"4F Goods locomotives"

This document was written by Mike Wheelwright and was originally published by The Worthing Model Engineering Society in Autumn 2017

A couple of years ago I resurrected my old 3½" G "Derby 4F" from the box in which it had been hibernating for thirty years. Nothing could be more typical of a British railway locomotive than an inside cylinder 0-6-0; most of the old railway companies ran them and they were far and away the most common type in this country, well over half of all the engines ever built were of the 0-6-0 arrangement. Any modeller preferring an example from his local railway would have no difficulty since the SR "Q" was almost an exact copy of the Derby product (surprise! the chief designer at Ashford had been No. 2 on the MR) and the LNER had many similar "Js" from constituent companies while the substitution of a taper boiler from a Pannier turns it into a GWR 2251 class. The first Midland Railway 4F was turned out at Derby in 1911, it was a slight enlargement of the previous 3F and known as the "Big Goods", but the significant improvement lay in the superheated boiler. Officially it was a Fowler design as Mr F was the company's CME at the time, but Kirtley had first built engines of the same wheel spacing and wheel diameter with inside cylinders and Stephenson valve gear in 1863. In the intervening half a century cylinders, boiler and pressure had just been enlarged successively until it became a freight engine of class 4 power rating (hence 4F) with piston valves above the cylinders and a superheated Belpaire boiler. Unfortunately the strength of the running gear, bearings and frames did not keep pace with the power output. Nevertheless over the following 30 years 772 4Fs were to be found in every corner of the LMS until Ivatt (the younger) declared "enough is enough" after WW2 thereby allowing the LMS to claim the prize for daring to kill off the British 0-6-0.

No. 4571 was one of the later engines built by the LMS at Crewe in 1937 and finished in the style of the Stanier era, it ran until withdrawn from service in 1964. It seems as though some ingenious physical process (of which I have no details) was then carried out as the engine experienced a size reduction of all dimensions down to one sixteenth leaving its wheels a mere 3½" apart. It came into my possession in 1979 as a cure for acute steam locomotive withdrawal symptoms, although I was unsuccessful in getting it on a NHS prescription. Steam on BR ended while I was abroad and the

disappearance of the engines with which I had grown up introduced me to model engineering in 1974 as a means of owning a steam locomotive. As a beginner I naturally turned to 3½" gauge, seeking something big enough to pull a couple of people without the complications of bogies and difficult outside motion, but there was little to choose other than the old 1930s quasi-freelance designs by LBSC. Don Young's "Derby 4F" series, starting in ME in January 1975 and directed at beginners, came as a godsend, the fact that Big Goods were scarcely my favourite engines was immaterial as it looked as though with a bit of luck I could build it, and at least it was LMS.

Skipping over the bit about setting up a workshop, four years later with the help of an out-sourced boiler (even Crewe did that) my No. 4571 was finished. I brought it back to the UK as checked luggage, took it along to the next meeting in the Broadwater Hall, and obtained a boiler certificate. The signatures of the inspectors would take you back a bit. Within 24 hours a trolley was put behind 4571 and I took a turn round the new single circuit at Field Place. I was elated to find it actually ran and would pull two of us. In fact it was quite a learning process as my only footplate experience in the miniature world had been the odd up-and-down with somebody's engine on the portable track. I could complete the level circuit by stuffing coal through the fire door, topping the water with the tender pump, and blowing up. I had maintained contact with Don Young while building the engine, including visiting the Island a few times to pick up castings and fittings, so the following morning I reported to him that she ran OK and in Don's typical style he replied "So, did you think she wouldn't?"

Over the next year or two I fitted in a few runs in July when I was home on leave and more or less learned to handle the engine for a turn or two of the original track, but I remember it was not that easy to do.

In 1985 I arrived with another engine, also a DY model but this time a 5"G 4-4-0. With limited opportunity to use my engines the bigger NBR Glen received all the attention and poor old 4571 stayed in her box. The Glen was followed by my Hunslet 4-6-0T, a real passenger mover, and in turn by my Claughton, and so on. Things might have stayed like that but in 2015 I needed a small engine to run with my grandson and the 4F saw the light of day again. Amazingly very little work was required, of course the fittings needed cleaning up so I removed the boiler, stripped all fittings and pipework and put on a new injector with much improved pipe runs. Once I had a new "ticket", just like 35 years before, I was off for a run, now of course extended to 1300 ft with ups and downs and much more challenging. The locomotive was the same but the driver had definitely learned a thing or two: how that little engine runs when driven properly! I find the performance really exhilarating, definitely more fun than pulling a load of passengers with an engine that could move a good bit more weight.

How do these little 4Fs do it? Mine is no exception as I know of several and all are “good un’s” including one that has shown its colours at IMLEC. A closer look at the design is quite revealing, particularly the relationship between the sizes of things for which there are a number of golden rules in locomotive work. I built my 4F in total ignorance, I just stuck rigidly to the drawings and relied on Don, but as I became more widely read on the subject I examined various commonly built model designs as well as each new engine that was featured in Locomotives Large & Small, and I did a few calculations on ratios of areas and other proportions. I found that irrespective of the model the proportionality of critical bits remains the same; this of course stood me in good stead as I began to design my own engines. The WD Hunslet was really a compendium of bits of Don’s engines that could be used or adapted, but with the Claughton I was definitely designing from scratch, but always sticking to the basic rules. So perhaps it is no surprise that little 4571 behaves pretty well like the Claughton, taking into account that its cylinder volume is only 22% of the 4-6-0’s and the grate area 43%. The 4F definitely pulls, notches up (well, a bit anyway, not quite like No. 650), and keeps the needle on the red line. They both do what the driver wants.

The 4F has 2 cylinders of 1⅛ d x 1½”s with ports of 0.094 x 0.688”. Port area = 6.4% of piston area, full gear steam opening = 5.6% of piston area. This is a bit small but comes partly from simplifying construction by using Joy valve gear with its limited travel: the maximum travel is only 0.348”, nevertheless this scales up to 5½” in full size which is just about the longest ever used with Joy (LNWR George Vs). Even with the short travel some advantage could be gained by widening the ports to give a bit extra exhaust opening, the exhaust is limited by the port size and performance of the model begins to fall off if the driver takes more than a couple of turns off the reverser.

Even so 4571 is pretty sprightly and the shortcomings at the cylinders are compensated by a boiler that provides all the steam required from a grate of a mere 10 sq in. Like the boiler on the Jumbos it has a good free area through the tubes, 16%, so a high rate of combustion can be used to keep the needle on the mark. Of course to pull the gases through the tubes the exhaust arrangements in the smokebox have to be right. Sure enough the solid angle of the imaginary cone from the blast pipe nozzle to the chimney choke is exactly 17°, well I never did, just like my other engines, not to mention many on 4’ 8½”! And the diameter of the nozzle? A fraction under ⅕ of the piston diameter, you will never believe it, again just like my other engines.

Getting behind 4571 again after so many years has been a real pleasure, an enormous amount of satisfaction can be gained from driving an engine that goes well, it doesn’t have to be a big one, but it does need to be a well designed one. Of course it also helps if the driver has had some years of experience before being transferred to lighter duties. Now I must get back to building a 3½” G Scot, you know, a sort of 4F with big wheels and an extra cylinder.