

REDBROOK IRON WORKS: AN EXAMINATION OF THE EVIDENCE FROM THOMAS ANSLEY'S ACCOUNT BOOK FOR 1794-1798

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Introduction

Gloucestershire Archives holds a photocopy of the Account Book of Thomas Ansley, Haulier, of Redbrook (1). The book is a record of mixed haulage accounts, notes of the births and deaths of members of the Ansley family, their neighbours and friends and of trows under repair on the wharves of Redbrook. The Ansleys hauled agricultural produce, timber, coal, stone and iron, and worked at threshing, brewing and cider making. Thomas Ansley rented Upper Mill Farm from Lord Gage, and occupied a house and mill sub-let by David Tanner. Thomas Ansley was dead by December 1799 and his wife sought to retain the lease from James Davis, who replaced David Tanner as lessee of the Upper Redbrook works (2). The accounts show that Mrs Ansley and her son continued the haulage business.

Of particular interest are the accounts of haulage for David Tanner, iron master, of Monmouth, who held iron works at Redbrook (3). This study examines the movement of materials to and from the component parts of David Tanner's Redbrook works in an attempt to identify the developing activities at Redbrook at the critical period when Tanner was reorganizing and modernising the work carried out there to create the 'Tin Works' at Lower Redbrook.

Background to the Sites 1790-1804

In June 1790 David Tanner had bought the *Lower Redbrook* Works for £2,700. When for sale in 1790 the works had been described as *a freehold copper works consisting of furnaces, forges, foundrys, mills, utensils, implements, erections and works for calcining, smelting, refining, hammering, rolling and manufacturing copper ores and copper....*. In the following year, June 1791, when David Tanner took out a mortgage on the property with James Sevier of Bristol for £2,200, it was described as *a site lately used as a copper works and converted into an iron work*. There was no mention of tin, but some of the buildings must have been adapted to iron working (4).

In 1793 David Tanner, his brother William, William Cowley (or Coley) and Henry Hathaway, both the latter being formerly of the Framilode tin works, signed a co-partnership to manufacture tin plates at Lower Redbrook from 24 June 1793 as Cowley, Hathaway and Company, for 21 years at £500 p.a. rent. Cowley and Hathaway each put into the partnership £1000. As part of the agreement David Tanner was to erect a New Mill and build the necessary furnaces, tin shops and finishing shops. Henry Hathaway was to undertake the rolling and tinning branches. David Tanner was to supply the iron (5). It appears the existing premises

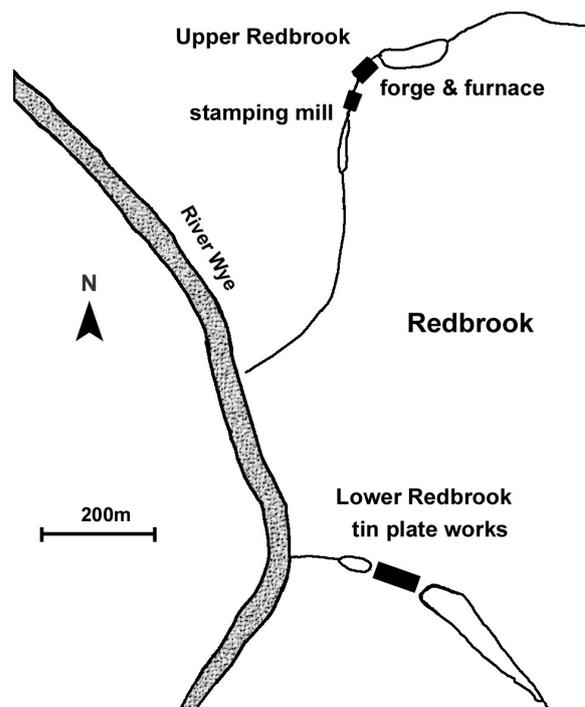


Figure 1. Location map for sites

were thought inadequate for the new tin plate works. That tin shops and finishing shops had to be built suggests that finished tin plate had not previously been produced on the site in any quantity (6).

At *Upper Redbrook* Tanner leased a furnace and forge from Lord Gage on 5 July 1793 along with two forges at Lydbrook. These were intended to supply the bar iron for the tin works.

These were only two of the many industrial sites David Tanner acquired. He overstretched himself financially. In September 1796 the Lower Redbrook Works was again mortgaged, now to John Rollings for £7,300. David Tanner also owed Edward Estcourt sums of £1000, £5000, £5000 and £1500 (7). On December 28 1798 he was made bankrupt. At Lower Redbrook his trustees gave a new lease to William Cowley from Christmas Day 1798 at £700 a year for 21 years (8). The Cowley and Hathaway partnership had lasted under 6 years. At Upper Redbrook Edward Estcourt continued to work up stock until February 1799 and surrendered the keys in October 1799 (9).

The Ansley-Tanner haulage accounts refer to the years 1794-98 and the relevant entries are headed *David Tanner Esq. to Thomas Ansley*. The formal name of the Upper Redbrook firm was probably the Redbrook and Monmouth Company, the title which was used by Lord Gage and his agent (10). The entries relate principally to the Upper Redbrook site, from which some material was hauled to the Lower Redbrook site. Cowley, Hathaway & Co. are not mentioned between these dates, though this is within the period of their partnership. It was only after Tanner's bankruptcy and the new lease to William Cowley that a few of Ansley's accounts for hauling coal were directed to Messrs Cowley Hathaway & Co in 1801 & 1802. In 1801 Henry Hathaway appears to have left Lower Redbrook. In that year, Henry Hathaway and Benjamin Haselwood, both of Monmouth, had signed an agreement to repair and build works at Kidwelly. They took a third partner, Winniatt Perkins. Benjamin Haselwood, who undertook the management, died in 1806, and this partnership was also dissolved (11). As Henry Hathaway had managed the rolling and tinning processes at Lower Redbrook his departure must have caused another set back at that site. In 1802 the Lower Redbrook Works were offered for sale by Tanner's Trustees in bankruptcy (12). By 1804 John James was working there with William Cowley (13).

Clearly the years 1793 -1802 were troubled at both Redbrook works. The haulage accounts throw some light on events of the period between 1794 and 1798. The origin and destination of the goods hauled is sometimes given and sometimes evident. Movement between both Redbrook sites is indicated and materials moved suggest activities undertaken. The accounts refer directly only to land haulage. Water transport would have brought ore up the Wye and taken plate and other materials away.

Component sites are named. The accounts are principally of the Upper Redbrook works, but materials were hauled 'down' and to 'the Tin works,' so incidentally showing activity there. Buildings and processes are named which do not appear in the sale document of 1790 (above) or of 1802 at Lower Redbrook or in Lord Gage's list of necessary repairs after 1798 at Upper Redbrook.

At Upper Redbrook, Harford Partridge & Co., Lord Gage's tenant until 1793, had leased from him a furnace, finery, chafery, rolling mill and balling furnace, and erected an additional finery and aqueduct (14). In 1798/9 men paid for work there included puddlers, rollers, a probable 'baller' and an engineer who cleaned the boilers. These imply refining, puddling and balling furnaces and a steam engine by that date (15).

Correspondence between Lord Gage and his agent James Davies in 1799 and 1800, listing repairs needed at the end of the Tanner tenancy, gives other detail. The site included -

the furnace with bridge house, mine (iron ore) sheds, charcoal houses and coal houses,
the stamps,
a forge with finery and chafery,
carpenters and blacksmiths (workshops), a kiln,
7-8 houses,
5 pools and an aqueduct.

By 1800 the furnace needed a new hearth, lining and chimney, and a new wheel and shaft, the finery needed new wheels and the troughs repaired. The forge needed a new roof, the stores and workmen's houses needed repair, as did the stamps and floodgates. A rolling mill had been sold (16). Much of this work must normally have been done as annual maintenance, but the quantity of work needed suggests disuse or neglect.

The two lists of 1793 and 1799 show changes. Tanner appears to have ceased using the furnace, forge building and water wheels to power them, and to have allowed them to decay, contrary to his lease, which required him to return the site in the condition he received it in 1793. Instead, by 1798, he appears to have installed more modern and efficient processes and machinery, including puddling furnaces and a steam engine, which were in use at the point of his bankruptcy.

Of Lower Redbrook P G Harris wrote that John Wright 'had designed a steam engine for rolling tin plates etc' in use at Lower Redbrook (17). This suggests that iron was rolled into black plate. Wright left there in 1790 to become manager of Taibach Works, Port Talbot. However, no other evidence has shown that a steam engine was in use at Redbrook before Wright's departure in 1790.

Twelve years later at Lower Redbrook the 1802 sale document details, -

one forge with two fineries and two balling furnaces,
two rolling mills, with three bar iron furnaces
four tin furnaces for making tin plates,
a steam engine for working the rolling mill,
shear shops, scouring room, tin house & two wash houses
a set of stamps
a brick kiln.

These probably include buildings remaining from before 1790 as well as those built by Tanner after 1793 (18). By 1802 not only was black plate produced but the sheets were tinned and finished on site, by Henry Hathaway. The steam engine was probably that shown in a drawing dated 20 May 1798 powering a rolling mill (19).

After 1798 Cowley and Hathaway are unlikely to have made any significant financial investment in new building because David Tanner had by then built and adapted existing structures over 5 years, because they are unlikely to have had reserves of capital themselves and the recent bankruptcy cannot have created confidence in the enterprise. The annual rent had increased from £500 to £700 by 1802, presumably reflecting the additional premises. It is probably safe to assume that the buildings existing in 1802 were those bought or built by David Tanner.

The accounts show the decline in activities at the furnace and Upper Redbrook Works from late 1796. The Lower Redbrook Works were developed 1795-6. The two sites had different functions. Upper Redbrook had been an Iron works extracting iron from iron ore in a charcoal fired blast furnace. Lower Redbrook was to be a Tin works, using the charcoal produced iron for a specialist product, tin plate. This is an example of vertical integration in the iron industry, for a brief period, and also of Tanner's specialisation in response to the mass output of bar iron in large coal fired blast furnaces in South Wales.

Thomas Ansley's Accounts - The Sites and Sequence of Operations

Upper Redbrook : The Furnace

David Tanner held the works at Upper Redbrook from July 1793. The site was active from at least 7 March 1794 when Thomas Ansley hauled 577 tons of Lancashire Ore from the Wye to Redbrook furnace between 7 March 1794 and 24 October 1794, and again 3009 tons between 24 October 1794 and 25 December 1796. This was part of a regular trade in which trows took oak bark for tanning down river and to Ireland, returned across the Irish sea to Whitehaven and Lancashire ports and brought ore back to the Wye (20). The dates of delivery effectively indicate the period when the Blast Furnace was active. It was usual to keep a furnace in blast for several months, a 'campaign,' then undertake repairs or alterations. As the bulk of the accounts date from October 1795 dates of furnace campaigns before then cannot be proposed.

The main product of the furnace campaigns was pig iron. Pig Iron haulage declined over winter after October 1795 until March 1796. This probably indicates the break between 1795 and 1796 campaigns. Some 22 tons of sand were carried to the furnace in November 1795. and in January 1796 'Hurth' (Hearth) stones were renewed over two days, probably in the blast furnace (Table 1). This must mark a break between campaigns during winter, with repairs to the furnace and renewal of part of the casting house floor or the making of moulds. The greatest volumes of pig iron were moved between March and November 1796. Of this some 20 tons were taken to Lydbrook forge between May and July. The remainder moved was usually hauled 'Down,' presumably to the tin works site or for transport by water. In June 1796 another 21 tons of sand were delivered to the furnace.

Apart from pig iron, the products of the furnace were cast iron components and slag. Castings were moved on 5 occasions between December 1795 and April 1796. They were probably produced in the 1795 season and in April from the first iron smelted in 1796. The latter were hauled to the 'Roulin Mill' by six horses, costing 15s. One ton of castings usually cost 9d a ton to move, so these were substantial. No later castings are mentioned. The sand delivered in Nov 1795 may have been required for making the moulds for these. There is no further evidence of the use of the furnace.

Stamping Mills had been used to crush iron ore or bloomery slag, rich in iron from early workings, for use in the furnaces. The Stamping Mill at Upper Redbrook was just downhill from the furnace and forge (21). The hammers were powered by water. By their lease the Redbrook and Monmouth Company were obliged to take iron cinders (bloomery slag) from Staunton manor. They had taken none for two or three years before 1798 (22). In the late 18th century stamps were also used to crush blast furnace slag. It contained material used in making green glass, but amongst that were considerable quantities of granulated iron, and ragged lumps of iron called shot or scrap iron (23). This was used at the forges in making bar and rolled iron. Stamp, crushed cinders or slag, was moved between November 1795 and June 1796. On two

occasions its destination was given as the 'Ballin,' but where calculable the haulage cost was the same, 9d a ton, so all might have gone to the same place. Part of the haulage costs must have been loading and unloading.

The largest quantities of 'stamp' were moved in November and December 1795, so probably represent crushed slag removed when repairing the blast furnace after the previous campaign. Regular movements in March 1796 may represent the end of that year's campaign. They also coincided with clearing rubbish from a yard, and may be part of that process (though there is no confirmation of which yard was being cleared). Two lots of stamp were moved 'Up,' possibly to the forge. There was a balling furnace at Upper Redbrook, there when John Partridge held the lease and used by Edward Estcourt in 1798 (24). In total 193 tons were moved by July 1796. 'Shot' was sent to Lydbrook in June 1796 (2 tons), and 'scrap' moved in March and June 1796 (6 tons). (Tables 1 & 2).

Pig Iron was converted to blooms in a refinery, part of the foundry. The movement of blooms peaked November 1795 to January 1796 and in March 1796, then declined, with 28 tons (of a total of c. 290 tons) moved to Lydbrook between March and July 1796 (Table 2). The remainder was again regularly charged at 9d a ton for haulage, but only once noted as travelling 'Down.' The pig iron may have undergone initial refining into blooms at Upper Redbrook foundry before being carried to Lower Redbrook for further processing to iron sheet or black plate. In 1796 the blast furnace product was moved 'Down' as pig iron (above) rather than refined at Upper Redbrook. It looks as if the foundry there fell into disuse, as did the Lydbrook Forges.

The evidence appears to indicate blast furnace campaigns in summer 1794, summer 1795, winter repairs before an intended campaign early in 1796 and pig iron movements after the 1795 and 1796 campaigns. Riden notes that the furnace was out of blast when a survey of working blast furnaces was undertaken in 1796 (25). The survey may have taken place later in the year. The 1796 campaign may have been merely to cast machinery for use at Lower Redbrook (below), and have been brief. The data gives no evidence for the use of the furnace in 1797. David Tanner probably did not use the furnace again. By 1800 new inwalls, chimney, furnace head, wheel and shaft were needed (26).

This was probably the furnace built sometime between 1725 & 1742. It was charcoal fired (27). New high output furnaces in South Wales using coked coal as a fuel were producing iron for rails in increasing quantities. In comparison the charcoal fired furnaces produced higher quality pig iron suitable, after further refining, for specialist uses like tin plate. But they were small and old fashioned compared with the coal fired furnace which served the new market. The Redbrook furnace no longer used local ore, the best of which was not then available.

Lydbrook

David Tanner held two forges at Lydbrook leased from Lord Gage since July 1793. The Lydbrook forges received blooms and pig iron from Redbrook furnace and processed it into Bar Iron, which was returned to Redbrook. Both journeys were by land, reflecting the distances the furnace and forges were from the River Wye and the difficulties of navigation above Redbrook. James Davis described the sites as 'a furnace and two forges, six or seven miles distant and each about a quarter of a mile from a navigable river,' (28).

Whatever use Tanner had made of the Lydbrook forges since 1793, by mid 1796 he was sending a limited amount of material their way (Table 3). From August 1796 to June 1798, almost 2 years, Tanner seems to have moved no material to and made no use of the Lydbrook

forges, at least via his usual haulier. The iron hauled 'back' in 1797 cost £1 in haulage. In 1796 it had cost 12s to move 2 tons, so some 3 tons may have been returned to Redbrook. The 1797 work looks like clearing up the site. This period follows the disuse of the blast furnace.

Tanner is known to have sub-let the forges to Hobbes and Ellaway (Allaway), at some point, before his bankruptcy (29). The resumed haulage in June 1798 may mark the beginning of Hobbes and Ellaway's sub-tenancy of the forges. The rapid decline of the quantity of iron they received from Redbrook in 1798 demonstrates Tanner's impending failure, the instability of Hobbes and Allaway's trade and their financial problems (30).

Tanner was bankrupt by 1799 and there was then little stock to be found on any of the Upper Redbrook premises (31). What remained was worked up during November and December 1798 (32).

Lower Redbrook : The 'Tin Works'

David Tanner owned the Lower Redbrook Tin Works. By his partnership with Cowley and Hathaway in 1793 he had agreed to build a new mill, the necessary furnaces, tin shops and finishing shops for a tin works.

Tin working comprised groups of processes, at the Forge, the Black Plate Mill and the Tinning House (33).

At the Forge, in the 18th century, pig iron was refined in a charcoal furnace to remove impurities, then taken to be hammered into bars in a chafery or heated in a balling furnace and rolled into bar iron.

In the Mill the bar iron was heated in a reverberatory furnace (tin furnace) then repeatedly rolled and doubled into thin iron sheet or black plate, which was then trimmed and cut to size (sheared). In the 18th century a pair of rolls was worked by 3 men.

At the Tin House, to prepare for tinning, the plates were soaked in dilute acid, heated in a furnace (annealed), cold rolled to create a smooth surface, soaked in fermented bran lees for a week, then washed (scoured). At last they were dipped in molten tin. They still had to be cleaned, sorted and boxed. Men were identified by the job they performed, eg. doubler, shearer, cold roller, washman, etc.

The 1802 sale document listing the features on site does so in the order of function, as above. It is clear that David Tanner had created a substantial tin works with two rolling mills (of which one was new) and four tin furnaces.

The process of transforming the copper works into a functioning tin works can be glimpsed from building and alterations indicated in the Ansley accounts. Building activity must have gone on alongside iron working. Harris records 'tin plate' output of twenty two and a half tons in 1794, which increased to twenty seven tons in 1795 and 40 tons in 1796 (34). The measurement in tons rather than in boxes is unusual for finished tin plate, and may refer to black plate.

The Rolling Mill

In 1793, as part of his agreement with Coley and Hathaway, David Tanner had contracted to build a New Mill at Lower Redbrook. In 1802 there were two Rolling Mills there.

In November 1795 and January 1796 timber was hauled to the Tin Works, and in December 1795 some was hauled to the 'New Mill'. A separate account for February-May 1796 records hauling stone to the Rolling Mill for fifteen and a half days. In April castings were taken there. They were probably those made at the furnace earlier in the year. It took 6 horses and cost 15s, probably reflecting the weight of the castings. Also in April 1796 the waggon and 6 horses

were sent to 'Fromelod ' for Blocks. The journey cost £1.10.0. This was when the New Mill was being built and may result from the involvement of Coaley and Hathaway. The full description 'New Rolling Mill' was used in June 1796. Bar iron was brought there in June, first in small amounts, and fire coal from July 21. Twenty four and a half tons were delivered that month, but little afterwards. The partners had been without their new mill for the first three years of their contract.

The earliest site plan of Lower Redbrook works found is undated (35). There is considerable but not complete correspondence with a written survey of 1827 (36). The plan shows 'Old Rolling Mills' alongside the River Wye and adjacent to the Kings Head Public House. The Mill had been sited there to use water power from the lowest pond. In 1827 the survey referred to it as 'the Lower Rolling Mill,' and stated that the pond had been enlarged by taking away the balling furnace. The Mill building was then constructed of iron and wood pillars, a pantile roof and wooden walls. Despite the later date of the plan and survey, the use of water power and the construction materials suggests this was the Old Mill of 1790. Location by the River Wye was also ideal for river transport of rolled plate. In contrast, Tanner's New Mill would have been located near the tinning and finishing shops he was also building, and near the engine house used to power the rolls. That group of buildings became the central core of the subsequent tin works (37).

There had also been a rolling mill at Upper Redbrook. In May 1798 it was reported much out of repair and some of the furnaces there taken down (38). In 1799 Tanner had sold the machinery in a Rolling Mill, which Lord Gage felt he had no right to sell (39). This must have been at Upper Redbrook, and probably surplus to Tanner's needs once the New Mill was built and machinery brought to the Tin works from other sites.

A Balling Furnace was at work in 1796 & 1797, as indicated by the 'fire coal' or 'pit' coal, delivered there by Thomas Ansley (Table 4). Coked coal, not charcoal, was used in reverberatory furnaces, where iron did not make contact with the impurities given off from the coal, burnt in a separate part of the furnace. In a 'balling furnace', the iron was heated, then it passed through a series of rollers to produce bar iron (40). For efficiency the balling furnace and rolling mills must have been adjacent. The 'Ballin' work at Lower Redbrook was first mentioned in Ansley's accounts in Nov 1795 when 20 tons of 'Stamp' were delivered there. The period when the 'Ballin' work was in greatest use follows the apparent disuse of Lydbrook forges and the furnace (Tables 3 & 4). The sale description of 1802 still shows 2 balling furnaces at Lower Redbrook so the balling furnace by the lower mill was probably removed after then.

The Engine House

From late in December 1796 most of Thomas Ansley's work was in hauling coal (Table 4). Work was concentrated at Lower Redbrook. There was no longer a need to move iron between sites. Three categories of coal were transported, fire coal most frequently, '3d coal' and lime coal. Most of it was sent to the 'tin works,' in quantities of four and a half or two and a quarter tons. Some went specifically to the Ballin some to RB, which may stand for Red Brook (eg. Red B, June 7 1797).

Coal supplies in quantity started in September 1796 and were usually for the 'tin works', exact location unspecified. This was just after Sam Martin paid for the haulage of bricks to the works in August and September, and after the carriage of a ton of iron plates there in November 1796. It is tempting to interpret this as the building of the Lower Redbrook Engine House as illustrated in the 1798 drawing (41). An inventory of the Lower Redbrook site made by James

Hall in 1827 described the Engine House as it was then, *A substantial, well built Engine House of Stone wallingA wrought iron Boiler completely cased round with Brick.* There was also an engine stack, *70 ft high from the foundation, built with part stone and part with brick with a cast iron plate on the top....* (42). There had been a lot of stone hauled to the rolling mill earlier in the year. The materials, description, illustration and dates together support this interpretation.

Certainly Ansley's accounts show the huge quantity of coal used at the site and the delivery requirements before the tramway was built in 1812. Perhaps David Tanner underestimated the cumulative cost of all the changes he was making, in adapting the copper works buildings, installing up to date techniques in iron refining, embarking on full scale tin making and in installing a steam engine. He continued to use coal in large quantities until his bankruptcy (43).

Coal was the principal material moved in the later months of 1796 and in 1797. It appears to have been supplied by more than one source. William Williams was a supplier before July 1796, during February - June 1798 and in 1802. Some of the journeys taking iron to Lydbrook in 1798 brought back coal from Williams, usually two and a quarter tons loads at a haulage cost of 11s 3d, but with the additional 1s 6d turnpike charge. The Mitcheldean to Coleford road became a turnpike in 1796. The shortest haulage route from Redbrook to Lydbrook forges was up the Red Brook valley, then to Berry Hill and down to Lydbrook by a turning west of Worrall Hill. This route would involve use of the turnpike. A William Williams, freeminer, with others, granted to Sarah Whitehouse, widow, the Speedwell New Mine from 1825 (44). As Sarah Whitehouse was of the family which then held the tin works in Redbrook, this may mark a continuing trade link.

James Teague also supplied coal in August - September 1797 and in or before 1801. James Teague built his first tramway 1795 from his mines in Wimberry Slade to the road which became the turnpike in the following year. In 1799 he began to extend the tramway to the wharves at Lydbrook where he sold coal at the Wyeside wharves for river transport to Hereford (45). He also had pits at Edge End, on the haulage route which Ansley might have used, and at Lydbrook. The coal could have come from any of these points.

J Lewis supplied 14 tons of coal between 4-17 October 1798.

'Lime coal' was a term used for the coal used in lime burning. 10 tons were delivered to the tin works over May, June and September 1796. It is possible that lime was burnt on site for the building work going on at that time.

The haulage charges for a load of coal varied considerably. Coal brought from William Williams on the return journey from Lydbrook in June 1798 cost 5s a ton in haulage. The higher charges were probably for the longer journeys, or for journeys without a return load. The number of horses used is mentioned only for activities other than coal haulage, eg. six horses for tushing timber to the tin works in November 1795 at 8s, for hauling castings to the Rolling Mill in April 1796 for 15s, and for hauling iron from Lydbrook to Redbrook on Oct 10 1798 for £1.

Tin Plating. In 1793 David Tanner had also undertaken to build the necessary tin shops and finishing shops for a tin works. The accounts give only indirect evidence for these. Thomas Ansley delivered to the tin works a bushel of oats and a bushel of bran on 30 December 1796. More followed, 4 cwts of bran on 20 January 1797, 2 cwts on 25 January, 2 cwts on 25 July plus payment for grinding it, and another 2 cwts on 26 July. The bran was needed to steep the plates in preparation for dipping them in molten tin.

The sequence of events suggests that while black plate may have been produced by Tanner since 1794, tin plating in earnest only began in 1797 after the new rolling mill and engine house were built in the new compact tin works. The purchase of bran at six monthly intervals suggests that at first output was relatively modest.

Accounts

The final account of Thomas Ansley with David Tanner to the end of December 1798 is drawn up in a different and more elegant hand. It shows that Tanner had paid 'By Bill on Account' sums varying from £10 to £60 since August 1794, usually four times a year (1794 - £60; 1795 - £140; 1796 - £70; 1797 - £283.18.8). Tanner also paid the rent of Lord Gage's land, apparently in arrears by up to three and a half years until paid in June 1798. The accounts balanced. Mr. & Mrs Ansley did not find themselves out of pocket on David Tanner's bankruptcy.

Tanner, Cowley and Hathaway

The haulage accounts refer back to 1794, but Cowley and Hathaway are mentioned only in 1801 & 1802 for coal deliveries. The new buildings promised in 1793 were not completed and in use until 1795 and the engine house late in 1796. Henry Hathaway's expertise in rolling black plate could have been exercised since 1793/4 using the 'old mills,' but up to date tinning facilities were available only in 1797. That Harris could give figures for tonnage of 'tin plate' for 1794-6 only, not the years 1797-9, may itself be an indication of the change in output. Finished tin plate was usually sold and transported by boxes not by tonnage, so records for the two products would not be comparable. It may not be a coincidence that Thomas Ansley hauled 'iron to Bigsware' for three days at the end of 1796. Were these the last loads of iron sheet/black plate to leave Redbrook? (46)

The accounts give no indication of the source of iron to the tin works 1797-9, except the 14 tons returned to Redbrook from Lydbrook forges 1797-8. Between January and April 1799 Cowley and Hathaway did take delivery of 31 tons of refined iron and c. 15 tons of bar iron, probably from another of Tanner's businesses (47).

In 1793 the co-partnership agreement had specified in detail how Henry Hathaway was to be remunerated.

'Henry Hathaway is to have and undertake the whole of the rolling and tinning branches of the said co-partnership, trade or business upon the same terms and that he is to be paid for the same at and after the same rates and prices upon and for which he now performed all like branches of Trade at ffarmilo in the County of Gloucester that is to say -

- for Rolling at and after the rate of fifteen pence per box,
 - for Tinning at and after the rate of twenty two pence per box,
 - for extra wages at and after the rate of two pence per box,
 - for mineral acid of twelve ounces per box at and after the rate of three pence per ounce,
 - for Spirits of Salts of five ounces per box at and after the rate of 6d per ounce,
 - for No 1 xx at and after the rate of 4d a box,
 - for keeping Cold Rolls at and after the rate of £1.0.0 per year.
 - for over boxes at and after the rate of 4d per box
- and £150 salary. Each Cowley and Hathaway shall have a dwelling, coals and candles.'

Doubtless when negotiated this looked like a very good bargain, but apart from the salary, dwelling, coals and candles, all the remainder were payments 'by the box' and all but possibly one refer to the tinning and finishing processes which appear only to have begun in 1797 and

then probably in a fairly small way. Perhaps this helps explain why Henry Hathaway moved in 1801 to another works.

Conclusion

Thomas Ansley's haulage accounts add a little detail to our knowledge of the Redbrook iron and tin works in the period following 1794. In particular, they strongly suggest that the Upper Redbrook blast furnace was in use until late Spring 1796, after which it and the forges there were effectively disused until the brief re-use in 1799 by Estcourt.

Hobbes and Ellaway appear not to have taken use of the Lydbrook forges (and Redbrook furnace) until 1798 after a period of 2 years disuse. From 1796 David Tanner concentrated his work at Lower Redbrook. As early as 1793 he had intended to develop a Tin works there. The New Rolling Mill was not in operation until July 1796, powered by a steam engine which remained in use until his bankruptcy. During the early period the production of 'tin plate' continued in existing buildings, probably at the lower rolling mill by the Wye, but the strong suspicion remains that this was sheet for tinning elsewhere, rather than finished tin plate. Tinning processes on site are glimpsed in 1797 (Table 5).

Notes and References

All documents used are from Gloucestershire Archives (GA).

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- (16) D1677 GG 1545/57; GA ROL E5/FOD, Harris P, Upper Redbrook, 15-16.
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- (21) Hart, Cyril, 1971, *The Industrial History of Dean*, Newton Abbot, 440.
- (22) D1677 GG1545/13.
- (23) Hart, 1971 137-8; Maclean, Sir John, 1878, George Wyrall's Observations on the Iron Cinders found in the Forest of Dean, *TBGAS* 2, 216-234, 217.
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- (25) Riden, P, 1993, 47.
- (26) D167 GG1545/57.
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- (33) John, AH, 1995 2nd ed., *The Industrial Development of South Wales 1750-1850*, Cardiff,

- 159-162.
- (34) GA ROL E5/FOD, The Industrial History of Lower Redbrook, 9.
- (35) D2166.
- (36) D639/13.
- (37) In S.D. Coates, 1972, *The Water Powered Industries of the Lower Wye Valley*, Monmouth, the undated drawing of Lower Redbrook works given, when compared with the three dimensional map, pp 39-37, shows the Old Rolling Mill chimneys, the manager's house behind it, both near the river, and up the valley the tall engine house chimney on the left and the shorter New Rolling Mill chimneys to the right.
- (38) D1677 GG 1545/33.
- (30) Ibid. /56; /57a.
- (40) John 1995, 159.
- (41) D2166; Tucker 1971, 63.
- (42) D639/13.
- (43) See also, Parr H.W., 1978, The Redbrook Tramroad Incline in the Wye Valley, GSIA Journal for 1978, 30-33;
Jenkins, Rhys, 1942, 160.
- (44) Wood, James, 1878, *The Laws of the Dean Forest*, 209 .
- (45) Clissold G. & Standing I., 1980, Mr Teague's Railway, Some new Information, GSIA Journal for 1980, 51-60, 56.
- (46) The Wye is tidal to Bigsweir.
- (47) D326/24.

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Table 1. Furnace - Materials moved

Date	Lancs Ore	Repairs	Pig Iron	Pig iron to Lydbrook	Stamp
1795	Oct.	√	48 tons down		
	Nov.	√			31 tons
	Dec.	√	14 tons		44 tons
1796	Jan.	√	Hearth stones		18 tons up
	Feb.	√	10 tons down		Half a day
	March	√	72 down		(33 tons & 5 t. scrap)
	April	√	56 "		18 tons
	May	√	72 "	2 tons	14 tons up
	June	√	87 tons	10 tons	27 tons
	July	√	84 "	8 tons	& 1 t. scrap & 2 t. shot
	Aug.	√	84 "		
	Sept.	√	57 tons		
	Oct.	√	"		
	Nov.	√	46 "		
	Dec.	√	48 "		
1797	Jan.		12 "		

A √ means Lancashire ore was hauled this month

Table 2. Blooms Transported

Date	Blooms	Blooms to Lydbrook	Stamp
1795	Oct (part)	11 tons	
	Nov.	59 tons	51 tons
	Dec.	32 tons	44 tons
1796	Jan.	42 tons	18 tons
	Feb.	6 tons	
	Mar.	71 tons	1 & half tons
	April	7 tons	10 tons
	May	17 tons	12 tons
	June	10 tons	4 tons
	July		2 tons
			15 & 1 tons
			18 tons
			3 tons
			14 & 1&2 ton
			27 & 2 tons

Blooms were the product of refining pig iron at a preliminary stage to bar iron. Bar iron could be produced at Lydbrook forges or in the balling furnace. Bar iron could have gone to the rolling mill or for sale.

Table 3. Lydbrook

Date	Hauled to Lydbrook			Hauled back to Redbrook	
	Blooms tons	Pig tons	Other Iron tons	Bar Iron	Other
1796	Feb.	1.5			
	Mar.	6		4 tons & half	
	April	10		7 tons & a half	3 cwt ringers for furnace
	May	12	2	10 tons 12 cwt.	
	June	4	10	2 shot iron	12 tons 3 quarters
	July	2	8		7 tons & a half
1797	Oct			Hauling iron from Lydbrook to Redbrook with 6 horses	
1798	June		20 iron		6 tons iron
	July		8 iron	4 & half tons bar	
	Aug.		2 tons 5 cwt iron		1 ton 15 cwt
	Sept.		2 iron	1 ton 15 cwt bar iron	

Table 4. Coal deliveries in tons

Date	to Ballin	to Tin Works 3d coal fire coal	to RB	Other
1796	Feb. 2 & quarter			2 & quarter to furnace
	Mar. 6 & 3 quarter			
	May 2 & quarter			4 lime coal
	June	8		4 lime coal
	July			23 & 3 quarter to New Rolling Mill
Sept	18			2 lime coal to tin wk
	Nov. 13 & half			
	Dec. 4 & half	12	11 & quarter	6 & 3 quarter fire c.
1797	Jan.	12	45	
	Feb. 24 & 3 quarter		13 & half	
	Mar. 36			40 & half
	April 9			4 & half
	May 13 & a half		2 & quarter	4 & half, Rolling M
	June 49 & a half	6		6 & quarter
	July 45	4		
	Aug. 4 & a half	2	9	
	Sept.		11 & quarter	1 load coal 'stok put'

3d coal delivered in 2 ton quantities, all other in 2.25 or 4.5 ton quantities.
RB appears to be an alternative reference to Tin works.

Table 5 Key Dates

1790	Lower Redbrook Copper Works bought
1793	Cowley and Hathaway Partnership began. Upper Redbrook site Leased from Lord Gage.
1794-6*	Upper Redbrook Blast Furnace campaigns.
1796*	Spring, Lower Redbrook New Rolling Mill building Summer - Autumn, New Engine House Built August, Lydbrook Forges no longer used.
1797*	First evidence of tinned sheet
1798	December, David Tanner bankrupt

* Date inferred from the analysis