The 'Agenoria' and the Shutt End Railway

David Fort

The need for the Shutt End Railway

In the 1820s, the coal pits of the Pensnett area on the Western edge of the Black Country depended for their future growth upon their ability to transport coal to the expanding industrial sites in Britain. The key to their success in this respect was to get the coal to the Staffordshire & Worcestershire (Staffs & Worcs) Canal, which was one of the main North-South transport arteries of the time. This canal, which had been opened in 1772, lay some 3 miles to the West of Pensnett, although the slightly later (1779) Stourbridge Canal, which connected with the Staffs & Worcs at Stourton, passed within one mile of the Pensnett coal field on its way to Dudley. Logic would seem to suggest that a spur from the Stourbridge Canal to Pensnett would solve any transport problems (one was in fact built in 1840), but travel along the Stourbridge Canal would still have been very slow due to the number of locks in the area. The local mine owners, in an attempt to overcome these problems, conceived the idea of building a railway to run directly from the coal area to the Staffs & Worcs canal. Railways, or tramways, were by no means a new idea in the area (indeed the first ever use of the term 'railway' is reputed[i] to have been in the Pensnett area in 1681); although narrow gauge lines employing horse traction were the order of the day.

Construction

On 17 January 1827 an agreement was signed between the 4th Viscount Dudley & Ward, Lord of the Manor; landowner and mine operator, and James Foster Esq., to build what was to be variously called the Shutt End; Shut End, or Kingswinford Railway. It was to be the first standard gauge railway in the area. The line was to run from the Corbyns Hall Colliery at Shutt End to the Staffs & Worcs Canal at Ashwood, where a rail/canal exchange basin was to be built; the construction of the line is attributed to John Rastrick[ii] using Lord Dudley's own men and thereby ignoring claims by the canal owners that they had constructional rights[iii]. In the fullness of time, the Shutt End Railway was to become part of a much larger system, which came to be known as the Pensnett Railway or the Earl of Dudley's Railway. This system eventually stretched from Ashwood Basin in the West to Baggeridge Colliery in the North and Netherton in the East taking in the Round Oak Ironworks complex as well as innumerable pits. The late Keith Gale described the whole Pensnett Railway, including its locomotives and workings, in detail[iv]. The map in **Figure 13** (above) shows the route of the Shutt End Railway, together with the canals and major roads existing in 1829.

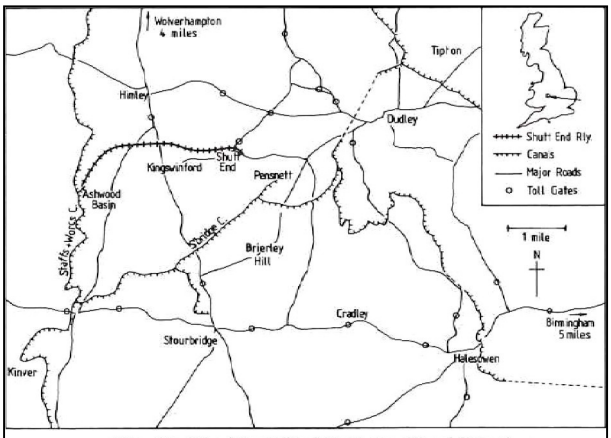

Fig. 13. ***The Shutt End Railway*** (David Fort)

As built, the Shutt End Railway started at Corbyns Hall Colliery and ran westwards, descending initially at a gradient of 1-in-28.7 for 1,000 yards, before levelling out to 1-in-330 down for a further 1 7/8 miles. The final 500 yards was a a gradient of 1-in-28.1, again downwards, the line now running in a south westerly direction.

From: Collins, Paul (Ed.) *Stourbridge & Its Historic Locomotives*: Dudley: Dudley Libraries, 1989

The builders did not duplicate the mistake, which was being made on the Honesdale to Carbondale line in America, but had a substantial iron rail track mounted upon stone blocks placed at 5 to 6 ft intervals[v]. The canal basin at Ashwood was built to a length of 760 yards, with the railway parallel to it on both sides, and could accommodate 60 boats, this capacity giving some idea of the scale of the proposed traffic.

Rastrick's other railway activities around 1829

Before describing the opening of the line and the locomotive which was to operate on it, it is worthwhile changing course slightly to discuss some of John Rastrick's other activities at this time, as he was playing an important part in one of the most significant events in the whole history of railways, namely the planning of the Liverpool & Manchester (L&M) Railway and the Rainhill Trials. Although steam locomotives had been used regularly on colliery lines for a decade or more, they were still far from accepted or proven as the best or most reliable form of motive power in the late 1820s. Engineers were generally divided as to the best way to work railways (assuming that horses were not to be used), many favouring the use of stationary engines and rope haulage or the mixed system of fixed engines on inclines (or 'self acting' inclines) with, possibly, steam locomotives on the more level stretches as was proposed for the D&HCC in America.

It was, indeed, only a few years since the adhesive qualities of an iron wheel upon an iron rail had become appreciated – previously many engineers had assumed that rack propulsion would be required to run locomotives on even the level stretches of railway. Although to a modern way of thinking the idea of a 'mixed' or 'hybrid' railway would seem to make travel impossibly slow and disjointed, such a system effectively mirrored the established practice on canals where the (necessarily) level sections were connected by time consuming flights of locks. Therefore, hybrid railways would not have presented any new or unusual concepts to hauliers in the early 19th century, who may have seen the apparent disadvantages of hybrid railways in a slightly different light.

Towards the end of 1828, construction of the L&M Railway was well in hand, this being the most important line to be built in Britain, or the World for that matter, at the time. The L&M board were undecided, however, as to the best means of working the line although the railways' engineer, George Stephenson, favoured locomotives rather than the fixed engine system. John Rastrick had first become involved with the L&M in January 1825 when he and George Stephenson had visited collieries in the North East of England on behalf of the L&M's promoters to ascertain the performance of their steam locomotives. In the April of the same year he had acted as a witness in support of the L&M line before a committee of the House of Commons on the first (unsuccessful) L&M Railroad Bill, speaking in defence of the practicality of steam locomotive traction.

At a meeting held on 17 November 1828, the L&M board resolved to call upon Rastrick once again to request him, along with another prominent engineer, James Walker, to prepare a report on the advantages of the various types of railway traction and to recommend the best form for use on the new L&M line.

The 'Agenoria' and the Shutt End Railway

David Fort

During January 1829, Walker and Rastrick embarked upon an arduous tour of most of the railways, which had working steam locomotives. Their tour started at Stourbridge on 10 January when they saw at the works of Foster, Rastrick & Co., a locomotive 'bound for the USA'. This would clearly have been one of the engines, which were being prepared for the D&HCC, and was probably the 'Stourbridge Lion' itself, which left the town on its journey to America during the following month. Besides spending a few days looking at the L&M line, then under construction, they also visited the Bolton & Leigh Railway, upon which Stephenson's 'Lancashire Witch' (the probable sister engine of 'America'/'Pride of Newcastle') was working. Further travels took them to Leeds, where they saw some locomotives built by Blenkinsop; and to Stockton, Hetton Colliery; the Brunton & Shields Railway, and to Killingworth Colliery. On 9 March 1829 Rastrick and Walker submitted their reports to the L&M board. Whilst neither report was particularly conclusive, although Rastrick was generally in favour of operating to L&M with fixed engines, Walker suggested that a locomotive trial be held with a premium being offered for the best entrant. From this suggestion the famous Rainhill Trials were instigated some seven months later in October 1829. In the meantime, however, the Shutt End Railway and its locomotive had been completed, and the opening of the line was imminent.

The operation of the Shutt End Railway

As described earlier, the Shutt End Railway consisted of two steep inclines at its ends, with a level (or nearly level) section linking them. On both inclines, which were considered too steep for locomotive haulage, the loaded coal wagons always travelled in the downhill direction so they were made to pull an equal number of empty wagons uphill via a rope connection. Three and a half minutes was required for the wagons to traverse the larger incline at the Eastern end of the line in this manner; while $1^{3}/_{4}$ minutes was taken at the shorter Ashwood Basin incline. The section between the inclines was worked by a steam locomotive, which Rastrick had built at Stourbridge. Thus the Shutt End Railway was a true hybrid railway, consisting of locomotive haulage and self-acting inclines, there being no need for any fixed engines. **Figure 14** (above) shows a profile map of the line, together with the positions of the main road bridges which crossed the line in the first years after its opening.

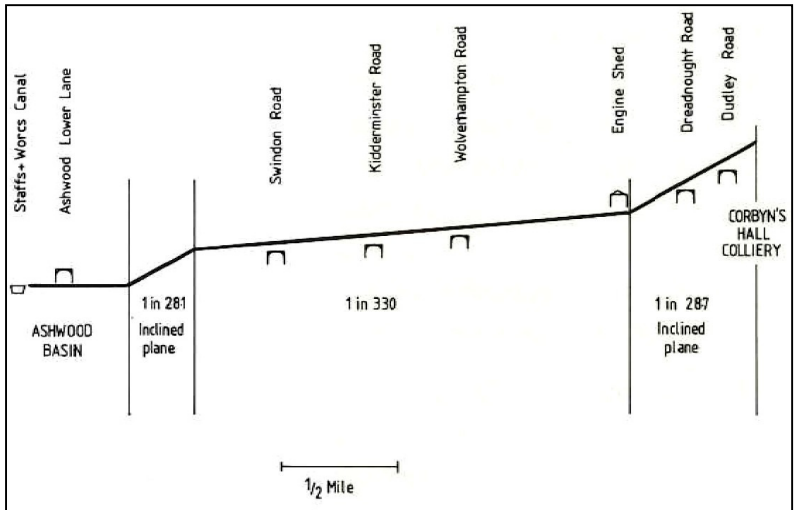

Fig. 14. ***Section of the Shutt End Railway as built (Gradients exaggerated)*** (David Fort)

From: Collins, Paul (Ed.) *Stourbridge & Its Historic Locomotives*: Dudley: Dudley Libraries, 1989

The 'Agenoria' and the Shutt End Railway

David Fort

The 'Agenoria'

The locomotive which had been built for the railway was very similar to the 'Stourbridge Lion' (although of standard 4 ft 8½ in) gauge) and was called The 'Agenoria', a female corruption of the name 'Agenor', the god of Courage and Industry. **Figure 15** (left) shows a drawing of the locomotive and is taken from an 1890 issue of *The Engineer*[vi] which described it as follows: '*The Agenoria has upright cylinders working half-beams, thus reducing the stroke of the pistons to the cranks. The cylinders are 7 ½ in. diameter, with a stroke of 3 ft. There is a parallel motion to the piston-rod, and the feed pump is worked from one of the half-beams. The fire is within a large tubular boiler, branching into two tubes, with the chimney at the end of the boiler, the barrel of which is 10ft. long and 4ft. diameter. The excentrics for driving the slides are loose on the axle, with a clutch to drive either way, and there is hand gear to the valves to cause the axle to turn half round to bring the right clutch into action. The exhaust steam is discharged into the chimney, but it does not necessarily follow that it acted as a steam blast. Indeed, the great height given to the chimney can have no other object than to create the required draught. The driving wheels are 4 ft. diameter, and there are coupling rods to the front wheels, which are provided with springs. It will be noticed that the driving wheel is furnished with a counterweight, but it is not quite certain that this is original. Locomotive experience in 1829 was very limited, and the necessity for a counterweight could hardly have been suggested by `a priori considerations, so that we are inclined to think that this is a later addition.*'

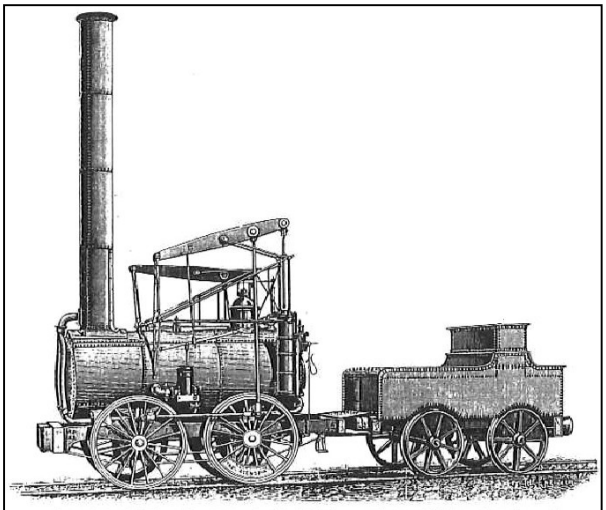

Fig. 15. ***"The Agenoria"*** (University of Birmingham)

The most apparent difference between The 'Agenoria' (see **Plate 15**, below) and 'Stourbridge Lion' is probably the extreme height of the former's chimney, which, at 14 ft 4 in made the top over 20 ft above rail level, and her therefore a leading contender in any competition for the tallest ever locomotive chimney. After the railway's opening ceremony on 2 June 1829, Aris's Birmingham Gazette[vii] further described The 'Agenoria' thus: '*The engine was made under the superintendence of Mr J. U. Rastrick, at Stourbridge, who has bestowed no ordinary pains in its construction, so as to obviate the noise and smoke which those of original make, and used in the North of England are subject to; and we must do him the justice to say that he has succeeded beyond what could have been expected. The noise occasioned by the escape of the steam, when discharged from the cylinder, is wholly done away with, and the smoke is scarcely more than that produced by an ordinary chimney.*

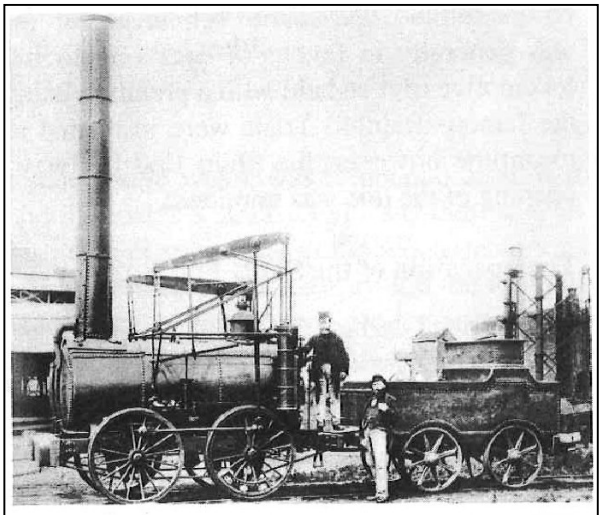

Plate 15. ***"The Agenoria" on the Pensnett Railway c.1860*** (Dudley Libraries)

From: Collins, Paul (Ed.) *Stourbridge & Its Historic Locomotives*: Dudley: Dudley Libraries, 1989

The 'Agenoria' and the Shutt End Railway

David Fort

The safety valve is much improved by a spring, so as to prevent the escape of steam from vibrations of the engine; and another safety valve is added, which is entirely inaccessible to the engine-men, thus rendering the engine infallibly secure from explosion. Another very ingenious contrivance is introduced, by which the engine oils its bearings on the carriage at every revolution of the wheels.'

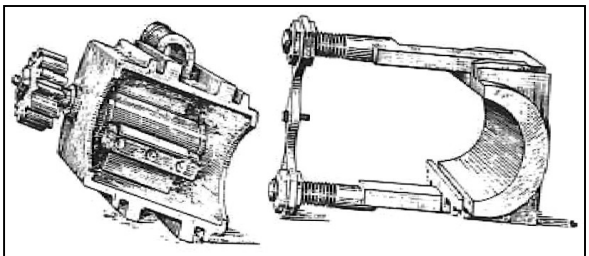

Fig. 16. ***Axle-boxes from "The Agenoria"*** (Ironbridge Gorge Museum)

The apparent lack of smoke and noise were important features, for much of the contemporary popular criticism of steam locomotives centred upon these factors. The frequency of boiler explosions was another feature which was ruining public confidence in steam engines, so the double safety valve arrangement would, again, have helped The 'Agenoria' to become accepted. Lowe[viii] speculates that the 'contrivance by which the engine oils its bearings' was probably the first mechanical lubricator fitted to a locomotive. Each one consisted of toothed rings on the axles driving leather throwers at twice the speed of the axle. An excellent illustration of one of the axle boxes was shown by Dendy Marshall[ix], and is reproduced in **Figure 16** (above).

The opening of the Shutt End Railway: 2 June 1829

Aris's Birmingham Gazette[x] also gave a comprehensive description of the line, including the still-used eleven arch bridge which takes the Wordsley to New Inn road over the basin at Ashwood, and detailed the running of The 'Agenoria' on the opening day; 2 June 1829: '*The experiments on Tuesday commenced by the passing of a train of four carriages, each leaded with 3½ tons of coal, down the first inclined plane, an operation which highly gratified the spectators, from its extreme simplicity. The locomotive engine was then attached to eight carriages, carrying 360 passengers, the weight being -*

	Tons.	*cwt.*	*qr.*
The eight carriages	*8*	*8*	*0*
Locomotive engine, tender, and water ...	*11*	*0*	*0*
360 passengers, estimated at	*22*	*10*	*0*
	41	*18*	*0*

and the whole proceeded, attended by a band of music, from the foot of the first inclined plane to the head of the second, and returned, being a distance of 3¾ miles, in half an hour, or at the rate of 7 ½ miles per hour. The distance might have been accomplished in much less time, but being the first experiment, all the power of the engine was not applied. On the return of the engine and passengers carriages laden with coal, to the number of twelve, had descended the inclined plane; these were attached to the engine with eight carriages of passengers, the weight being -

	Tons	*cwt.*	*qr.*
Twenty carriages	*21*	*0*	*0*
Engine, tender, and water	*11*	*0*	*0*
Coal in twelve wagons, 3 1/2 tons each	*42*	*0*	*0*
360 passengers in the eight carriages,			

540 ditto on the coal carriages, and			
20 ditto on the engine, tender;			
920, estimated at	*57*	*10*	*0*
	131	*10*	*0*

The engine then started with its load of 131 tons, and proceeded to the head of the second inclined plane; and the distance, 1 7/8 mile, was performed in 33 minutes, being at the rate of nearly three and a-half miles per hour. On arriving at the head of the inclined plane, the carriages loaded with coals descended the plane. The engine next returned with the eight carriages loaded with passengers at the rate of six miles per hour, and on reaching the foot of the first inclined plane, all the carriages were disengaged from the engine, except the tender carriage, with twenty persons on it. The engine was again started, and proceeded with the tender and twenty passengers about a mile on the road, performing the trip at the rate of eleven miles per hour, although not more than half of the engine power was laid on. This concluded the experiments; and we are happy to add that not the slightest accident occurred, although an immense crowd was collected about the carriages while proceeding; many of whom, by hanging to them, very much impeded the progress of the engine in the second trip with the twenty carriages, indeed, it was computed that in addition to the 920 passengers in the carriages, 300 others were dragged along. '

The 'Agenoria' was one of only 26 steam railway locomotives known to have been working in Britain at the time[xi] and the only one in the Midlands or South of England.

Rastrick, the Rainhill Trials, and the future of locomotive design

Four months after the opening of the Shutt End Railway, the Rainhill Trails took place with John Rastrick as one of the three judges. Only a handful of locomotives competed, partly as a result of the short period of time allowed for their building and partly because the rules regarding weight restrictions rendered many typical engines ineligible, but the winner; Stephenson's 'Rocket' combined many of the features of future locomotive practice. The success of 'Rocket' was to win over the L&M board to steam locomotives for what was to become the first 'inter-city' goods and passenger-carrying railway. 'Rocket' had several advantages over 'The Agenoria'. Its multi-tubular boiler was far more economical on fuel, while the Rocket's inclined cylinders and simple motion reduced hammer blows and eased maintenance. Nevertheless, The 'Agenoria' was to work for a further 35 years[xii] apparently without significant modification, for the York Railway Museum[xiii] were to claim that it was the World's Oldest Locomotive in near-original condition. On a longer line, however, it would probably have run short of steam so exposing its lack of a proper blast pipe and dated boiler design.

1829 had been a momentous year for railways. The Rainhill Trails and the success of 'Rocket' were a turning point in railway development, after which steam locomotive traction finally began to be widely accepted as preferable to fixed engine haulage (except on the steepest of gradients) and the railway era really started. Although the first trips of both 'Stourbridge Lion' and 'The Agenoria' took place only weeks before Rainhill, they really represented the end of the old generation of steam engines, whereas 'Rocket' heralded a new age. Had the Shutt End Railway or The 'Agenoria' been built a year or two later, they may both have been rather different.

From: Collins, Paul (Ed.) *Stourbridge & Its Historic Locomotives*: Dudley: Dudley Libraries, 1989

The 'Agenoria' and the Shutt End Railway

David Fort

'**The Agenoria**' vs '**Stourbridge Lion**'

One further question needs to be asked: which of 'Stourbridge Lion' and The 'Agenoria' was the older? Many reports state that 'Stourbridge Lion' was the first of the locomotives to be built because it was completed and sent to America four months before The 'Agenoria's first run at Kingswinford. However, Horatio Allen had visited Foster, Rastrick & Co. in the summer of 1828 in order to see a locomotive demonstrated – could this have been The 'Agenoria'? Although the date cast into the balance weights of The 'Agenoria' is 1829, these are generally thought to be a later addition so this evidence would not preclude the possibility that The 'Agenoria' was substantially complete in 1828, before the 'Stourbridge Lion' was even ordered.

An alternative possibility is that Rastrick may have switched engines, because 'Stourbridge Lion' was required before the projected opening of the Shutt End Railway - hence the locomotive which Horatio Allen viewed (and was presumably destined for Shutt End) was regauged and sent to America. However, other evidence, particularly the standard of boiler construction[xiv], would seem to indicate that The 'Agenoria', or at least its boiler, was built before 'Stourbridge Lion'.

One further point is that The 'Agenoria' is never shown as having the water feed heater, which was sent by Rastrick to America as an improvement for 'Stourbridge Lion', so it could be concluded that its design was more dated. It must be asked, however, that if the water feed heater worked well, why was one not fitted to The 'Agenoria', which surely would have been Rastrick's local mobile 'test-bed'? One possible explanation is that a water feed heater was at one time fitted to The 'Agenoria', but it was removed either because it did not work particularly well, or because it ruined the blast effect of the exhaust steam going up the chimney - an important feature of steam locomotive design which became universally recognised in the early 1830s. All in all, it may never be possible to unambiguously date and sequence the two locomotives.

Footnotes

[i] Marshall, J., (1985), p 9
[ii] Dickenson, H.W., & Lee, A., (1923-1924), p 58
[iii] Christiansen, R., (1978), p 21
[iv] Gale, W.K.V., (1975)
[v] Gale, W.K.V., & Hoskison, T.M., (1969), p 24
[vi] *The Engineer*, 7 March 1890, p 200
[vii] Aris's Birmingham Gazette, 8 June 1829
[viii] Lowe, J.W., (1975), entry for Foster, Rastrick & Co.
[ix] Dendy Marshall, C.F. (1953), p 199
[x] Aris's Birmingham Gazette, Ibid
[xi] Skeat, W.O., (1973), p 117
[xii] Forward, E.A., (1910), p 396
[xiii] Rolt, L.T.C., (1958), reference to The 'Agenoria'; pages not numbered
[xiv] John Crompton, Keeper of Social and Industrial History at the Black Country Museum, has been conducting an extensive and intricate investigation into the construction of both The 'Agenoria' and the 'Stourbridge Lion'. This point is taken from some of his observations contained notes enclosed in a personal communication to Dr Paul Collins dated 6 January 1989.

From: Collins, Paul (Ed.) *Stourbridge & Its Historic Locomotives*: Dudley: Dudley Libraries, 1989