

The South Devon Atmospheric Railway Myth Exploded

Numerous written references exist to the belief that the first two James Watt engines installed at Sandfields in 1857 were transferred from the South Devon Atmospheric Railway after this form of propulsion for the rolling stock was abandoned. Evidence has now been discovered by Mr. Graham Smart of Stourbridge that only a limited number of components from the dismantled South Devon engines were used in the manufacture of the Sandfields engines. Mr Graham Jennings has also carried out further research on the subject and has put forward further highly plausible theories as to the origins of the various engine components including the possibility that some were sourced from another ill fated atmospheric railway scheme in London.

Here is an extract from Mr. Smart's findings:-

"The engines never worked on the South Devon Atmospheric Railway but were built as new pumping engines to an order from the South Staffordshire Waterworks Company for this, their first pumping station.

In 1985 I delved into the Boulton and Watt collection at Birmingham Reference Library and found the following.

The most direct information comes from order books, the relevant item reference being No. 333 - "Order Book for 1852 - 1872". On page 141 is the first reference to "South Staffordshire Water Works - Sandfields Pumping Station" with the entry:-

"The engines AR and AS are ordered by this Co. and must be proceeded with without delay. The nozzles and valves to drwg SLM. Main levers and plummer blocks to drwg SLN. Parallel motion to drwg SLO. To contract and specifications dated 13th November 1855 - erected near Lichfield"

Immediately above this entry occurs:-

ENGINES - AR & AS - 2 double acting engines having cylinders 4ft (altered to 46") by 8ft stroke, the steam cylinders, cases and pistons to drwg SLL

9th January 1857

On page 157 this brief description is expanded as follows:-

"SOUTH STAFFORDE (sic)WW"

"The air pump, condensers, hot water cisterns and waste pipe to drwg SNX. The working gear to drwg SOJ. The steam cases and air force pumps to be charged extra to estimate (See J. R. McLean letter 27th April and W. Blakes 6th May). The columns and entablature, column plates, flywheel and shaft, headstock plates and plummer blocks, crank and pins, bearer beams and boxes in well, steadying beam sat top of well for 3rd engine are to be prepared and will be charged extra, including the additional length of injection pipe, suction and C.W. pumps and enlarged steam and feed pipe (See estimate 23rd March) The connecting rods (S. Devon altered) shafts, flywheels (S. Devon 36"), headstock plates and plummer blocks to drwg SPU".

6th June 1857

The above is a verbatim copy of this item which I think, indicates the origin of the S. Devon myth at Sandfields. These new engines incorporated connecting rods and flywheels only from S. Devon pumping engines left on B&W's hands when the decision was taken to change the S. Devon line from atmospheric to normal steam traction. These engines were obviously built to a high specification - the new engines for S. Staffs, that is - as a letter entry refers to - "All joints being made metal to metal, all levers, journals and other working bearings being case hardened and joint pins under 1½" dia. to be of steel".

On page 364 of the same order book is the entry:- "The engine UU is ordered by this company" (i.e. S. Staffs Co.). The following list of drawing references shows this engine to be identical to AR and AS already supplied. This entry dated 26th July 1864.

Along with these engines B&W supplied 6 Lancashire boilers 32 foot long x 7 foot diameter with 2 flues 2 ft 6 2/22 diameter. The first 4 (Works Nos. 1239 - 1242) were supplied with engines AR and AS. A fifth identical boiler was ordered March 1867 and a sixth ditto December 1867. These were works nos. 1475 and 1478 respectively.

In another item in the collection entitled "Catalogue of Old Engines" under "Section K - Vacuum and Blowing Engines" there is an entry relating to the engines built for the S. Devon Rly. - p 272. There are details of 3 sets of engines:-

a) Steam cyl 33" x 6' 0". Air cyl 51" x 6' 0"

NHP = 252 (total) h 42 NHP each (6 engines)

Order date 1845

p 273 gives info - "Vertical engines with vac cyl overhead.

b) No dimensions - 6 engines 72 NHP total

(i.e. 12 NHP each) - "Independent to assist vertical above

(These would appear to be the small beam engines shown in Hadfield's book)

c) Steam cyl 40" x 80", Air cyl 80" x 8' 0"

680.8 NHP (total) - 10 engines (5 sets)

Date of order 1846

p 273 states - "Horizontal engine and vac cylinders.

M.N. Countermanded. Made but not erected.

Presumably the Sandfields bits came from these engines, for which, presumably B&W got some sort of financial compensation from the S. Devon Rly. for the cancelled orders. There are also 3 entries in the same section detailing pumping (vacuum) engines for the

London, Croydon and Epsom Rly which were obviously also "countermanded" as there is a note giving details of the customers who actually got these engines.

In summary, therefore, it appears that initially two double acting rotatory beam engines were ordered from B&W, their refs. AR and AS - 46" bore x 96" stroke. This order about Jan 1857. Preparations and certain parts for a 3rd identical were to be made at this time. For these engines the connecting rods from the S. Devon 40" engine and flywheels from 36" engines were to be used.

Four boilers were also ordered - Nos. 1239 - 1242 to be supplied with AR & AS

On 26th July 1864 a 3rd engine was ordered - this was referenced UU by B&W - and was made to the same drawings as AR & AS. Many of the parts were already in place at Sandfields, including the flywheel, and we can assume this was ex Devon also, although the order books do not make this absolutely clear. This engine probably started work early 1865.

A 5th identical boiler ordered March 1867 and a 6th ditto Dec. 1867. All boilers 32' x 7' dia. - 2 flues 2' 6" dia. each.

There is a problem with these details in that the engines shown for S. Devon are 33" & 40" bore, not 36" & 40" as per the S. Staffs entries. It could be that this is an error by the clerk entering the details, or the S. Devon engines could have been built 36" instead of 33", or perhaps there were more S. Devon engines left on B&W's hands which I have not found details of."

Mr. Smart's permission to reproduce his findings here is gratefully acknowledged.

Here is Mr Jennings article, published in August 2011: -

The mystery of the James Watt engines at Sandfields Pumping Station.

Messrs Clegg and Samuda patented 'Atmospheric Railways, in the 1840's. This was a method of propelling a train by means of piston on an arm attached to a carriage. The piston was located in a tube between the tracks. Stationary steam pumping engines at about three mile intervals produced a vacuum in the tube which 'sucked' the piston and therefore the train along. Some engineers saw this method as the future of railways and a few schemes were built. Unfortunately they were beset with technical problems and were all finally abandoned.

Towards the end of Howard Clayton's excellent book 'The Atmospheric Railways' he states the following. "When the atmospheric equipment was sold in 1848 the stationary engines were disposed of to various industrial undertakings. Two pairs were purchased by the South Staffordshire Waterworks Company, and installed in one of their pumping stations at Lichfield. Here, for seventy-five years (sic) they pumped water from Lichfield to parts of the Black Country until they were replaced by more modern plant in 1925 (sic)". He goes on to say, "Incidentally, their long working life with the South Staffordshire Waterworks Company refutes the allegations put forward that the engines supplied to the South Devon were mal-constructed".

Howard Clayton lived in Lichfield and he was aware that the two engines installed there in 1857 were believed to be from the South Devon Railway. Isambard Kingdom Brunel the engineer on the South Devon Railway had on two occasions in August 1847 and again in August 1848 cast doubt upon the engines which were made by Boulton and Watt (later James Watt & Co). Brunel had written to the directors of the SDR blaming defects and the poor efficiency of the vacuum engines as a contributing factor to the ills of the atmospheric railway. In truth the engines were required to work much faster than originally planned. It seems that Howard Clayton also wanted to correct the perception that the Boulton and Watt engines were anyway at fault for the demise of the South Devon Atmospheric Railway by citing their long life at Sandfields

So how could engines from South Devon be installed at Lichfield? In the 1850's the area of South Staffordshire known as the Black Country was experiencing a shortage of drinking water owing to contamination of its existing resources by intensive industrialisation. Lichfield was chosen for the source of fresh water. John Robinson McClean the eminent engineer proposed to harness the spring and streams west of Lichfield and pump the water by steam engine through a pipe alongside the track belonging to the South Staffordshire Railway eleven miles to Walsall for distribution to the surrounding area. In 1853 the South Staffordshire Waterworks Company was founded. Following agreement of amendments to the scheme in 1856 construction commenced.

James Watt and Co. was awarded the contract to supply and erect the steam engines to the planned pumping station at Sandfields, Lichfield. They were experienced at manufacturing pumping engines and it may be that they saw the opportunity to 'tailor' the specification to suit engines they had at Soho that were surplus to requirements. The fact that they won the contract with the lowest price may have also been due to almost 'free issue' machinery they still had at the works from their atmospheric railway adventures. James Watt and Co. was compensated when atmospheric railway orders were cancelled. The arrangement was they would pass on half the money from any re-sale within two years and a quarter after that.

The following is an order sent to James Watt and Co. for the engines at Sandfields:-

To 2 Pumping Engines of the high pressure expansion condensing construction having cylinders of 46 inches diameter and 8 foot stroke and double acting pumps, together with 4 boilers and their complete apparatus, including duplicates and tools as per specification and contract, the whole delivered and erected at Lichfield. £10,750.

James Watt and Co. was asked if they would take payment in South Staffordshire Waterworks Company shares. They declined this proposal but did offer preferential payment terms. Half the value of the contract to be paid on completion of the works with the balance being paid eighteen months later.

The two original engines at Sandfields were officially started at the opening ceremony on 26th October 1858. A third engine was added in 1866. They were to have long working lives, major repairs were carried out in 1909 and the engines were finally de-commissioned in June 1923.

When the pumping station was reconstructed in 1924-25 a plaque was erected in the engine house. This left the reader in no doubt of the origins of the original engines.

SOUTH STAFFORDSHIRE WATERWORKS COMPANY

SANDFIELDS PUMPING STATION (RE-CONSTRUCTED 1924-25))

THIS DUPLICATE UNIFLOW-CENTRIFUGAL PUMPING PLANT WAS ERECTED IN 1924 TO REPLACE THE THREE JAMES WATT SINGLE CYLINDER ROTATIVE BEAM ENGINES IN USE FROM 1858 TO 1923 ORIGINALLY USED BY THE SOUTH DEVON ATMOSPHERIC RAILWAY COMPANY AS BLOWING ENGINES.

In 1985 Mr. Graham Smart of Stourbridge researched the source of the engines at the Boulton and Watt collection at Birmingham Archives. He writes:-

“The most direct information comes from order books, the relevant being No. 333-“Order book for 1852-1872”. On page 141 is the first reference to “South Staffordshire Water Works – “Sandfields Pumping Station” with the entry:-

“The engines AR and AS are ordered by this Co. and must be proceeded without delay. The nozzles and valves to drwg SLM. Main levers and plummer blocks to drwg SLN. Parallel motion to drwg SLO. To contract and specifications dated 13th November 1855 – erected near Lichfield”

Immediately above this entry occurs:-

ENGINES – AR & AS – 2 double acting engines having cylinders 4ft (altered to 46”) by 8ft stroke, the steam cylinders, cases and pistons to drwg SLL.
9th January 1857.

On page 157 this brief description is expanded as follows:-

“SOUTH STAFFORDE (sic) WW”

“The air pump, condensers, hot water cisterns and waste pipe to drwg SNX. The working gear to drwg SOJ. The steam cases and air force pumps to be charged extra to estimate (See J. R. McLean letter 27th April and W. Blakes 6th May). The columns and entablature, column plates, flywheel and shaft, headstock plates and plummer blocks, crank and pins, bearer beams and boxes in well, charged extra, including the additional length of injection pipe, suction and C.W. pumps and enlarged steam and feed pipe (see estimate 23rd March) The connecting rods (S. Devon altered) shafts, flywheels (S. Devon 36”) headstock plates and plummer blocks to drwg SPU”

Mr. Smart goes on to say: - “The above is a verbatim copy of this item which I think indicates the origin of the S. Devon myth at Sandfields. These new engines incorporated only connecting rods and flywheels from S. Devon pumping engines left on B&W’s hands

when the decision was taken to convert the S. Devon line from atmospheric to normal steam traction.”

This seems to indicate that only certain parts of the atmospheric railway engines were used. Connecting rods could only have come from the redundant 8 feet stroke engine and the flywheels were used from a redundant engine that would have had a 36 inch steam cylinder. It is not surprising that only parts were used as the Sandfields engine specification was different from the ‘atmospheric’ engines and 7-8 years had elapsed from the demise of the atmospheric experiment.

So from which of the engines left on James Watt’s hands did the parts originate? The connecting rods probably came from the some of the 5 No. 68HP horizontal engines manufactured in 1846-47 for the South Devon. Two were originally destined for the line between Newton Abbot and Plymouth and it is thought that the remaining three would have replaced the underpowered and overworked engines that were erected by Boulton and Watt at Exeter, Turf and Starcross.

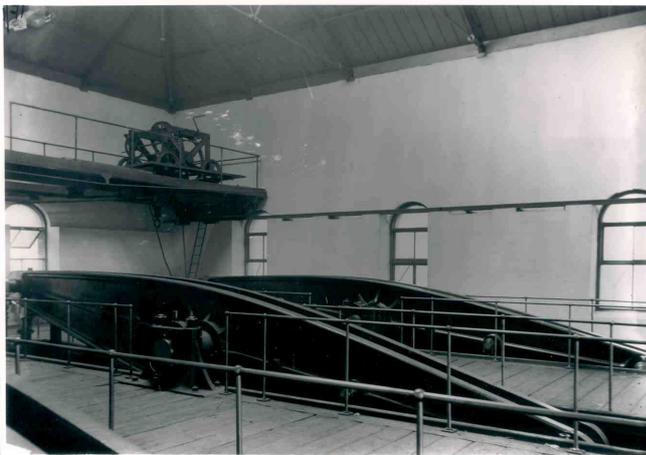
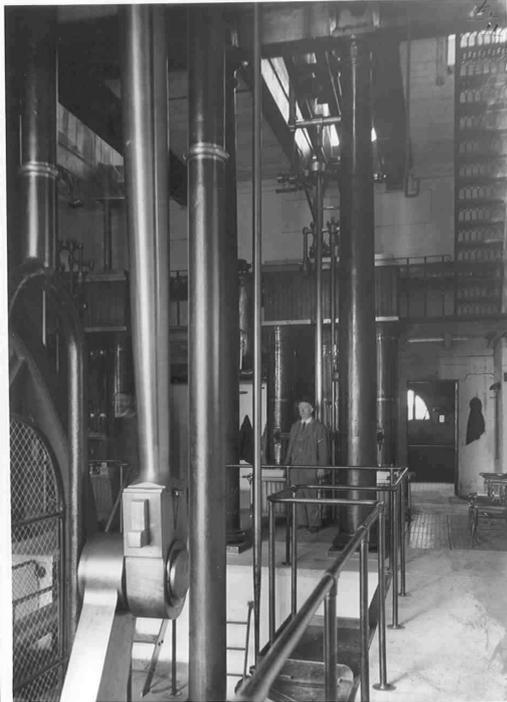
Mr. Smart, in his research, speculated that the clerk at James Watt & Co. could have made an error when referring to a 36 inch South Devon engine when the engines at Exeter, Turf and Starcross had 33 inch steam cylinders. However these engines had already been erected and released for sale in 1852 by the South Devon Railway and their bankers. Mr. Smart did say that the flywheels could have come from South Devon engines which he had not found details of. It is more likely that the flywheels came from engines originally manufactured for the London and Croydon Atmospheric Railway. In December 1846 the Directors of the London and Croydon Railway decide to suspend work on all atmospheric equipment past Epsom and engines already made at Soho Works were not to be delivered. Boulton and Watt were released from their contract. In September 1847 three engines were sold to the South Devon Railway. Only one engine a large 80HP engine was installed, at Daignton on the SDR. The other two, 50HP engines with 36 inch steam cylinders remained at Soho. It appears that they were never sold as entire engines and it is likely it was their flywheels that ended up at Sandfields. The B&W reference (S.Devon 36”) is correct as they were originally destined for South Devon. Matthew Bates at The South Staffordshire Waterworks Company, Walsall has found in the archives a drawing showing the original James Watt engines. The flywheels scale 24 Feet the same as the 50HP London and Croydon engines.

Although it is not correct to say that complete engines used on the South Devon Atmospheric Railway were installed at Sandfields Pumping Station, it is gratifying to know that some engine parts originally intended for the atmospheric railway experiment had a useful working life at Lichfield.

Graham Jennings
August 2011

We also gratefully acknowledge Mr Jennings’ kind permission to publish his article.

The four photographs of the Sandfields engines below are undated, but were probably taken just prior to their decommissioning and scrapping c. 1924



Sandfields Boilers (date not known)

1858 Plaque

