

Steam around Switzerland. Part 7, Gotthardbahn Express passenger locomotive. type A 3/5

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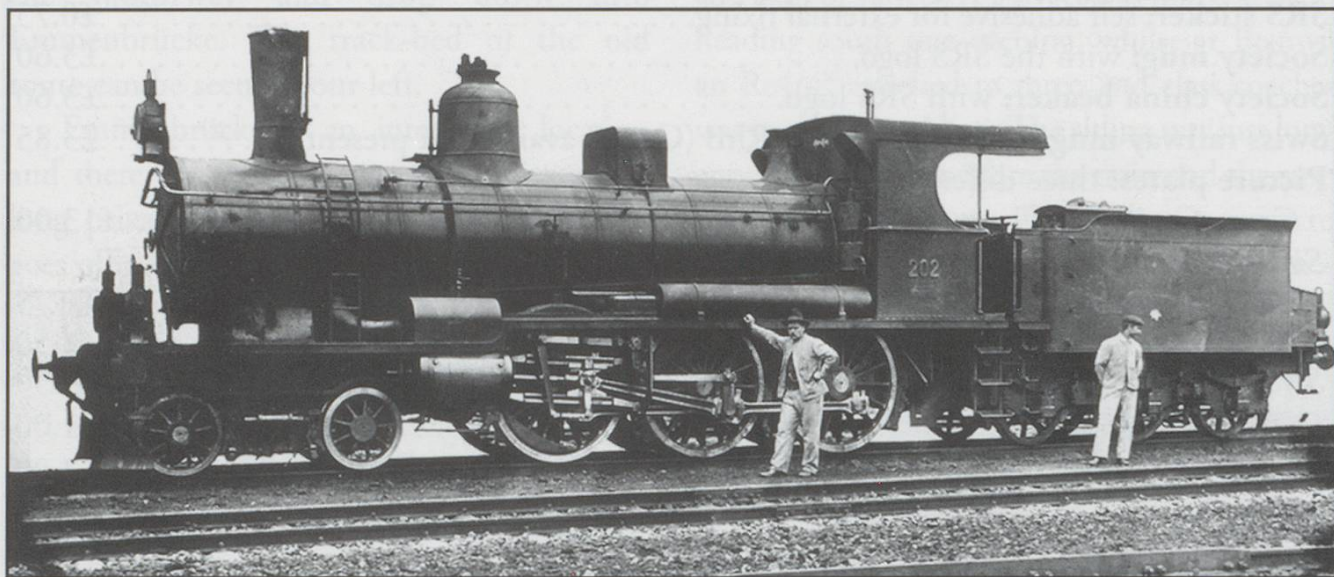
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**PART 7 - GOTTHARDBAHN
EXPRESS PASSENGER LOCOMOTIVE. TYPE A 3/5**



From 1890 there was a need for passenger trains to be both faster and heavier, so a locomotive more equal to the task had to be designed. The railway company therefore called for a locomotive able to achieve a top speed of 90 km/h, and to be able to haul a trailing load of 250 tonnes on the valley lines or 140 tonnes on the mountain ramps all at a speed of 40 km/h. The new locomotive had to have a much greater range than previous types to enable the company to cut down on the number of locomotive changes on the route. To cater for this demand SLM designed and built the Type A3T [A 3/5] rated at 806 kW for hauling the passenger trains on both valley and mountain sections. The locomotive built with a large high-pressure boiler, four wheel front bogie for stability and slightly smaller than normal driving wheels, had the ability to reach and maintain 90 km/h maximum speed. This would mean that the whole journey over the Gotthard could be reduced by up to two hours.

The first locomotive of this type was No.201 [SBB No.901]. This was built as a three cylinder compound unit with one high pressure internally mounted cylinder, and two

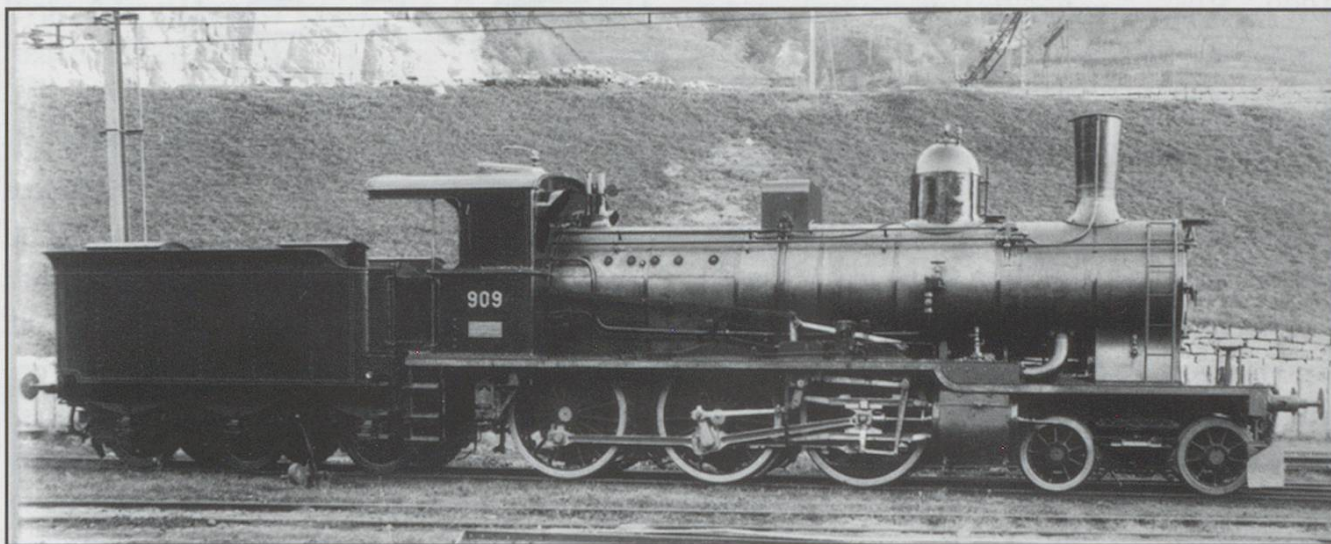
outside mounted cylinders operating at low pressure. The second locomotive was No.202 [SBB No.902], built as a four cylinder compound locomotive with two internal high-pressure and two external low-pressure cylinders. Cylinder control on all locomotives was as per the Walschaerts system. Power from the high pressure cylinder fed the first driving axle, power from the low pressure cylinders fed the second axle based on the De Glehn principle. No.201 was tested extensively on the valley sections and no.202 worked the whole route. These tests showed that locomotive No.202 was the better of the two in so far as economics and performance was concerned, so the railway company decided that all further deliveries of locomotive type A 3/5 would be constructed in this form.

The four cylinder A 3/5 was capable of hauling a maximum trailing load of 600 tonnes, or 320 tonnes at 50 km/h on the sections with gradients up to 10 per mille and up to 140 tonnes on the 26 per mille mountain sections at 40 km/h. However the mountain load was later reduced to 120 tonnes to ensure good timekeeping on the ramps. Both prototype locomotives had a boiler similar to the

design that had been used for the Gotthardbahn D 4/4, with protection provided by safety valves fitted in pairs on the large steam dome and above the firebox, all operating at the release pressure of 14 bars. The large firebox was supported between driving axles 2 & 3. The cylinders received wet steam via a double slide regulator fitted under the steam

for locomotive service and more importantly passenger refreshment.

Locomotives Nos.203 to 210 delivered in 1897 were to be the forerunners of an order for a further 20. The second series of locomotive was built with two high pressure and two low pressure cylinders powered by wet steam from a slightly larger boiler - 50 mm in diameter



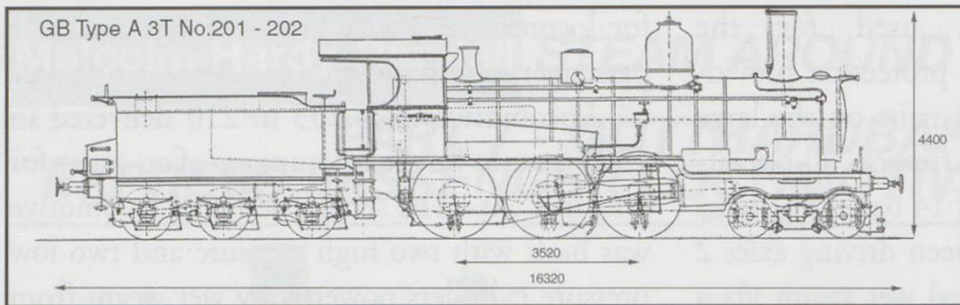
dome. A sand box located above the mid point between driving axles one and two fed sand to the leading edge of both. Adhesion weight of the locomotive was 46 tonnes.

A screw brake system operated on eight brake shoes on the locomotive fitted to driving axles two and three. The whole class of A 3/5 locomotive later underwent installation of the Westinghouse brake system, operating on the brake shoes of the middle and rear driving wheels as well as those on the leading bogie and tender. The locomotives had speed indication equipment designed by Klöse and firebox grate equipment by Langer. Both prototype locomotives had an automatic lubrication system installed in 1906. This type of locomotive was the principal motive power on the Gotthard section of the Basel to Milan Express No.41, which was allowed 8 hours and 5 mins. for the outward journey and 9 hours and 59 mins for the return journey between the two cities. Programmed into the timetable were stops at Luzern, Göschenen, Bellinzona and Chiasso

increase - operating at a pressure of 15 bars. The safety valves, located on the top of the firebox area, were not encased, as had been the situation on the earlier models of this locomotive type.

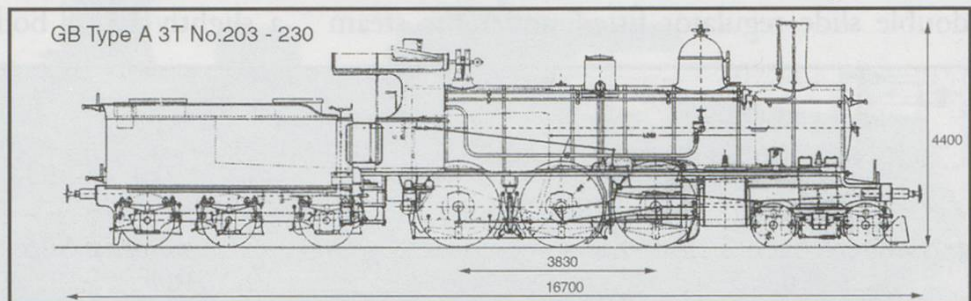
The power rating of the early delivery locomotives was 1,100 HP, but with the later deliveries it increased to 1,400 HP. Suspension of the driving axles was provided by double coil springs, but due to the bouncing effect that these springs had, they were replaced with flat leaf springs. Locomotives in the series 225 - 230 were delivered with leaf springs.

After the construction of No.209 the low pressure cylinder diameter increased by 10 mm in all following locomotives in the series. In all the four cylinder locomotives there was the capability of feeding fresh steam to the low-pressure cylinders. This was fitted to give better starting and also to boost a restart on the mountain section. The braking system fitted to this batch of locomotives was exactly the same as for the prototypes. The double acting Westinghouse brake system supplemented the



improve the steam generation under high demand conditions. This batch of locomotives never had the steam drying or superheating equipment fitted. The weight of the

screw brake system from 1899. Klöse speed indicators and the Langer fire grate system were also fitted as standard. The capacity of the three-axle tender on loco Nos.203



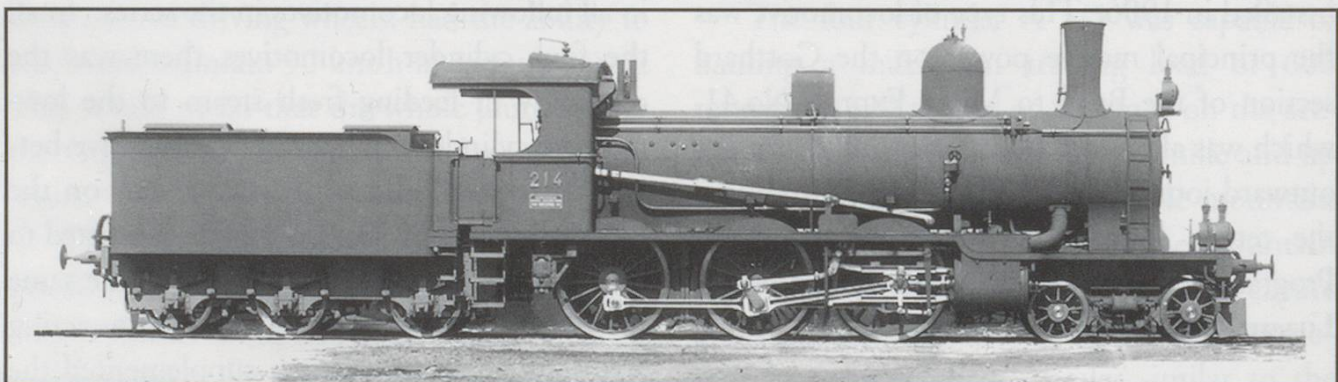
to 230 increased to 17 m³ water and 5 Tonnes of coal, making the overall weight of the lighter locomotive and the heavier tender just 10 kgs more than the prototype No.201.

tender increased to 37.4 tonnes due to the fitting of brake equipment that operated on all three axles.

A delivery of ten A 3/5 locomotives - Nos.211 to 220 - from SLM was part of the original order for 28 machines to be manufactured between 1894 and 1905. The design was the same as the previous shipment except for the low-pressure cylinder size, which was increased by 20 mm in diameter. Apart from a new boiler required for locomotive No.214 in 1909, this group had, from a servicing viewpoint, a rather uneventful life.

Locomotive No.222 was the first Gotthardbahn locomotive to be fitted with an automatic lubrication system, undertaken by the main SBB Workshops in Bellinzona during 1904. During the following two years this system was fitted to all other locomotives in this series. The performance figures for this delivery batch are the same as for the previous A3/5 locomotive deliveries. The final batch of six locomotives was numbered Nos: 225 - 230 delivered in 1905, was basically the same design as before but differing in minor ways. The low-pressure cylinder diameter again changed, but this time to 600 mm making it the largest cylinder fitted to a steam locomotive running on the Swiss railways. Locomotive No: 229 had the Pielock steam drier system from 1905 to 1917. After this time the whole batch entered the workshops for the fitting of

The delivery in 1902 of the type A 3/5 locomotives, Nos.221 to 224, from the SLM works consisted of four locomotives basically the same as the previous models but as usual fitted with some refinements. There was a reduction in the diameter of the low-pressure cylinders from 590 to 570 mm. The number of boiler tubes increased from 244 to 267, to



the more efficient Schmidt superheater system. The A 3/5 locomotives remained on express passenger train services until the electric locomotive type Be 4/6 superseded them, and were withdrawn from service in 1926.

Locomotive No.228 was sent to the World Fair in Milan during 1906, and accompanying the locomotive were the following coaches: type A4u passenger coach No.71, type AB4u passenger coach No.254, type C4u passenger coach No.1256 and baggage coach Type FZ4u No.1659. Two years later this locomotive and passenger coaches from the same series played a pivotal role in the provision of the luxury Gotthard Express service.

Locomotive No.202 received a great deal of attention during the prestigious Swiss Regional Exhibition held in Geneva during the summer of 1896. To get the locomotive to the exhibition site, a special track had to be laid along the main street using the creeping track system. The A 3/5 was towed along the temporary track by Jura Simplon type A 2/4 No.126 also a participant in the exhibition.

*References used: -
Der Dampfbetrieb der Schweizerischen Eisenbahn. 1847 - 1922. Moser.
Les locomotive Suisse. 1896. Barbey.
VRS Association documents.
All photographs are from my collection purchased from; SBB Photos, State Archiv. Bern and VHS.*

Locomotive Data.							
Type		A3T					
SBB Type		A 3/5					
Nos		201	202	203-210	211-220	221-224	225-230
SBB Nos		901	902	903-910	911-920	921-924	925-930
Built by		SLM	SLM	SLM	SLM	SLM	SLM
Works No		877	878	1025-32	1123-32	1411-14	1659-64
Date built		1894	1894	1897	1898	1902	1905
Power	HP	1,100	1,100	1,400	1,400	1,400	1,400
Power	kW	806	806	1,026	1,026	1,026	1,026
T/E at wheel rim.	kN	76.00	76.00	83.03	83.03	83.03	83.03
Date in Service		1894	1894	1897	1898	1902	1905
Date out of service		1923	1924	1924/7	1925	1925	1926
Speed max:	km/h	90	90	90	90	90	90
Speed Indicator		Klöse	Klöse	Klöse	Klöse	Klöse	Klöse
Driving wheels							
Diameter	mm	1,610	1,610	1,610	1,610	1,610	1,610
Rigid wheelbase	mm	3,520	3,520	3,830	3,830	3,830	3,830
Total wheelbase	mm	13,400	13,400	14,000	14,000	14,000	14,000
Length overall	mm	16,320	16,320	16,700	16,700	16,700	16,700
Loco weight.							
Empty	Tonnes	59.50	61.00	57.30	57.30	58.30	58.30
Service	Tonnes	66.50	68.00	63.70	63.70	65.00	65.00
Adhesion	Tonnes	46.00	46.00	45.90	45.90	46.80	46.80
Water capacity	m ³	14.40	14.40	17.00	17.00	17.00	17.00
Coal capacity	Tonnes	5.0	5.0	5.0	5.0	5.0	5.0
Brakes	Screw and double Westinghouse brakes.						
Cylinders							
Number	LP	2	2	2	2	2	2
Bore	mm	498	548	570	590	570	600
Stroke	mm	600	600	600	600	600	600
Number	HP	1	2	2	2	2	2
Bore	mm	458	360	370	370	370	370
Stroke	mm	600	600	600	600	600	600
Boiler							
Working pressure	Atm	14	14	15	15	15	15
Length	mm	4000	4000	4000	4000	4000	4000
Tubes		244	244	244	244	267	227
Firebox	m ²	12.3	12.3	12.8	12.8	12.8	12.8
Grate area	m ² ¹⁷	2.3	2.3	2.4	2.4	2.4	2.4
Trailing load							
Gradient 10 ‰ tonnes @ km/h		320/50	320/50	380/50	380/50	380/50	380/50
Gradient 27 ‰ tonnes @ km/h		140/40	140/40	160/40	160/40	160/40	160/40
Construction cost							
	SFr	108,500	108,500	106,300	106,300	117,500	109,800