

THE EARLY STEAM ENGINE ON MERSEYSIDE

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Read 18 December 1952

THE technical importance of the Newcomen engine⁽¹⁾ has long been a commonplace among historians of engineering, but both its technical and its economic significance are still too little appreciated by others. The Newcomen engine is one of the key inventions in a period of technical revolution 1685–1720. During these years the art of coal smelting was carried from the lead into the copper and thence into the iron industry, the earliest powered textile machinery was introduced into this country, and man, through the early steam engine, transcended for the first time the limits of wind or water power. Perhaps one day we will be talking of the First and Second Industrial Revolutions.

For many years, due to the absence of any means for imparting a rotative motion, the Newcomen engine could be utilised solely by making it rock a heavy beam mounted on a central pivot. Until the crank was perfected the sole purpose to which the engine could be applied was pumping; pump-rods were attached to the working end of the beam. Generally speaking, there was employment for the engine only in the mining districts. Particularly in its early days, certain factors retarded the adoption of the machine even for pumping. Difficulties and expenses due to the elementary level of contemporary engineering, especially in the manufacture of suitable cylinders, were no more serious than the cost of erection. This was increased by the distance over which the more important parts had often to be carried, and by the obtaining of a licence to erect the engine from the company of proprietors who controlled the patent rights. As a result it was only feasible to employ the engine where there was a serious drainage problem insuperable by other means (such as the horse whim), and where mines were profitable and likely to continue so. The total outlay, in the region of £1,000,⁽²⁾ was no small one for the times, and many mine proprietors were not

⁽¹⁾ For an account of the Newcomen engine see H. W. Dickinson, *A Short History of the Steam Engine* (1939) Part I, *passim*; H. Davey, "The Newcomen Engine", in *Proc. Inst. Mech. Eng.* (1903) Parts 3–4, pp. 655 *seq.*; Rhys Jenkins "Savery, Newcomen and the Early History of the Steam Engine" in his *Collected Papers* (1936); and Chapter Eight, "The Steam Engine", of A. Raistrick, *Dynasty of Ironfounders* (1953). Interesting regional studies of the engine's adoption are the last author's "The Steam Engine on Tyneside 1715–1778" in *Trans. Newcomen Soc.*, Vol. XVII (1936–37), pp. 131 *seq.*, and E. Hughes's "The First Steam Engines in the Durham Coalfield", in *Archaeologia Aeliana* (1949), pp. 29 *seq.*

⁽²⁾ Dickinson, *op. cit.*, pp. 59–61; Raistrick, *Dynasty of Ironfounders*, p. 129.

able to find such a sum themselves, nor able to induce others to lend it to them. The adoption of the Newcomen engine on any coalfield implied, firstly, that depths were being reached at which existing draining machinery was ineffective, secondly, that the industry was prosperous enough to attract considerable capital investment.

Our knowledge of the invention and marketing of the engine has hitherto been of a fragmentary nature, but an interesting document recently printed by Professor Hughes confirms a great deal of what had formerly only been suspected. This is a statement by the strangely-named Stonier (or Staniere) Parrot. Parrot⁽³⁾ was the earliest and most celebrated of the erectors of Newcomen engines and his testimony fits in neatly with the facts as we know them. It has the added merit that no one was more likely to know the truth than he, for he had known both Newcomen and Savery in their lifetimes. Parrot declared⁽⁴⁾ that the installation of Newcomen engines under the Savery patent of 1698 was an absurd anomaly, and was simply the result of Savery's prior possession of a comprehensive patent embracing too wide a field and extended for an unusually long period; a conclusion which has been arrived at independently by modern historians of engineering. In Parrot's cogent phrase the engines of the two inventors were as different "as a Distil is from a Windmill, the one working by the impellant force of fire and the other impelled by the atmosphere only and not the least imitation of Savory's [*sic*] engine." Newcomen's engine, he declared, was based upon, and was a development of, that of "Monsieur Pappein". Savery's was virtually the same as that of the Marquis of Worcester, and he was so far from being the inventor of the atmospheric engine "that to his dying day I could never make him understand how that Engine was wrought or to have any opinion of it".

It is this same engineer, Stanier Parrot, who tacitly provides the evidence that there was an intention to erect a Newcomen engine on Merseyside as early as 1716. We know from his activities in County Durham that he was ready to take a speculative interest in the mining projects of the coalfields which the Newcomen engine was helping to develop.⁽⁵⁾ When, therefore, we find that in 1716 Parrot took a lease of mines in Tarbock owned by Viscount Molyneux,⁽⁶⁾ we immediately look for the erection of an engine nearby. Nor are we disappointed. The diarist Nicholas Blundell tells us that in May 1719 a remarkable new engine was being erected somewhere in the neighbourhood of Prescot. His account seems to imply that it

⁽³⁾ For Parrot see Raistrick, *Dynasty*, pp. 128, 129, 133, 294; E. Hughes, *op. cit.*, pp. 32 *seq.*; and the same writer's *North Country Life in the Eighteenth Century* (1952), pp. 152-3.

⁽⁴⁾ Hughes, "Early Steam Engines", pp. 41-3.

⁽⁵⁾ *Ibid.*, pp. 37, 44.

⁽⁶⁾ R. Sharpe France, "Lancashire Papist Estates, 1717-1788", Vol. I, *Record Soc. of Lancs. & Ches.* (1945), p. 195.

was connected with the family of Case of Redhasles, the lords of the manors of Huyton and Whiston, adjacent both to Prescott and to Tarbock. "I went to Mr. Case his, but he was not at home so I smoaked a Pipe with his son Henry and then went to the New Engine as is to draw water from one of the Cole-pits, then I went to the New Glass-hous, Mr. Case came past whilst I was there so I followed him to his Hous where I stayed awhile and desired him to be one of my Executors".⁽⁷⁾ When we possess the further information that Jonathan Case of Redhasles left an existing and completed Newcomen or "Fire Engine" by his will of 1729,⁽⁸⁾ there can be little doubt why Parrot was in this part of Lancashire in 1716.

This engine, erected in Whiston at one of Case's collieries, must be high on the list of early Newcomen engines, and seems to be the first recorded in Lancashire. On the technical side there is little information about it, but on the economic and financial aspects we are more fortunate. The Case family not only owned collieries most advantageously placed near the chief regional markets, Liverpool and the saltfield, but was interested in the salt trade itself. This interest can be traced as early as 1701, and for a time the very important Dungeon rock salt refinery at Hale was in their hands. The strength of their position lay in the fact that communications had not yet been opened up by turnpike road or waterway with the more easterly section of the local coalfield; after the Prescott-St. Helens road had been turnpiked by the act of 1746, and the Sankey Canal cut following the act of 1755, competition was much greater.

But though the Case collieries were important enough to attract outside capital and to encourage the family to embark on costly schemes of development, including the installation of the Newcomen engine, the price paid was almost disastrous. In 1729 Jonathan Case made his will, charging the Whiston coalmines with £1,500 "for the benefit of his . . . son Thomas towards reimbursing him such sums of money as he had advanced in obtaining liberty to erect and erecting a fire Engine upon the said Coal Works [enabling them] to be carried on in a more successful and advantageous manner". In 1731, after coming into the property, Thomas Case had to increase the heavy debt already owed to his mother-in-law, Elizabeth Clayton, widow of the famous Liverpool merchant, mayor, and M.P., William Clayton. Elizabeth Clayton, her daughter Sarah, and the great Lancashire lawyer and capitalist Nicholas Fazackerly were among the principal creditors who forced a settlement of his affairs on Thomas Case in 1744.⁽⁹⁾ By this his income was strictly limited, and a great deal of property in Prescott, Whiston, Huyton

⁽⁷⁾ Nicholas Blundell, *Diary*, ed. Gibson (Liverpool 1895). Entry for 7 May 1719.

⁽⁸⁾ Lancs. Record Office. Cross Papers. Abstract of Title of Henry Case.

⁽⁹⁾ For the Cases, their coal and salt concerns, and their relations with their creditors, see T. C. Barker and J. R. Harris, *A Merseyside Town in the Industrial Revolution*, pp. 24-27.

and Hale was sold up, including the Dungeon salt works. However, Thomas Case's son Jonathan was to be permitted to work the mines during his father's lifetime, with a small annuity from the profits for his pains, and was allowed to "take the Fire Engine and Appurtenances for working the said Mines".⁽¹⁰⁾

When we consider that these embarrassments had afflicted a family owning some of the most advantageously-situated collieries on Merseyside, we realize the dangers of business enterprise in the eighteenth century and the frightening burden of expense in which the erection of a Newcomen engine involved coal-masters. We also understand why the Cases's example was so long unimitated, and why steam engines did not become at all common in this district until thirty years after the Whiston engine was erected. When also we compare the slowness with which the steam engine was adopted on Merseyside, even after its practical success had been demonstrated, with the much more rapid speed at which it was taken up by the coal-masters of the North-East, the smaller scale and poorer markets of the industry on Merseyside are clear. The pull of the market, the ability of the industry to attract capital, and the incentives to deeper working were here not sufficient to call for the employment of the costly engine in anything like the same degree. Even after the Savery patent expired in the 1730's, and an expensive licence was no longer required, there was a delay before it became extensively adopted.

When conditions became more favourable as the Liverpool and Cheshire coal markets expanded it was still at the Prescott end of the coalfield that interest in the Newcomen engine was greatest. In 1735 the use of an engine was proposed at Prescott Hall Colliery, and in the 1740's the lessee, a Mrs. Bradshaw, actually installed one. This led to a quarrel with Case of Redhasles, who in 1748 had re-opened an extensive mine in the immediate neighbourhood, possibly the one already mentioned in Whiston manor. He certainly had an engine at these collieries, for when Mrs. Bradshaw started to plan a new and more powerful engine in 1750, Case claimed that copperas in the water pumped from her mines would drain into the reservoir for his engine and ruin it. Nevertheless, an expensive new engine was installed at Prescott Hall about 1753, in order to drain water from a depth of 240 feet. Here, once again, the highly costly nature of these engines may have had important repercussions. The Prescott coal was raised in price to cover the cost of installation, and when the increase was passed on to the Liverpool householders and industrialists and to the rock salt refiners at Hale and Liverpool it

⁽¹⁰⁾ This settlement of 1744 has two interesting connections with the wider economic history of Merseyside. Sarah Clayton, as one of the trust administering the settlement, made an acquaintance with mining which must have influenced her entry into that industry on a large scale in the 1750s. John Ashton bought the Dungeon salt works; the reason for his becoming the principal promoter of the Sankey Canal in 1755 was no doubt the supplying of these works with coal. For Ashton and his canal and salt interests see Barker and Harris, *op. cit.*, pp. 16-17; For Sarah Clayton as a coal proprietor, *Ibid.*, Chapters III to V.

was the final straw which led to the promotion of the Sankey Canal of 1755.⁽¹¹⁾

The Newcomen engine was introduced to the St. Helens section of the coalfield shortly before this canal was planned, but only after the turnpiking of the road from Prescot to St. Helens had been completed. Charles Dagnall, a local comb-maker and coal-master, indicated his intentions of building one in a document of 1746 relating to mines in Eccleston. This was certainly at work by 1751, when it was consuming coal, but Dagnall, in a disillusioned mood, was trying to sell it in 1754. Whether he succeeded or not is not certain, but he is known to have employed a Newcomen engine subsequently at another colliery. Peter Berry, another local man, started the St. Helens colliery about 1754 but was trying to sell the mine together with a Newcomen engine in 1759, and advertised them again in 1761.⁽¹²⁾

Once the Sankey Canal was completed, atmospheric engines became common on the St. Helens section of the coalfield; all the great coal-masters of the early canal period like Sarah Clayton, her nephew Jonathan Case, and John Mackay employed these machines. Towards the end of the century there were few important collieries without one. Even the introduction of the Watt steam engine at the Ravenhead Plate glassworks, and, in a pirated version, at the neighbouring works of the Parys Mine Co.,⁽¹³⁾ did not mean the end of the Newcomen engine in the district. One of the chief objections to the older engine was its wastefulness of fuel, but to a colliery proprietor this did not matter, for cheap and poor fuel could be used, even some which was quite unsaleable. Thus, despite the advantages of the Watt engine, Newcomen-type engines continued to be used, and even installed, for more than a generation after the superior machine had been put on the market, though the expiration of the Watt patent and the need for more efficient engines which would drain mines of increasing depth marked the beginning of the end. Considerable numbers of Newcomen-type engines were in fact employed until late in the nineteenth century.

There was one instance in the St. Helens district of the use of a Newcomen engine to pump back water above a mill-race in order to help turn the mill-wheel of a water-powered factory. There were also a few instances of the application of rotative motion to such engines. These, however, form a very minor episode in the advent of the steam age. Thomas Greenall and his partners had an engine to pump back water at their Eccleston Cotton Mill, founded in 1783;⁽¹⁴⁾ a St. Helens cotton mill which was sold in 1794 was powered by steam,⁽¹⁵⁾ and so was a corn mill sold in 1801.⁽¹⁶⁾

⁽¹¹⁾ For this information on Prescot engines I am indebted to Mr. F. A. Bailey.

⁽¹²⁾ Barker and Harris, *op. cit.*, pp. 32, 32n.

⁽¹³⁾ *Ibid.*, pp. 115, and 85-6.

⁽¹⁴⁾ *Gore's General Advertiser*, 11 July 1793.

⁽¹⁵⁾ *Ibid.*, 30 October 1794.

⁽¹⁶⁾ *Billings's Advertiser*, 9 Feb. 1801.

The St. Helens coalfield was relatively slow in adopting the Newcomen engine, but, nevertheless, a most remarkable feature is the interest taken by local engineers in its application and improvement. Here we must mention the activities of four local men, two patrons and two inventors, whose efforts should not be forgotten.

Both of the inventors were very humble men. One, Jonathan Greenall, was a Parr blacksmith, and it is unlikely that he would have got far with his inventing had he not been assisted. The name of his patron can easily be discovered, since Greenall was granted two patents on the same day, one in partnership. The first (No. 760)⁽¹⁷⁾ was for a new design for a salt refinery. Here his partner was John Mackay, subsequently the leading spirit in the development of industrial St. Helens, but at this time still living in London, and describing himself as "of the Parish of St. Andrew, Holborn [*sic*] in the County of Middlesex, Esquire." Greenall styled himself "Engineer". The next patent (No. 761) was taken out by Greenall alone, and was for a "New-Invented Fire Engine for Draining of Mines, Coal Pitts, and Lands, and for Raising Heavy Bodies; and also my New-Invented Engine for Grinding of Flint and Hard Bodies Dry".⁽¹⁸⁾ Whether a practical engine was ever made to his specification is not known. The editor of *Patents Abridgements* notes the existence in the "confused drawing" of an intermediate receiver between the boiler and the cylinder, and that "this seems among the earliest attempts at placing the boiler and the engine each on a separate foundation".⁽¹⁹⁾

After these two patents nothing further is heard of Greenall as an inventor, but they do not mark the end of Mackay's interest in the steam engine. James Watt, writing to correspondents in April 1789, discussed the schemes of a certain William Blackly "an adventurer who has been for many years employed in searching for dupes all over Europe, in which he has not been unsuccessful". Recently, he had been advancing a project for a steam engine giving rotative motion with which he "has bubbled many people in Russia, Holland and elsewhere. He let poor Mackay⁽²⁰⁾ at Ravenhead into the secret pretty handsomely many years ago".⁽²¹⁾

John Smith is as obscure as his name is commonplace. First heard of in 1791, he was in the August of that year advertised for as a deserter from the Royal Lancashire Militia, into which he had

⁽¹⁷⁾ *Patents Specifications*. Chemical Compositions, year 1761; John Mackay and Jonathan Greenall, Manufacture of Salt.

⁽¹⁸⁾ *Ibid.*, Steam Engine, etc., year 1761; Jonathan Greenall, Steam Engine.

⁽¹⁹⁾ *Patents Abridgements*, Vol. 49, Steam Engine Pt. 1, 1618-1859, Vol. 1 (1871), p. 52.

⁽²⁰⁾ For Mackay's wide range of interests, particularly in the coal and glass industries, see Barker and Harris, *op. cit.*, Chapters IV to IX.

⁽²¹⁾ Bouton and Watt Colln., Birmingham Public Library; Watt to Wolff 16 April 1789, and Watt to Wyatt 21 April 1789. I am indebted to Dr. W. H. Chaloner for these references.

enrolled in 1788 as a substitute for a Windle man.⁽²²⁾ This alone would suggest his poverty at the time of enlistment. The reward of twenty shillings for his apprehension must have remained unclaimed, for Smith was not long absent from Windle.

The best account of Smith's invention is given in a letter of 1832, written by the St. Helens coalowner, William Bromilow, to the editor of the *Liverpool Mercury*.

... "The engine in the boat alluded to, and which is generally supposed to be the first invented, was constructed for propelling boats by steam, as before stated, by Smith of St. Helens, in the year 1793, and her first excursion was down the Sankey to Newton Races, in June the same year, laden with passengers. On the Saturday following she sailed to Runcorn, from thence down the Duke of Bridgewater's Canal to Manchester. On her arrival there, such was the curiosity at this wonderful, and some would have it, this mad idea, that thousands of the people came from all directions to see what their eyes could not believe, nor their senses understand; and, indeed, such were the numbers, and such the curiosity that this vessel excited, that Smith was obliged, for the safety of his property, to give notice that no one would be allowed to come on board of her, excepting those who paid a certain sum. This exasperated the populace to such an extent, that a party of mechanics immediately got possession of, and almost destroyed her. Amongst the visitors was Mr. Sherratt, of the firm of Bateman and Sherratt, of Manchester; also several other respectable engineers of the same place, whom it is unnecessary to name. So far as memory serves me (after a lapse of 39 years) the following is a short description of this wonderful discovery, but having made no memorandums at the time, and, I may say, being then young, and to a certain extent, like the rest of my friends, incredulous, I never anticipated what is almost to everyone at the present day, so common. The vessel had on her an engine on the old atmospheric principle, was worked with a beam, connecting-rod, double-crank in a horizontal line, and with seven paddles on each side, which propelled her after the rate of about two miles an hour. John Smith was a rude, self-taught mechanic, and was supported by a Thomas Baldwin, at that time of St. Helens, and was the first aeronaut [i.e. Baldwin] who ever ascended in a balloon, either in this or the adjoining counties. Perhaps, I may observe, that the vessel or boat was purchased at Liverpool, and on Smith's informing the parties from whom he bought it, what his intentions were, he was treated as an insane person; he was laughed at by one, insulted by another, and pitied generally; but, having money with him, he was allowed to purchase her. On being questioned and laughed at by a merchant at the time the purchase was made, he replied, "those may laugh who will, but my opinion is, before twenty years are over, you will see this river [Mersey] covered with smoke".

I feel pleasure in giving you these particulars, and the substance of the remarks I can vouch for as being correct, having been an eye-witness to most of them, and one of the party who took the first excursion".⁽²³⁾

There is no reason why we should doubt Bromilow's word; he was a wealthy and respected man who would be unlikely to seek notoriety by telling tall stories. In two particulars, however, he was mistaken. It is no reflection on his testimony that he had not heard of prior experiments like those of Fitch in America and of Symington, financed by Miller, in Scotland. His memory, too, seems to have betrayed him in the matter of the date, as the following extract from Billinge's *Advertiser* of 26 June 1797 indicates.

⁽²²⁾ *Gore's Advertiser*, 15 August 1791.

⁽²³⁾ *Liverpool Mercury*, 20 July 1832.

"An unusual occurrence took place at Newton Common, on Friday the 16th inst.: being the last day of the races there—a vessel, heavily laden with copper slag, passed along the Sankey Canal, without the aid of hawlers [*sic*] or rowers; the oars performing 18 strokes a minute, by the application of *steam* only. On enquiry since made, it appears that the vessel, after a course of ten miles, returned the same evening to St. Helen's, whence it had set out. The form and motion of the oars is not easily described, but it bids fair to be ranked among the most useful of modern inventions".

Little more is heard of Smith. His was one of the earliest steamboats to be invented and built by an Englishman, and it may well have been an entirely independent invention, made without knowledge of any of his predecessors.⁽²⁴⁾

This paper is a compilation of scattered facts, a bringing-together of isolated episodes. It does not aim to be a complete record of all Merseyside Newcomen engines. It is merely an essay towards that subject, and towards the wider topic of the application of steam power to Lancashire industry. The steam engine and the factory system made our county the wonder of the world in the nineteenth century; a history of steam power in Lancashire would be invaluable. Perhaps one day someone with the necessary technical knowledge will write it, and put all economic historians in his debt.

⁽²⁴⁾ By an interesting coincidence Capt. N. W. Kennedy of the Liverpool Nautical Research Society has been rediscovering Smith about the same time as, but unknown to, the writer. See their Transactions, Vol. III, p. 7, and Vol. IV, pp. 5-6.