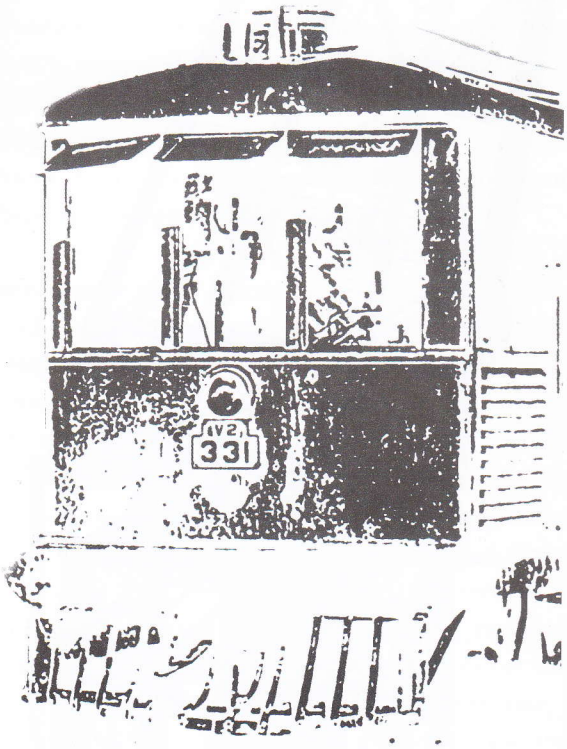



# Sentinel Camel Steam Railcar:

## A machine ahead of its time.

By Rasika Wickramanayaka

Alley & MacLellan Limited (1875 -1950) was a company established in Glasgow, Scotland to manufacture valves and compressors for steam engines and later, steam ships. The company was acquired by Simpson and Bibby, which was a steam powered road vehicle manufacturing company in 1903. Around 1915, a separate company was established to produce steam wagons. The new company, Sentinel Wagon Works, was established in 1915 and the factory was switched to a new location at Shrewsbury, London. Due to financial problems, Sentinel Wagon Works Limited was incorporated in 1920.

The first steam rail car of Sentinel Wagon Works Limited was built in 1923, for the narrow gauge Jersey Railways & Tramways Ltd, England. The Company used a coach constructed by Camel Laird & Co. of Nottingham, and was reportedly successful. The Company produced a prototype model for the British Empire Exhibition in 1924. This was the beginning of the success of Sentinel Camel Railcars. Although the company produced successful steam locomotives and other railway vehicles, this article will mainly focus on the story of steam rail cars.

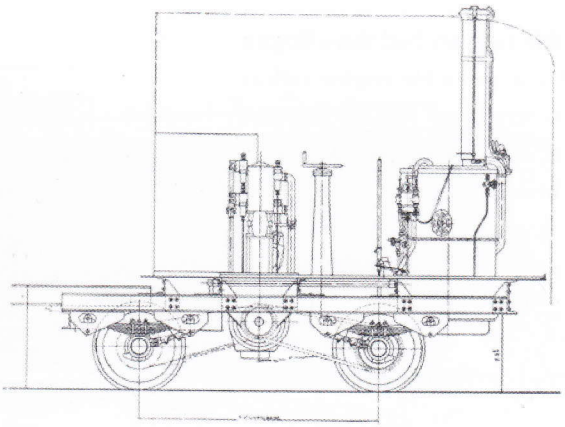

A steam railcar being loaded in England

Sentinel railcars are self-propelled mobile vehicles of light weight, with high strength and power. They were intended for general use in new railway lines and underdeveloped countries, branch lines and localized transport networks. These railway vehicles were highly reliable, cost effective (up to 80% compared to engine hauled services), easy to maintain and technologically ahead of their time. They were built in various sizes to meet individual load and gauge conditions. Sentinel railcars were developed throughout and there were two generations of railcars.

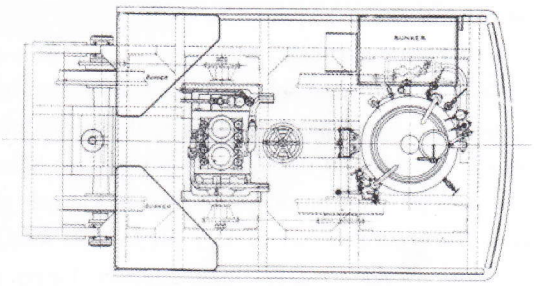
The first generation of railcars were articulated railcars. They had a vertical boiler, two cylinder engine, coal storage, water tank and controls mounted on a four wheeled truck, both axles were chain driven connected with the carriage body by an articulated joint placed immediately above the rear driving axle. The other end of the passenger coach was carried on a bogie truck which was lightweight but rigid. Controls were fixed to the trailing end too as direct acting mechanical controls. Engines had either vertical or horizontal piston arrangement. Very early rail cars had two horizontal pistons and later versions had two vertical pistons. There were two basic configurations. Those were,

- Double articulated rail cars (with power unit in the centre, three bogies)
- Single articulated rail cars (Power unit at one end, two bogies)

The Ceylon Government Railway (CGR) had 20 railcars of this generation. Three of them had two horizontal pistons and the others had two vertical pistons. They were Narrow Gauge V1 and Broad gauge R1 and R2 classes. (CGR numbers 301 to 313, 317 to 320, 328 to 330) R2 was a double articulated rail car and the others were single articulated rail cars. Refer Figure 1 and Figure 2.



"Sentinel" Patent Power Unit.
Elevation.



"Sentinel" Patent Power Unit.
Plan.

Figure 1: Sentinel Patent Power Unit of First Generation of Railcars.

The second generation of Sentinel railcars were more technically advanced. The significant difference was the advanced 6 pistoned single action engine. This engine was fitted to the rigid frame of the carriage and power transmission was through a shaft. Unlike the first generation, the engine was fitted under the frame increasing accessibility and affording easy maintenance. It provided much cleaner cabin space. Positioning of the water tank and the coal bunker was altered to ensure hassle free maintenance and easy access. During the second generation, there were four basic configurations of railcars.

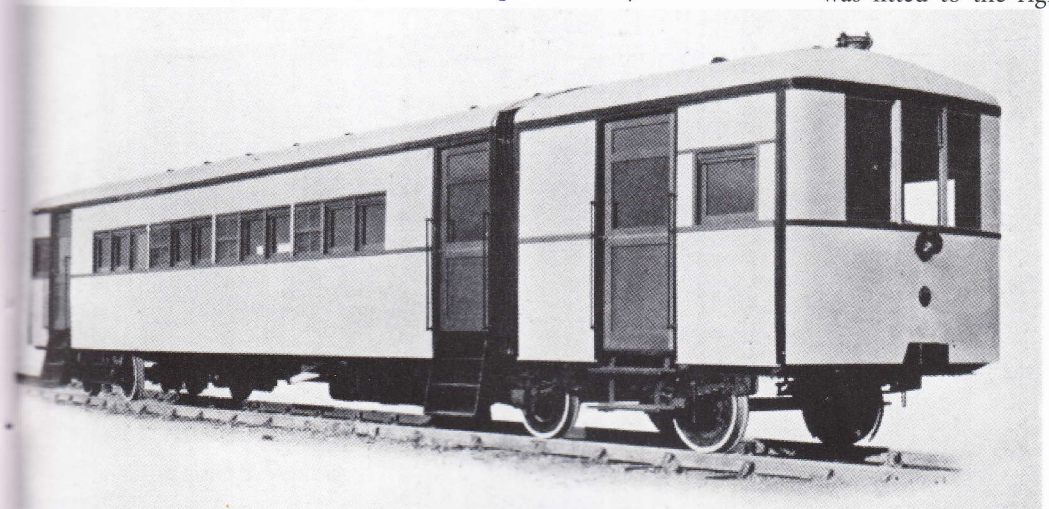


Figure 2: Factory Plate of Ceylon Government Railway R1 Railcar. 5'6" gauge. The same prototype was used to produce 2'6" gauge V1 railcars.

- Single engine single railcar. (single carriage, single boiler, single under frame engine)
- Double engine single railcar. (single carriage, Single boiler, two under frame engines)
- Single engine double railcar. (two carriages, single boiler, single underframe engine)
- Double engine double railcar. (two carriages, single boiler, two underframe engines)

Double rail cars had three bogies. If it was a double engine railcar, the centre bogie was the powered bogie. The centre powered bogie was being arranged in the "Gresley" patent system, with specially designed universal shaft allowing free movement of the powered bogie. Sentinel Wagon Works Limited developed various engines to cater to the power and fuel requirements. For double engine railcars, there were high powered boilers to cater to two engines, similar to the concept applied in Garratt steam locomotives. There were boilers which were able to fire with low quality coal and crude oil. The Ceylon Government Railway narrow gauge V2 rail cars and broad gauge R3 railcars belonged to the second generation of Sentinel Camel steam railcars. (CGR number 321 to 327, 331 to 333) All CGR's railcars were single engine single railcars. Later, some R3s were fitted with diesel engines and re-classified T2.

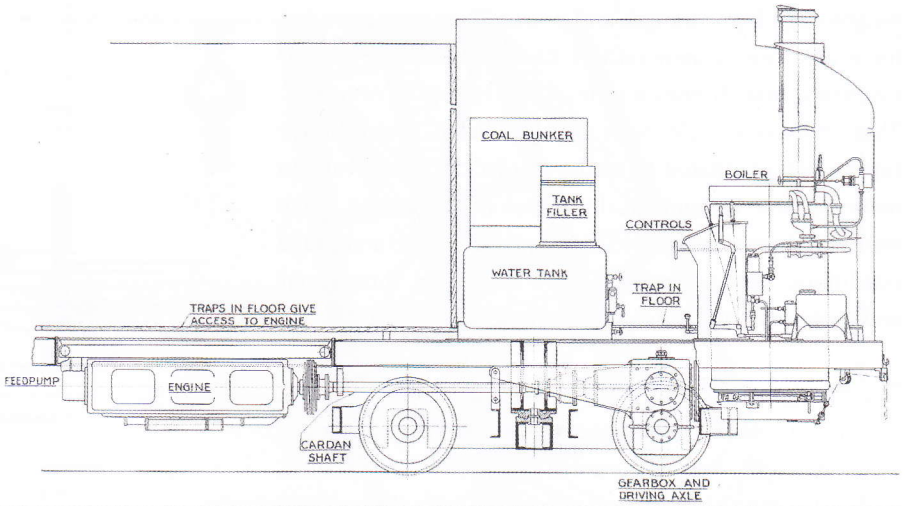



Figure 3: Sentinel Patient Engine of Second Generation of Railcars.

and were developed for several fuel types, namely coal, crude oil, coke, timber and charcoal. The firebox was replaceable and easy to clean due to vertical arrangement in most of the designs. They had a spiral tube arrangement increasing the heating surface. Controls were fitted in both ends, therefore there was no need to turn them and driver visibility was high.

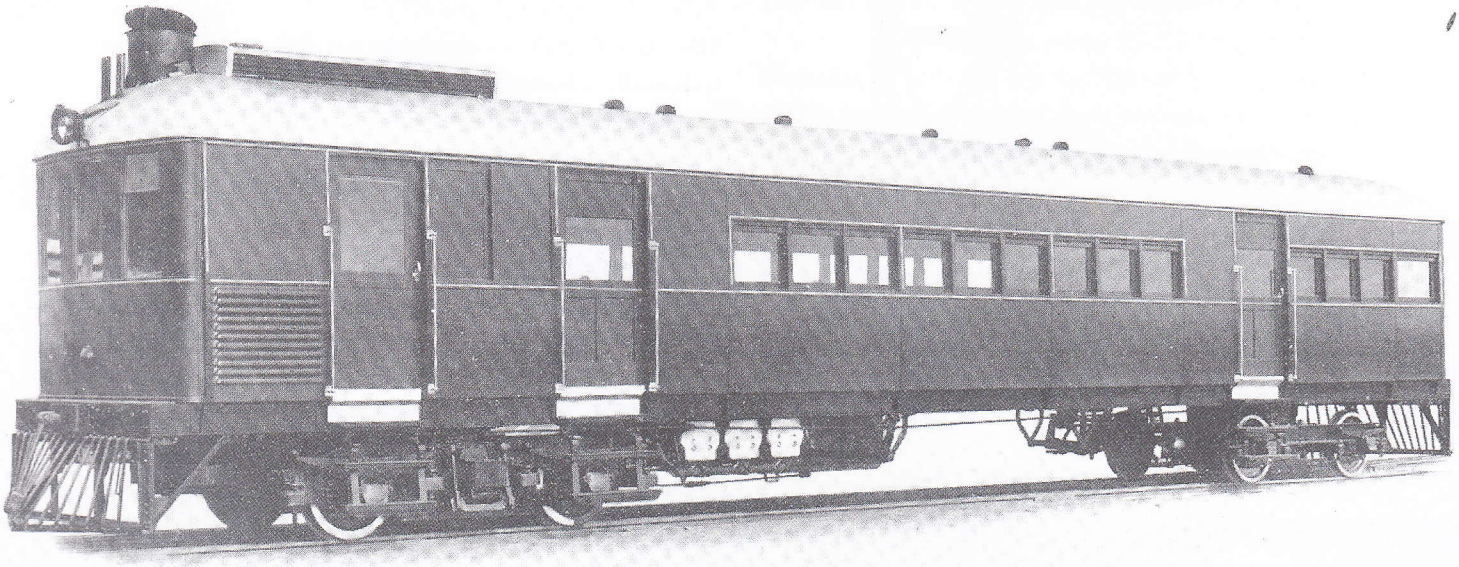


Figure 4: Factory Plate of Ceylon Government Railway R3 Railcar. 5'6" gauge. The same prototype was used to produce 2'6" gauge V2 rail cars.

Refer Figure 3, Figure 4, Figure 5 and Figure 6.

Sentinel railcars had many advantages and were technologically ahead of their time. Sentinel engines and boilers were all patented accessories and they were specially developed for rail cars. These boilers were highly adoptive

After early twin piston engines, Sentinel switched to more advanced six cylinder engines. Unlike externally fixed double piston driven conventional railway vehicles, these engines had 6 cylinders in a crank case lubricated by oil and the crankshaft delivered power to the bogies through a gear box. This special design maximized the power usage

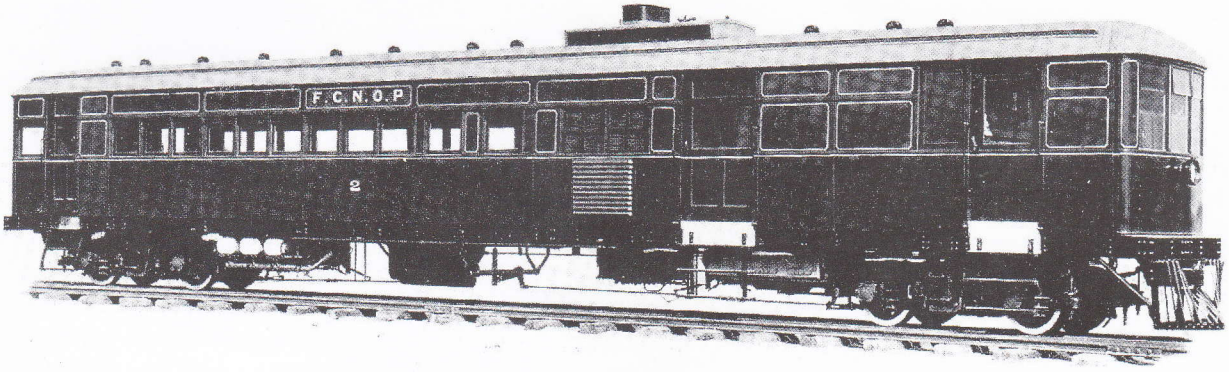



Figure 6: A Double Engine Single Rail Car of Peru Railways.

and economized the run. It had a lightweight and solid all-steel underframe and outer body construction. Body panels were riveted. Shipment was easy since they could be either dismounted (bogies removed) or dismantled, (total separation of bogies, boiler, underframe and body panels) .

These railcars were equipped with different types of brakes including air brakes, vacuum brakes (Straight vacuum or automatic continuous vacuum), and hand brakes. In an extreme emergency, the engine itself could be used as a braking mechanism by quick reversing.

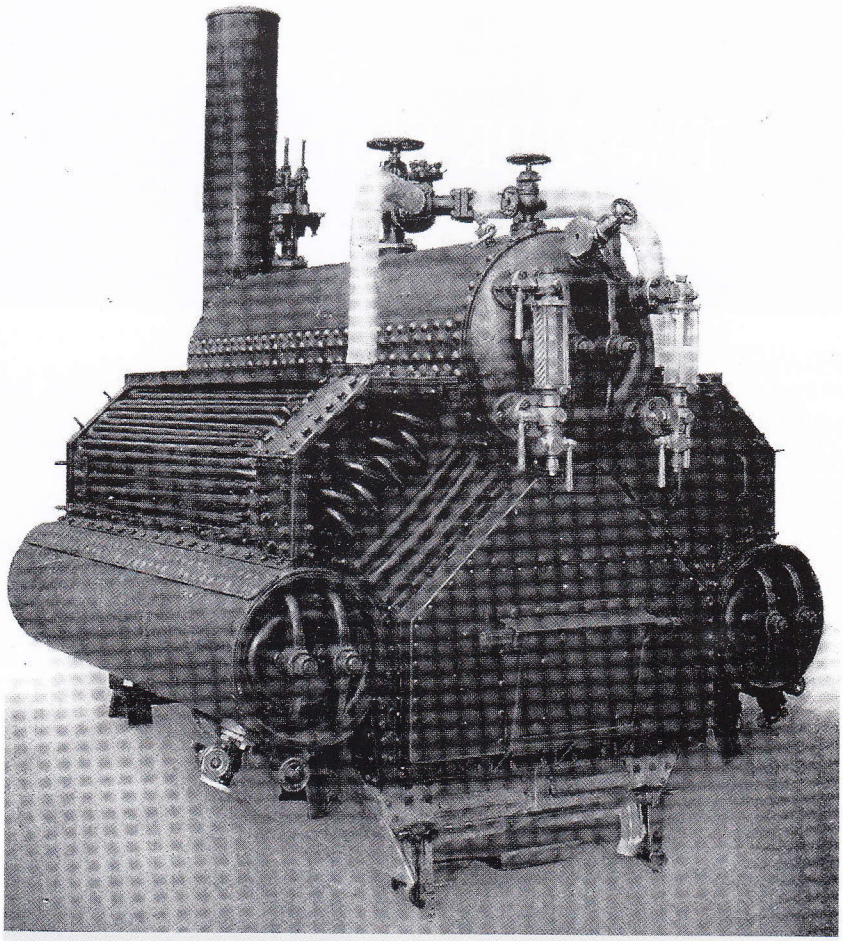


Figure 5: 200 HP Sentinel High Powered Engine used for Double Engine Railcars of Second Generation.

Sentinel Wagon Works Limited was specialized in a wide array of other railway vehicles too. This included rail-buses, rail lorries, Sentinel Patent locomotives, yard shunters and a lot more.

After the late 1930's steam rail cars and locomotives were not able to compete with their diesel counterparts. As a result steam rolling stock production was diminished by the late 1950s. The company was acquired by different companies from time to time, but survives as Sentinel Manufacturing to date. Sentinel Manufacturing has no involvement in manufacturing of railway vehicles but is a machining company.

The Ceylon Government Railway had 30 Sentinel railcars (24 Broad gauge and 6 Narrow gauge) during its heyday. At present, other than 4, all other railcars have been scrapped. Of the surviving railcars, diesel converted T2 323, V2 332 and V2 333 are not in running condition. The only serviceable railcar, which is V2 331 is lying under the sun and moon without any attention from the authorities. Several rescue attempts from local and foreign railway enthusiasts have unfortunately not resulted in any success to date. ▪