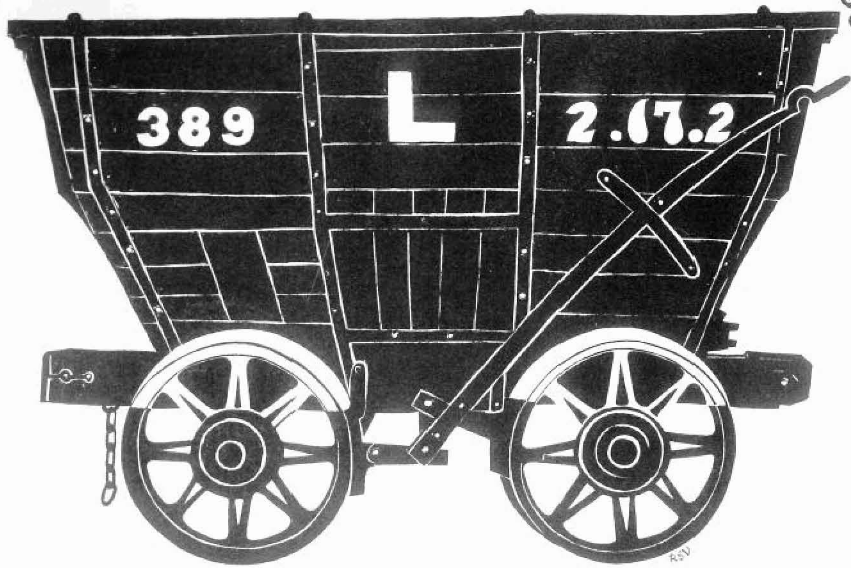
The North East Industrial Archaeology Society



Spring 1972

BULLETIN 15

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Editorial

In this issue we feature an article on 'Tiny Tim' the steam hammer, from The Darlington Forge, which this year has been transported to Beamish to take its place among the exhibits there in the future. Mr. Ronald Benson of Croft-on-Tees, the author was Manager of the Forge Department of English Steel Corporation in 1931, and moved to The Darlington Forge in 1936, retiring as a Special Director in 1963. A member of the Newcomen Society he has contributed much to Engineering Historical Records, particularly in the field of forging.

Mr. David Pattenden who contributes an article on 'Seaham Harbour' is a member of the Institution of Electrical Engineers. He is Treasurer of the Cleveland and Teesside Local History Society and is well known in archaeological circles on Teesside.

Mr. William Huby of Redcar whose notes on the 'Ingleby Incline and the Rosedale Railway' are also featured is a member of a family whose connections with railways originated from the days when horses pulled carriages on the Whitby and Pickering Railway. He spent all of his working life on Cleveland's railways and part of this time he was Stationmaster for some of the stations in the Battersby area. Readers will remember his previous article on the 'Kilton Viaduct', near Loftus.

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Copies of past issues of the Bulletin, when still available, may be obtained from the North of England Open Air Museum, BEAMISH, Co. Durham.

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PHOTOGRAPHS AND MAPS

The Origins of Seaham Harbour.

D. W. Pattenden.

Prior to the early part of the nineteenth century the Harbour of Seaham was no more than two small natural coves in the cliffs which afforded some slight protection for the boats of local inshore fishermen. The development of Seaham into an important coal port is often attributed to the third Marquess of Londonderry's energetic agent, John Biddle. No doubt Biddle had some influence on the work, but the true architect of the original development at Seaham was one William Chapman, a Civil Engineer and a member of the Royal Irish Academy. This is clear from a report which Chapman, who claimed 'a long and extensive experience in Harbours', published in 1832, because he writes, 'of many incorrect reports of the Harbour of Seaham still propagated'. The report is entitled 'The Rise, Progress, Present State and Projected Extension of the Harbour of Seaham' and was printed by Charles Henry Cook (successor to the late Edward Walker), Pilgrim Street, Newcastle. I found a copy in the Library of the Cleveland Scientific Institution in Middlesbrough, and the Plan (fig. 1) which accompanies this article, and the details of the construction of Seaham Harbour are taken from William Chapman's Report.

It appears that in 1820, Sir Ralph Milbanke Noel, the owner of the Seaham Hall Estate, envisaged the creation of a 'Port Milbanke' on the site of the present Seaham Harbour to export coal. He engaged William Chapman to prepare a scheme for the two natural coves (marked 'A' and 'B' on fig. 1), to be enlarged and sheltered with piers. Chapman duly prepared his plans for the proposed port, which also included the use of a small part of the bay to the south of the headland which is marked 'C' - 'D', fig. 1. However by 1821 Sir Ralph was in financial difficulties, partly due to electioneering expenses, and sold that part of his estates to the third Marquess of Londonderry.

Lord Londonderry, after serving with Wellington at Waterloo, was British Ambassador at Vienna for three or four years, and had recently married Frances Anne Vane Tempest, the heiress to the Tempest Estates. On returning to this country he sought an alternative outlet to the Wear, for the coal produced by the new pits on his wife's estates at Rainton and Pittington. At that time the Wear at Sunderland was becoming overcrowded with shipping and consequently expensive. He, therefore, asked William Chapman to devise a plan for a more extensive harbour than the proposed

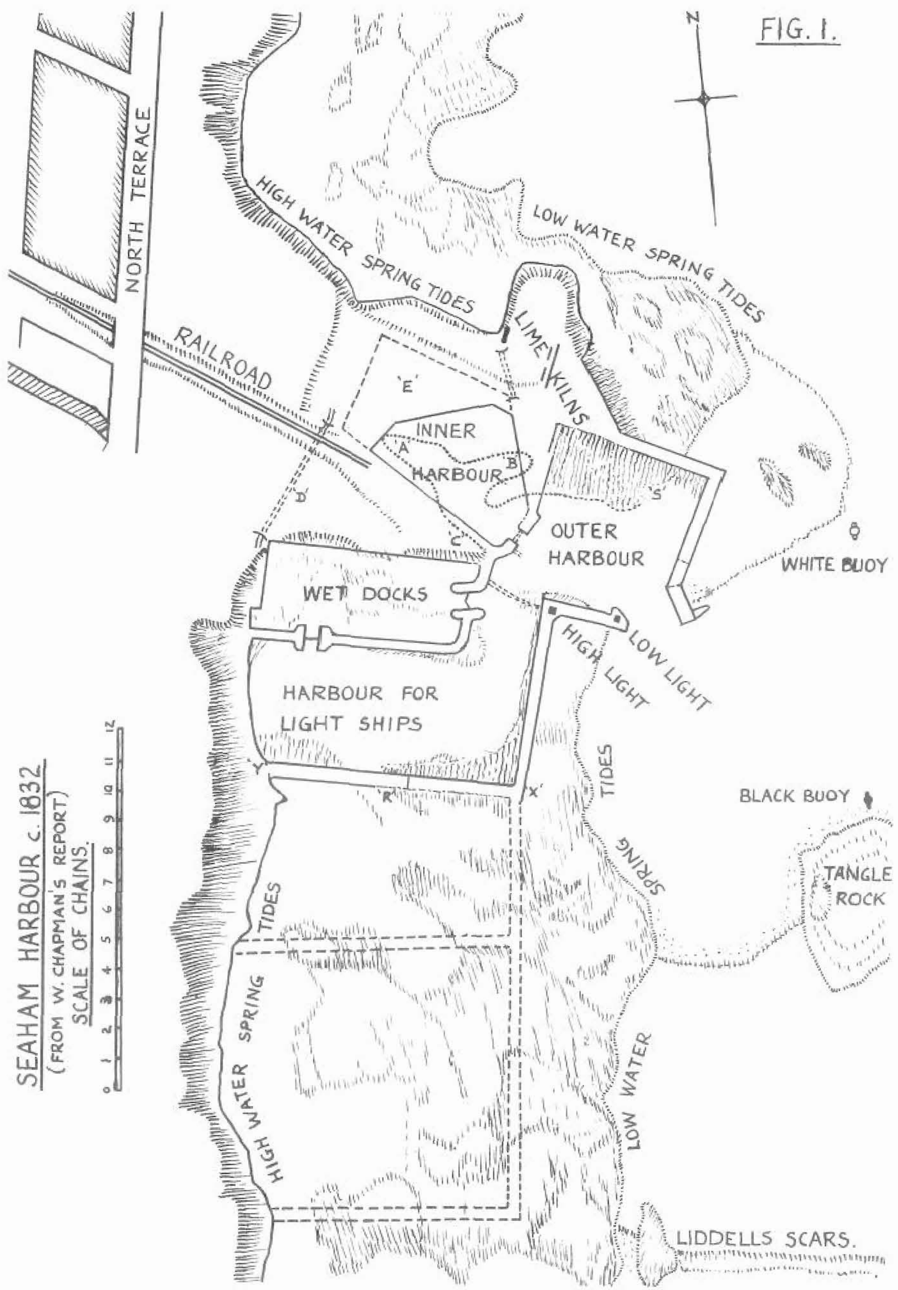
Port Milbanke and then to put the revised plan into effect. Work started on the enlargement of the two natural coves in September, 1828. The original outline of these coves 'A' and 'B' is shown as a fine dotted line on fig. 1.

Chapman remarks in his report that the rock formation at Seaham is mainly limestone, with interstices of marl, and that his plan made as much use as possible of the natural features of the area. The limestone excavated in the enlargement of the coves, and in subsequent excavations, was converted into lime in the kilns shown on the cliff to the north of the Harbour. These kilns were capable of burning 40 chaldrons of limestone, each of 36 heaped Winchester bushels, each day - say 50 tons of limestone per day. Chapman tells us that the burnt limestone was used to fill the piers which he was constructing to shelter his harbour, but no doubt some would have been exported for use as fertiliser, possibly to the farms of the Cleveland Plain, as a profitable sideline.

The first stone of the North Pier was laid on 28th November, 1828, by the Marquess, accompanied by the Marchioness, and many local gentry. Whilst the Inner Harbour was being formed out of the coves the South Quay, with railway access, was being built and provided with 'geers' for two loading berths. The extent of this first stage of the Inner Harbour is shown in full lines on the accompanying plan. Jetties were also built at the entrance, leaving a passage 32ft. wide which was closed by a 'falling gate' which retained the water in the Inner Harbour to within a few feet of neap tide level. A line of temporary booms provided protection from the sea until the North Pier was completed. When the South Pier was nearly complete and about three quarters of the length of the North Pier was finished, the Inner Harbour was judged ready to receive its first ship. This occurred on 25th July, 1831, and the honour went to 'a new vessel of 14 keels of coal'. The Marquess of Londonderry 'and a select party' were present to see her put to sea.

Notwithstanding the unfinished state of the Piers and Harbour, and to quote Chapman 'the then incomplete state of the railway', 388 vessels were loaded in the last six months of 1831 as follows:-

July	10
August	59
September	89
October	101
November	78
December	51



The average register tonnage of these vessels was 182 tons, the largest being 271tons. Over 30,000 chaldrons of coal were shipped from Seaham in the last four months of 1831, when the third loading 'gear' was in service in the Inner Harbour. Chapman remarks that, although many people had predicted that his harbour would be unsafe for shipping, not one loss or accident had occurred in that period.

In his description of the building of the harbour, Chapman states that the first stage of his South Pier terminated at the point marked 'X' on the plan, and that a temporary gangway had been built (shown as a dotted line) for the conveyance of stone from the headland 'C' to the pier. With the Inner Harbour in use, Chapman continued with the building of the more ambitious South Harbour, which he considered to be his principal objective. This was to be formed by building a return pier from 'X' to the shore at 'Y', fig. 1, and he anticipated that as soon as the pier was complete on the seaward side up to the high rock 'R', it would be possible to remove the temporary gangway and allow ships to enter the new South Harbour, as and when the Inner Harbour was full. It must be appreciated that with sailing ships a steady flow of vessels was rarely possible as unfavourable winds might keep them in harbour for several days after loading and space must be provided for them which would allow other vessels to load.

Chapman, however, anticipated some periods of favourable weather which would allow ships to both enter and leave the Harbour, and, therefore, planned a 'Wet Dock', with entrance and exit gates in the north west corner of the South Harbour. The method of working this was to be as follows: Unladen ships would enter the main area of the South Harbour (the 'Harbour for Light Ships' on Chapman's plan, fig. 1) on a rising tide. As soon as the tide was high enough for the eastern gates to be opened to allow vessels to proceed to sea, the unladen vessels would enter the Wet Dock by the inner gates and take up the berths just vacated. An early example of one-way traffic! Ships would be manoeuvred in and out of the dock by warping from the piers or possibly towed by the crew rowing the ship's boat. Four loading berths were proposed on each side of the Wet Dock, which with the three berths in the Inner Harbour, would give a total of eleven loading points. Chapman expected that upwards of 330,000 chaldrons of coal would be exported from these eleven berths in each year from 1833-4 onwards. This was about 75% of the coal exported from Sunderland in 1831. The two dock gates were to be high enough to retain the water at least at neap tide level and the sills were to be 2ft. below low water level. He also planned a 'beach of broken limestone in the Outer Harbour at 'S' against the North Pier for vessels to run upon' ... should they miss getting a rope onto the South Pier during a southerly gale'.

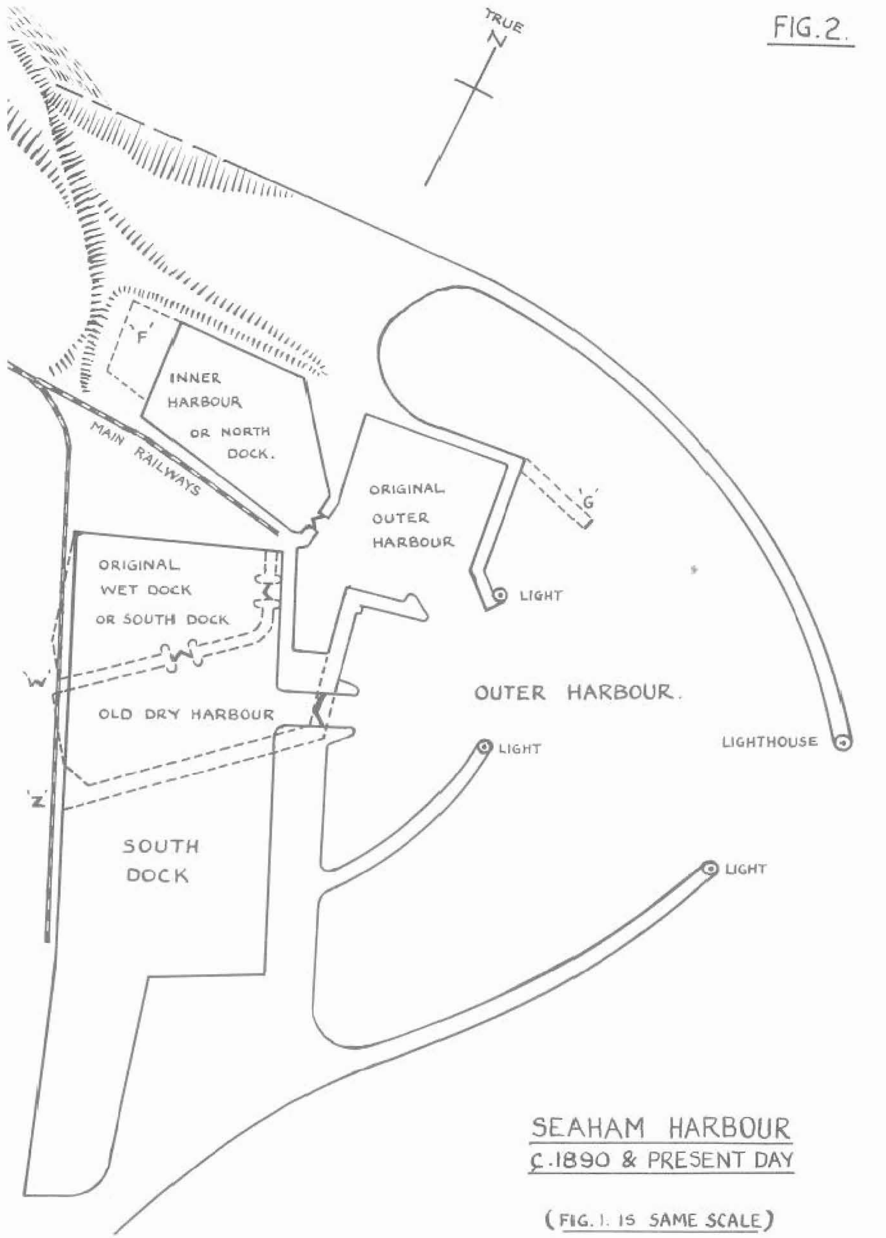


FIG. 2.

SEAHAM HARBOUR
c.1890 & PRESENT DAY
(FIG. 1. IS SAME SCALE)

Examination of the 1897 edition of the six inch Ordnance Survey map shows that Chapman's scheme was carried out generally as he planned it. The main difference was that the return pier from 'X' and the south wall of the Wet Dock were not built square to the coast, as he showed them, fig. 1, but at an angle to meet the high water line at 'Z' and 'W' respectively, as shown in broken lines on Sketch Map, fig. 2.

In his report Chapman makes the point that full advantage was to be taken of the longitudinal and transverse ridges of limestone in the area of the Harbour and this was probably the reason for the change which, incidentally, gave a Wet Dock of slightly larger area and a stronger south wall to the South Harbour. Chapman says that the South Pier was built on natural rock '...many feet in height' and that the North Pier was protected from the most violent seas by the large rocks to the north and north east of it. It is noteworthy that by 1897, a short additional pier 'G', fig. 2, and been built seawards, presumably to afford extra protection to the North Pier. This is shown in broken lines on fig. 2. Chapman's Plan fig. 1, also shows in broken lines a proposed extension 'E' to the Inner Harbour and two additional basins south of his South Harbour. The 1897 map shows this Inner Harbour extension 'F', fig. 2, and this was probably carried out in 1845. However, the southward extension was not started until 1898, when the general use of large capacity steam driven colliers, which were not dependent on favourable winds, demanded a quite different harbour layout. The present arrangement, shown in full lines on fig. 2, shows that the old 'Wet Dock' or South Dock and the associated 'Dry Harbour' as the 1897 map calls it, were demolished and the whole area rebuilt as a much enlarged 'South Dock'. Additional curving breakwaters, with navigation lights at their extremities were also added at this time to give further protection to the harbour.

It should be noted that the 'true north' shown on fig. 2, differs from the north shown on Chapman's Plan and thus on fig. 1. This latter north indication is approximately magnetic north in 1832, and is 33^{o} west of True North. Both maps are to the scale of 20 ins. to 1 mile.

In his report Chapman anticipated Seaham Harbour becoming 'the import and export harbour for the City of Durham'. He dismissed Sunderland's prospects of development in this respect because of the River Wear's limited breadth, violent land-floods and floating ice in winter. Hartlepool, he considered, although much further from Durham City, 'is capable, by proper designs, of being made an excellent Harbour, but in the strong and prevalent easterly winds, which prevail on this coast in the spring of the year, vessels from that Harbour will frequently be unable to clear the Yorkshire coast, whilst from Seaham Harbour, whose outlet is equally fair from the south, they may lead past that impediment.' He includes a small map in his report showing a 17° advantage in bearing as between Seaham and Hartlepool to clear Kettleness. However, Seaham Harbour proved to be equally vulnerable to prolonged north-easterly gales and was recognised as a difficult port to enter or leave. This, together with the development of a comprehensive railway system and the introduction of even larger power driven colliers meant that Seaham stagnated and killed Chapman's dreams of Seaham as a major port. Thus Seaham Harbour remains very definitely a nineteenth century artificial harbour with many interesting engineering features. The inner Harbour has reverted to its original use, as the many fishing cobles now moored there bear witness and only about three vessels per week now call at the South Dock to load coal.

Finally, William Chapman after paying tribute in his Report to 'The affluence and adventurous spirit of the Marquess of Londonderry 'in enabling his harbour' to be constructed with such rapidity', goes on to suggest that the new town of Seaham Harbour would become a superior resort for sea bathers on account of the very extensive sands and beautiful and secluded walks in the gardens thereabouts. Could he but see it now! The Marquess had engaged John Dobson, the famous architect from Newcastle to plan his new town of Seaham Harbour. This was to have, amongst other advantages, a piped hot water supply and the most advanced sewage system in the county. After one terrace of houses was built, the Marquess was short of cash and the development of the model town was left to private speculative builders and Dobson's plans were forgotten. In this respect William Chapman was luckier, for his immediate plans were carried to fruition and the Harbour of Seaham remains as his monument.

For further reading see 'The Harbour of Seaham' by William Chapman referred to above, and Section 23 of 'History Field Studies in the Durham Area' also bibliography pages 151/2. University of Durham Institute of Education, published 1966.
There are also useful aerial photographs of Seaham Harbour, with notes in 'Durham History from the Air' - Durham County Local History Society, 1971.

THE ROSEDALE MINERAL LINE AND INGLEBY INCLINE.

W. Huby.

In the year 1855, a weekly newspaper published in Darlington, announced on behalf of Lord de Lile and Dudley of Ingleby Greenhow Manor that land in the Burton Head area of Ingleby was available for the mining of iron ore, and this resulted in the formation of the Ingleby Mining Co., the first nineteenth century development of iron ore in this locality. The Ingleby Mining Co., constructed a narrow gauge single line railway to Ingleby Junction (afterwards re-named Battersby Junction) to which place the North Yorkshire and Cleveland Railway was under construction, and a narrow gauge incline was also constructed from their mine to the terminus of the line to Ingleby Junction. This line was opened on 6th April, 1858.

At about this time a royalty for ironstone mining had been taken in the beautiful, but remote valley of West Rosedale by Mr. George Leeman, M.P., the Deputy Chairman of the North Eastern Railway Co., Mr. Alexander Clunes Sherriff, until 1856 the Traffic Manager of that railway and Mr. Isaac Hartas of Wrelton, so it was only natural that an application should be made to Parliament by the North Yorkshire and Cleveland Railway in which the N.E.R. had large shares, for powers to acquire the private line of the Ingleby Mining Co., and to extend it to Rosedale.

The construction of the Rosedale Mineral Railway with the self-acting incline at Ingleby in the period up to 1861, was a notable achievement involving much foresight and skill, plus heavy manual labour with the handtools of the period, pick, spade and shovel, together with the added difficulties of steep hills, deep valleys, high altitudes and severe weather conditions.

The Ingleby Incline and Branch to Rosedale West Mines was opened on 27th March, 1861. Subsequently the branch from Blakey Junction to Rosedale East Mines was opened on 18th August, 1865. Some ideas of the distances and altitudes involved will become obvious from the following notes.

THE ROSEDALE MINERAL LINE

Distances	Battersby Junction to Incline Foot	about $3\frac{1}{2}$ miles
	" " " Blakey Junction	" 10 miles
	Incline Top to Blowith Crossing	" $\frac{1}{2}$ mile
	" " " Blakey Junction	" $7\frac{1}{2}$ miles
	Blakey Junction to Rosedale West	" $4\frac{1}{2}$ miles
	Blakey Junction to Rosedale East	" 5 miles
	" " " Sherriff Pit	" 2 miles
	Rosedale East Goods Station and Depot to Rosedale Abbey by road	" $1\frac{1}{2}$ miles

Gradients	Battersby Junction - Incline Foot	1-50 rising
	Blakey Junction - Incline Top	1-98 "
	Rosedale East - Blakey Junction	1-50 "
	" West - " "	varied
	Ingleby Incline	1-5 1-6

Altitudes	Battersby Junction Station	431 feet
	Incline Bank Foot	650 feet
	" Top	1,350-1,370 feet
	Blakey Junction	1,150-1,198 feet
	Rosedale East Terminus	858 feet
	" Valley	500 feet
	" Engine Shed	1,000-1,030 feet
	Chimney	1,000 feet

Rosedale Goods Station was a short distance from the East Mine. The Railway Clearing House arrangements for allocating traffic receipts from traffic passing over 'foreign railways', i. e. railways worked by Companies other than N. E. R., did not apply to this station, and such traffic had to be invoiced locally between Rosedale and Battersby Junction Stations, the latter re-invoicing forward to destination stations and similarly for inward consignments arriving from 'foreign' stations.

Accountancy - Mineral traffic, iron ore etc., from the Rosedale Branch was weighed at Ingleby Incline Foot Wagon Weighbridge, the records and accounts etc., being dealt with at Battersby Junction Station. These arrangements were applicable to consignments consisting of loads to one consignee and more or less occupying the whole capacity of the wagon.

During the earlier years, the weighing was done at Battersby, the wagon weighbridge there being also available for traffic to Junction and from Great Ayton, Picton and Grosmont directions. At one period the Coal Depot cells at Rosedale East were owned by the Mining Company, who sold coal to the general public.

Sherriff Pit - A shaft worked mine, the only one in the Rosedale area. The East and West Mines were drifts and nearby were batteries of Calcining Kilns. At one period calcined ironstone from the East Mines was despatched to the Carlton Ironworks near Stockton-on-Tees. Iron hopper wagons were used for this traffic as the ore was loaded before it had cooled.

Rosedale Branch Locomotives - Near the Engine Shed at Rosedale West were two rail tracks with standage for five locomotives. In the early busy years of the branch five engines were stationed at this shed. These were of Stockton and Darlington Railway type, long boilered 0-6-0 with six wheeled tenders, Class 0T. Owing to the high altitude and severe weather conditions an iron weatherboard was fitted at the front and of the tender with hooks etc., for spreading tarpaulin sheets to serve as protection. The following locomotives worked the line at various periods Nos. 1001, 1003, 1009, 1126, 1128, 1129, 1192, 1255, 1282, 1286, 1289, 1860 and 1895.

The Engine Shed at Battersby Junction was built in 1877 and re-built in 1889. Near were four rail tracks with standage for twelve engines. The Engine Turntable was also situated near the shed and as the position was rather exposed, sometimes during gale force winds difficulties were experienced in turning the engines and bringing the table to a stand after the turn had been completed. A sanding of the turntable rail track had to be made to assist in controlling this movement.

Train Control Arrangements - A metal ring or "Token" was provided for each of the three sections of the single line track, viz. West Rosedale Mines and Blakey Junction - East Rosedale Mines and Blakey Junction - Incline Top and Blakey Junction. When only one engine in steam was working on the branch all the rings were secured together and kept in charge of the Shed Foreman at West Rosedale. When two engines were working on the branch at the same time, the driver of the first engine to leave Rosedale West was responsible for personally seeing the ring for the West Rosedale Mine - Blakey Junction Section and leaving it for the second engine. He must take possession of and carry the ring for the section of the line he was going to work over from Blakey Junction, namely: Blakey Junction - Incline Top or East Rosedale Mines - Blakey Junction, as the case might be. The second driver had to carry the ring for West Rosedale - Blakey Junction, also the ring for the section he was working over from Blakey Junction. On arriving at Blakey Junction the second driver had to leave the ring for the West Rosedale - Blakey Junction Section in the Staff Cabin. The driver of the first engine to return from Blakey Junction to West Rosedale had to attach the ring he had been working with to the West Rosedale - Blakey Junction ring and leave them both in the Staff Cabin, in order that the driver of the second engine might know he was the last one from Blakey Junction to West Rosedale.

Rail Track Not Fenced - Moor sheep frequently laid on the rail track and a series of pop whistles by the engines arned sheep of approaching trains and the sheep usually cleared the track, but in some cases failed to do so, and were maimed or killed. In these cases the ownership of the animals was ascertained from their branding marks and the owners notified, the Railway Co., admitted liability and compensation was paid. The carcasses were usually reported by the train crews as worthless, but there was perhaps sufficient "salvage" to make some good meals for the staff.

At Blakey Junction a hut was situated adjacent to the rail track to accommodate a bogie or trolley, specially provided for use by Lord Faversham, and principally used during the grouse shooting season to facilitate movements around the moors.

Snowstorms and Gales - Owing to the high altitude and the bleak large open areas of un-fenced moorland, also the absence of any fencing of the rail track, the working of traffic was often suspended for shorter or longer periods. At some exposed positions when snow drifting regularly occurred snowboard fencing was erected, usually consisting of used sleepers sawn lengthwise into planks of about one inch in thickness and the fence supported on old sleepers. At positions where considerable drifting occurred and no snow fencing was provided, long wooden poles were erected at intervals alongside the rail track where the line was curved to enable platelayers and snow cutting staff to locate the actual position of the track, which otherwise was not discernable in the apparently endless area of snow, the few landmarks normally available being obliterated.

Exceptionally severe snowstorms occurred during the following periods:-

From 23rd November, 1878, no thaw until February, 1879
" 2nd December, 1882, " " " " 1883
" 31st December, 1894, " " " March, 1895 - This was said to be the worst on record for the North Yorkshire Moors. By 3rd January, even the houses were almost completely buried. A thaw set in on 19th March, but it was mid-April before the line was re-opened and drifts remained in the cuttings until mid-June.

There were heavy snowstorms in February, 1900, and during the winter of 1900/1901.

At Sherriffs Pit a huge pile of ironstone awaiting the re-opening of the line was not removed until late August, and at that date there was a layer of black snow three feet thick under the iron ore.

During a snowstorm in 1901, a snow plough became derailed near Blowith Crossing and the drifting snow almost buried the engines and snow ploughs before a re-railment could be made. When in use a snow plough was placed at both ends of the set, with two or three engines in between the ploughs to enable the engines to be reversed in direction with a snow plough as the leading vehicle. There was accommodation for staff riding in the ploughs, also space for tools, ramps, timber for re-railing, lifting jacks etc., and a coal stove was fitted. As a safety precaution no staff travelled in the leading plough because if the leading plough became nearly buried in a drift and could not travel any further staff riding on it would be very liable to become fastened in, despite the doors being fitted to open inwards.

Two snow ploughs were stationed at Rosedale Loco Shed and when in use there were usually two engines with a snow plough at each end; if three engines were used there was rather too much power and the result could well be that the weight of hard packed snow would lift the leading snow plough off the rails. The best results were usually obtained by pushing away the snow to the limit of the power of the two engines and then cutting back the hard packed snow, after which another attempt was made to remove the remaining snow, and so by degrees a clearance was effected.

Heavy drifting occurred in the winter of 1916/17 when the snow blocked the line for about five weeks. There were drifts of 30 feet of frozen snow at Incline Top and Blakey Junction. An engine was buried in a snowdrift and enginemen had to tunnel their way out. Even in April snow still lay about four feet deep.

When severe blocks occurred platelayers from the N. Y. and C. branch lines in each direction were collected by special train consisting of two or three goods train vans and worked to Incline Foot. The renewal gang of platelayers, normally engaged on re-laying tracks etc., were utilized and having regard to the remote position on the moors, food etc., had to be made available. I knew a platelayer who in the 1882/83 storm travelled with others from their home lengths at Grosmont and Glaisdale to cut snow on the Rosedale line, and at that time they had to bring with them as much food etc., as possible. I have heard many accounts from trainmen who have had long and sometimes overnight shifts and it was days before they were able to return to their homes in weather conditions of storms and gales. In 1895 a whirlwind accompanied by a thunderstorm struck Incline Top and damaged nearby cottages.

Huts with shovels and appropriate equipment were maintained at positions which were liable to heavy drifts of snow.

Tonnages of Iron Ore ex Rosedale Branch:-

Period		Tonnages	Value £	
May/Dec.	1861	79,786	11,967	The tonnage had
	1862	219,213	32,768	fallen to 6,079 tons
	1864	297,580	66,950	for the year 1880
East and West Mines	1866	230,382	93,940	
	1873	560,668	168,200	Maximum production

Year	Iron Ore	Calcined ore (small)	
1920	80,209	9,210	
1921	25,826	25,546	
1922	28,857	33,765	
1923	19,312	39,855	
1924	9,233	45,779	
1925	14,749	28,387	
1926	Nil	13,052	The year of the General strike after which the mines did not re-start.

During the time the Rosedale line was in use sixteen million tons of iron ore are estimated to have been conveyed and during the very busy early years considerable periods of night working must have been involved, and this under the somewhat primitive lighting arrangements at the Incline would indicate considerable skill in handling the traffic and much credit is due to the staff concerned working at such an exposed position.

The Rosedale Chimney - This still remains as a relic of the early mining and was the chimney of the engine house for the winding gear of an incline tramway. The lofty chimney is said to have been at the request of the landowner, in order to avoid the smoke having any adverse effect on the grouse on the nearby moor! The builder of the chimney, John Flintoft of Lastingham, is said to have danced on the top on completion of the work.

Railway owned houses were built as follows:-

Ingleby Greenhow (Battersby Junction)	2
Poultry House Crossing	1
Incline Foot	4
Incline Top (one used as general storeroom etc.)	4
Blakey Junction	7
Blackhouses	2
Rosedale East/Rosedale West	16

Average Weekly Wages on the Branch in the 'Good Old Days':-

Engine Drivers	£2 2s. 0d.
Firemen	£1 4s. 0d.
Guards	£1 1s. 0d.
Platelayers	18s. 0d./19s. 0d.

Engine Cleaners commenced at 1s. 8d. per day in 1884.

The Loco Foreman travelled to Middlesbrough each Thursday for wages cash for the staff, leaving on the 8 a.m. 'trip' on which railwaymen's wives also travelled to Battersby Junction on route to Middlesbrough and/or Stockton for shopping.

The Ingleby Incline

The Ingleby Incline constructed about 1859/60 was of the self-acting type, with gradients of 1 in 5, 1 in 6 and was built diagonally along the steep edge of the moorland at a position with an altitude of 1,198 feet at Incline Top to 650 feet at Incline Foot, which was the terminal of a $3\frac{1}{2}$ mile single line connection with Battersby Junction on the Stockton/Whitby branch of the late N. E. R.

Lay-Out of Rail Track on Incline - There was single track for about 100 yards at the lower end, then double track (loop line) to a point just beyond half the length of the incline, thence to the Incline Top, the track was three rails, the centre rail being common to and used by ascending and descending sets.

A switch near the Pointsman's Cabin at the lower end of the double (loop line) was provided for switching the ascending sets to left or right side track, this being done alternately for each set in order to avoid the haulage wires becoming crossed. A switch on the upper portion of the three rail section was provided to alternate the descending sets to right or left side track, this switch being worked by hand by a Banksman, using a long iron bar, the points being secured in position by wooden wedges. The iron bar was also used to lever over the haulage wire to the correct side of the guiding sheaves for the next set to be worked, usually two or three sheaves being involved.

A large stone built Drum House erected at the summit of the Incline contained two drums, each 14 feet in diameter, mounted horizontally on the same shaft, one haulage wire being secured to each drum, one winding on when in motion and the other un-winding. Incidentally, two dis-used drums remained in position in the drum house, in the rear of the two in use, probably left in position to strengthen the structure.

One end of each haulage wire was permanently secured to the drum and at the other end of the wire a length of about 16 feet of chain was similarly attached, to which was connected a three link wagon coupling, which was attached to the drawbar of the front wagon of each ascending set and to the drawbar of the rear wagon of the descending set. The three link coupling was attached to the drawbar of the wagon by a flat circular fitment, known locally as a 'quoit', and held in position by a cotter pin.

The speed of sets was controlled by a Brakesman at a cabin situated on the outer side of the rail track, namely:- the right hand side when facing towards Incline Top, and the braking equipment was controlled by a large wheel, thė spokes of which were similar to the steering wheel of a ship. A bank type of brake, fitted around the drums, the brake shoes being of a special metallic substance. The usual time for running a set was about three minutes, the average speed being approximately 20 miles per hour.

A Treadle was connected to the rail track about half way along the three rail section and when depressed by the wagon wheels caused a bell to ring in the Brakesman's cabin indicating to him the position of ascending sets. This was useful for braking purposes, especially after dusk, during fog or poor visibility due to falling snow or heavy rain-storms. The middle section of the Incline would often be enveloped in mist or fog, whilst at the lower or upper portions of the incline visibility was normal. When riding up on a set under these circumstances it was a somewhat eerie experience to pass from sunshine through fog and/or low cloud to sunshine.

Run-away points were situated in the outer rails of the three rail section near the Brakesman's cabin, both sets being connected to the same control lever and were normally set in the 'run-off' position until working over the incline was about to commence. On reaching the top of the incline the sets passed on to what was known as the 'Kip', this being a direct continuation of the track. The gradient at this position was falling towards the Drum House, thus enabling the sets to be lowered forwards as necessary, to facilitate the disconnection of the haulage wire, viz:- to obtain a 'slack wire'.

The distance between the 'Kip' and the Drum House was somewhat limited having regard to the speed at which the rear wagon of the set had to pass clear onto the 'Kip' and within the safety rail provided to prevent a break-away towards the incline. It was necessary to bring the set to a standstill a sufficient distance from the Drum House to avoid the leading wagon being lifted off the rail track by the haulage wire and/or damage to the drawbar gear and buffer plank of the wagon. For this purpose oak spraggs, about three feet long and tapered at each end, were used by the Banksman, who threw one or more spraggs, as necessary, in between the spokes of the wagon wheels. The spraggs were of a standard pattern as carried in the brake vans of goods and mineral trains.

The safety rail equipment at the 'Kip' was a short length of old rail mounted on a fixture in the four foot way, the rail pivoting off-centre so that one end was normally at ground level and the other was depressed by each axle as the wagons passed.

Wagons with solid or disc wheel centres as in the case of some types of G. W. R. wagons had to be restricted to one such wagon per set of three, thus leaving two wagons with spoke wheels available for braking purposes.

Balancing of Sets - Three empty mineral wagons were drawn up by three wagons of iron ore descending. If there was a shortage of mineral empty wagons at Incline Top four empty wagons were run instead of three. Loading varied as necessary, owing to weather conditions.

In the case of loaded wagons to the Rosedale Branch, such as coal, pit props, mining equipment, agricultural traffic and general goods the loading was varied according to the weight and nature of the traffic. A margin in weight, including tare of wagons, plus weight of contents were maintained to 30 tons, i. e. the total weight of the descending load should exceed the ascending load by about 30 tons.

Instructions were issued to all stations regarding restrictions on wagons passing over the incline including six wheeled wagons, low loading wagons and covered vans which latter were too high to pass under the drums when returning from the Rosedale line. The low loading wagons had insufficient clearance for the wagon floors and other fittings to clear the haulage wire guiding sheaves. The prohibition on six wheeled vehicles was in consequence of the change from normal rail level to incline rail level, resulting in the middle wheels of such vehicles becoming suspended clear of rail level when entering on the incline and the tendency for a 'pivoting' effect at top of incline when passing over the very considerable change in gradient, this being increased in consequence of the 'Kip'. For similar reasons, the middle wheels of 0-6-0 (tender type) engines, originally classified as 'O. T. ' (Old Tender) were removed, also the motion gear etc. The tenders were also disconnected, the middle wheels removed and engine and tender worked over the incline separately and where necessary a wagon attached in the rear of the engine. Engine tenders were lowered under drums, but engines and brake vans had to be lowered by 'Kip' track, a more difficult working. All sets of ordinary four wheeled type of vehicles were lowered under drums providing there was sufficient head room available.

Normal winding arrangements applied when engines were being worked over the incline, but great care was necessary and favourable weather conditions.

Wagons breaking adrift whilst passing over the Incline - These usually occurred owing to breakage of drawbar gear or coupling links. During severe frosts, a jerk or a 'click' could result in breakage by 'snapping' of material. A wagon examiner stationed at Battersby Junction was responsible for the examination of all wagons passing through that Marshalling Yard, including empties and loaded wagons for the Rosedale Branch.

On one occasion a steam crane, used in connection with a break-away was propelled as far as possible at the Incline Foot to assist in reaching derailed wagons and debris. In order to maintain its position on the heavy rising gradient the engine of the crane train after propelling the crane onto the incline stood with steam on in addition to the engine brakes to counteract the effect of the steep gradient. The Loco Foreman in charge of the crane said chocks could not be used as it would be impossible to remove them against the pressing weight of the crane and vehicles involved.

Lighting Arrangements. No Fixed Lighting Provided - When working in fog or after dusk fire grates and oil flares were kept burning near the vital working positions; on the 'Kip' for the Banksman spragging ascending sets, the Brakesman's cabin, Pointsman's cabin on Incline, Incline Foot cabin, Weigh cabin. Fire grates were also in use during frost and snow.

Staff etc. Riding on Sets - Riding on descending sets was not permitted although many years ago children from Blowith Crossing and Incline Top cottages rode down the Incline en route for school at Ingleby Greenhow. One day however, a breakaway occurred on the incline shortly after a party of school children had ridden down and the practice was immediately stopped, never being resumed.

Special trips were arranged for railwaymen's wives going to and from town shopping etc. , also from Rosedale. The wives of railwaymen were issued with a free travel pass known as a 'market pass' and these were issued annually available to the nearest market town. Battersby and Rosedale personnel could travel to Middlesbrough or Stockton. When the wives returned from town the traffic working was varied to enable them to travel home in a similar manner and instead of walking up the long steep incline with their purchases etc., they rode up seated on the buffers of wagons, and a number of old coats were kept at Incline Foot for use as cushions.

During summer months, about the time the daffodils at Farndale were in bloom, an office party from Middlesbrough area railway offices would travel in a similar manner, except they walked up the incline, also occasionally an office outing party would make a trip, probably going via the Rosedale line to Rosedale West and forward by road to Pickering, returning via Grosmont and Battersby.

Lay-out of Rail Tracks - There were two tracks at each side of Drum House for empties arriving up the incline and three sidings at Incline Top for inward traffic arriving from Branch.

Two sidings at Incline Foot were on a raise 'Kip' with the gradient sloping towards the foot of the incline so that wagons for Rosedale, empties or loaded, could be run by gravity into position for attaching to haulage wire. A long siding near Railway Cottages was available for standage purposes with trap points at the lower end towards Battersby Junction. Incidentally, the date on the point handle was 1857 and the makers 'Fossdick and Hackworth, Stockton'.

Traffic Working Arrangements, Battersby Junction/Incline Foot - On account of the 1 in 50 gradient rising from Battersby Junction, and the lack of rounding facilities at Incline Foot, trains were marshalled at Battersby Junction and propelled to Incline Foot. The engine remained in the rear of the vehicles until the train was ready for returning to Battersby Junction, wagon brakes being applied as necessary. It was the practice at the Junction to avoid using the line towards Incline Foot whenever a train was on that line so that in the event of a train going out of control whilst on the return journey, there was a clear track for it to regain control before reaching the buffer stop at the Kildale end of Battersby Marshalling Yard. The engine whistle was used for sounding a warning, usually a series of 'pop, pop' whistles to alert the crossing keepers at Poultry House and Battersby Road Level Crossing, also the yard staff at the Battersby Junction Marshalling Yard.

Dismantling of the Rosedale Branch Line and Equipment - The Rosedale West Mines famous for their magnetic ironstone had closed by 1885, and the shaft workings at Sherriff's Pit closed just before the First World War. The Rosedale East Ironstone Mines finally closed down in 1926, and it is interesting to note that the working expenses of the Rosedale

Branch in 1925/26 were estimated to be £3,000 per annum in excess of traffic receipts. This compares with 1919 when working expenses were about £8,208 and receipts approximately £8,090, therefore, the eventual decision to close down the branch was a foregone conclusion.

Messrs. T. W. Ward of Sheffield, were given the contract for dismantling the line and a representative of the firm, together with a Local District Officer arrived by train at Battersby one cold and foggy morning during the latter part of 1928, en route to the Rosedale Branch. When the firm's representative was told, in reply to his enquiry, that the Incline Foot was about $3\frac{1}{2}$ miles distant he looked out of the Station Office window and remarked that he knew someone who would not make the journey and they returned to Middlesbrough on the next train.

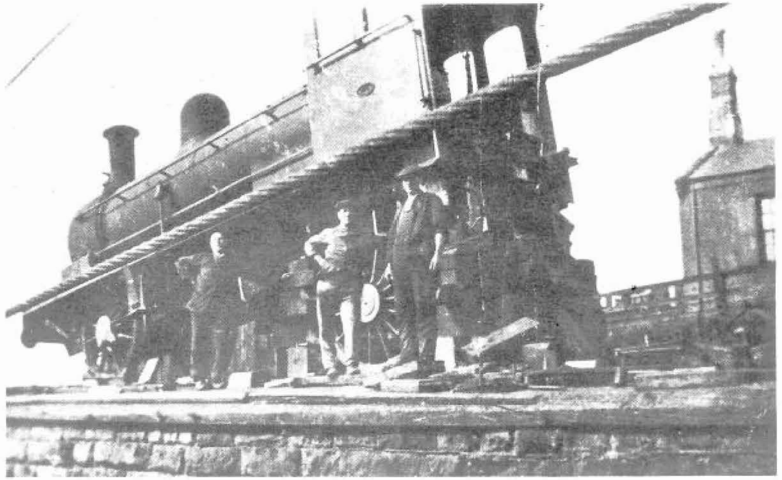
Railway wagons and equipment not included in the contract were taken away and the line regarded as closed from 29th September, 1928. Later, a small four wheeled 0-4-0 tank engine, such as was used at small works, quarries etc., arrived from T. W. Ward for use in uplifting the rail track, equipment etc. This engine was hauled to Incline Top but was soon found unsuitable, not having sufficient power, also inadequate coal and water accommodation. The engine had to be returned so T. W. Ward incurred considerable expense in hiring a Railway Company's engine of the type used on the line, and having the middle wheels removed and taken up the incline. After a short time one of the firm's men was passed by the Railway Company as competent to work the engine, the supplies of coal and water for its use becoming a charge against the firm. It is considered that this unnecessary cost and work could have been avoided if the firm's representative had taken more care to ascertain the local conditions.

The procedure of uplifting the rail track was to propel to the rail head one double bolster type wagon for the rails, this class of wagon being fitted with chains, screws and stanchions, which were necessary to secure the rails, especially down the 1-5 incline gradient; these wagons had low sides, an advantage as the rails had to be man-handled from ground level; next an ordinary goods wagon for loading the sleepers and a single bolster for rail chairs, fishplates, bolts etc. The weight of the rails and the distances to be dragged along the ground precluded long lengths of track being removed on each trip and when practicable the separation of serviceable sleepers from older and/or damaged ones was made. The marshalling order when proceeding to the rail head was: double bolster leading vehicle, single bolster next and ordinary goods wagon, finally the engine.

In cases of rails too long for the double bolster wagon the single was placed next so that it could act as an under-runner or match wagon. The position has been stated in some detail in order to indicate the difficulty and slow rate of progress. The weather conditions in the last winter for the railway 'ran true to form' with considerable falls of snow and frosts so severe that it was said the whistle of the engine froze whilst the engine was in steam and standing at Blakey Junction. Considerable difficulty occurred owing to the demolition men throwing the material onto the wagons without any regard for safety down the Incline, and the 'requirements of the standard gauge and safety of wagon loads in transit', but to enforce compliance with railway loading regulations, acceptance of unsafe loads was refused and after the men concerned had had to sort out sleepers and rectify rails whilst on the wagons, much more difficult when not alongside a platform or staging they realised 'slip shod' work was not of use to them. During dismantling, care had to be taken to maintain a correct number of suitable wagons, also a sufficient number that all material, equipment and wagons were lowered before the incline working ceased.

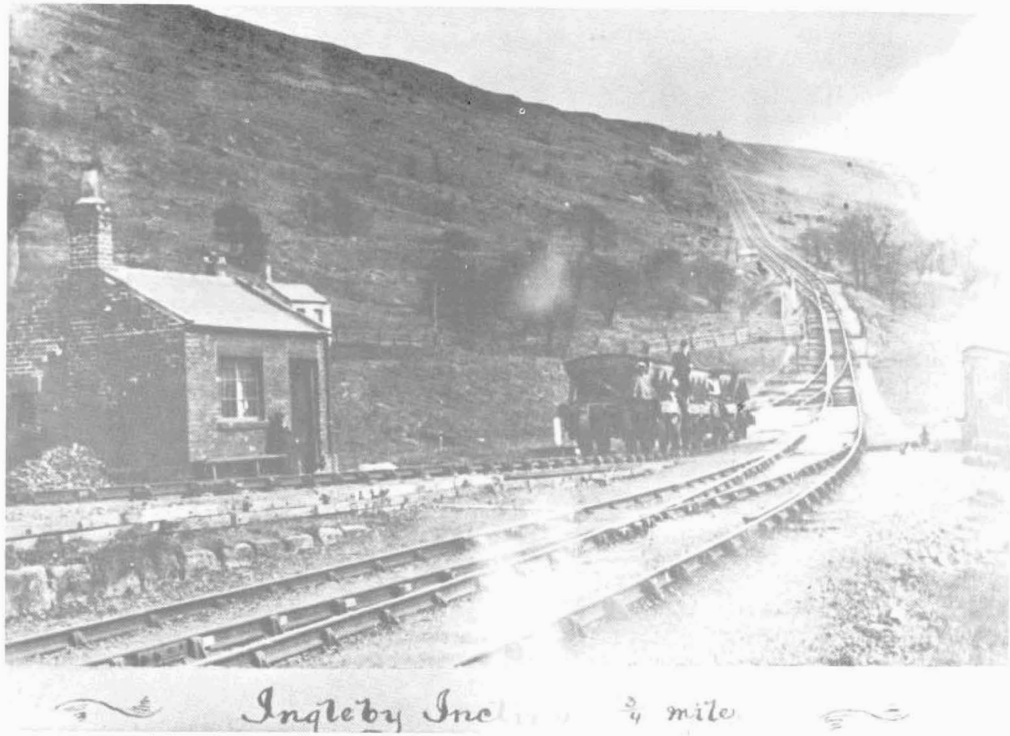
The Railway Company's engine No. 1893, with middle wheels removed was safely lowered for the last time on 8th June, 1929, 'true to form', 'the last to leave the ship' and three days later the line was regarded as finally closed.

Local men were engaged in the uplifting of the track and would probably be the grandsons of some of those who were employed in the construction of the line and now they would perhaps revert to their previous work on the land as shepherds. The black faced sheep can now, with safety, lie on the route of the rail track and they and the bracken take over the vast areas of moorland with its varying conditions of calm and storm.

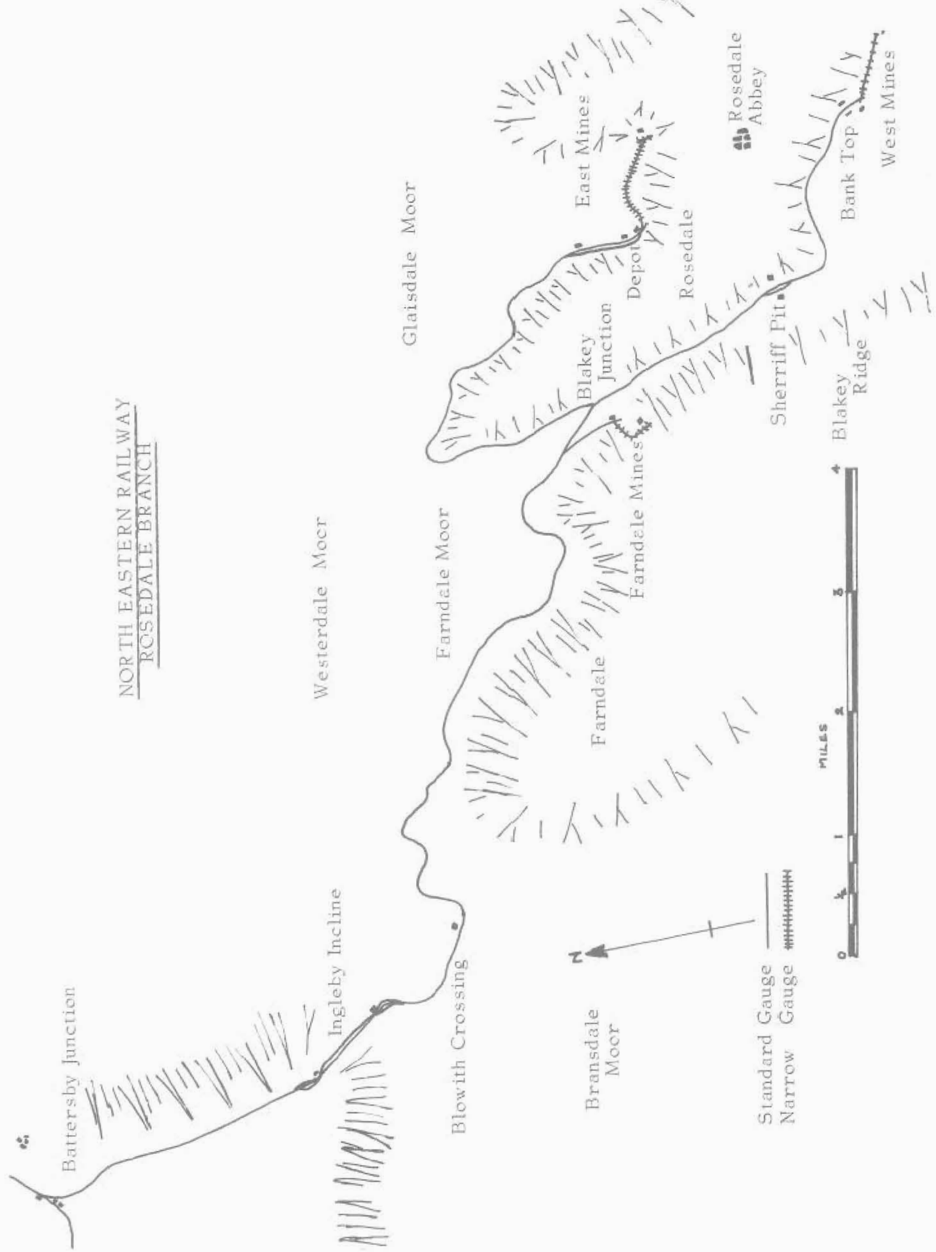


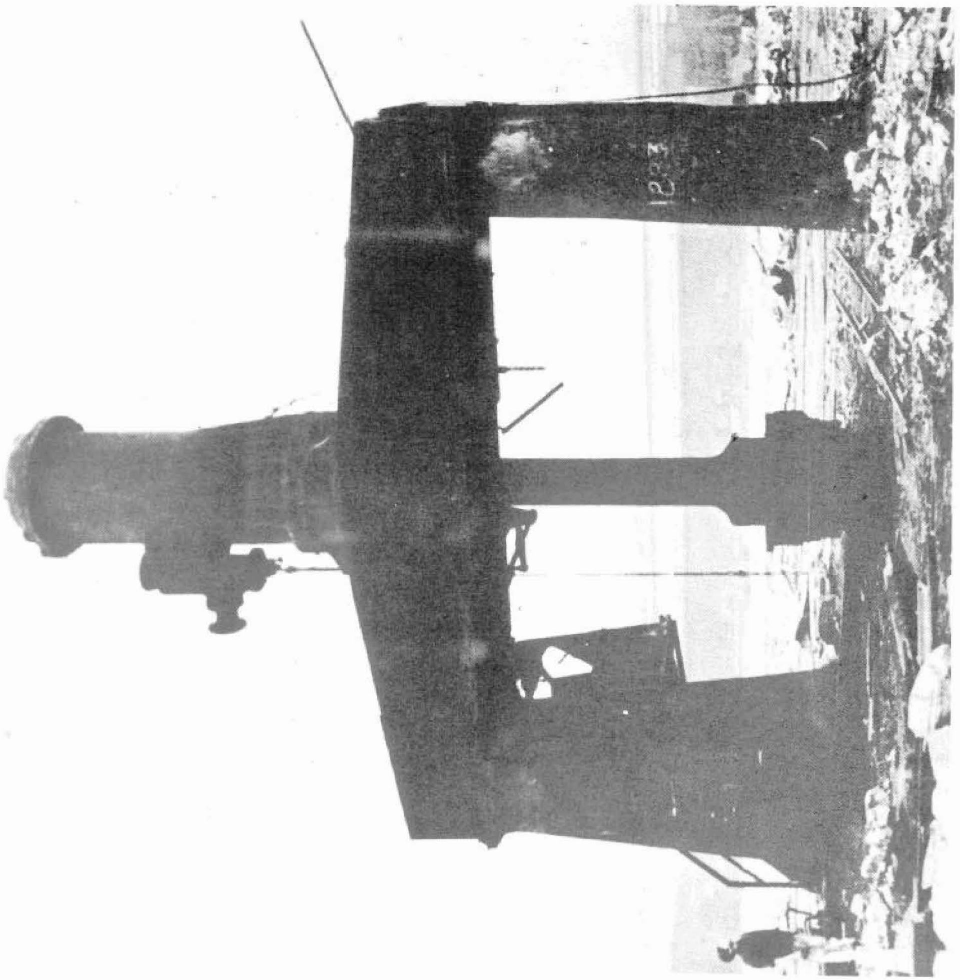
ROSEDALE RAILWAY, Loco No.1893 on 8/6/1929 about to be lowered down the Incline. This was the last loco on the line.

BLAKEY JUNCTION



BOTTOM OF INGLEBY INCLINE





TINY TIM, A RELIC OF A BYGONE AGE.

Ronald Benson.

The story of these hammers covers the period known as the Industrial Revolution. This was the development which called them into existence, and without them the Industrial Revolution would not have been possible.

Most of them have found their way to the scrap heap and their history is being forgotten. By a fortunate circumstance one of them is still in existence, and may indeed present the last chance of showing to future generations an actual example of what these giants of the past were like.

This hammer was built in Darlington, and bears on the leg the inscription:

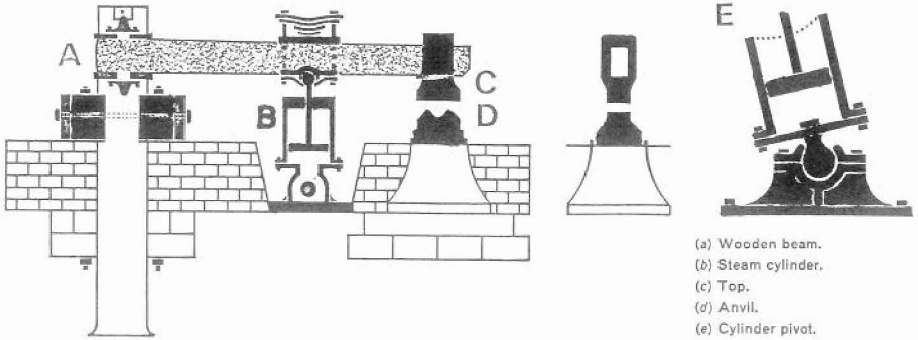
"Rigby Patent
Glen & Ross Engineers
Glasgow
1883"

Its nickname, Tiny Tim, was given to it perhaps half in admiration and half in resentment, for in the Albert Hill district of Darlington, even on the far side of the Skerne, ornaments fell off mantlepieces, windows broke and walls began to crack under its thundering impacts. This was the universal experience as hammers grew heavier and heavier to meet the demand for larger and larger forgings.

A general account of these hammers provides a background to Tiny Tim.

The demands, particularly in the second half of the last century, were firstly for the making of larger and more intricate forgings built up from welded wrought iron and later, the making of steel forgings in one piece from first Crucible steel, then Bessemer, and finally Open Hearth steel.

The type of hammer which ultimately survived almost unchanged for over a century is the directly driven steam hammer in which steam lifts the hammer block in a truly vertical line. James Nasmyth designed the first of this type in 1839, and Schneider of Le Creusot made the first one in 1842. The first hammer made by Nasmyth for his own use in the same year had a hammer block weighing 30 cwts. with a fall of 4ft. It took some time for the use of such hammers to become universal, and there



(a) Wooden beam.
(b) Steam cylinder.
(c) Top.
(d) Anvil.
(e) Cylinder pivot.

Fig. 1. Beam Hammer, drawn from Alfred Krupp's original sketch, circa 1852.

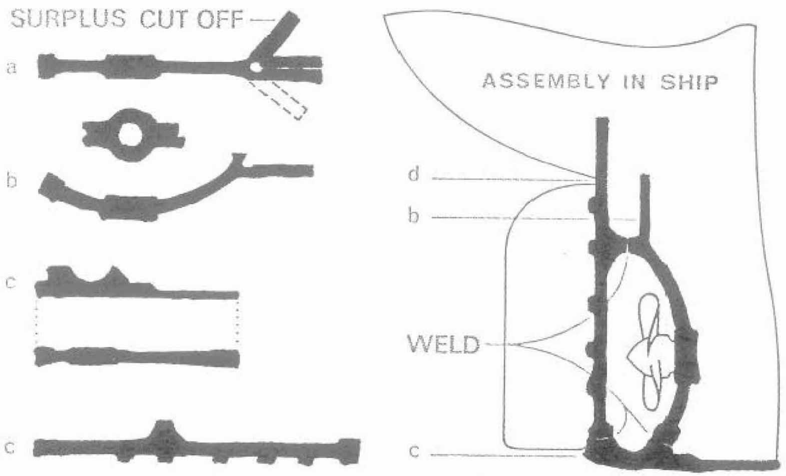


Fig. 6.
Forgings for typical stern frame.
(a) Boss piece, forged straight.
(b) Boss piece, split and bent.
(c) Keel piece.
(d) Back post.

was an intermediate period during which various expedients were adopted for using the power of steam to augment the power of the water hammers. One such expedient was the use of steam engines to pump the water back to the reservoir after it had been used to drive the water wheel. The next step was to rotate the cam shaft of a water hammer by a steam engine instead of a water wheel. Krupps of Essen, in 1852, actually applied a direct acting steam piston and cylinder to lift the beam of a tilting beam hammer (See Fig. 1).

A survey of existing hammers in 1869 shows how the size of hammers had increased in the 27 years since 1842, and also shows that, like Tiny Tim, many of them had nicknames.

The largest hammer at that time was a 40 ton hammer made by Messrs. Morrison & Co. of Newcastle for the Alexandrovski Steel Works, St. Petersburg. The anvil block weighed 240 tons, cast in three pieces by men sent out from this country using furnaces actually sent with them.

The parent firms of the English Electric Corporation figure in this survey. Messrs. Charles Cammell & Co. of Grimesthorpe had a hammer built by Messrs. Nasmyth Wilson & Co. of Patricroft. The head weighed 25 tons; the stroke was 8ft. The anvil block weighed 125 tons; the legs stood on four stone pillars, 14ft. deep, and the anvil block on a deeper pillar, also of stone - all fastened together by iron cramps.

Messrs. Vickers, Sons & Co. of River Don Works, had a 15 ton hammer built by Messrs. Thwaites & Carbutt of Bradford. This firm built a 10 ton hammer for Messrs. John Brown of Sheffield in 1863, and later one of 15 tons. Tradition in Sheffield is that this one was nicknamed "Gold-beater" whilst Krupps of Essen built a 30 ton hammer in 1862, which they later increased to 50 tons, and which continued working till 1911. This was christened "Fritz".

Nasmyth Wilson built a 25 ton hammer for the Bolton Iron & Steel Co. for which they cast an anvil block weighing 210 tons. It was becoming accepted practice that a ratio of something like 10 to 1 of anvil block to hammer head was desirable. This 210 ton anvil block was at the time claimed to be the largest casting made in this country. The story of its production has been told before, but it is worth repeating, showing as it does that the Victorian Engineers were afraid of nothing and would tackle anything.

The block, which of course was of cast iron, was cast upside down in a pit. This was no doubt to present the soundest part to the blows of the hammer. Casting was carried out alternately from two cupolas and took $10\frac{3}{4}$ hours. The blast was diverted for this job from the blowers of the Bessemer furnaces. Trunnions were cast on the block at each side. The sand of the mould was removed after a week and the brickwork after a month. Brick walls and bearers were then built under the trunnions and the block turned over. Finally it was moved horizontally 16ft. to its working position, and bedded on a thick layer of concrete and a cement of iron borings and sal-ammoniac.

To continue the story of the growing size of hammers, one of 100 tons was built at Terni in Italy - though this was not a steam hammer, but operated by air supplied from air compressors driven by water turbines.

Another 100 tonner was built by Schneider of Le Creusot in 1876. From floor to top of cylinder was 21 metres (67ft.). The stroke was 16ft. and it is not surprising that it could be heard for seven miles.

Probably the largest hammer ever built in the world was one of 125 tons built at Bethlehem, U. S. A., in 1891 (See Fig. 2). This hammer was found to be an almost intolerable nuisance and after only two years it was superseded by a press.

Design and Construction of the Hammers

The original Nasmyth design had a large rectangular tup or moving head connected by a comparatively slender rod to the piston. The tup was guided by long slides, on the legs of the hammer, coming well down to the rather low arch between the legs. Fig. 3 is engraved from a picture painted by Nasmyth himself, entitled "Steam hammer in full work". There are many interesting points about this picture, the first one being the very cramped space inside the hammer arch - a man is shown in the foreground holding a cutter - if he had attempted to go inside the arch of the hammer to apply it to the shaft shown he would have been roasted to death. Another point about the slender Nasmyth rod was that in the original design, steam below the piston lifted the hammer but only gravity returned it - the rod remaining in tension. Shortly after Nasmyth added "top steam", making his hammers double acting. This produced both compression in the rod and considerable whipping and vibration, leading sometimes to breakage through fatigue.

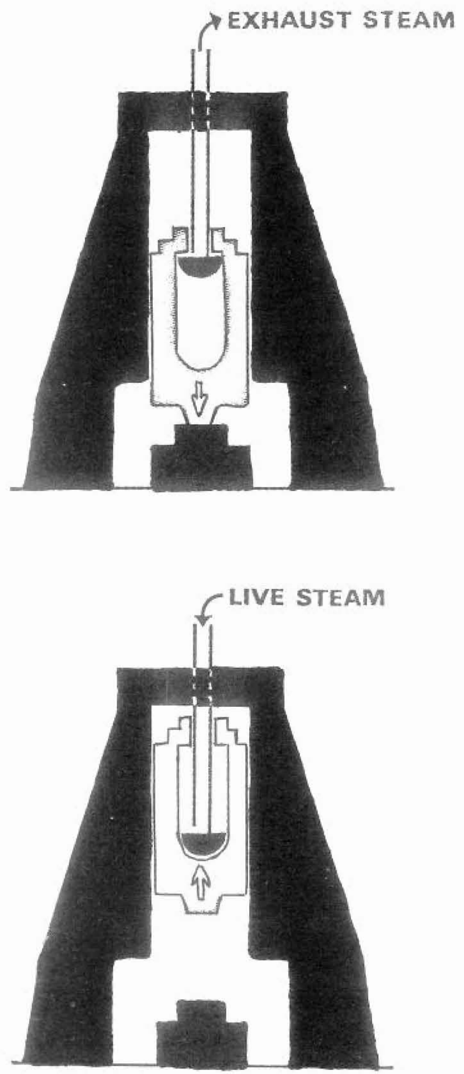


Fig. 4. Condie Moving Cylinde. Hammer, single acting type.

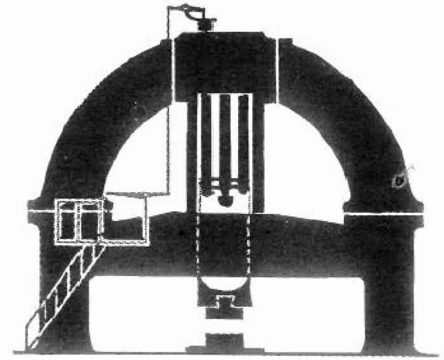


Fig. 5. Condie Double Acting Hammer, up to 25-tons, combining arch and beam construction. The three steampipes from the top of the arch slid through glands in the moving cylinder. The central pipe admitted steam above the piston for lift. The sidepipes admitted steam through communicating holes to the bottom of the cylinder for down motion.

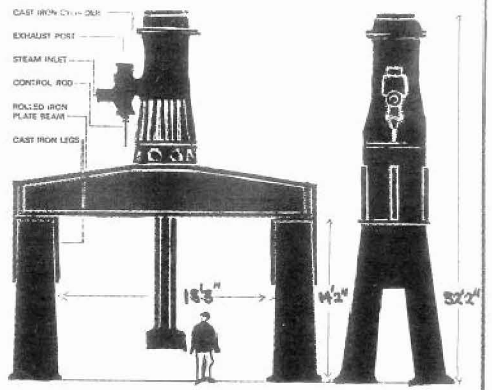


Fig. 8. General arrangement drawing of "Tiny Tim".

These two difficulties, that is to say, the cramped arch and the slender rod, were avoided in what is sometimes called the Rigby type of hammer. The piston rod was quite thick and heavy; the bottom part of it widened out to give extra weight and to carry the dovetail holding the top tool. The piston rod had flats along each side and the gland at the bottom of the cylinder was shaped so that these flats acted as guides. The piston rod and piston head and top tool were the striking parts of the hammer - there was no "tup" as in the Nasmyth type. The high and roomy arch was especially needed for the forging of stern frames and crank shafts. It allowed the men to use cutters and other hand tools with long handles, so that they were reasonably far from the heat of the forging, a very important and often ignored point in forging work.

A most interesting type of hammer, now quite obsolete and forgotten was the Condie hammer. Fig. 4 shows a section of one such hammer and Fig. 5 the final design. This design was no doubt adopted in an effort to avoid the breakages of piston rods to which the Nasmyth type was liable. It will be seen that the cylinder was itself the hammer head, moving up and down whilst the piston and piston rod were attached to a cross beam above and remained stationary. Originally these hammers were probably designed to give the roomy arch of the Rigby design, while providing a long guide as in the original Nasmyth type. It will be realised that to put the cylinder on top and a long guided tup underneath, and also to allow a high and roomy arch, would make the whole hammer unacceptably tall.

Condie hammers were offered in powers up to 25 tons by at least two firms, one being Musgrave of Bolton and the other Rowan of Glasgow. A battery of Condie hammers was installed at the Lancefield Forge, Glasgow, with the express purpose of making the forging required for Brunel's great ship "The Great Eastern", which first sailed (or rather steamed) in 1860. It was around this time that screw propellers were coming into use in place of paddles, and this had an influence on the design of hammers.

Stern Frames.

The rudders of sailing ships could be hinged quite simply to a plain stern post. The propellers of screw driven ships introduced a complication, as the rudder had to be mounted behind the propeller. A loop shaped stern frame was adopted for this purpose. The forging of these stern frames was a very specialised activity of the Darlington Forge, and no doubt influenced the designer of Tiny Tim,

causing them to adopt the rather unusual course of mounting the cylinder on a long wrought iron box beam resting on vertical columns or legs instead of the more usual arch formed by two cast iron legs.

Fig. 6, shows a typical stern frame and the three separate forgings which were eventually joined by welding at the three points indicated. It will be seen that each part was quite a difficult forging in itself with much shaping and numerous side projections. The boss piece was pierced by punching under the hammer, leaving a small machining allowance in the hole through which the propeller shaft projected.

To make the welds the three forgings were strapped together and held in their final positions. The straps were heavy iron bars, as can be seen in Fig. 7. Only one pair of ends could be welded at a time. These ends were heated to a white heat and then the whole frame quickly swung under the welding hammer.

A square glut piece of wrought iron turned with its corners up and down also raised to a welding heat was driven into the vee shaped gap and first just tapped, then as the slag shot out, allowing metallic contact, between the ends being joined, a little more force flattened the top corner of the glut whilst the bottom corner filled the vee aperture. The weld shown in Fig. 8, is that joining the boss piece to the keel piece.

The long beam and roomy aperture of Tiny Tim was suitable for this work but th power of the hammer was much too great. The piston rod weighed 13 tons and the top tool 2 tons, a total of 15 tons. It must be mentioned that if a blow slightly too heavy was struck during the welding, the straps broke and the whole assembly flew to bits; this was not only a disaster to production, but also a considerable danger to life and limb.

The Frame Smith's Hammer

Within two years of the installation of Tiny Tim, a hammer was built expressly for the welding work. It had a similar beam but an even wider aperture, 30ft. between the standards, but its weight of head was only 2 tons, with a fall of 4ft. being only single acting. These two hammers, Tiny Tim and the Frame Smith's Hammer, were noticeably alike in construction and worked as a team, one to make the forgings and the other to join them by welding.

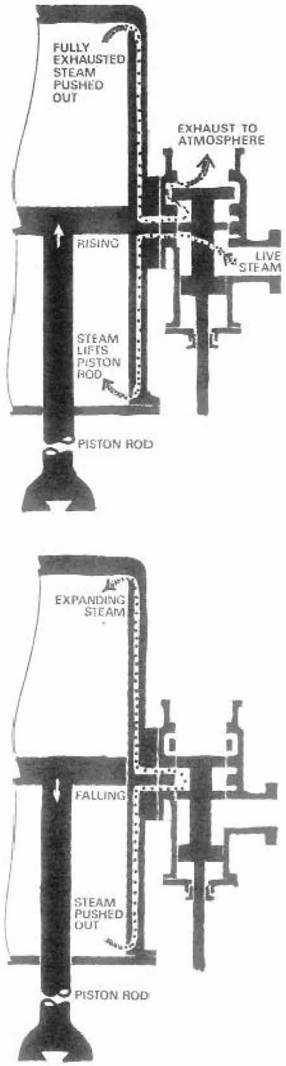


Fig. 9. Valve gear for "Tiny Tim".
(*a*) Upstroke.
(*b*) Downstroke.

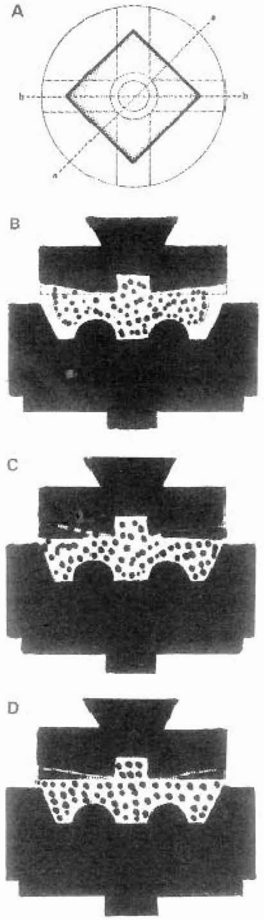


Fig. 12. Tools to produce railway wheel discs. (Not to scale).

(*a*) Plan view of top tool with cruciform fullers. Tinted area indicates workpiece.

(*b*) Side elevation of top and bottom tools through section a--a.

(*c*) Side elevation of top and bottom tools through section b—b. In each case, tinted area indicates displacement of workpiece material after first few blows.

(*d*) Side elevation at completion of hammering. In each case, dotted lines indicate slope of gap between fullers.

Construction of Tiny Tim

Fig. 8 shows the general arrangement. Each leg was in two halves bolted together, so that in addition to the roomy aperture there was access through the arches in the legs themselves. The forgeman could stand back from the heat, a striking contrast to the cramped arch of the Nasmyth hammer in Fig. 3.

The beam was essentially a box made of wrought iron plates $1\frac{1}{2}$ inches thick strengthened by 5 inch angles inside. These angles can be seen at the present time, because the hammer is dismantled and are a wonderful example of the angle-smith's work, being fitted round the whole of the edge of the beam, 24ft. long and 4ft. wide in the middle in a continuous loop with no visible joints. This means that over 50ft. of 5 inch by $\frac{3}{4}$ inch angle must have been smithed to fit the corners and finally joined by welding, somewhat after the manner of the stern-frames on a small scale. Electric welding would make nothing of such a job but this was long before that.

Tiny Tim was described as a single acting hammer, which implies that steam was admitted below the piston to lift it and exhausted to allow it to fall. Actually, as shown in Fig. 9, steam was used to lift the hammer and exhausted, not to atmosphere, but through the valve chest to the top of the cylinder on the downward stroke, and finally exhausted to atmosphere driven out by the rising piston. This arrangement may have been intended to have a silencing effect and it certainly gave the hammer a characteristic double impact sound which was easily recognised.

The hammer driver stood on a platform about 8ft. from the floor. There does not seem to be a very convincing reason for this, but it was the practice at that time. The same elevated platform can be seen in Fig. 10, which shows the 12 ton double acting hammer "No. 5B" which replaced the "Old No. 5". This was preferred to Tiny Tim, being faster though a little lighter and it continued to make both built-up wrought iron forgings and one-piece forgings from steel ingots till this latter work was taken over by the introduction of the first hydraulic press in 1902.

Later Use of Tiny Tim

Tiny Tim thus became redundant at Darlington and was bought in 1910 by Messrs. Baker Bros., which became Messrs. John Baker and Bessemer in 1929. It was installed in their Railway Wheel Forge at Kilnhurst near

Rotherham in 1912. It was used at that time, before they had any presses, to rough out disc wheel centres. For this work a rotating anvil was fitted, at first rotated by hand, but later by a hydraulic ratchet gear, shown in Fig. 11. The slabs to be forged were sheared from rolled bars and were roughly 20 inches square by 5 inches thick, weighing approximately 5 cwts.

To produce a round disc from these square pieces was an ingenious piece of forgemanship. (See Fig. 12). The top tool had fullers in the form of projecting cross pieces. These fullers extended from the edge of the top tool inwards, stopping short of the centre so as to leave the boss projecting. The space between the fullers was cut away so as to slope upwards. The slabs were placed with the corners of the square under the fullers and several heavy blows struck which caused the material to flow sideways, from the fullers, assisted by the sloping faces between them. The bottom tool was then rotated after each further blow and hammering continued till a flash was formed all round the impression in the bottom tool. The forging was then turned over and the flash removed by wheel cutters. At this stage the forgings were reheated and then hammered between a further pair of tools to form an even-sided head to the wheel; this head was then, without further reheating, expanded to size by rolling in the wheel mill.

When presses were installed at Kilnhurst, Tiny Tim was only used for forging turbine rotor discs. Discs up to 5ft. in diameter and 30 cwts. in weight were forged using a plain bottom tool which was rotated continuously and a narrow top fullering tool. The hammer did this work better than the presses, striking about twenty blows a minute and was used for this purpose as recently as 1963.

We are indebted to Mr. Henry Baker who was joint Managing Director of Messrs. John Baker and Bessemer Limited, when it closed down at the end of 1963, for the later information about Tiny Tim.

Conclusion

It is only by the fortunate accident of this hammer being utilised for the special work described that it is now available for preservation. Quite a number of water hammers have been preserved as ancient monuments, both in this and in other countries, but a steam hammer of this size and of this vintage is unique.

Latterly the component parts of Tiny Tim have been stored at the Darlington Forge, its original home. The United Steel Companies and English Steel Corporation jointly bore the scrap purchase price, the Steel Group of Sunderland providing transport from Kilnhurst to Darlington Forge free of charge. During the present year the pieces have been uplifted again and are now stored on the site of the North of England Open Air Museum, BEAMISH, Co. Durham.

The 80 years of Tiny Tim's working life spanned one of the most important periods of engineering development. This hammer and its contemporaries made possible the manipulation of large wrought iron masses, enabling the engineer to use the hitherto largely untapped potential of this material. It is entirely proper that this surviving relic of such an age should be preserved in tribute to the men of genius who conceived it.

[It has not been found possible to reproduce all the illustrations from this article. The full article is to be found in the English Steel Corp--oration Review, Summer 1967.]

A Durham Canal

Don Wilcock

Canal enthusiasts who have always regretted that the proposed coal canals between Stockton and the South Durham Coalfield were never started, may take heart that there was an attempt to build a canal in the County. An extract from The Agricultural Survey of the County of Durham by John Bailey, London, 1813 states, " the first attempt to make a canal was by the late Mr. George Dixon, upward of 50 years ago [? about 1760] to carry coals from Cockfield Fell Colliery (which he rented from the Earl of Darlington) by a small canal without a lock, to the top of Raby Bank near Keverstone, and then to convey them in wagons down an inclined plane to the foot of the bank, the loaded wagons to draw up the empty ones; from the foot of the bank the coals were to be conveyed in another canal, without a lock to near the top of Grout Bank, where they were to be taken in carts to Yorkshire, that came over Pierse Bridge and Winston etc. He cut a short piece of canal upon Cockfield Fell, and had a flat-bottomed boat upon it, to prove to the late Earl of Darlington the practicability of the scheme; but his Lordship refusing to advance any money, the scheme was abandoned..."
Somewhere among the hills and hollows of Cockfield Fell is an embryo Canal!