"The age of the Jumbos"

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I am in the final stages of constructing a 5"G model of a L&NWR "Whitworth", a class also known as "Small Jumbos". To those who spent their youth near the West Coast main line Jumbos were legendary as they were the forerunners of the Scots and Coronations of our day. They are probably less well known by others and it is worthwhile having a closer look at them and how their spectacular performance was achieved.

Effectively they were the result of successive improvement of the typical Victorian three axle passenger engine which by the 1860´s had evolved into a single or a 2-4-0 with two cylinders inside the frames sharing a common steam chest between them. The flat valves occupied much of the steam chest space working back-to-back on vertical port faces and they were driven by two sets of Stephenson Link Motion from eccentrics mounted between the cranks. This arrangement was justifiably popular as it was compact, sturdy and when designed correctly gave excellent movement to the valves, so popular in fact that even BR used it on engines built in 1954 at the end of the steam age, although in fairness they were to quite an old Swindon design originating from Wolverhampton.

In 1866 a 2-4-0 with 6ft coupled wheels to a design by Ramsbottom was turned out at Crewe, and a similar class with wheels slightly bigger followed; subsequently both versions were enlarged and provided with boilers of higher pressure to increase their power output. Finally they were "rebuilt" but in reality they were replaced by new engines of similar appearance bearing the same number and nameplate (still showing the original build date) so by the nineties the North Western had a fleet of 236 engines of the 2-4-0 wheel arrangement for working the principal trains on all routes including the Scottish expresses. They were collectively known as "Jumbos" (I have yet to find out why).

They were officially the "Precedent" and "Whitworth" classes generally referred to as "Big Jumbos" or "Small Jumbos" but the only distinction lay in the coupled wheel diameter of 6´ 9" or 6´ 3". The significant features of the Jumbos lay in the boiler of excellent proportions pressed to 150 psi and the provision of cylinders of 17" x 24" to a novel design with valves driven by Allan Straight Link Motion. The existing arrangement of cylinders and valve gear used on over 90% of engines gave every satisfaction so why

did Webb, the CME of the L&NWR, opt for something more complicated? In the traditional layout the steam chest is squeezed between the cylinders and as their diameter increases the squeeze becomes more acute. While this is of little consequence for shunting and goods engines it becomes a critical factor in high speed express work. The crank axle of a Jumbo travelling at 55 mph rotates at 230 rpm, almost 4 strokes per second, so at 30% cut-off the ports only open for about 1/25 second, not much of an opportunity to fill the space in front of the piston with steam. If the steam is waiting in the chest to get through the opening there will be far less pressure drop than if it has to be supplied from a long pipe: a crowd of ladies waiting for the opening of a sale pour into the shop faster than the queue of codgers shuffling into a model exhibition!

Webb recognised the advantage of a large steam chest and by raising the port faces above the centre line and tilting them back on to the sides of a 60° valley he created a fairly big V-shaped space. The port faces were also inclined up forwards so that the valves could be driven directly from the usual eccentrics on the crankshaft, but this arrangement had the inconvenient effect of lifting the expansion link of the valve gear too close to the underside of the low-set boiler. The solution lay in replacing Stephenson`s gear with Allan`s Link Motion in which the expansion link rises by a lesser extent when set in back gear. The change of valve gear was detrimental as the valve movements from the straight link motion are nowhere near as good and events at each end of the cylinder differ considerably. An interesting side effect was that in this particular valve gear the reach rod is pulled back for “forwards” but as the North Western wasn´t a company prepared to alter the thread of the reverser (it would cost a few “bob”) the men just got used to rotating the wheel anticlockwise to put the Jumbos into fore gear.

The improvement gained from the large valve chests was very significant even if the use of Allan gear was a step in the wrong direction. At any particular cut-off and regulator setting more steam passed through the ports and more work could be done, provided of course that the boiler was up to it, and this boiler definitely was. It was the latest of a series of simple boilers with a grate area of 17 sq.ft., barrel diameter of 4 ft. and 198 tubes of 1⅞” diameter. The tubes were a little large for their short length and the A/S ratio was nearer 1/300 than the ideal 1/400. (The A/S ratio of boiler tubes is the ratio of the **A**rea of the Internal Cross Section to the **S**urface Area for heat transfer. Big A/S = short fat tubes, bad for heat transfer, the opposite is long & thin, bad for passage of gases. In engineering you never win, you compromise). However in practice things turned out well as although the heat transfer was a bit on the low side the big tubes offered less resistance to the gases.

The Free Gas Area was almost 17% of the grate area so this was a boiler asking to be pushed to the limit, and it was.

The engines were famous for their lively performance and were worked well beyond a normal rate (flogged, but not to death) pulling trains of up to 200 tons at fairly high speeds on the easy stretches and slogging away on the severe gradients of the Lancaster & Carlisle section. Performances were recorded in which engines were worked up to 400 EDBHP, for example when averaging 55mph up the 1-in-350 to Tring with 200 tons, consuming an estimated 2400 lb of coal per hour.

Maybe not too much of a problem for a fit fireman but the grate was burning 140 lb per sq.ft. per hour (80 lb is reckoned pretty good) so combustion was well beyond an economic rate and it was said that the blast of cinders from the chimney at night was a sight to behold. Extra closure “dogs” were fitted to the lower part of smokebox doors as they became distorted by the heat of burning coals inside.

These engines personified the L&NWR culture of minimising capital investment and squeezing every last ounce from resources: the CME provided cheap engines that would stand up to the job without excessive maintenance costs. Not surprisingly the Company habitually paid good

dividends. The swan song of the Jumbos came at the end of the century with the introduction of corridor trains having dining and sleeping cars whose weight outstripped their capacity, and they were quickly replaced by larger engines of similar sturdy construction fired by even sturdier men.