"The Hornbys"

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A few years ago, I extended my miniature railway activities into the realm of Gauge 1, 1/32 scale or half of 3½" gauge. I have not abandoned 5" Gauge but I am adapting myself to an alternative more suited to the reality of advancing age. A fellow G1 modeller recently bought a used model of SR electric No. CC3 and gave it a nice overhaul, more detail and a different livery, it brought back memories of these Southern Railway electric Co-Co locomotives that I saw on odd occasions in the 1950s and early 60s when I was South of the Thames. Later on, our late member Ken Pursley, ex-SR footplateman, referred to them by their nickname of "Hornbys", quite appropriate since they rattled along like tinplate engines from an oversized train set. Surprisingly they have not been popular as 5" Gauge models, a pity as there is a trend towards electrically powered engines and what better than to recall something that was part of the Central Section scene, at one time running not far from our own track.

The innards would of course contain a couple of batteries as I cannot imagine a full-blown model with boosters and flywheels, anyway I don't suppose our Chief Engineer would be amenable to an electrified rail, a 5th rail in our case. Although really a steam man I find ancient electrics interesting, especially when very complicated as is the case with these engines. I had the good fortune to be offered an official guided tour at Stewarts Lane of what I recall as being the third engine then numbered BR 20003 and I found the design to be very complex and rather fascinating. It was quite definitely not just an overgrown Hornby!

Three locomotives were built over the period 1941 to 1948 so the last was never the property of the Southern Railway but it was definitely a SR design as it was based on the original CC1 but incorporated modifications reflecting operating experience. By the middle of the 1930s the 3rd rail electrification had been extended throughout the Central Section to the coast, shortly to be followed by the Portsmouth "Direct" with intention to continue in the Eastern Section. The electrified area was no longer just a suburban system but a complete railway on which passengers mainly travelled in electric MUs while freight traffic continued in the hands of steam. Richard Maunsell, the CME, turned his attention

to providing electric locomotives for the main freight routes and some thought was given to a Bo-Bo arrangement (two bogies) rather like a shortened power car with more powerful motors. One of the main concerns was the discontinuity of supply of the 660 volt DC, up until then it had not been a problem as even 2-car sets were long enough to bridge the inevitable gaps in the 3rd rail through points and crossings but a vehicle of less than 60 ft length would lose power, especially in the complicated platform layouts at major stations. The problem was novel as electric locomotives on other railways were supplied from overhead wires (except for the Met "Growlers" that had jumpers to the train). Even on the main line a brief interruption coasting though a short gap would play havoc with loose coupled goods trains, the very trains for which these engines were intended. By the time the definitive design had been worked out Oliver Bulleid had become CME and CC1 was a joint design with Alfred Raworth, the Chief Electrical Engineer, who was responsible for the power and control systems leaving the mechanical part (and the continental numbering) to the CME. Both areas were highly innovative and unlike Bulleid's other forays into the untried the result was very successful.

The supply interruption was resolved by a development of a fairly old electrical control method known as the Ward Leonard system. This was a solution to the early 20th century problem of varying the speed of a DC motor without the use of banks of resistors wasting power and generating heat, for example in a crane where control of speed was essential. The DC supply is fed to a constant speed motor directly coupled to a generator used in turn to power the crane, small changes in the generator's field current produce large changes in its output voltage to vary the speed of the crane's motor. Additionally, CC1 had 2000lb flywheels mounted on the motor-generator shafts to cover brief power interruptions crossing gaps and the output from the generator was arranged to run in series with the line voltage (from the pick-up shoes) thereby providing a very smooth way of controlling speed, important in avoiding breaks in loose coupled trains. The solution to the problem of sidings where a live rail was considered very hazardous (even before the birth of the Elf & Safety twins) came by installing an overhead line capable of handling a low current and fitting a central pantograph raised as required.

The engine came outweighing 100 tons so bogies with three axles were needed, each powered by three 245HP motors in series which were a reworking of similar motors on the multiple units but wound for 400v (rather than 660v) with forced air cooling. Each bogie was supplied by its own motor-generator set (so a part failure could limp home) and another smaller set provided auxiliary supply.

A boiler for passenger train heating supplying steam at 50psi was installed along with cold water storage and pumps, all located in a sealed space to avoid any possibility of water and electricity meeting and special measures were taken to ensure no spillage could reach the electrical compartments when taking on water at a conventional column.

The really clever part was the "buck-boost" method of motor control. Immediately on starting it was arranged for the output voltage of the generator to buck (oppose) the line voltage leaving just 45v across the three motors in series, then advancing through the first 15 notches the generator voltage was progressively reduced until the motors received the full 660v from the line, i.e. half rated voltage. At this point the generator polarity was reversed so that it boosted (supplemented) the line voltage increasing from zero to "full" at notch 23, this provided 1200v with each motor working at 400v. All of this was terribly complicated and many problems of flash-overs and return-feeds were encountered in strange combinations of running conditions. One was traced to intermittent live rail earthing due to swinging chains and other objects from goods wagons. The high voltage spike protectors had been designed to operate within ⅕ second but a much faster reaction of $\frac{1}{300}$ sec. was needed to avoid damage!

it appears sleeker and less of a box on wheels. All three were used on passenger trains otherwise steam hauled such as the Newhaven boat trains and latterly the Brighton – Plymouth service, well, as far as the 3rd rail went. They were designed to pull 450-ton trains at 60 mph on the level, about 800 DBHP, and had a nominal tractive effort of 40,000lbf, comparable to a Lord Nelson. Unfortunately, they cost about £12,000 a piece, about twice the steam equivalent. They were not perpetuated, as Electro-diesels followed by normal diesel-electrics were regarded as a simpler solution for the 3rd rail system. A nice try!