The History of the Hunshelf Tin Mill

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With thanks to Margaret for her archive research and support

Introduction.

This is an account of our research into the Wortley (or more correctly Hunshelf) Tin Mill. This mill is unusual as being a tin mill in the north of England. It was considered to be in Wortley because the other two mills which it is associated with, Top and Low Forges were placed in Wortley, South Yorkshire, although Top Forge is really in Hunshelf parish, as the boundary has always been the river Don and both the Tin Mill and Top Forge are on the Hunshelf side. The site is also long linked to and was owned by the Wortley family of Wortley Hall (about a mile away) who at various times had leased, rented or worked it through agents. Hunshelf is famous for its Green Moor quarries, but to this should be added the Tin Mill, a unique and important addition to the parish history. As the Tin Mill had ceased production many years ago, it was disputed that it did indeed use liquid tin metal to make tin plate, as the name tin plate is also a local name for rolled black iron plate to make for example shovels, which the Tin Mill did towards the end of its life. There is much more to find out and hopefully this booklet will stimulate interest to do so…but the mill is reclaimed as being in Hunshelf.

Early Years

The remains of the mill and associated structures are situated in a lovely part of the Don, peaceful now but years ago the valley would have been filled with the noise and smoke of industry; and with the two rows of cottages for the workers, it would have been quite a thriving community. There is no 'exact date' which has been found for the start of the mill by John Cockshutt I, although 1743 looks a best guess. However, there was industry on this site previously. This mill site became owned by the Wortley family when the lower part of Hunshelf was incorporated into their estate and leased in April 1621 for 21 years for a Bloomery* to Sir Francis Fane, Sir Richard Beaumont, Francis Burdet and Edmund Cundy, all connected to other iron making sites with Fane recorded as loaning money to Sir Francis Wortley II upon a mortgage. Upon the ending of the lease in 1642 a new lease was taken up by Robert Woolorth, Henry Haughton and George Dancy. It's recorded that the site consisted of water courses and dams, bloomery hearths, water-wheel operated iron smithy, and possibly tilt hammers to forge the blooms into iron bar. If this was again a 21 year lease until 1663, it's not known who took this on, only that another 21 years later in 1684, Sidney Wortley leased it to a William Wood for £40 per annum. This lease gives an interesting description of the accompanying land – *'woodland of 71 acres from which to extract charcoal fuel, four fields of 21 acres and 2 cinder hills of 17 acres'.* This enormous acreage of cinder shows how long the bloomeries had been operating. The works were later used as a slitting mill to make rod and nail iron from the bar iron. The ending of this lease would take us to 1705. It seems that William Wood continued the lease, as there is a reference to his operation on the site by a Swedish visitor…

The Swedish Vistors (Spies?)

In 1720 a Swede called, Alstromer, wrote in his diary*: 'I travelled seven miles from Huthersfield (sic) and two miles from Penistone to see a slitting mill in a works for iron wire belonging to Mr Woods who draws wire from Welsh iron. This is better than wool cards than the Swedish and is soft when drawn…. I travelled from there about five miles to another slitting mill on the same side of the river (the Tin Mill site) and then to Wortley Forge.'*

*** A bloomery was the earliest form of furnace for making iron, producing a porous mass of iron and slag – a bloom.**

This report is the first of a number made by Swedish visitors presumably on the lookout for markets for Swedish iron and steel, but also interested in the technical details; and English industrialists did the same, with a record of a John Cockshutt visiting Germany, dressing as a musician and performing outside a factory, no doubt to tempt the workers and discover what's going on. The leases after 1705 are confusing, with numerous iron masters involved. A Matthew Wilson appeared to have the lease and then William Spencer took it over from 1739 – 1743 after Wilson's death, but was forced to surrender the forges on arbitration, including presumably the Tin Mill, to his nephew John Cockshutt I. The Spencer family/syndicate was a major player in the area for iron production and tried for many years, by fair means or foul, to dominate the industry. It seems that the Tin Mill site was then rebuilt, probably in 1743 with the dam enlarged to provide for two water wheels. It is a good site, as the weir, near to the old corn mill, is well built (still in excellent condition) and would have produced a good head of water from the 5 acre dam, due to the distance of the river's fall from the weir to the mill. Maps at that time are not particularly helpful; the Wortley Estate map of 1746 does not show the mill and the earliest one is the large scale Jeffries map of 1771. This interestingly shows the position of the Tin Mill but not the other Wortley Mills, even though it would not be on any main highway; possibly emphasising its importance. The earliest estate map showing the mill is the 1746 one, and it's just illustrated as a square block. The 1801 map of the area's fields gives details about the layout of the buildings and the names of the fields, mostly called after Cockshutt.

Jeffries Map 1771

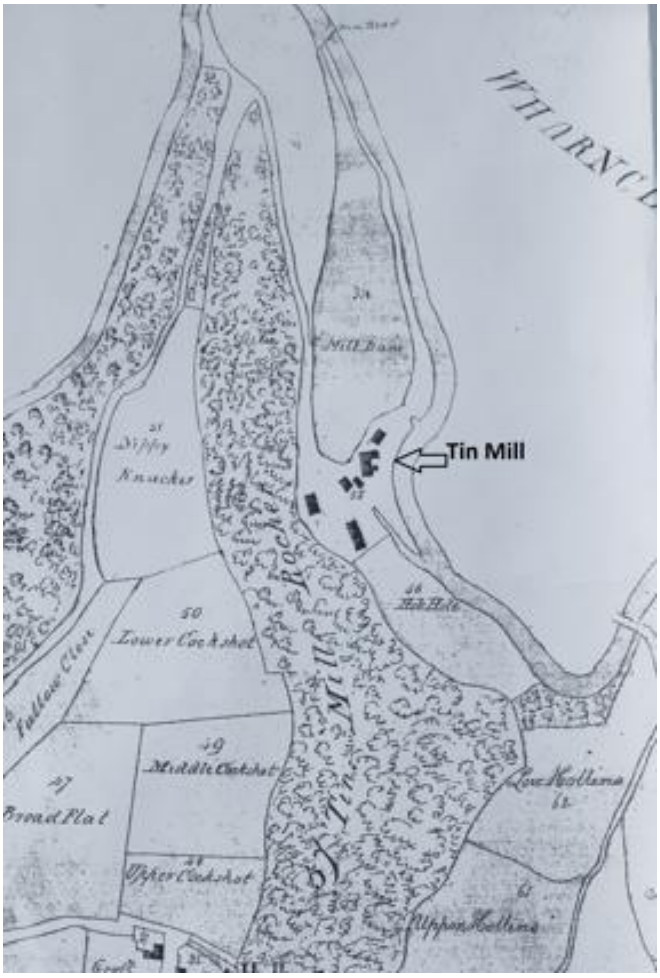
We have a report of another Swede, John Robsham, visiting the Tim Mill and then the most important description from R R Angerstein (appendix 1) who visited between 1753 -55. We don't know the exact date for his visit but he described the tinning process in great detail. Not surprisingly these Swedish visitors were not permitted to view the whole process, as their descriptions do not accord completely with that of John Cockshutt II. His account, presumed to have been written between 1765 and 1770 is undated, and was only found in the 1950s (appendix 2). It doesn't state that the process is from our Tin Mill site, but the similarities are so great that it must be so. His father, John Cockshutt I, learnt about the process of tinning onto thin iron plate from his business dealings in South Wales where the English tin plate industry was developed, using nearby Cornish tin. The process was developed in Germany a century earlier and then introduced into South Wales and the West Midlands, but until Angerstein's diary was translated it was not thought that it had progressed further north until a Tin Plate Works was erected in Rotherham in 1758 (possibly from the initiative at Hunshelf Tin Mill) and this then became Joshua Walkers in 1806. It is generally considered that the English Tinplate industry developed after a visit by Andrew Yarranton to Saxony in 1665. The doubling of the sheet (as carried out at the Tin Mill) seemed to be the critical stage in the success, retaining heat and stopping the metal cracking and breaking, the cause of previous failures. Eventually this process was transferred to Pontypool, South Wales. John Cockshutt I had reputedly travelled to South Wales, so he must have observed the process and saw the potential in the northern market place for these products. Although not as learned as his son, the first John Cockshutt was well known enough for his enterprises to be mentioned in a poem in the Gentleman's Magazine of 1743(at the beginning of this booklet) describing the local environs and industry.

On the day of Angerstein's visit the works were making tinned plates for aglets (metal tips for shoe laces) for a Manchester factory. Angerstein gives the price for a box of these, possibly impressed at the added value of tinned material over straight-forward iron. There would have been other factors which would help the introduction of this industry. Although small scale iron working was becoming commonplace throughout the small fast-running river valleys in this area, transport of goods would have been very slow. However, a transport revolution was underway making rivers navigable and developing canals. There was a program of improvements to the River Don which had been carried out in 1742 and the development of turnpike roads near to the site, making the importation of the expensive tin and the export of the finished goods much easier and presumably cheaper.

Unfortunately, we have not found any details of the origin of the tin metal used. All the records of the site were believed to have been destroyed when a barrel of old documents, including account books, were reputedly burnt. We know that a William Favel of Rotherham acted for Cockshutt in purchasing goods via London banks, but haven't to date, found any records. Maybe Favel wasn't a good choice of agent as he was arrested in 1767 for unpaid debts and conveyed to the Debtors' Prison, York, possibly dying there. Another agent for the Cockshutts appears in 1795, one Edward Bunn of London, but again no records have been found so far.

John Cockshutt (either father or son)

James Cockshutt as a boy



1801 map

The Cockshutt family

John Cockshutt I (1692-1765) had four sons, two of which are associated with the Tin Mill, John Cockshutt II (baptised 1740-1798) and James (christened 1742 -1819), and two other sons Edward (1745 – 1824) and Thomas (1748-1812) the latter going into the clergy. As far as we know, they did not take any part in the operation of the Tin Mill, although Edward, also became an iron master, renewing a lease on Mousehole Forge in 1791. It's unclear who their mother was; possibly a Jane Crow* from Essex, married in 1740. The son John worked at the Wortley Forges with his father, and presumably also at the Tin Mill. James worked with his father for about ten years from 1760; he then became the manager of Pontypool Forge, and at that time the largest finery forge** in Great Britain. In 1784 he went to Cyfarthfa Ironworks. South Wales, where as manager and partner of Richard Crawshaw he had introduced Henry Cort's method of making wrought iron from pig iron by puddling***. In 1793 he returned to the Wortley Forges; his father was long dead and maybe his brother wasn't well, as he died 5 years later. Neither John nor James married and James' estate went to a distant relative in the Bland family.

[1]*** The census records are not clear as there are a number of John Cockshutts and the mother's name is not on the sons' birth certificates.**

**** A finery forge makes wrought iron from pig iron.**

***** Puddling is a technology used to create wrought iron from pig iron. The furnace is constructed to pull hot air over the iron without the fuel coming into contact with the iron.**

It was no doubt useful for James to be working in tin plating in South Wales, presumably keeping his father and brother abreast of any technological improvements. After James return to Yorkshire, several Welshman were employed at the forges and there are a number of gravestones in Wortley Church graveyard of Welshmen with at least one stating that the deceased was a 'Tinman'. James was the most educated and innovative member of the Cockshutt family. He was a man of letters, took out a Patent and became a Fellow of the Royal Society in 1804. He was also taken under the wing of John Smeaton, a famous engineer, and later worked with him on some commissions. John Smeaton may have helped in the redesign of the Tin Mill (see' Excavations' below).

The End of Tinning

There is a reference from a bundle of papers found in Wortley Hall dated 1814 stating that *'and all that Rolling Mill heretofore used as a Tin Mill'*; so the end came some time before 1814. The use of tinned plate for making tinned food saw a large rise in demand and the process became much more mechanised as at Walkers of Rotherham. The Hunshelf tin mill was always only a small operation and presumably, although the demand for plate increased, it could not compete. The next record we have of the site is in 1824 (James had died in 1819) when Fairbanks carried out a survey of all the ironworks, including the Tin Mill for the Earl of Wharncliffe which described:

Wortley Tin Mill, now a Rolling Mill. Tenant Vincent Corbett, Esq. 2 wheels each 2 ft. 3 1/2" wide, 4 ft. head. Aperture about 7 ins lifting shuttle. Dam 4 or 5 acres. [1]

An advert then appeared in the Sheffield Mercury, 20th March 1824 – *' To be let upon lease all those three water mills on the Don in the townships of Wortley and Hunshelf now in the occupation of the executors of the late James Cockshutt, Esq' . There is a description of the Top Forge and Low Forge and then -' The TIN MILL – has a fall of 14' 10" with a reservoir of 4a. or. 9p. of land and turns 2 waterwheels for the purpose of rolling bar iron into plates for tinning, one wheel 17' 8" and the other 16' 6" diameter. The building is in good repair and contains 2 are furnaces. There are also smith's and carpenter's shops and 8 cottages for workmen. '*

The Earl of Wharncliffe then leased the Ironworks to Vincent Corbett, his agent, or maybe he instructed Vincent to manage the Ironworks until he was able to sell them. Vincent was the son of Stuart Corbett, a good friend of James and one of his trustees. In 1833 Vincent Corbett was described as being a manufacturer of scrap and charcoal iron bars, rods, hoop, sheets, share-moulds, etc. We next hear that in 1847 trade is bad and that negotiations are underway for a take-over of all the Wortley Ironworks. Corbett wrote to the Earl that ' *With the two Forges (i.e. Top and Low) I could keep all my Manchester customers and some at Sheffield, and keep the best part of my trade.'* He obviously could not find customers for the product which the Tin Mill was producing – thin iron plate. In April 1847 Newbold and Sons of Sheffield inspected the site and proposed that they take over the Tin Mill and the Corn Mill leases for £150 a year. However, they later proposed that because of the poor state, a year's rent ought to be allowed for repairs, especially to the roof of the Tin Mill. Their intention was to run a steel rolling mill, but eventually no deal was done and they withdrew. It seems that in 1847 Lord Wharncliffe was also approached by someone who represented a German firm with a view to leasing or buying the forges.

The following letter from Richard Surtees, Wharncliffe's agent to Lord Wharncliffe dated the 15th March 1847:

'My Lord, I have seen Mr Corbett this morning, he merely told me if your Lordship had a better chance of letting the Works, he would not stand in the way, but he was of the same opinion as myself. He did not like the party, but on my return home I called at the Upper Forge and there met with Mr. Corbett and the Gentleman your Lordship saw ? in London. Mr Corbett told him if he was to pay your Lordship a valuation for all the working tools, take to his scraps at a valuation, and pay your Lordship a higher rent he would give all up. He thought this was fair and would see your Lordship tomorrow, of possible. He (presumably the 'Gentleman') told me they should want to take down the Old Rolling Mill and erect a new work at the cost of £5,000 at least. He told me they should lay a line of rails from the Upper Forge to the Tin Mill, he said the works would be carried on with great spirit. If he has capital to carry on the works as he states, it is not a small one. I hope the application for the Ironworks will be substantial if they are carried on in that spirit this Gent. talks of, it will make them better here.

There was further correspondence from representatives of the 'Gentleman 'but Surtees discovers that they were not who they claimed to be and had left a sting of debts in the area. They eventually disappeared and the bid fizzled out.

In 1852 we find that Messrs Andrews, Burrows and Co. were now in charge and had made great changes to the Top and Low forges as well to the Tin Mill, whose roof was finally repaired with essential work undertaken to maintain it as a sheet rolling mill. The main building at the Tin Mill is described by Andrew's son, writing much later after the mill had shut, as: '*an oblong building and on either side of it was a water- wheel so arranged as to run in opposite directions and fitted with heavy stone segments within the rim to act as flywheels. Between the two water wheels stood the rolling mill, one wheel driving the top roll, the other the lower: there was no gearing to couple the rolls. Near the housings were platforms on which stood two men to manipulate the screws which raised and lowered the rolls, these being gradually brought nearer together as the sheet passed to and fro. The furnace for heating the blooms was, as far as I can remember, similar to those used in Sheffield Steel Works, the blooms being of special quality Charcoal Iron. In my father's day charcoal iron was still being made in some sort of Chafery* (a variety of heath used to reheat a bloom of iron) *at the Top Forge. A great deal of the iron was made into sheets suitable for the shovel trade but I recollect an old order book which showed that plates could be rolled from ½" to 3/8" thick down to quite thin gauges of sheet iron.'* The grandson of Thomas, Rev. C R Andrews provided a description of the Tin Mill in The Story of the Wortley Ironworks, 1950, as he worked there for his father.

In 1879 there appears to have been a down-turn in the iron trade and Thomas Andrews & Co. were in difficulties and wrote to the Earl of their intention to give up the tenancy and hoped that he would find another tenant. They also asked for a reduction in the rent and the Earl offered £100 less for the half year due on the 31st December 1879. It seems that the management were running the company down and withdrawing capital from the business. In 1880 the company sold the cinder hills at the Tin Mill for £69 3s 5p to the Thorncliffe Blast Furnace for iron recovery. Thomas Andrews gave a 'brief story of the Wortley Ironworks' to the Society of Engineers on October 6th1879. He talked about David Burkinshaw, a millwright, who was apprenticed as a boy to James Cockshutt at Wortley Ironworks, and worked all his life there dying aged 72 on October 30th 1868. 'Mr Andrews had often

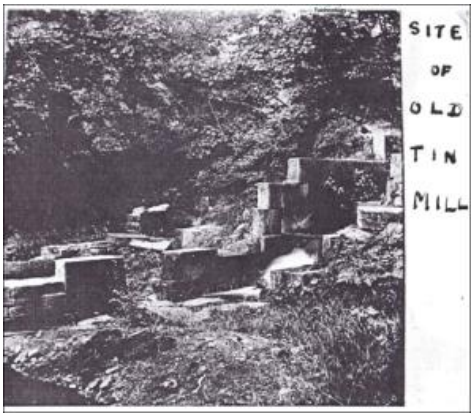
heard David Burkinshaw say that when young he had seen as many as a dozen carts from all parts of Yorkshire within as radius of 30 miles waiting for shovels to be rolled and iron to be tilted for them at the Tin Mill and forges.'

The Tin Mill was still operating as a rolling mill in 1879 but in 1883 there is a reference to the tenancy being abandoned. In 1887 the Earl was informed that his agent had received an offer of £20 for the plant at the Tin Mill 'as it stands' with the weight of iron estimated at 20 tons; the purchaser responsible for the demolition and the carriage away for £10. Andrews apparently prevaricated over want he wanted to do with the plant; he considered reusing the water wheels and rolling equipment elsewhere. However on the 5th December 1887 the Earl was informed that Andrews had bought the water wheels, but was too late to get the rolling mills, which had been blown up on the Earl's instruction. Eventually the Earl received £25 for the Tin Mill plant. It has also been reported that the Science Museum wanted to buy the rolling mills but again was too late in application. A set of stone weights (photo) from one of the water wheels, inset into the wheels to effect a flywheel, can be seen at Top Forge. One piece of equipment essential for the Tin Mill would be a roll-cutting lathe to keep the rolls in exact condition for rolling, especially for thin iron sheet. It is not known whether this machine was at Low Forge or the Tin Mill (probably the later) but is has been tracked down to a museum at Ironbridge (photo).

In 1931 the site was rented to Armitage Works Company, Deepcar for some purpose. The last record we have of industrial use is General Refractories occupying (renting?) the Tin Mill site and 'using water' in 1951; what were they doing -maybe dumping waste on to the site- the excavation did find plenty of broken bricks. The relatives of the last inhabitants of the cottages have said that there was a vehicle workshop on the site in the 1960s and 70s. They also said the Dads' Army had 'practised on the site in World War II and had blown it up' – maybe this is a distorted memory from the 1887 destruction.

Tin Mill Site Surveys

A number of site surveys have been done over the years; the Field recording Group of the Sheffield Trades Historical Society carried out one in the 1980s, but it wasn't written up, although photos of their visit survive. Students from Sheffield University carried out a 'Geophysical and Optical Survey in Archaeology' in 2003. In 2013 Wessex Archaeology was contracted by Hunshelf Parish Council to do a site survey. Essentially all these surveys identified the same surface features, mill remains, weir, water controls from dam etc., and didn't detect any other buildings or structures. Wessex's conclusion was that "there were likely to be a lot of features below the ground, but that the site had Regional Significance"**.**



Third goit in 1920 photo


Stone inserts for one of the Tin Mill wheels


Trench 1 – bases of machines and bearing support for water wheel

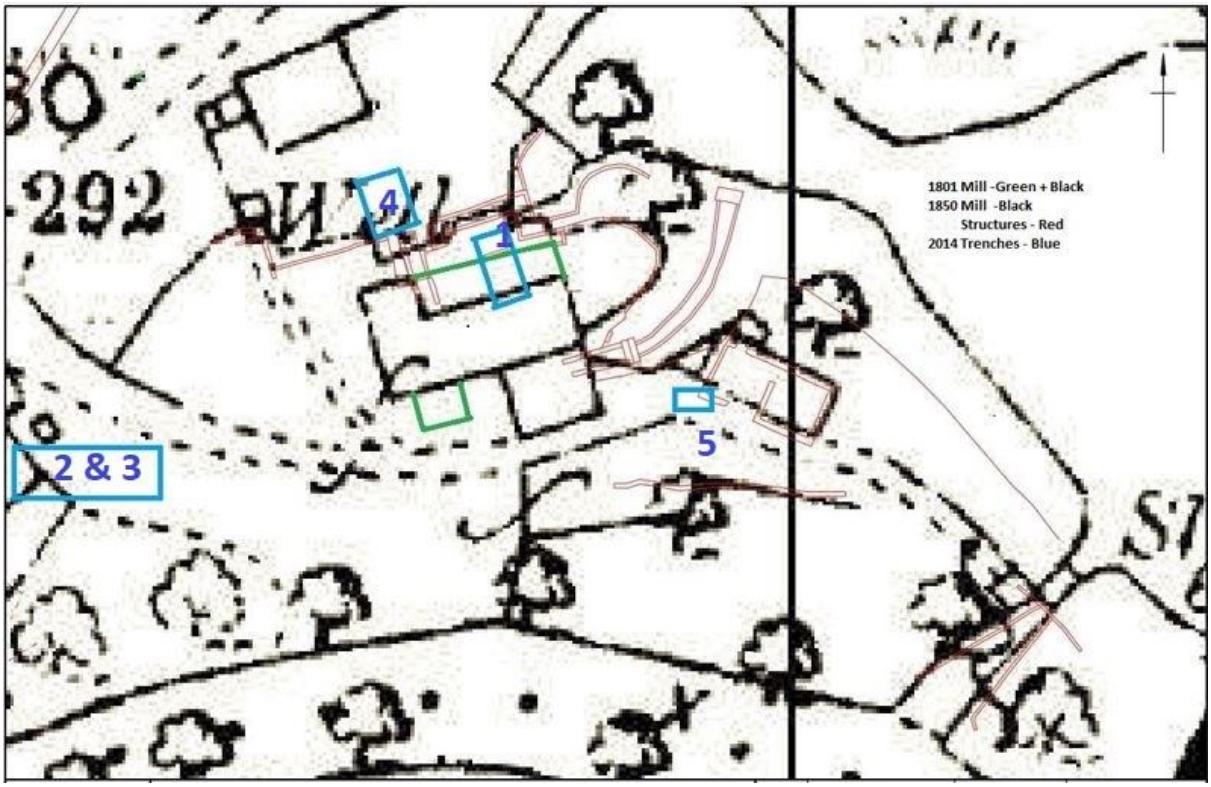

Comparison with bolt fixing positions – Tin Mill (top), Top Forge no. 2 wheel (below)

Tin Mill Excavation Survey

As the layout of the mill could not be determined due to its almost complete dereliction, ArcHeritage was contracted to carry out a Community Excavation in 2014. This took place over ten days with four trenches excavated.

Trench 1 – This excavation found that at the southern and western ends of this trench were a large number of stone slabs, some of which contained socket holes, which would be the bases of machinery, possibly the rolling mills. The most interesting find was the large stone set upright in the trench, with the upper portion neatly dressed with peck marks and having three rectangular sockets and a smooth scar on the south face. A wall was identified, aligned east-west with three courses

visible, the upper courses made of large well-dressed stones. A gap in the upper course had a north to south incised grove. A possible floor surface associated with the wall was located, with aligned wooden timbers cut into the floor surface and a likely drain. This surface was covered with metal flakes from the years of rolling. In the northern end of the trench was the wheel pit, filled with loose topsoil and rubble. The bottom of the pit couldn't be reached due to the sizes of the stones, but the wheel axle base was still in place with its iron bolts set in a trapezoidal arrangement, similar to those at Top Forge (photo). Also a possible I-beam (0.29m in length 0.19m in width, visible height of 0.25m) was found in the gap between the wheel pit wall and the axle. Analysis showed that it was iron, but not whether it's wrought or steel. Removing a fallen stone from the wheel pit revealed a crown design by John Smeaton (patented 1794) designed to increase the speed of the water onto a breast shot wheel. This device was later proven not to increase the velocity onto the wheel (i.e. making water go upwards and then falling the same distance would not increase the force on the wheel).



1893 plan of the Tin Mill, showing an earlier building and trench locations

Trenches 2 and 3- These were originally intended to be one trench, placed to investigate the assumed presence of a subterranean goit taking the water away from the wheels and the washing processes. Due to the location of a footpath within the area it was decided to open two smaller ones. In the centre of the trench 2 was a small deposit of metal flakes, identical to those from trench 1, possibly dumped as waste. While a lot of 18th to 20th century debris was found, no evidence of the goit was discovered. This was a pity, as it can be seen on maps over the years that there is definite evidence of a very wide goit leading to the river and starting in the place where trenches 2/3 were positioned. The goits from the wheels must have gone underground to meet it. It could be that the trenches were in the wrong position but all the tree roots and buried large stones made extending these impossible in the time allowed.

Trench 4 - This was located to the south of the exposed wheel pit and believed to be the above ground remains of a later wheel pit. Substantial above-ground remains were visible and much of the work involved cleaning and exposing further structures. Most of the remains comprised a well-built stone culvert (photo), indeed the best preserved structure found. To the west of this structure and above it were the remains of walls and floors, but no sense of what structure they might have been could be determined. At the bottom of the possible water-wheel structure there were modern stonework and some cement, showing later reuse.

Trench 5 – This was located over an area of high response from a metal detector and located in a corner of a former two-room structure identified from site surveys. A large piece of sheet metal (0.37m x 0.37m x 0.004m) was recovered. Also, a roughly aligned brick wall was found and underneath was a small brick-lined drain, obviously a more recent modification.

Tin in Soil

It had been hoped that the excavation would find some evidence of tinning metal, but no artefacts were found which would be evidence of tinning. This is probably not surprising, as the sheet iron rolled would be very thin and any tinned portions left would have rusted away. There were a lot of flakes from the rolling, rusted on one side and shiny on the other, due to rolling changing them into two different iron oxides, one-the appearance of rust and the second, of magnetite (shiny). After the excavation, soil samples were taken for tin analyses, and happily these showed high concentrations of tin (table below) along with high concentrations of other common metals/elements common on industrial sites. In this part of the country you would only expect concentrations of tin in soil of less than 1 ppm. The results below could, of course, have come from dumping waste onto the site, but are much more likely to have come from 50 or more years of using tin metal on the site. The location with the very high concentration could have come from the building where tinning took place.

Sample Location	Tin ppm (range)	Iron %	Manganese ppm	Lead ppm	Arsenic ppm	Copper ppm
Trench 1	**454 -577**	10%	1192	381	63	320
Near Trench 5	**1131 -1436**	20%	1487	391	72	643
In Trench 5	**233 - 296**	60%	6070	677	118	1419

Observations of the Mill's layout

It is fairly clear where the location and orientation of the Tin Mill's water wheels and the rolling mill would have been from the excavation in trench 1. Unfortunately, the layout of the other parts of the mill is unknown. There were walls detected in many places in trenches, 1, 4 and 5, but no associated artefacts which might hint at their purpose. It is probable that trenches 2 and 3 were not deep enough to discover the tail goit. The great mystery is what the goit/water course (trench 4 area) was for. Many have assumed that it supplied a third wheel, but the surveys and adverts of the years from the 1800's onwards make no mention of this, which would surely have added to the mill's value. Once the tinning process stopped and the site became a rolling mill, then two wheels would have been adequate for this and to power any ancillary equipment such as shears etc.. The water course/goit is extremely well made with ashlar blocks and it could be postulated that this was the site of the original wheel, when it was used for slitting and as a tilt hammer. Currently at the site, at

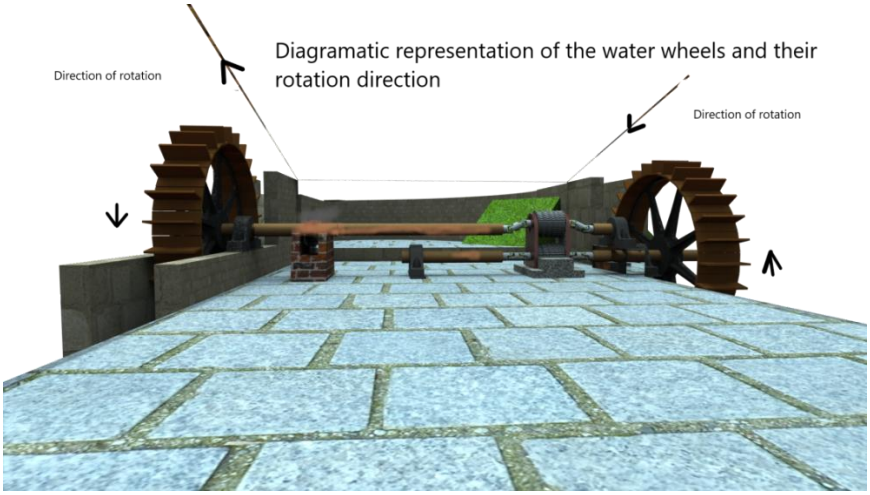
all times of the year, the water drains straight from the outlet of this goit directly to the river. It doesn't drain into the wide tail goit, which would go into the river further down, a greater fall. The tail goits from the 'new' wheels were deeper that the original wheel pit as the wheels were so large in circumference and would have needed a much deeper drainage system.

It is clear from the descriptions of the wheels over the years that '*on either side of it was a water-wheel so arranged as to run in opposite directions and fitted with heavy stone segments within the rim to act as flywheels* '– no gearing was in place to reverse the direction. As the fall of water, 14 feet 10 inches, was excellent for the Don in this location, it must be that one wheel was overshot or high breast-shot and one was pitch back. The original location of the former wheel would not have been suitable, so a different arrangement was needed when John Cockshutt redesigned the site for rolling. The arrangement would also explain why one wheel was larger, as both were the same width and as the water would need to fall through the same distance to generate the same power (see diagram below). This was particularly important as the rolls would need to go around at exactly the same speed otherwise rolling thin metal would not have been possible. The remaining stonework on the site, supporting the goit and penstock for wheel 1 and the curved goit for wheel 2 are substantial structures, with excellent stonework, whereas there is no evidence for substantial stonework for the 'wheel 3', which would have to have been built much later. There was a need for large volumes of water for washing the rolled pieces, so maybe this goit proved useful for that purpose.

With regards to the cottages on the site, these were never supplied with water or electricity (or gas) even though they were occupied into the 1970s. Relatives of occupants of the cottages in the 1960s have stated that a generator was set up on 'wheel 3' watercourse by Mr Roebuck and this suppled DC electricity to a vehicle workshop (near Trench 5) and was then converted to AC electricity for the cottages, hence the evidence of cement, stainless steel and re-use on the base. The job for his son was to keep the generator going, but at some point he got his hand trapped in this construction and unfortunately lost his thumb, still visible today!

Tin Mill Cottages

We know quite a bit about the Cockshutts, but of course less about the workers in the mill. There were 6 or 8 cottages for the workers at the site, a lower terrace of 5/6 dwellings and an upper site of 2 dwellings. These upper cottages were converted into a pig sty for the occupants of the lower cottages in the 1950s. The lower terrace was occupied until the 1970s when presumably they were becoming derelict and the Wharncliffe Estate demolished them. They must have been in a poor state then, no services and only partially occupied. There are stories from local people when they were adolescents, claiming that an old lady living there was a witch and that they shouted and threw stones at her when she was collecting firewood. The last occupants were apparently evicted and the buildings demolished with some of the lintels being re-used in the repair of the blacksmith's shop at Top Forge. The only other evidence was a fallen stone post (photo) which until recently could be seen and is almost certainly the one in the photo at the corner of the cottages. The earliest record we have of people living in these cottages is 1841 and these continue until 1921, although from 1891 the people living there wouldn't have been working at the Tin Mill, so for the sake of brevity these census returns are not reproduced below. We do have a record from the 1939 census and from electoral rolls from 1960, when some of the names are still recognisable to local people. In the earlier censuses many of the job descriptions are obviously from occupations at the



Water wheels driving a set of rolls


Author entering third goit


Inside third goit


Roll cutting lathe from Wortley Forges


Bottom cottages (date unknown) Reproduced with permission of Sheffield Archives


Ronnie Brelstaff (with carer)


Stone post (seen at corner of houses above)

Tin Mill and the other forges. One family, Leech, lived in the cottages for quite a number of years. With regards to the more recent occupants, we do know quite a bit about Ronald (Ronnie) Brelstaff (photo) as he turned up, quite by chance during the excavation to see where he had previously lived with his Aunt Senior, his parents both having died. He left the Tin Mill cottages at the age of 17 in 1956, to go into the Navy, but is still recorded in 1960, maybe home on leave? The cottage numbers are only given in the 1960 roll, not in the other records and we see that there are only 3 left occupied, the top two cottages having been demolished and one of the bottom row unoccupied. It is difficult to date the demolition of the bottom row, but it was sometime in the 1970s.

1841

The census image is very faint - information taken from the transcript.
Described as living at Tenn Mill

Joseph Lee	45	Sheet iron roller	b Yorkshire
Matilda	40		"
Ann	15		"
Charles	13		"
John	11		"
Harriott	8		"
Joseph	1		"
Thomas Highton	20	Nailmaker	b Yorks
Mary	20		b Ireland
John Woodhouse	65	Carpenter	b Yorks
Hannah	65		"
Harriott	30		"
Joseph Parker	20		b Yorks
Hannah	20		"
Ann	4		"
George Leech	65	Gamekeeper	b Yorks
John	30		"
Jonathan	25		"
Joseph	24		"
Mary	24		"
Abraham	20		"
Lydia	12		"

1851

(In order of appearance on census form)

Thomas Parkin	36	Steel Roller	b Rawmarsh
Harriot	37		b Sheffield
John	16	Steel Roller	b Sheffield
Ann	14	At home	b Sheffield
Harriot	12		b Sheffield
Ann	70	Widow	b Leeds
Sylvester	34	Steel Roller (brother)	b Rawmarsh

William Marshall	20	Steel Roller (lodger)	b Sheffield
James Mycock	29	Steel Furnishman	b Darnel
Elizabeth	24		b Sheffield
Edward	5		b Sheffield
Harriot	10mths		b Sheffield
Daniel Nithsdale	36	Stone Cutter	b Kirkaybeck, Scotland
Mary Ann	31		b Maryport
Daniel	10	Scholar	b Maryport
Henry	6	Scholar	b Maryport
Sarah Ann	1		b Penistone
Charles Nithsdale	34	Stone Cutter	b Krikaybeck, Scotland
Ann	34		b Maryport
Charlotte	5		b Maryport
Sarah Ann	2		b Hull
Daniel	1mth		b Penistone
Hannah Woodhouse	76	Quilter	b Bradfield
Elizabeth Marsden	78	(Visitor)	b Sheffield
George Rowley	28	Farm Labourer	?
John Leech	45	Blacksmith	b Hunshelf
Abraham Leech	28	Quarry Labourer (brother)	b Hunshelf
Benjamin Rooley	34	Agricultural Labourer	b Adwick-le-Street
Mary	37		b Adwick-le-Street
Cristopher	13		b Doncaster
Annis	10		b Adwick-le-Street
Mary Ann	8		?
Susan	5		b Thorp Hesley
George	3		b Wortley

1861

In order of appearance on census form

Thomas Williams	25	Puddler	b Staffordshire
Ann	28		b Staffordshire
Elizabeth	5		b Staffordshire
Mary Ann	3		b Hunshelf
Sarah Jane	2		b Hunslet nr Leeds
Aron Selby	59	Sheet Parer	b Attercliff
Ann Selby	49		b Attercliff
James Leech	43	Cordwainer (Lodger)	b Hunshelf
Edward Morgan	23	Miller Journeyman (Lodger)	B Shropshire, Sheriffhales
Joseph Hague	23	Labourer (Boarder)	Denbighshire, Betty(?)
Thomas Young	34	Furnaceman	b Brightside
Georgina	31		bHoyle St, Sheffield

William H	10		b Mill St, Sheffield
Elenor	6		b Dickson St, Sheffield
Charlotte	4		b Dickson St, Sheffield
Anne	1		b Dickson St, Sheffield
Abraham Leech	40	Furnish Heater	b Hunshelf
Ann Leech	33		b Hunshelf
John Sheilds	32	Iron & Steel Roller	b Barnsley
Sarah	28	Book Binder	b Sheffield
Eliza	9	Scholar	b Sheffield
John	7		b Sheffield
Mary	3		b Sheffield
Sarah	1		b Sheffield
Joseph Cryer	35	Labourer	b Sheffield
Harriott	30		b Denbighshire, Betty(?)
Ellinor	2		b Oxspring

1871

No separate numbers but in order of appearance on census form

David Rowley	37	Iron Roller	b Bilston, Staffs
Hannah	35		b Wednesbury
Jane	9		b Wednesbury
John	8		b Wednesbury
Elizabeth	1		b Wednesbury
Joseph Winter	38	Forgeman	b Hoyland
Maria	37		b Hoyland
Rebecca	13		b Masboro
John	11		b Masboro
George	9		b Hoyland
William	6		b Hunshelf
May J	4		b Hunshelf
Henry	2		b Hunshelf
Josh	1mth		b Hunshelf
Edwin Cartwright	26	Die Sinker	b Birmingham
Ann	27		b not listed
Edwin H	4mth		b Hunshelf
Joseph Clark	39	Forge Labourer	b Newark, Notts
Betsey	39		b Newark
Edward	14		b Newark
Arthur	9		b Newark
Isaac	7		b Rotherham
Mary E	3		b Mexboro
James Elson	51	Sheet Iron Roller	b Gainsbrough, Lincs
Harriet	55		b Sheffield
James	16	Labourer in Ironworks	b Wadsley

William H	12		b Hunshelf
Harriet Sykes	11	Granddaughter	b Hunshelf
John W "	9	Grandson	b Hunshelf
James "	7	Grandson	b Hunshelf
Fanny	5	Granddaughter	b Hunshelf
Albert	3	Grandson	b Hunshelf
Abraham Leech	36	Iron Heater	b Hunshelf
Ann	39		b Hunshelf
Joseph Jukes	52	Bricklayer	b Gornal, Staffs
Elizabeth	49		b Sedgley, Staffs
Herbert Barton	22	Puddler (Son-in-law)	b West Bromwich
Elizabeth Barton	21	Daughter-in-law	b West Bromwich
Edwin Jukes	11		b Bilston

1881

No separate numbers but in order of appearance on census form

Abraham Leech	50	Labourer in Ironworks	b Penistone
Ann	46		b Penistone
Joseph Button	42	Labourer in Ironworks (Boarder)	b Tipton, Staffs

3 properties uninhabited

Benjamin Eyre	52	Labourer in Gannister Works	b Wadsworth
Ann	52		b Doncaster
George	26	Labourer in Ironworks	b Sheffield
Thomas	17	Labourer in Ironworks	b Deepcar
David Downing	45	General Labourer	b Sheffield
Sarah	36		b Norton
Sarah Ann	13		b Sheffield
David	6		b Sheffield
George	4		b Deepcar
Mary A	1		b Deepcar
William Martin	31	Stone Mason	b Yaxley, Hintingdon
Esther	37		b Sheffield
Edward G	9		b Sheffield

1939 Census

Roebuck Wilfred	45	Rollers Helper, Wire Rod Mill	
Roebuck Doris	37	Housewife	
Roebuck George	17	Coal Miner	
Roebuck Alfred	15	Coal Miner	
Roebuck Jean	4		
Roebuck Byran	3		

Laycock Alice	32	Unpaid domestic duties	
Laycock Tom	85	Boiler firer (retired)	
Laycock Frank	36	General labourer	
Senior Arnold	48	Ganister miner (Heavy worker)	
Senior Ethel	44	Household duties	
Senior Lawrence	20	Small poultry farmer	
Senior Arnold	15	Labourer Brickworks	
Senior Ethel	13	At school	

1960 Electoral Register, Hunshelf

Ronald Brelstaff	20	1 Tin Mill
Arnold Senior		1 Tin Mill
Ethel Senior		1 Tin Mill
Lawrence Senior		1 Tin Mill
Henry J Moore		2 Tin Mill
Alice M Moore		2 Tin Mill
Lucy Crosland		3 Tin Mill

1960 – 1970 Local people remember that 4 cottages were still occupied

Crossland
Roebuck
Roebuck
Senior

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Appendix 1

Angerstein's Observation on Iron-sheet rolling and tinning at Wortley 1753-55

The tinplate works is located 1 mile from the forges and 2 miles from the wire mill. It consisted of a rolling mill with its reheating furnaces, a workshop for annealing and removal of scale, a workshop for pickling and scouring and another one with three pots for tinning, polishing and removal of the thick tin on the lower edge. In the rolling mill there are two separate stands of rolls and their reheating furnaces. The first stand rolled sheets for tinning and was provided with rolls 12 inches long and 11 inches in diameter and was otherwise designed in the same way as the mills at Pontypool from where the art of making tinplate was stolen…

Double sheets rolled here are 16 1/2 inches long and 12 1/2 inches wide, English measurement, and 100 sheets go into each box. Single sheets are 13 1/2 inches long and 10 1/2 inches wide, and packed 225 to a box. Each of these sheets is rolled from one piece of iron, 4 inches wide, 10 1/2 inches long and ½ inch thick or 16 of the thinnest, that are used in Manchester for making tags for shoe laces. Although they are paper thin these sheets these sheets are sold at the same price as the double sheets and a box holds 100.

The second stand of rolls is designed to roll larger, black sheets, and the rolls are 30 inches long and have a diameter of 12 inches, with other parts of the stand in proportion. The furnace for this stand of rolls was larger inside than the one previously mentioned and was fired with pit-coal that was thrown into it. The largest sheets that could be rolled were 28 inches wide and 5 feet to 10 feet long. The sheet-bars, which were forged quite wide and thick, were first rolled broadside-on to 28 inches in length, then rolled lengthwise in further heats. When the sheet reached 5 feet in length it had to be doubled because the furnace did not hold greater lengths and because of the difficulty of handling long sheets and their rapid cooling when thin and single.

Besides these stands of rolls, there were two additional ones used for the turning of rolls and for flattening the sheets, by cold rolling after annealing and removal of scale by rubbing. At the roll-turning machine it was observed that a long but defective roll was made into a shorter (but sound) one by turning a new neck where a blow hole had been found in the surface. In order to facilitate the turning of the necks, the posts of roll-turnings were longer than usual.

A new method had been invented here to remove the cinder that forms on the surface during rolling and annealing. This consisted of removing the sheets from the furnace with tongs as soon as they had become red-hot and throwing them into a water-trough hewn out of sandstone, plentiful in this district. In the trough there was a grid of iron that could be raised with a winch, thus removing all the sheets from the hot water in one operation. In spite of this invention the sheets had to be scrutinised very carefully in order to ensure that all scale or cinder was removed that might prevent the functioning of the pickling process and consequently of the tinning itself. When this has been carried out properly the plates are rolled flat in the mill already mentioned and are subsequently taken to the pickling room, which is built above the furnaces, in order to heat the pickle made up of wheat-bran and water and give it acidity. Then follows the scouring after which the plates are submerged in water to prevent rusting, whilst they are waiting to be placed in the tin pot. When I asked if the water in which the plates were protected from corrosion had been mixed with some other substance,

the answer was no. Just the same, it appears probable that some lime had been added as this material is known to be corrosive.

During tinning, tallow, whale-oil and resin are used, mixed together. The pates are first boiled in one cell and then dipped consecutively into a second and a third pot, which gives the tin more lustre. Afterwards the plates are scored with wheat-bran and the tin on the lower edges melted off in a trough. The single pates, whether thick or thin, are packed 225 to a box, that sells for 53s. 6d, of double 100 are packed in a box selling at the same price.

Appendix 2 – Mr Cockshutt's Description Of The Process Of Making Tinplates presumed written between 1765 to 1770

THE PROCESS OF MAKING TINPLATES

By Mr. Cockshutt, Iron-master, Huthwaite, Yorkshire

The iron being forged into Bars of different breadths and thickness as the Tin is intended to be of the thinner or stronger kind known by the Names of Common and Cross is cut into proper lengths, by a pair of shears when cold, viz. 11 inches which allows a little to be afterwards cut off to take out any cracks or raggedness which is always occasioned on the edges of the plates by rolling. (Beside common and cross, there are other kinds of Tin, which differ in the size of the sheets as double Tin, which is both stronger and larger, 'tagging tin' and 'double cross' [tin] which only vary in thickness but is of the same dimensions [sheet width and length] as common and cross).

A number of the pieces being thus cut into lengths, about 30 of them are thrown into a strong reverberatory furnace; when they are so hot that the scale rises strongly upon them the Rolling Engine (rolling stand) is set to work, and they (the iron bars) are taken out from the furnace one by one, and passed breadthwise through the rollers until they (the bars) are so cold that the rollers make no perceptible impression (which is not until they are so stretched out as to be considerably longer than they are broad).

They (the rolled bars of iron) are then again placed in the same furnace, but, as they now become not so thick as a half-Crown (a British coin of the Realm) *only a few are placed in the furnace at a time, and as one is taken out to be carried to the rolls, a cold one is put in its place. They (the plates) are now passed only twice through the rolls and while they continue (to be) hot are doubled (over) in the middle, and are beat close together with a smith's hammer. When they (the plates) have all gone through this process they are reconveyed to the furnace. A few (are) put in at first (to heat up) and as one is taken out hot to be passed through the rolls, a cold one is put in its place. They (the workers) are careful not to heat the iron so hot that any scale shall rise upon it which could cause the sides (faces) which were inward (the facing surfaces) to have a very rough, uneven, surface and (which) very often cause them to stick so fast together (so) as not to be separated without such violence as would tear the iron to pieces.*

The iron (plate), with this caution, being a third time taken to the Rollers is several times passed through until it has so far lost its heat as not to be perceptively red, it is then taken in a pair of forceps and a narrow shred is, with a pair of shears, cut off from that end which, before it was doubled was the middle of the plate.

They (the two resultant plates) are now doubled again so that there are 4 sheets together and they are, a fourth time, put into the furnace and treated there in the same manner as the preceeding time. If the plates were designed for Double Tin, they are this time rolled to the proper length of the plate and the rolling part is finished. But if the plates are designed for Common and Cross Tin, they are passed through the rolls so long as any heat can be distinguished by the eye, and are taken a second time taken to the

shears to have the inequality taken off at the open end of the plate and a narrow shred (sliced) from the other (end) that they might be opened and separated. After which they are evenly laid out one upon another and again doubled and beat together, so the piece now consists of 8 sheets which are carried a fifth time to the furnace and there treated in the same manner as the two preceeding times, only, as the plates grow thinner, they (the workers) make them still less hot in the furnace, and when they are brought this time to the rolls they are but a warm red. A greater degree of heat would cause many of them to adhere so strongly together as not to be separated without tearing the iron which notwithstanding the greatest care will sometimes be the case.

Being now the fifth time brought to the rolls, they are passed through until they are of the proper length which is about 14 or 15 inches to leave a little to be afterwards taken off to reduce the plates to an exact form and size without any raggedness or inequality to the edges.

If the plates were designed for Common and Cross they are now finished at the rolling mill (completing their processing at the mill), but if (they are) for Taggers (shoe lace tag making) the two ends are cut off, the plates are separated and again laid carefully and evenly together, doubled and carried to the furnace a sixth time. The piece now containing sixteen sheets which are heated so as to be scarcely red hot, and passed through the rolls until they are 14 or 15 inches long when (by which time) they are (finally)finished at the rolling mill.

The workmen then stop the wheels which turn the rolls until the (new) pieces of iron which are cut into proper lengths and thrown into the furnace are become hot enough to begin again to roll.

The plates, being thus finished at the rolling mill, are taken to be cut to the proper size. They are first separated, 4 and 4 together, and then a plate of strong (thicker) iron of the proper form (a template) is laid upon them and a line marked by the sides of it, and these lines being afterwards followed with a pair of shears. The plates are all reduced to an equal size by 4 at a time.

The plates made at different works vary a little in size and weights but the following may be about the medium:
Common, Cross, Taggers, and Double Cross are about 10 inches to 10 1/2 inches broad and from 13 to 13 1/2 inches long.
Double Tin (are) 12 or 12 1/2 inches broad and 16 inches long.
When they are finished (tinned) they are put up in boxes: 225 (sheets) in each box of Common, Cross, and Double Cross. 450 (sheets) of Taggers, and 100 sheets of Double Tin.

The box of	*Double Tin weighs*	*1 cwt.*	*0 quarters*	*0 lbs.*
	Taggers weighs	*1 cwt*	*0 quarters*	*0 lbs*
	Common weighs	*1 cwt*	*0 quarters*	*0 lbs*
	Cross weighs	*1 cwt*	*1 quarters*	*0 lbs*
	Double Cross weighs	*1 cwt*	*2 quarters*	*0 lbs*

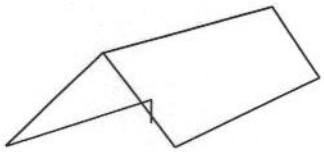
Taggers, Common Tin, and Double Tin are usually made of the same sized bar, cut by the shears about 1/2 an inch longer than the breadth of the plates when cut.

Cross Iron is thicker and broader but cut to the same length.

Double cross is sometimes made of still stronger Iron but generally of Iron slenderer than the Common which is only rolled into 4 sheets.

After the iron is cut into the size and form it is to bear, the next operation is to clean it and make it fit to imbibe the block tin.

A number of the plates are taken and soaked for several hours in a strong solution of Sal Ammoniac, and when taken out are bent in this form, endwise:



so as to support themselves on their edges.

They are placed side by side on the ground, 4 or 5 in a row. A reverberatory furnace, large enough within to hold 5 or six plates in length and as many in breadth, is made aglowing red, and an iron rod (is) put under the row of the plates (a workman) raises them up and they hang on the rod, and with that the workman sets them within the furnace in the same form (that) he took them up from the ground. Then, withdrawing the rod, he puts it under another row of the plates on the ground and places that in the same order in the furnace by the side of the other row, which he repeats until the furnace be full. He then shuts the door of the furnace and applies himself to bending more plates, and setting them in rows on the ground. By the time he has placed sufficient to fill the furnace a second time, those which have been already placed there are in readiness to be taken out - which is when a scale has risen all over the plate. They are then taken out in the same order they were put in and placed carefully on the ground and the workman continues repeating the operation.

The place where this work is performed is carefully guarded from any current of air, which, by being directed against the plates when taken hot out from the furnace, would occasion the greatest part of the scale to fly off, and by that means destroy in a great measure the intention of this operation. For if the scale be, by any means, taken from the surface of the plate while hot, another immediately rises upon it, not like the former, which is of a reddish hue and adheres but in a very loose manner to the plate, whereas the second scale is black, and sticks so close to the iron as not without the greatest difficulty to be got from it. The same effect will be produced by the plate being made too hot in the furnace. And whenever this happens they (the plates) are redipped in the solution the workmen call 'Pickle' (Sal Ammoniac or Sulphuric Acid), and submitted to the fire (in the furnace) a second time.

The use of the (pickling) solution is to make a light scale arise from the iron that may easily be separated from it when cold. Which, I apprehend, it does by this (the following) means.

The iron, by lying in this solution, I imagine, is in part dissolved, and the fire evaporating the salt leaves the iron, which was penetrated by it (the salt), in the form of Colethar or Crocus Martis (up)on the surface of the plate.

When a number of the plates have been thus sealed in the furnace, and are grown cold, 20 or 30 of them are taken in a pair of short forceps and beat forcibly on an iron

plate. First one side, and then the other. And when one end of the plates is well beaten, the other which was before held by the forceps is beaten in the same manner. The workman then examines them, and those which are quite free from scale are laid, by themselves, as finished.

Those which have a little scale upon them are laid in another heap to be afterwards bent to and fro by the hand, and the heating repeated, which, except the scale be of that kind which rises after the first has fallen off, never fails effectually to discharge all the scale which remained after the first beating.

Those plates which, by having too much fire had a second scale raised upon them, or those which, by not having been sufficiently heated, the scale has not been raised at all, are both put again into the (pickle) solution and the whole operation repeated upon them.

The plates, when properly finished, are of a silver whiteness variegated with fine blue marks bearing a great resemblance to a map of islands finely shaded with blue edgings.

At night, when the work at this place is finished, the plates are again carried to a rolling engine, the rolls which are more exactly turned and have a finer surface than those which are used to roll the iron when hot. The plates are passed cold through these rolls one by one, which is done to smooth the surfaces and to take out the crimps and wrinkles caused by bending them to and fro in the former (descaling) operation.

From these rolls, they (the plates) are taken into what is called the Leesing Room.

The Leesing Room is furnished with a number of square wooden or stone vessels, 4 or 5 inches deeper than the broadest tin plates, viz. 16 or 18 inches. The other dimensions are immaterial, but they are generally so long as to contain a little more than two plates lengthwise.

Into these vessels the plates are set upon their edges, and overflowed with an acid liquor made of bran and water. The bran is put into a vessel to the quantity of 2 bushels, and 90 or 100 gallons of water poured upon it when warm which ferments, and in a little time becomes acid. Vessels which have been long used for this purpose are the best, and in such, a week is sufficient (time) to bring the liquor to a due degree of acidity. The plates are usually suffered to soak all night, the acid preys on the surface of the iron and dissolves any scale and other impurities which stick to it. When they (the plates) are taken out of this liquor they are put into vessels holding only water, and from thence (they are) taken out one by one and scoured on both side with sand or any sharp matter, and thrown again into a vessel of water where they sometimes are suffered to be several days, but, more frequently, they only remain until night when they are again immersed in the aforementioned acid liquor. This time they only use liquor which has never had any plates in it before. They stay here until morning, when they are taken out and if they appear not sufficiently cleaned are put in again. But if they appear to be leesed enough, they are taken and placed in a vessel of warm water and from thence taken out and scoured as before, one by one, on both sides and thrown into another vessel of hot water from whence they are carried, by 60 or 100 at a time, into the Tin House.

On the well performance of the work in the annealing and scouring rooms depends the tinning of the plates.

For if the scale is not sufficiently taken off by the annealers, the men in the Leesing Room cannot do their office as they ought. And if the scourers, by not attending,

as they should, to the management of the Lees - so as to make them of proper strength, or if they let the plates continue in them too long - or not long enough - all which things nothing but experience can teach - the plates will not tin but in a very imperfect manner notwithstanding all the art of the tinner. But if the preceeding work be well done, and the plates are carried into the Tin House clean and in good condition, the operation of tinning cannot fail of being well performed without the grossest ignorance, or the willful mismanagement of the workman.

The Tin House is furnished with several tinning and washing pots, according to the largeness of the work. The tin pot is about 20 inches long, 6 or 7 inches wide, and 16 or 18 inches deep, within. The sides of it are about 2 inches thick, and the bottom from 4 to 6 inches (thick). It is made of cast iron with flanges on the top 6 or 8 inches broad, and may rise in perpendicular height 3 or 4 inches above the surface of the pot which contains the metal. The washing pot differs in nothing from the tin pot but in width, which does not exceed 3 inches.

There are many other kinds of pot for different uses. Such as to melt the blocks (of tin) in; some to draw the tin down after the plates are washed; others to melt the list; of which, though they differ in some little particulars, an idea just enough may be formed of them from the description of those above. The pots are supported by brickwork under the flanges, and them walls make the side of the fire in which the pot hangs in such a manner as the flames and heat can quite surround it. The grate to support the fire is placed about 8 inches below the bottom of the pot. The door, in at which the fuel is thrown, is placed at one end of the pot, and the flue which causes the draught at the other.

A fire being made under the pot, it is filled with that kind of block tin known by the name 'Grain or Blowing House' tin, which is preferred on account of its being more of a silver colour and flowing more freely upon the iron. When the tin is well melted a quantity of tallow and rosin (resin), or train oil (sic) and rosin, is thrown upon it, which, when the tin is of a proper heat for penetrating the iron, bubbles much upon the metal and is not far from being hot enough to break out into a flame when the dross is well skimmed off the tin under the grease, which is thrown into a pot on purpose to hold it.

Sixty or a hundred plates are brought in wet from the hot water in the scouring room, and taken in a pair of long-handled iron forceps, the holding end (handles) of which is so bent that the reins lie horizontal when the tinplates are immersed which are held in the bits. The plates being brought to the side of the tinpot which is then covered with a large quantity of the compound of resin and oil to the thickness of 2 or 3 inches above the fluid metal (level), the water being then pressed out as much as possible, the plates are, by degrees, immersed in the melted tin and are there held until the bubbling caused by the water be entirely ceased. Then, by means of tongues, they are raised from the bottom of the pot and suddenly thrust down and moved about and turned in that manner for a considerable time. They then lay aside the large forceps and make use of a pair of small ones in the same shape by which they separate one sheet from another, taking them one sheet out alone, with a 'brush', made of refuse of flux called 'Hards', dipped in the hot grease they brush over each side of the plate while the metal is melting hot upon it, which serves to make the tin lie more even on the plate and to remove any small specks of burnt oil or dirt which might prevent the tin taking to the iron. After this it is again immersed in the metal, held there a little while, and drawn suddenly from it to

avoid any dross which might stick to it. It (the individual plate) is then put into an iron supporter with small, perpendicular, bars in it to prevent the tin plates from sticking to one another.

They continue doing so until all the plates are taken out of the pot which is then ready for another parcel, to continue the same process.

From this (tin) pot the plates are taken to a washing pot. When it is taken away from the tin pot the tin lies very unevenly on the surface of the plate and is, besides, covered with the composition of oil and resin, which by being burnt on the pot becomes a very glutinous substance and adheres strongly to anything that it touches. After it becomes too thick to use on the pot it is called 'Black Joak' (Black Jack) and carried to the rolling engine to lay upon the axis (bearings) of the hot rolls for which, perhaps, no substance can be better adapted for it becomes of the consistense of oil with a heat which renders oil useless for the purpose of preventing friction of the rolls against the brasses (bearings) they run in.

The washing pot (in the Tin House) is filled with the same kind of metal as the Tin Pot, only it is not heated by far so hot, and has only tallow or fine oil on the surface. By the side of this pot stands another of the same form full of oil or melted tallow made hot enough to keep tin in a melting state. These two (pots) being in readiness, and all dross well skimmed from the top of the washing pot, a single plate as it comes from the tin pot is immersed in the metal and held there until the tin melts on the surface of it. It is then taken out and brushed on both sides in the manner described in the tinning, and immediately dipped in the pot again and drawn suddenly out, (to be) immediately placed in the hot oil. At the bottom of which pot (the hot oil vessel) is placed an iron supporter to prevent the plate going too low into the tin which will lie melted at the bottom, which, as it keeps increasing by the tin draining off the sides of the plates which are placed in it, it is now and then taken out by a ladle. When the plate has stood a little time in the hot oil it is taken out. While the operator at the washing pot is preparing another plate to succeed that (one) taken out of the oil (which) stands in an iron grate supporter (a grid or grating) in the open air until it becomes so cool as to bear rubbing without disturbing the tin, and (it is) then thrown into a tub full of bran - the rubbing it with which takes away all the oil and leaves the plate of a shining whiteness, which, if every part of the operation has been well performed, is very smooth and of an even polished surface and not far from the colour of silver only with a blueness which silver has not.

The edge of the plate which lay downward in the melted oil still continues to have a bead (ridge) of tin all along it, which is taken off by dipping it about 1/4 of an inch into melted tin without oil on the surface, and with a guard but on finger and thumb of the person employed, it is, while melting hot, wiped off.

The plate is then finished for sale. They are then counted and put into boxes , and marked with such marks as the proprietors know to distinguish one kind from another without opening the boxes which are closely and firmly nailed down, that they may bear carriage from the Works to the markets they are designed for.

Some slight editing of the text has been carried out in order to clarify it.

Besides tin plate, the Tin Mill also, as explained above, produced larger sheets of black sheet iron suitable for the manufacture of shovels and spades, and for general sheet iron work, and was established to expand and widen the range of products from the Wortley Ironworks.