NEW WHISTLE AND VALVE ON MY POLLY V STEAM LOCOMOTIVE

Introduction

It had become a standing family joke on steaming outings that my Polly V whistle left a lot to be desired. Quite often it would do nothing more than a feeble splutter. The Polly V kit supplied whistle is fitted under the running board on the left hand side of the cab. The pipe run is long and somewhat tortuous. I had insulated the pipe to reduce feed loss but this made little difference. The whistle valve also had a gentle leak and was very stiff to activate. All in all not a good setup.

A recent article in Engineering In Miniature (EIM) by Richard Wightman (September 2022) went into detail about a whistle and valve combination he had created. The whistle was fairly conventional but very compact. The steam control valve was unusual in that he used a standard tyre Schrader valve. This tweaked my interest. I recommend reading his article.

Richard chose to use just the Schrader valve and scrap the housing shell. Instead he built a new housing around it. This meant he had to replicate the thread on the Schrader valve which is a 0.209" x 36TPI designated 5V1-36, a slightly weird standard. To his credit he describes how he created a pair of taps to cut this thread. The mounting of the Schrader valve also required a taper to be cut and he made a D bit form tool for this.

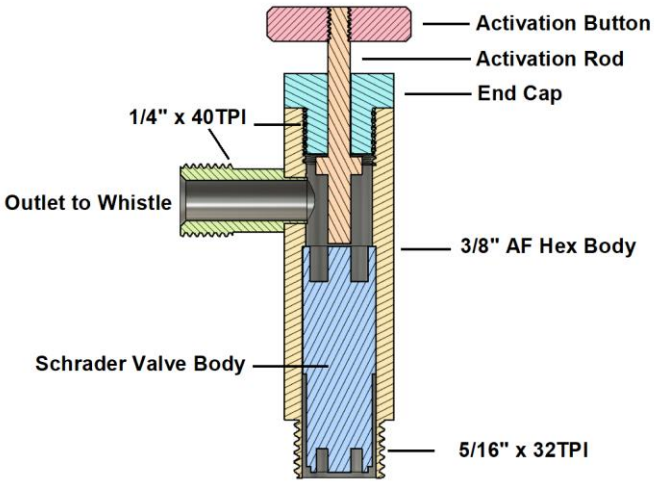
This all looked a bit complicated and a bit off putting to try to replicate what he had done. Lazy me (as usual) wanted to do it easily. No 3D printing on this one though.

I scrounged a few Schrader valve fitments from a local tyre dealer. I stripped the outer rubber casing from one of the valve bodies. This is best done initially with a sharp scalpel blade. Then as Richard suggests the rubber residue can be abraded off using a wire wheel. Once totally removed this leaves just the brass inner shell into which the Schrader valve is fitted. The brass shell has sufficient metal on it that it can be turned down to just two diameters. The valve cap thread and small flange can be carefully machined back to 6.35mm. The narrower section is left untouched but is reduced in length. See the image below.

With the valve shell cut down to its minimum size both in length and diameters I moved to Fusion to model a body to house it.

New Valve Construction

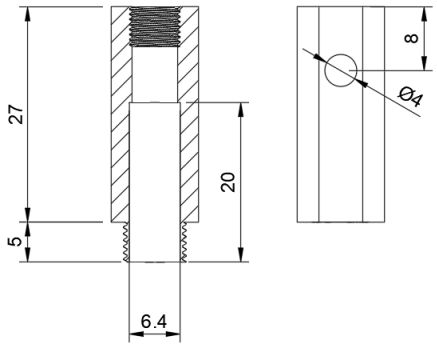
The following is a cross section view of the new whistle valve assembly.



The Schrader valve is not accurately modelled in this image (in blue) but is drawn as a representative shape of its housing shell. I opted to have the whistle valve activation as a press button. This will no doubt offend the purists but the idea appealed. There is no reason why a conventional lever action could not be used by changing the end cap construction.

The back head manifold on the Polly V has a 5/16" x 32 TPI ME threaded hole to mount the whistle valve body. (Note in Fusion you can model ME threads as UNS). This diameter would allow the use of 3/8" AF hex brass rod stock. Here are the processes in order.

1 Chuck the 3/8"AF hex brass stock, face off and part off at 30mm.



2 Turn one end to 7.9mm for a length of 4mm and then cut the 5/16" x 32 TPI thread. I used a very fine graver to then undercut the thread so it would run tight to the back head manifold. If you wish to fit thin copper washers this won't be needed.

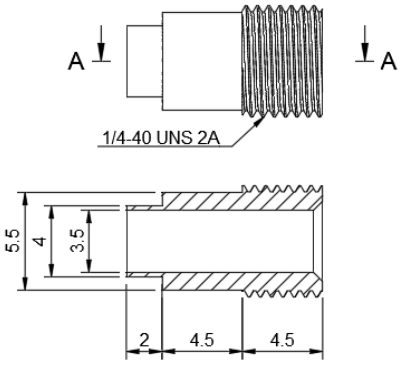
3 Drill through the whole body to 5.8mm diameter.

4 Drill though from the threaded end at 6.4mm diameter for a depth equal to the length of the finished modified Schrader valve shell (~20mm). Note this leaves a very fragile thread wall.

5 Reverse in the chuck and tap the activation end of the body with ¼" x 40 TPI ME thread to a depth of 5mm.

6 Dry fit the new body in the engine steam manifold and chose which flat on the body best suits your intended pipework run. Drill a 4mm hole at a distance of 8 mm down from the threaded end on this face. This completes the preparation of the valve body.

7 Next make the steam exhaust outlet.



8 Chuck a ¼" diameter round brass rod for the steam outlet. Tap ¼"x 40 TPI ME thread for 4.5mm.

9 Drill through at 3.5mm diameter and chamfer the entry hole with a spot countersink.

10 Reduce the body diameter from the end of the threaded section to 5mm for a distance of 4.5mm.

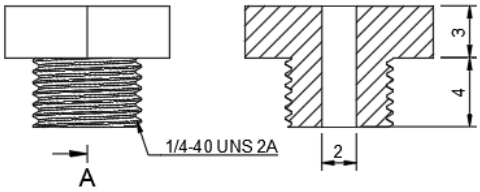
11 Further reduce the body from this point to 4mm diameter for a length of 2mm. Ensure a clean flat shoulder on this transition.

12 Partially part the part but pause the parting momentarily while cleaning the parted edge and then finish the parting cut. This completes the steam exhaust.

13 Remove the Schrader valve from its shell. Flux and fit the Schrader valve shell and the whistle outlet in place and braze these into the valve body.

14 Clean off all residual flux etc and refit the Schrader valve in its shell. This completes the new whistle control body.

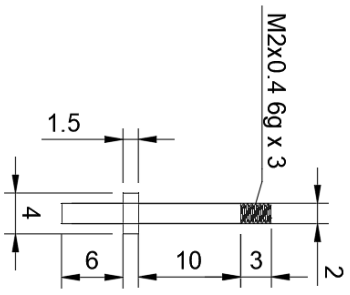
15 Chuck a further piece of 3/8" AF hex brass to make the end cap. Form a ¼"x 40 TPI ME thread for a distance of 4mm to mate with the newly made valve body. Undercut the thread with a fine parting tool or graver.



16 Drill through the end cap at 2mm diameter.

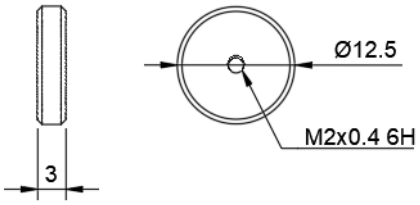
17 Partially part off the cap and round the hex edges on both faces before completing the parting off. This completes the cap.

18 Chuck a piece of 1/8" round brass rod and form the profile of the activation rod as drawn below. This is probably easier to work from the threaded end back. Do not take too large cuts or the brass will shear. The thread can be M2 or 8BA.

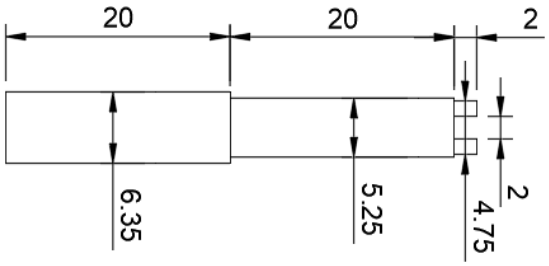


19 When the profile shape is complete, hacksaw or part off. This completes the activation rod.

20 Chuck a piece of ½" brass round rod and form the button to your preference and drill and tap the centre to match the rod thread. Partially part the button and shape the cut edge before completing the cut. The button is complete. Note if the button gets too hot in use then laminate a nonconductive face to the button.



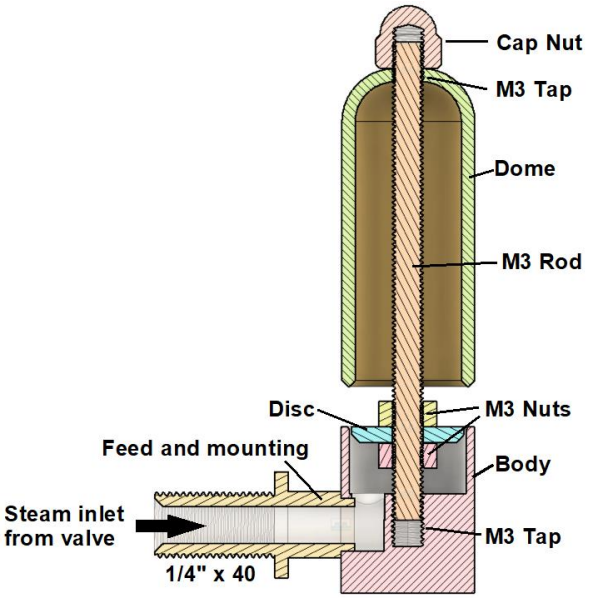
21 Fit the Schrader valve back into its shell. Fit the activation rod, end cap and button to complete the new whistle activation valve. The button thread may need Loctite. Here is a simple tool for fitting the valve into the new body. You may need to extend the central 20mm if you need access to remove the valve inside the new body.



Whistle Construction

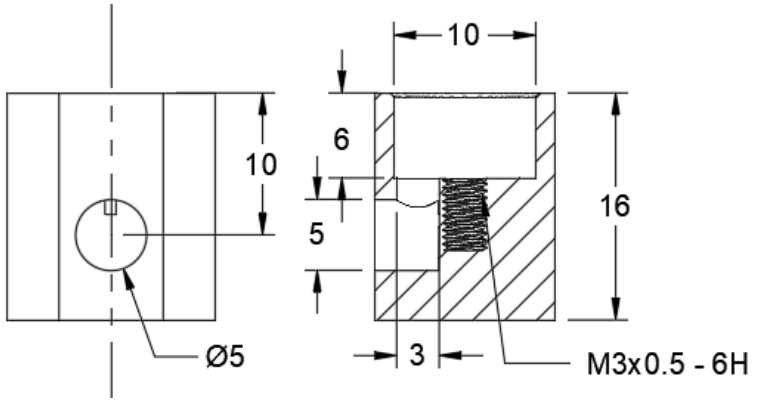
The whistle construction follows Richard's article with the exception that I removed the lower threaded section which was specific to his method of mounting. I chose instead to mount the whistle using the steam inlet pipe. This meant the pipe needed additional thread length and a flange. My intention was to mount the whistle centrally on the cab front face. This would allow a very short pipework run from the new valve to the whistle.

Here is a Fusion image of the modelled whistle.



The process is as follows : -

1 First make the base body as follows : -



2 Chuck a length of ½" AF hex brass rod. Face off. Using a 10mm end mill bore the end face to a depth of 6mm.

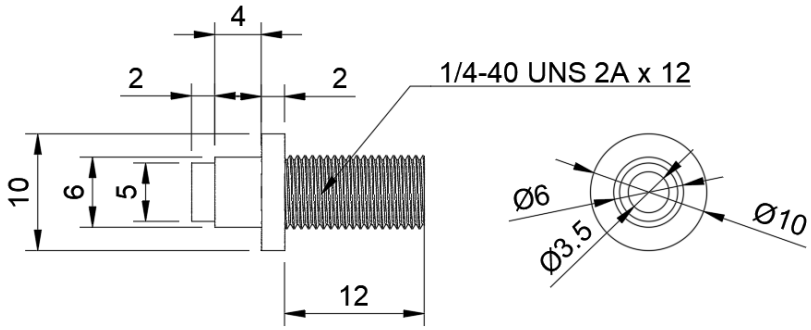
3 Drill M3 tapping size (2.5mm) into the bottom of the bore to a depth of 6mm and tap M3.

4 Part off at 16mm overall length. Reverse in the chuck if the parting needs cleaning up.

5 Place the hex piece horizontal in a vice in a drill press or mill and drill a 5mm clearance hole central in one of the flat faces and 10mm down from the bored end. This hole to be 4mm deep only.

6 Turn the piece upright so the bored end is upright. Drill a hole into the bottom of the cavity such as to roughly central between the 3mm central tapped hole and the side wall of the cavity. This is tricky to not break into the central thread so err on a small size hole if it looks to be a problem, say 2.5mm/3mm. This hole should break through into the 5mm side drilled hole. This will be the steam inlet to the cavity. This completes the whistle body.

7 Next is the steam inlet feed and mounting bush as follows with all processes working from right to left in the chuck.



8 Chuck and face a length of ½" or 7/16" brass round rod. Drill through at 4mm to a depth of 20mm. Add a chamfer to the open end with a centre drill.

9 Turn down the end to ¼" diameter for a length of 12mm and cut a ¼"x 40 TPI ME thread.

10 Lightly skim the rod to around 10mm for the next 2mm to form the mounting flange.

11 After the flange reduce the diameter to 6mm for the next 4mm.

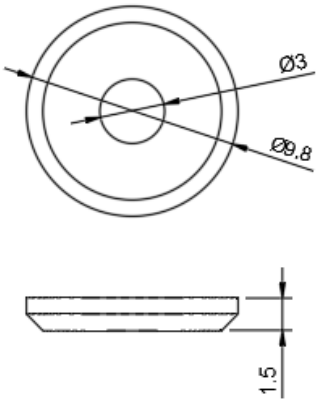
12 Following this reduce the diameter again to 5mm for a 2mm length.

13 Semi part and clean the cut edge for completing the parting off. The steam inlet port is now complete.

14 Clean up the hex surface around the port mounting hole then flux and braze the port in place.

15 A fixing nut is needed for the mounting of the base onto the front face of the engine cab. Rather than make one from scratch, run a ¼" x 40 TPI ME tap through a M6 brass nut.

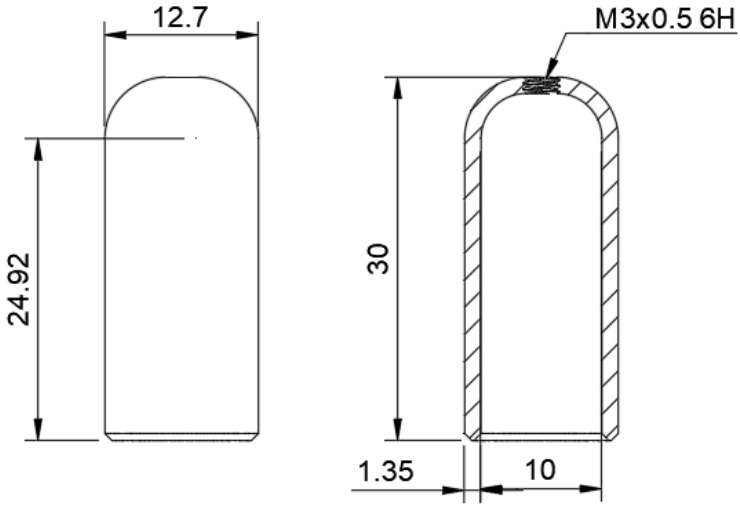
16 Using the same 7/16" or ½" round brass bar stock cut the whistle disc to the drawing details. Note the half chamfer. When mounted on the central rod the chamfer faces down into the cavity. The outer dimension of the disc is critical to get the optimum whistle gap around the disc when mounted in the cavity. Richard suggests a 8.5 thou gap.



17 Next is the central rod. Cut a length of 3mm threaded rod to 50mm and clean up each end.

18 It is useful to make a centralising taper from the ½" round bar stock. This will keep the centre rod in place while it is bonded in place. This is just a round of brass with a full chamfer and a tight fit (drill 2.8mm) central hole to slide over the threaded rod. Tighten a nut against the cone to pull up on the central rod to hold its position against the top edge of the 10mm cavity top.

19 The whistle cone is the next part and is cut from 1/2" bar stock.



20 Bore the bar in the lathe to a depth of 25 mm with a 10mm end mill.

21 Fully chamfer the inside and outside faces of the bore edge so they meet at a central peak.

22 Part the dome to a length of 30mm and drill the end face of the bore fully through with a 2.5mm drill and tap M3

23 You will now have a tubular cone with a flat face on the inside and outside of the end surface. Using a 10mm ball end mill gently round the inside face of the cone end wall. This is best done by rotating the lathe chuck by hand otherwise there is a danger of the tool grabbing. I am not convinced that the inside dome shape is critical and this process can possibly be ignored.

24 When you are happy that the inside end face looks reasonably curved, you should be able to see the residual end wall thickness by looking into the M3 tapped hole.

25 Using a graver or a ball turning jig you can now shape the cone external surface as you see fit. This completes the cone.

26 Using either a round or hex brass rod fashion a cap to mount on the residual protruding threaded rod once the cone is in its final position. Alternately use a standard dome nut.

27 Add a single brass M3 nut to position the sounding disc into the base cavity such that the disc top surface sits flush with the cavity top edge. Add a second nut to grip the disc in place. Remember the chamfer on the disc sits on the inside of the cavity.

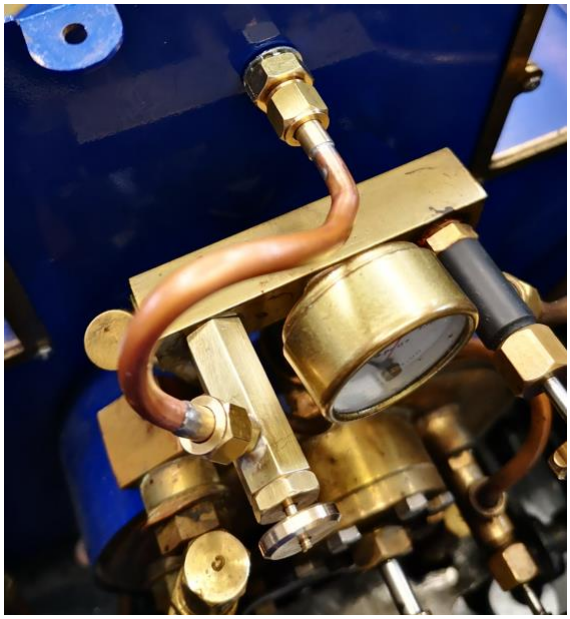
28 Fit the sounding cone in place on the central rod. Using compressed air as a driving force, listen and adjust the sound of the whistle by moving the cone up and down on the threaded central rod. When this hits a vague resonance, screw the finishing cap in place to grip the cone in position. The central rod might need shortening.

29 The valve and the whistle assemblies will need to be connected with a length of pipework with ¼"x 40 TPI fittings on each end. Don't forget to put the nuts back-to-back on the pipework before you solder / braze the second ferrule in place ….

Here are all the component parts including the valve remover and the centralising cone for centring the rod into the body while bonding in position.

Mounting

I removed the Polly footplate roof to ease access when fitting the whistle in position. It also helps when routing the new pipework. Bending pipework is never a simple job when it is a short run and it needed multiple annealing sessions before I got the pipe to shape and to look acceptable.



Results

On compressed air the whistle is shrill and deafening. The push button activation makes it easier to do a quick blip.

The whistle is even better when under steam where it seems to work well over a wide range of boiler pressure levels.

A well worthwhile upgrade albeit long overdue. Thank you to Richard and his article for providing the stimulus.

Next problem is that leaky steam cock feeding the injector …. Could I use a Shrader replacement or would it be too abrupt ON and OFF and not give me enough flow control ? ….