# West Wiltshire Society of Model Engineers Newsletter

Issue No. 10 December/January 2020

## Calendar

### December

**7th** - Saturday Steam Up. 10am-4pm
**7th** - Santa Train Rides. 2pm-5pm
**8th** – Christmas Meal at Golf Club. 1pm
**21st** - Saturday Steam Up. 10am-4pm

### January

**4th** - Saturday Steam Up. 10am-4pm
**18th** - Saturday Steam Up. 10am-4pm

### February

**1st** - Saturday Steam Up. 10am-4pm
**15th** - Saturday Steam Up. 10am-4pm

# News

## Santa Train Rides

Santa Train Rides are on Saturday 7th December from 2pm to 5pm. If you would like to help either with set up, clear down or at the event please add your name to the volunteer sheet in the clubhouse.

It is expected that we will be on site on Friday & Saturday mornings to set up the site followed by an hour after the event to begin the clear down finishing off the clear down on Monday morning so plenty of opportunities to help please.


## Thank You

As you can see from the pictures, the site and costumes were fantastic for the Ghost Train Rides on 27th October, a new event for this year. Thank you to everyone who has volunteered this year and helped set up, take down events, run trains, take cash, sell raffle tickets and generally promote the WWSME at all of our open days and the September show. Your work has made our events at the club such a success, thank you everyone!


# Roller Rebuild *(Part 6)*

*By Dan Jones*

### ***'Rebuilding an Aveling and Porter Steam Roller No. 11296 of 1925'***

Since the firebox had been finished and was just waiting to be fitted, it was time for me to move onto the next task of the boiler build- making and fitting cross-stays. The cross-stays run across the width of the boiler and screw into both hornplates in the space above the firebox, meaning they have to be fitted before the firebox. Personally I found this task the most challenging but probably one of the most rewarding tasks of the whole boiler-build project as it took quite a few hours of thought and planning before actually cutting any metal.

There are two rows of five cross stays, with the lower row succumbing to the same fate as the firebox stays, having been drilled out to Ø1" and had a solid bar pushed through and welded around. The top row had been untouched and were the original factory-fitted stays. After cutting out the old stays, I flushed off the heads on the outside with the grinder and pilot-drilled the top row of cross-stays only. Because these were untouched original stays, the plan was to take extra care when drilling out the old stays and keep/restore the original thread in the boiler plate. Once drilled out, I could then see the thread which measured as being 1" x 8tpi BSW. This information determined which thread I would have to produce for the new stays for the top row. But in much the same way as the firebox stays, the bottom row of cross-stays which had been welded would need to receive the same treatment- weld up the holes and drill new smaller holes to the new tapping size. After I had welded all the holes up, I would need to decide what size thread I would put in. I opted to use the same size thread as I would for the firebox stays and chose 15/16" x 11tpi BSF. I couldn't use as coarse of a thread as Whitworth (the same as the top row) because of the plate thicknesses- the top row screws through both the hornplate and the flange for the crown sheet whereas the bottom row only screws through the hornplate and consequently needs a much finer thread to compensate for this.

Since I had decided I would use 15/16" x 11tpi as the thread for the lower cross-stays, I could continue to open up the holes in that row to the tapping size of Ø13/16". With the holes prepared, the next task was to tap the holes and produce the internal thread into the hornplate. Because the hornplates are 2ft apart, the stay would need to be 2ft long, which means the tap needed to cut the threads would need to be 2ft long as well. Anyone who is into engineering and has used a tap to cut threads will understand that a 2ft long tap isn't something you can buy off the shelf and would cost about £1,000 to have professionally made, which is a number a young person operating on an apprentice wage can't justify for a single tool! So the only logical solution to the problem is to get on and make my own tap, how hard can it be?

Figure 1

I bought a 15/16" x 11tpi starting tap (standard length) and used a length of Ø1" steel bar to make my tap. I used the tap to cut the threads in one side of the boiler to make these the datums for the threads on the other side. I then turned down the end of the steel bar to Ø15/16" and screw cut 11tpi by the length of the cutting edge of the tap plus the thickness of the hornplate plus an inch extra for starting the thread. I bored out the opposite end of the steel bar to accept the square shank of tap. Now for the interesting bit, lining up the screw cut threads on the steel bar with the threads on the tap. I loosely fitted the tap into the end of the screw cut extension and supported it using the revolving centre in the tailstock **(fig 1.)**.


Figure 2

The thread cutting tool was lined up with the previously cut threads and the leadscrew engaged. I let the lathe run the tool up to the tailstock, where I was able to revolve the tap by hand and index the threads on the tap to meet to tool **(fig 2.)**. With the tap lined up with the tool and, subsequently, lined up with the threads on the extension bar, I was able to mark off and centre punch holes for locking screws to bind against the flats of the square on the end of the tap. These four locking screws then determined the rotational position of the tap in relation to the extension bar. I also measured the distance between the end of the tap and the end of the bar, which would then determine the linear position of the tap in relation to the extension bar. All I had to do when using the tool was ensure that the tap was in the correct rotational position and the correct distance from the end of the extension bar then go for it.

Figure 3

After machining two opposing flats into the extension to fit a ¾" spanner, it was time to try out the new tool and see if I had got it right. I removed the tap from the extension bar and tapped the five holes on one side of the boiler, with these threads becoming the guide for the extension bar to follow. The extension bar was pushed through the first tapped hole and the tap reinserted into the end in the correct orientation to ensure all the threads were aligned.

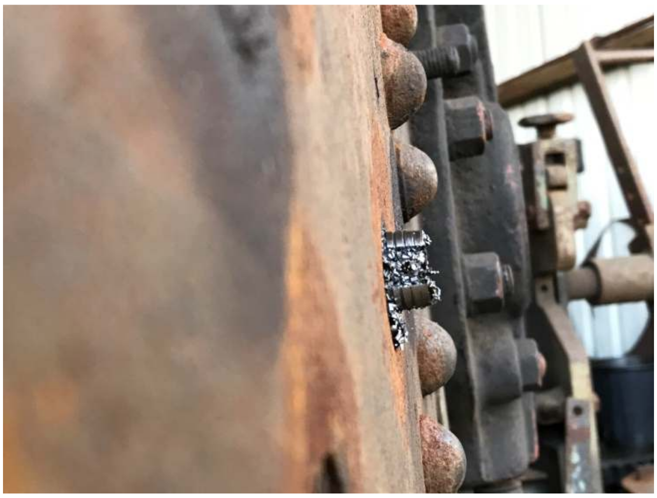

Figure 4

The extension bar was then pushed further through the hole and the guide threads started. It was a vital part of the tap design to ensure that the guide threads started to screw into the hornplate before the tap started to cut fresh threads in the opposite side as the guide threads are the datum and need to be worked from that point. As I wound the guide threads through the plate, the tap on the other end started to bite into the hole in the opposite hornplate and started to cut new threads **(fig 3-6)**.

Figure 5

With one set of cross-stay holes tapped, I needed to make a cross-stay to check that what I had done was correct. In theory, the cross-stays are relatively simple components to machine- a threaded section on each end to the correct dimension with a reduced diameter between the two. In reality, of course, there were a couple of challenges to overcome.


Figure 6

I cut a length of stay material 26" long x Ø15/16", this allowed for a 2' long stay plus 2" of chucking material. I fitted the material into the 3-jaw chuck in the lathe, faced off and centre-drilled. I took a 30thou (0.030") skim off the diameter to ensure the threads aren't too tight in the hole and made a small trough for the cutting tool to run into when it has finished the cut. I set up the thread cutting tool in the tool post, set the lathe change gears to 11tpi, and set the spindle speed to 25RPM.

Before I could take a cut, I had to calculate the depth of cut I was going to take:

D = Depth

P = Pitch

n = Threads per inch (tpi)

P = 1/n

D = 0.75 x P

15/16" x 11tpi:

P = 1/11 = 0.091

D = 0.75 x 0.091 = 0.06825"

The value for the depth of cut is then multiplied by two because the calculation only takes into account the depth on one side of the material, so the actual value for the depth of cut was 0.06825" x 2 = 0.1365". I was able to take 20thou (0.020") cuts until I had reached the correct depth **(fig 7.)**.

Figure 7

Once the thread on the one end had been cut, I then had to reduce the diameter of the stay until I reached the opposite end which would need to be screw cut. The issue with machining long material on a lathe is the amount of material deflection between the chuck and the revolving centre. This issue is normally countered by fixing a travelling steady to the saddle and machining against that- unfortunately there was no steady with the lathe I was using, so I ended up having to machine 5" lengths at a time.

Figure 8

When I reached the other end of the stay, I had to line up the thread cutting tool with the previously cut threads. To do this I had to take the tool to the threaded end, engage the leadscrew and run the lathe, then adjust the compound slide until the tool meshed correctly with the threads. Once locked in position, I could then run the tool to the blank end and start to cut the new threads and in turn, continuing the thread relative to the opposite end of the stay **(fig 8.)**.

Figure 9

With the stay completed it was time for a trial fit to prove that I had made the tap and the stay correctly. Thankfully the stay wound in without any trouble **(fig 9.)**, meaning I was able to get on and tap the rest of the stay holes and make the four remaining stays in that row.

Figure 10

I also made the five 1” x 8tpi (1” BSW) cross stays for the row above, but I don’t need to describe this process as it’s virtually the same as the first five stays **(fig 10-12.)**. When I machined the first stay, it took me over two hours to get the tooling set up, figure out the machining procedure and end up with a finished product. Once I had finished making the final stay I managed to complete it in just over an hour, a result of process improvement as I went.

Figure 11

I could finally start looking at getting ready to fit the firebox I made a few weeks prior now that the stays were all in place- a real turning point of the boiler restoration as metal was starting to go back in rather than continuing to come out!

Figure 12

...Firebox preparation, more drilling, fitting and rivets in ***Part 7!***