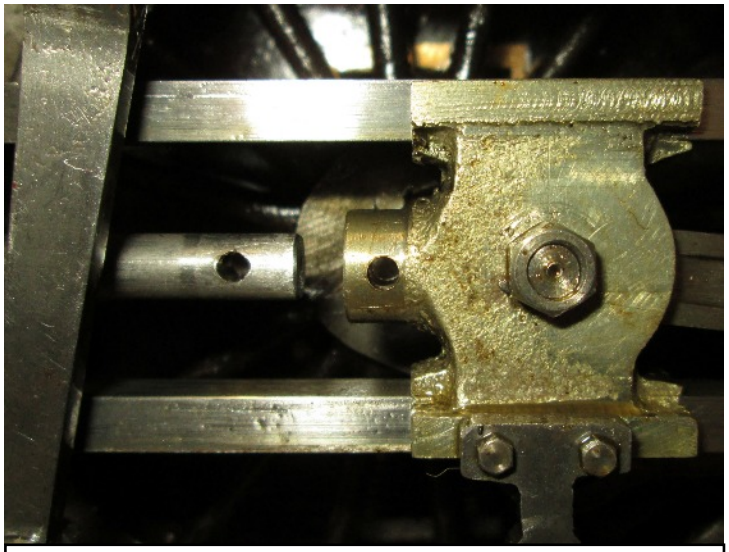
Another little job: No1, Princess Marina piston rod repair – Roger Stephen

Whilst demonstrating my Princess Marina on Tony Mason's track at last year's club exhibition she suffered an embarrassing failure: the left hand piston rod parted company with the crosshead. On my loco the design of this joint is rather poor – the plain end of the rod is held in a boss on the crosshead by a plain 3/32 inch diameter pin which is supposed to be a press fit but is actually loose. If this method is used it should really be a taper pin (or preferably two of them) which jams itself in. The pin had actually fallen out some years ago while running at Chipperfield and I had glued it back in with Loctite Retainer and I am amazed how long it held together! For reasons I can't remember I had replaced the one on the other side by a roll-pin which has proved absolutely fine except that there is a tiny bit of play in the joint which I don't like at all.



The joint between the piston rod and the crosshead had failed when the plain pin fell out. It had been held in with Loctite Retainer for some years!

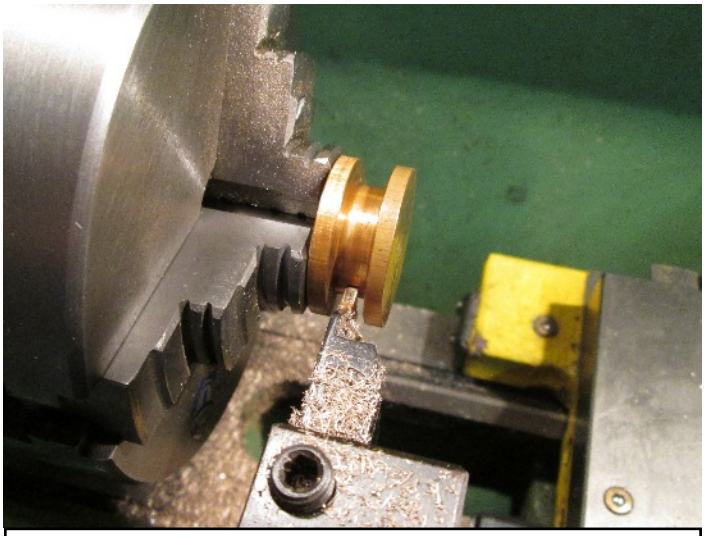
So I spent time over the winter hatching a repair plan and decided I wanted the piston rod to screw into the cross-head boss and then be held in with a pin of some sort. I ascertained that the cross head boss could be drilled and tapped 5/16 x 40 ME to receive a threaded steel insert to match. The insert would also be drilled and tapped 7/32 x 40 ME to match a thread on the end of the piston rod. Then I could assemble the joint, cross-drill the insert hoping to line up with the original retaining pin hole in the rod (yes I know it won't quite but I'm an engineer, not a mathematician), press a roll-pin in and job done. Easy.

Oh no it isn't! To do that I would have to get the crosshead out from between the guide bars. So I started to dismantle the motion all around it. That was simple enough but it very soon became apparent that to get the crosshead out I would need to remove the crosshead guide bar bracket which supports the rear end of the crosshead guide bars. The bracket is bolted to the loco frames and to get it off I need access to the bolts which means I have to take the boiler off. Blow that for a game of soldiers – I'll put a roll pin in the crosshead/piston rod joint like I did on the other side! I will keep my fingers crossed that holds for now and make the joint properly next time I have to take the boiler off.

The 3/16 inch square graphited yarn had spread in the 1/4 inch wide piston groove and the join opened up by about 1/8 inch. Not a good way to make a seal.

So I put the motion back together but before I put a roll-pin in the failed joint I took the opportunity of taking the piston out of the cylinder to look at the piston packing. I had suspected there was some 'blow-by' reducing the locomotive's power and thought it would be a simple job to replace the packing and restore the power. The piston came out easily enough – eight 6BA screws, off came the front cylinder cover and out came the piston and rod. Then the revelation: the groove in the piston was 1/4 inch wide and 3/16 deep. In it was a length of 3/16 square graphited yarn rope. Well, I think it was that size when it started but because the groove was so wide it had been able to spread sideways so it wasn't pressing the cylinder wall so well or not at all. As it spread it shortened and the join

between the yarn rope ends had opened up to about 1/8 inch wide. No wonder there was blow-by!



Making the piston groove deeper using a parting tool in the lathe. I took it from 3/16 to 1/4 inch deep for 1/4 inch square rope.

Now to my knowledge 3/16 by 1/4 inch graphited yarn has never been a standard size so why the piston groove was that size I don't know, although it does look like that in LBSC's original loco drawings and he says to pack the groove with graphited yarn. I had been expecting the groove to be 1/4 inch wide and deep to take 1/4 square graphited yarn rope and had previously bought some for the job. However, I had also discovered 6mm square PTFE braided rope gland packing on Ebay and thought that might perform well so I had bought some of that as too. That turned out to be lovely hard stuff about 6.5mm square (same as the 1/4 square yarn) to allow for some compression. Rather than try and cut the 1/4 inch rope down to fit a 3/16 deep groove (silly idea!) I did the sensible thing and put the piston and rod in the lathe and, using a parting off tool, carefully deepened the groove to 1/4 inch.

I decided to try out my PTFE rope and cut a piece slightly long with the ends trimmed at 45 degrees to make an overlapping scarf joint when wrapped round the piston groove. It needed a little more trimming when wrapped round but when I was happy I oiled it and put the piston back in the cylinder, poking and prodding the PTFE rope to compress it into the piston groove and cylinder bore as I did so. It was very fiddly but eventually it went in OK and I then brought the crosshead and piston rod together, tapped a roll-pin into the cross drilling and put the cylinder cover back on with a new oiled brown paper gasket (no need for fancy gasket material here – just ordinary brown paper and a bit of Castrol GTX!). Job done that side. While I was at it I did the same thing with the piston on the other side, the roll-pin tapping out and the joint coming apart quite easily.

Previously there had been very little resistance when Princess Marina was pushed up and down a length of track. Now you could definitely feel when the air in the cylinders was being compressed as she rolled along. It looked promising. A week later Den and Malcolm did a steam test for me in which the loco was put on a rolling road and fired up. As soon as the regulator was cracked open in forward gear the wheels began to turn. Previously she had been reluctant to get going without a bit of manual wheel turning until warmed up so I am optimistic her power has been restored. The proof of the pudding (and how durable the PTFE rope is) will be revealed on a run at the Puffing Field which is proving frustratingly elusive but I hope will happen soon. Watch this space for an update.

The piston fitted with new square PTFE braided rope gland packing ready for squeezing back into the cylinder. Note the ends are cut at about 45 degrees to make an overlapping scarf joint.

(Here's the update! Performance at the track is much improved and Princess Marina now even does passenger hauling, which was a bit of a nightmare previously. After some 21 hours of running the PTFE rope seems to be holding up OK too.)