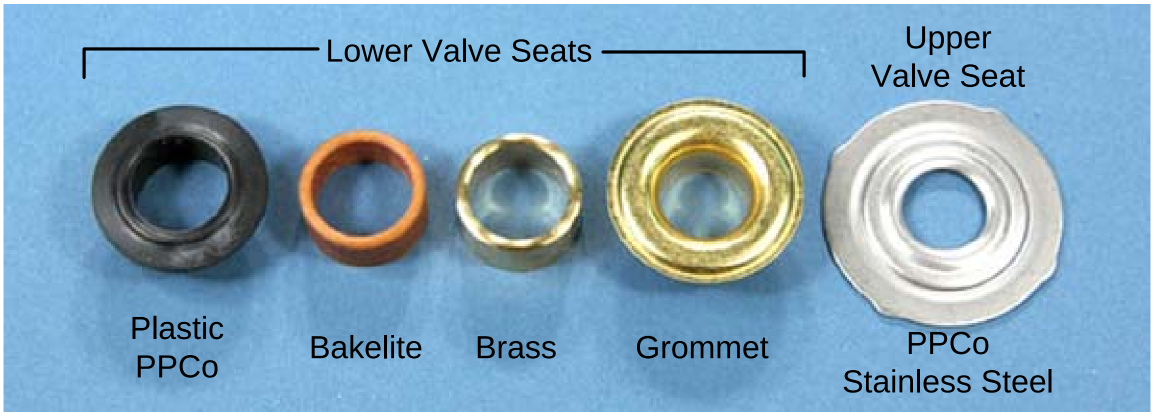
Notes on Making the Wurlitzer Unit Valve Part 3

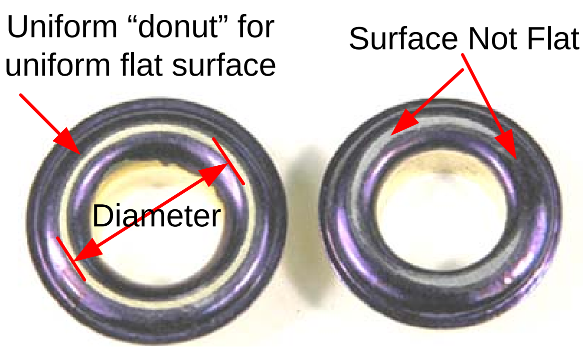
Valve Seats

I used the stainless steel upper valve seat available from PPCo. I tested a number of alternatives for the lower valve seat.



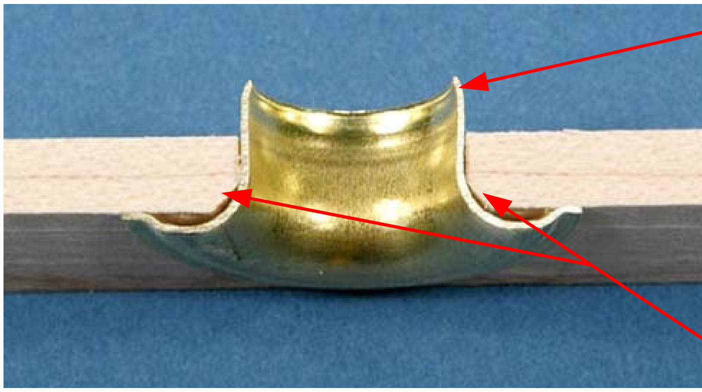
PPCo Plastic seat - PPCo uses an injection molded lower valve seat in the valves that they make. This seat is well made and accurate but extends up high above the floor of the valve block chamber limiting the room available for the stem assembly. They do not use an adjustable valve disk in their valves so they do not need as much space as the adjustable assembly requires. This valve seat is not in their catalog but generally they will sell a set to you if you call. I did not try this valve seat since I wanted to use the original Wurlitzer adjustable valve travel design.

Canvas Grommet seat - Perhaps the most popular choice for the lower valve seat is one of the brass rope grommets that are used for rope hold-downs in canvas tarps. Originally I had planned to use these grommets but after doing some tests, I opted to use the Bakelite lower seat instead. I tested several suppliers of the brass grommets and with some effort and "watch-outs", they can be made to give satisfactory results. Not all supplier's products are created equal. Some are solid brass and are preferred. Some are brass plated steel and are to be avoided.



Some grommets do not provide a flat uniform surface and therefore do not seat and seal well. In fact they can fail miserably. As a quick check, rub one of the grommet faces a few times on a sheet of very fine emery paper glued to a flat surface. Look at the area polished into the surface to make sure that you see a uniform "donut" shaped area with no breaks.

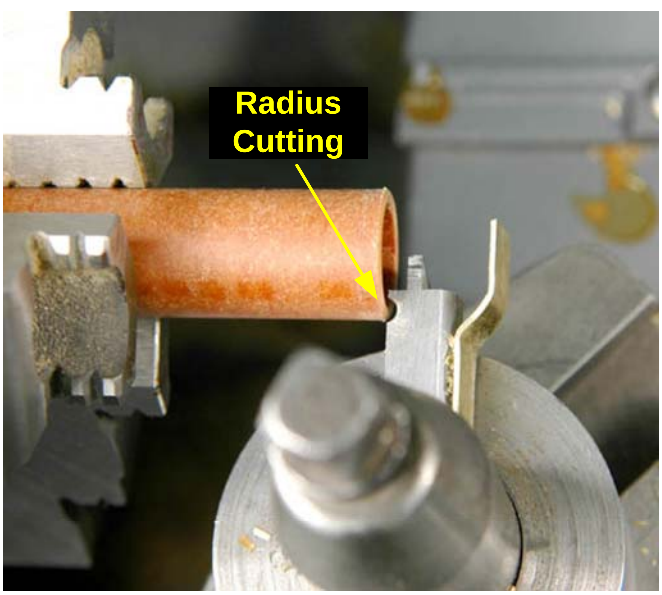
I used blue layout fluid on the grommets above, so that these polished areas would show up better. One other issue to consider when using the grommet is the larger effective diameter of the Grommet seat which can limit the “pull-down” effect of the lower valve leather and increase leakage, particularly if the lower leather is not glued right on the edge. I measured the leakage of the lower valve seat using a flow meter and the valve leakage could increase by as much as 50% if the valve stem was not centered on the valve seat. It may be possible to increase the diameter of the lower fiber disk to help but I did not try this.

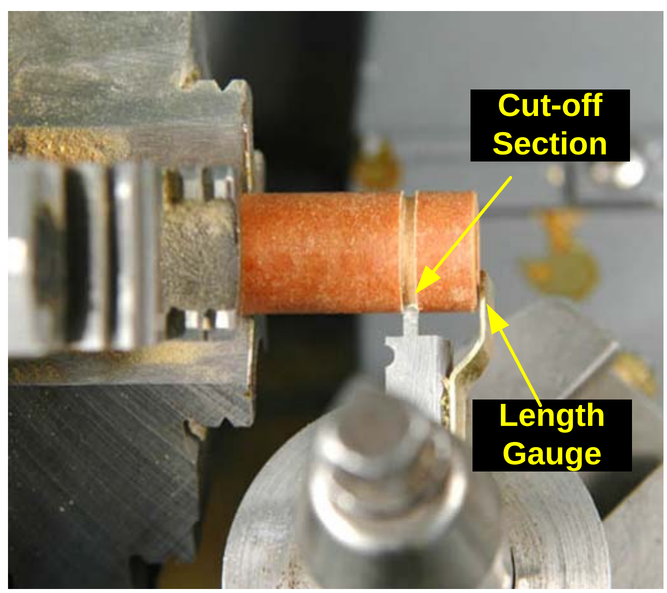


Some of the grommets narrow considerably at the neck and need to be trimmed. This section of the grommet needs to be ground away, down to the straight walled section of the the grommet opening. Also, you will have to make sure there are no burrs to catch the fluted stem. The valve floor will have to be counter-sunk so that the grommet will seat on the floor of the valve chamber.

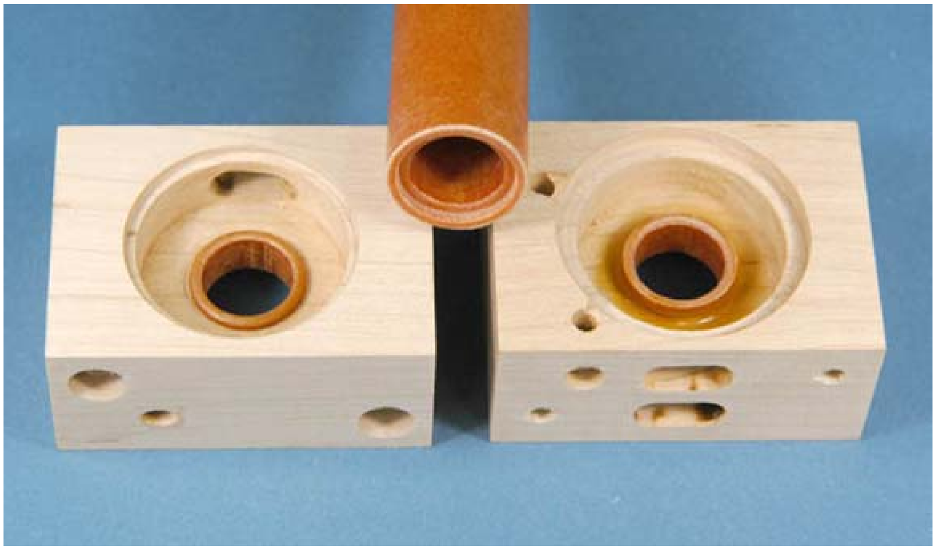
Brass Tubing seat - A short section of brass tubing press fit and sealed in the valve block makes a very good lower seat. The leather facing end needs to have a radius to mate with the leather facing and all burrs need to be removed from the other end. These are easier to make if you have a metal lathe, using a cut-off tool to cut short sections of equal length, and a lathe tool with a radius ground in it to make the radius.

Bakelite Tubing seat - Original Wurlitzer lower valve seats were made of Bakelite which historically was one of the earliest “plastics” used. Today’s version of Bakelite, or Phenolic goes by the trade name Garolite. Valve seats made from a Garolite tube are made with the same process as used for the brass tubing. The advantage of using a Garolite tube is that a small wood lathe could be used to make them. Unfortunately my little wood lathe’s spindle hole was not large enough to feed the Bakelite tubing through and I did not want the waste of cutting a bunch of short sections. I had already made a cutting tool for my wood lathe before I found this out. I ended up using the tool anyway on my metal lathe.



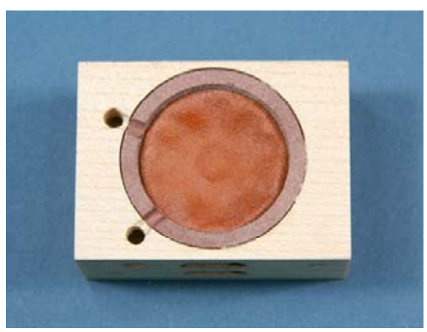


It doesn't take much to machine Bakelite. I made this tool out of unhardened drill rod. It includes a place on the side with a small radius ground in it for the face radius and a straight section to act as a cut-off tool. I fastened a short piece of brass to the side to act as a gauge to make the height of each seat the same. Since all lathe operations were consolidated in this one tool, I could make the seats on a production basis, cutting the radius and then cutting the tube and starting again.



I pressed the lower seats into the block with a piece of ¾" diameter Bakelite tubing. I cut a shoulder on the inside of the tube 1/16" deep and with a diameter just larger than the 5/8" seat outside diameter. I used this as a tool to press the seat in until the tool was flush with the floor of the valve block, making the seat stick up 1/16" from the floor.

I glued the seat in on the pouch side of the block. I then coated the Pouch Well shoulder with a thin hide glue sizing. This helps insure a good bond when the Pouch Assembly is glued in. Seal the inside of the block with thick shellac (2-3 lb mix) using a brush to coat all the inside surfaces and channels. Avoid getting shellac on the Pouch Well shoulder. The sizing will prevent shellac from bonding to this surface in any even event which is the reason to size this shoulder first. I use burnt shellac to glue and seal the upper seat and the tracker tube elbow in place.

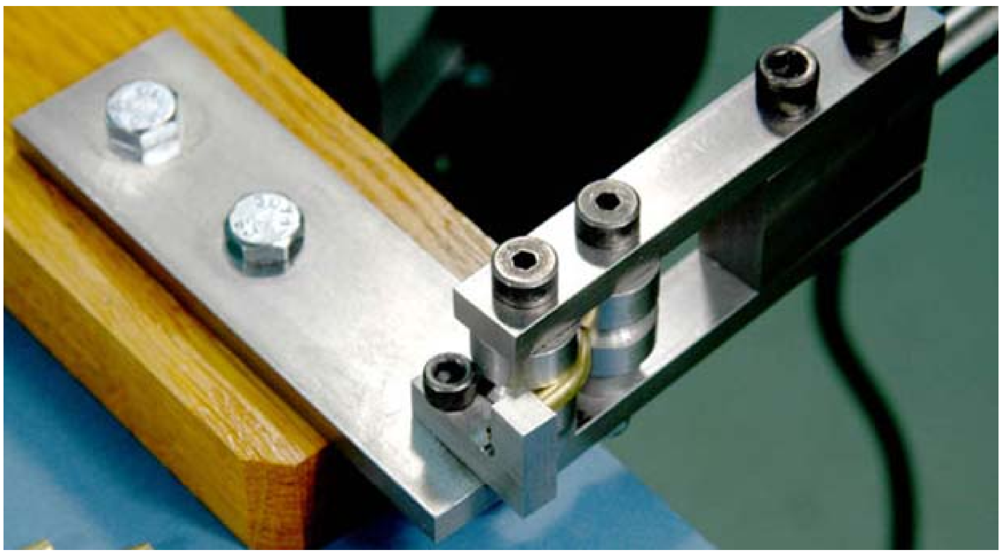


While the hole for the bleed cup was still damp with shellac, use a pin punch to tap the bleed in place. After gluing in the pouch assembly, I used a sharp chisel to cut a V-groove between the two face holes and the pouch on the pouch side of the valve. This provides air channels from these holes to the back of the pouch.

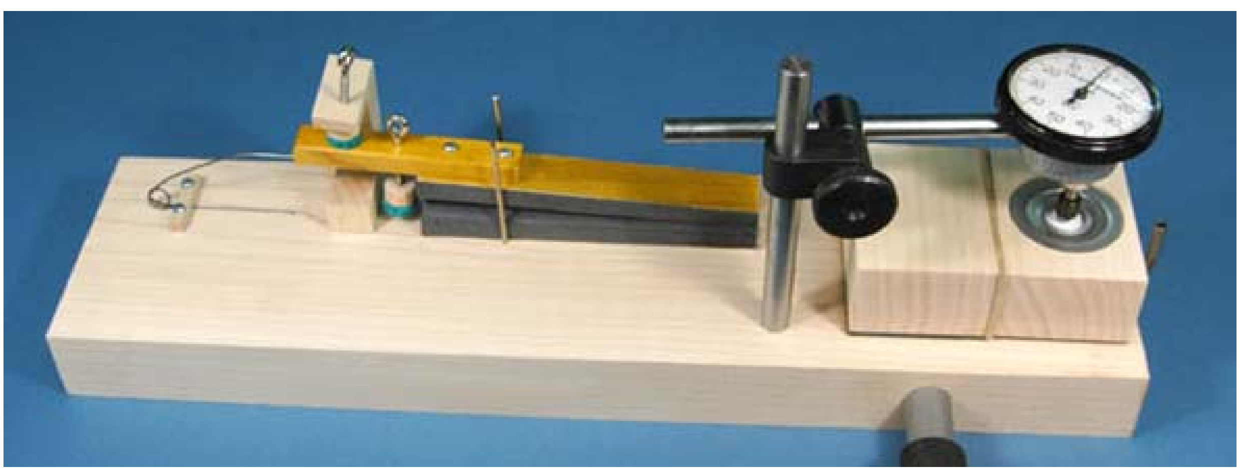
I then covered the pouch side of the valve with the fiber-board pouch cover. To make sure that no glue or glue surface came in contact with the pouch, I glued the board by first pushing the pouch down against the lower seat and then I rolled hide glue on to the valve block using a rubber glue roller. I then clamped the fiber-board to the block to dry. This way, no glue would get on the area of the fiber-board over the pouch.

Over the years I have used tracker tube elbows from a supplier whose product looks like they were made by just bending and kinking the tube over the corner of a bench. Although it is true that the channel inside these tubes are sufficiently large to work ok, they look like the devil. And they obviously do not look anything like the original.

I have always wanted to make my own tubing bender to solve this issue, but procrastination always won out. With this project, I finally bit the bullet and built the tubing bender shown here. Email me if you are interested in the details.



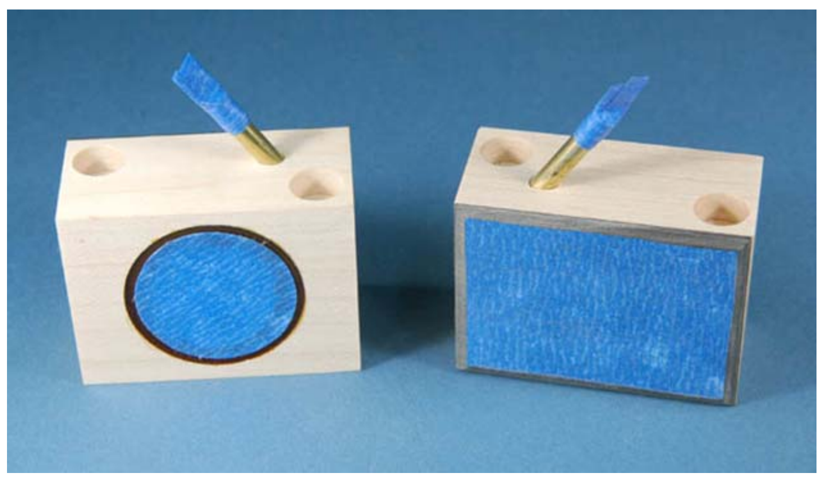
Valve Testing and Travel Adjustment



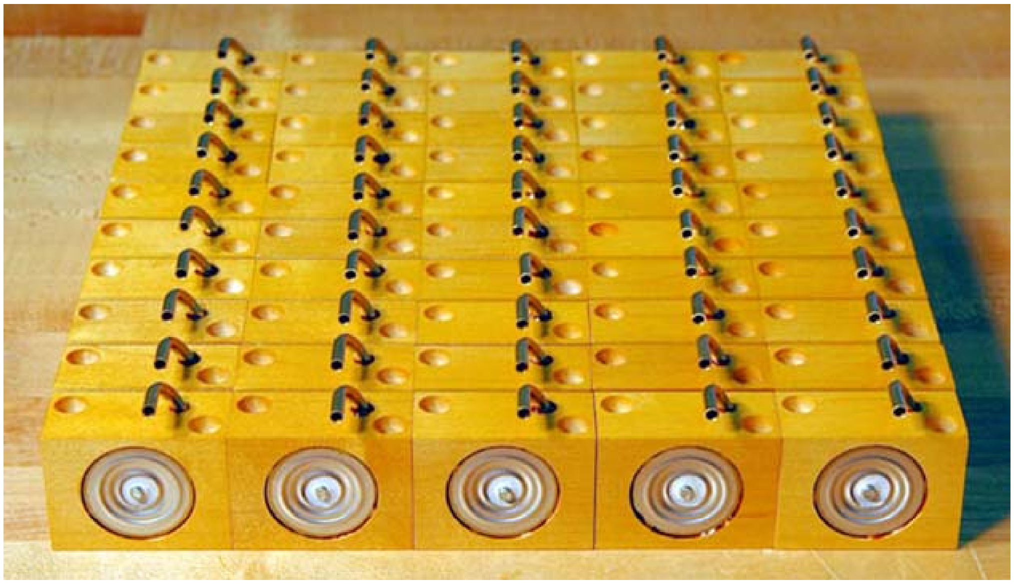
Here is the setup I used to test and adjust the valves. The test pneumatic is made to the specs of the 105, including the pneumatic movement adjustments and the pallet spring. I used a dial indicator for setting the valve travel with a rod mounted in the base to mount it over the valve. I used a quick release clamp to hold the valve during the test/adjust process.

I build and used the vacuum reservoir I will use for my 105 as a vacuum source/regulator for testing, driven by an old PPCo vacuum source. I probably would not have gone to so much trouble if I did not want to test various alternative valve seats, valve leathers and bleed cap combinations. I wanted to make sure that the valve had good response and repetition rate so I wanted the valve load and supply vacuum to match the actual 105 as much as possible. I set the valve travel to .035". Setting the travel on the first several valves can be painful with the frequent removal of the upper seat and turning of the upper disk. After about 10 valves, you will get a good feel for a starting point. By the 40^{th} valve...you will be an expert! Note that the upper valve seat does not have to be sealed to set the travel.

It just needs to be pushed own snug with the shoulder of the valve block. You may get some leakage on the edge, but it will not interfere with the travel adjustment. Some people will set the valve travel before the pouch cover is glued on by using their finger to push the pouch up and down manually. I wanted to operate the valve under actual conditions and cycle it through many operations to make sure it was seating properly and that the travel was not dependent on how much pressure I applied to the pouch.



Once the valve travel was set, I sealed the upper valve seat using burnt shellac. After this set up I was ready to put a coat of finish on the outside of the valves. I used blue masking tape to cover the pouch cover. I used a punch to make circles of masking tape to cover the upper seats. The fiber board I used to cover the pouch is very dense and needs no further sealing. The original valves used a cardboard-like material that was covered with pneumatic cloth and then shellac to get a good seal. The edges of the cover were chamfered and sealed to lessen the chance of the board delaminating on the edge. In my case, I covered the cover with masking tape before chamfering the edges and then chamfered the edge just before applying a finish. This made a clean finish line and the completed valve has the same look as the original Wurlitzer valve. Not masking the cover and just spraying it as well would also be fine. I temporarily put a short section of brass tubing sealed with tape at the end in the tracker tube hole just far enough to keep the finish from getting in the valve through the hole. I installed the permanent tracker tube elbow after the shellac dried and sealed it with burnt shellac. I used an airbrush to spray the block with shellac.



Finished Set of Valves

Sources of Parts and Supplies

Item	Discription	Supplier	Part #
Upper Valve Seat	Stainless Steel	PPCo.	706
Lower Valve Seat			
Plastic	Injection molded finished seat	PPCo.	3045
Brass Tubing	Made from 5/8"OD 1/2"ID tubing	McMaster	8950K671
Bakelite (Phenolic)	Made from 5/8"OD 1/2"ID tubing	McMaster	8527K136
Brass Grommet	Brass rope grommet size #3 with 7/16" hole	McMaster	9604K25
Valve Pouch Cover	Hard Fiber board 1/16" Thick	McMaster	8652K73
Mounting Spring	Steel spring	PPCo.	700
Mounting Screw	#6x2" round head screw	PPCo.	707
Brass Elbow	5/32" 90 degree Elbow	PPCo.	141
	5/32" Brass Stock	McMaster	8859K235
Bleed Cup	#68 hole	PPCo.	388
Stem Disk - Fixed	13/16"dia x1/16" w/ 1/16" hole	OSI	6400.32
Stem Disk - Adjustable	13/16"dia x1/32" w/ 3/16" hole	Note 1	
PEM threaded Stud	8-32 x 5/16" Press-In Stud	McMaster	93580A114
Pouch Assembly			
Pouch Ring	1-3/8"x1-1/8"x1/16" two required per Pouch	PPCo.	703
Lifter Disk	3/4" disk punched from .030" thick fiber board	McMaster	8490K14

Note 1: This part was originally sourced from PPCo as their part # 789 but is no longer available. I had a supplier make up a batch of these disks and will make sets of them available to anyone interested at my unit cost plus postage. Email me for details.
McMaster-Carr: www.mcmaster.com
OSI: Organ Supply Inc.: www.organsupply.com
PPCo: Player Piano Co., 704 East Douglas, Wichita, Kansas, 67202. Phone: 316-263-3241