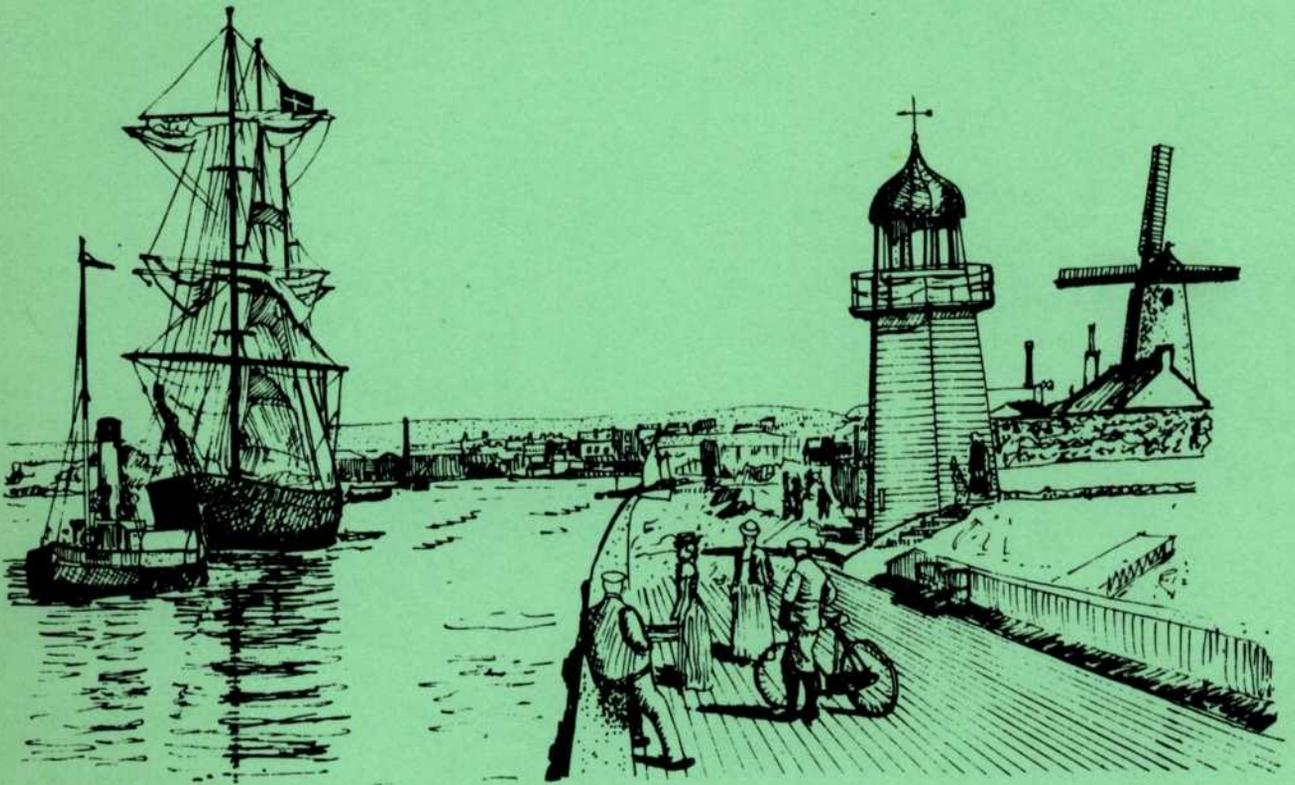




SUSSEX INDUSTRIAL HISTORY



LITTLEHAMPTON HARBOUR c.1900

R.G. Martin

**Sussex Harbours - Offham Chalkpit Tramway - Ashburnham Limeworks
North Laine, Brighton - Uppark Water Supply - Iron Ore Trade**

ISSUE No 15

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The Harbours of Sussex as part of an Inland Transport System in the Eighteenth and Nineteenth Centuries

The stretch of coast within the bounds of the ancient county of Sussex has no intrinsic significance in transport history.(1) Since the silting of Rye harbour in the seventeenth century, it has lacked a major natural harbour, for Chichester was and is accessible only to small craft. None of the harbours had more than a local hinterland (with one exception mentioned below): although the hinterlands cannot be defined with much precision, and varied over time and for different commodities, in general they probably did not reach beyond the limits of the county because of the proximity of Southampton to the west, London and the Medway to the north, and Dover to the east.

Furthermore, 'harbour' has to embrace any place frequented by shipping, whether or not graced by harbour works, because much cargo was landed from vessels run aground on the beach until the 1820s and continued to be at Hastings and in Chichester harbour until about 1880.

It is more useful, therefore to begin, not with harbour works, but with a measure of volume of traffic. The figures in Table 1 are, all but one (Rye, 1910), derived from the administration of the Customs, and refer to the 'tonnage' of the vessels which entered or cleared with cargo. They are confined to the coastal trade (including Ireland) because, again with one exception, foreign trade was comparatively slight and insufficient to determine the pattern of any harbour's development. (The exception was the cross-Channel passenger and goods traffic through Newhaven from 1849; much of this originated from or was bound for London and beyond.) The years chosen before 1841 are determined by the survival of records: in Sussex the Port Books, as anything approaching a complete series, end in 1714. For a dozen reasons the figures are not comparable from year to year: different ways of measuring the vessels' tonnages, changes in ports' boundaries (particularly affecting Chichester), changes in regulations as to what cargoes were entered in the records (increasing the 1880 and 1910 figures relative to the rest), etc. Probably, though, a greater shortcoming is that vessels' registered or measured tonnage is being used, in effect, as a proxy for cargo carried, and, though the ratio of carrying capacity (deadweight tonnage) and cargo carried may possibly have remained constant, the ratio of registered tonnage to deadweight tonnage did not. A crude multiplier has been included to derive the largely spurious measure: 'deadweight tons per 1000 population' for the county of Sussex.(2)

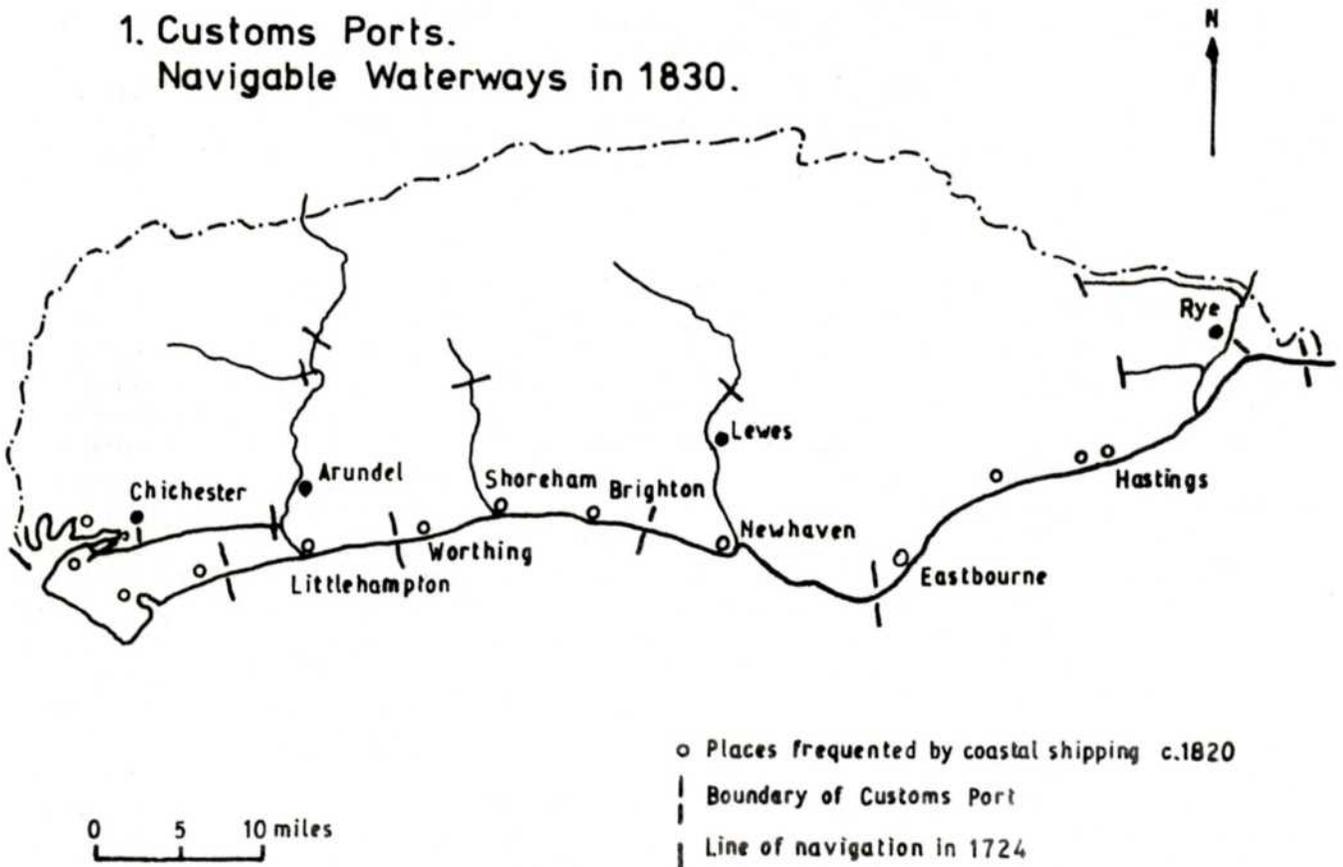
The following questions can be posed, both for the period before the railways (to 1841) and after their arrival (from 1851):

- (1) what were the principal reasons for the changes in the nature and volume of traffic indicated by the tables?
- (2) were harbour works a major contributory factor?
- (3) what was the role of other modes of transport, competing with, or complementary to, coastal shipping?

SUSSEX: TRANSPORT in the 18th. and 19th. CENTURIES

1. Customs Ports.

Navigable Waterways in 1830.



Before the Railway

Map 1

The pronounced shift towards imports, shown in Table 2, should not be allowed to conceal the fact that the volume of coastal exports increased at least five fold between 1701 and 1841. The goods exported were much the same at both dates. Corn shipments amounted to about 16,500 quarters a year in 1702-16, and 52,000 in 1818-23 - though a greater proportion at the latter date may have passed between Sussex Ports because processing was more concentrated. Some 1,200 loads of timber left the coastal plain Ports each year between 1694 and 1716, while the eastern Ports shipped perhaps 100 cargoes (at least 5,000 loads?) a year in the 1830s. Small quantities of wool passed at both the beginning and end of the period, as did hops, though on an increased scale in the 1830s; but iron exports had almost ceased by 1800. As time passed, London's dominance as the destination of exports grew.

But imports did increase much faster, perhaps 40 to 50 fold between 1701 and 1841. For this coal was above all responsible: the volume landed was some 2,500 tons and 200,000 tons at the two dates. Already in 1701 coal may have occupied half the importing shipping capacity and perhaps three quarters in 1841. Other goods were nevertheless also imported in larger quantities. Imports of corn, only 3,500 quarters a year in 1702-16, stood at 23,000 in 1818-23. More of other food-stuffs were imported (butter, cheese, salt, groceries), and similarly manufactured goods and also some building materials. Closer examination of the coastal trade suggests that, while some of its expansion must be attributed to population growth, some can be attributed to regional specialisation. Thus, wheat took a much larger part of the corn exports in the early nineteenth century, while imports of barley and oats may have exceeded exports by 1800; and the timber

shipments were probably possible because Scandinavian deals were imported to supplant oak in local building.

It is unfortunate that there are no sources which can provide figures comparable to those in Table 1 for any date between the beginning and end of the eighteenth century, as 'deadweight tonnage per 1,000 population' (Table 5) increased faster between 1701 and 1789-90 than between 1789-90 and 1841: 1.9 per cent a year against 1.2 per cent. This is probably the reverse of what would be expected, and any means of tracing the eighteenth century growth in more detail would be welcome.

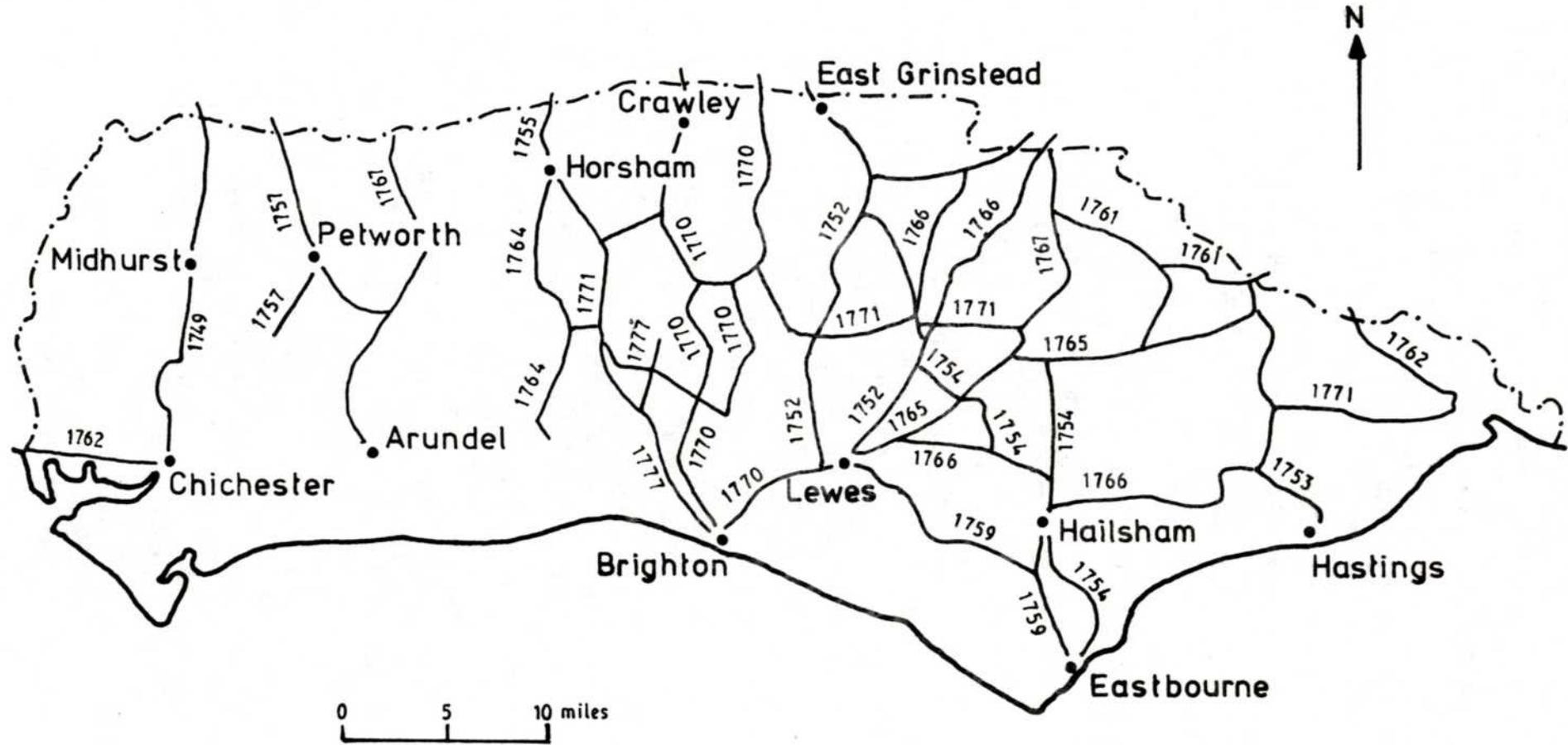
A good proportion of the coastal trade, at least up to about 1824, owed nothing to harbour works in Sussex, because it was conducted over the open beach. In 1710, Hastings beach saw about one sixth of the Port of Rye's cargoes (coastal and foreign) and one half in 1835. A growing share of the Port of Shoreham's trade was over Brighton's beach around 1800. The smaller resorts of Eastbourne, Worthing and Bognor all received coal over the beach in the early nineteenth century. A century earlier there were no effective harbour works in Sussex. In the seventeenth century, shingle drift seems to have become more troublesome to navigation of the river estuaries, and piers were completed at both Newhaven and Littlehampton in 1735, and at Shoreham in 1763. The piers, if only temporarily, eased access to the harbours and probably served to enable vessels of a given size to enter over a larger part of the tidal range, rather than to attract many larger vessels. For, in their unimproved states, the harbours could probably have admitted most vessels using them in 1789-90. At that date, Chichester and Rye still had no works, those of 1763 at Shoreham had been abandoned, and the piers at Newhaven and Littlehampton were sorely in need of maintenance. Hence the harbour works were not demonstrably a major factor in the growing volume of traffic. But it is reasonable to infer that the increase in average size of vessel between 1789-90 and 1841 was possible at Newhaven, Littlehampton and Shoreham because of further engineering works, piecemeal at the first two, and major at the last, completed in 1821.

Turnpike roads came relatively late to Sussex, and before 1750 there were none within 20 miles of the coast. Hence the surge in corn exports (foreign as much as coastal) in the 1730s and '40s came without the benefit of improved roads. The turnpikes of the 1750s radiated out from London and seem to have been intended for travellers and goods which already normally went by land. Thus the first two improved roads which reached the Sussex coast, at Hastings and Langney Bridge, were probably intended to speed fresh fish and fattened stock on their way to metropolitan markets. The next group, authorised c 1760-77, included cross-roads, particularly in the Weald, and may have helped the carriage of iron cannon to the coast, but only in the declining years of Wealden gunfounding.⁽³⁾ The only clear instances of turnpikes affecting harbours are roads linking them. Those east and west of Shoreham, to Brighton and Worthing, opened in 1823, transferred the beach traffic to the Shoreham's new harbour. Probably some traffic with London was diverted from sea to land, but the main significance of the turnpikes is likely to have been that they speeded and cheapened the distribution of goods from the harbours and so increased the demand for them which is reflected in the greatly enlarged imports.

River navigation was of more significance but again came late. One reason for the limited importance of roads was that Rye, Newhaven, Shoreham and Littlehampton harbours each lay at the mouth of a river navigable, in 1700, for five to ten miles by barge, and maybe further for rafts of felled timber. Improvements came wholly in the period 1790 to 1830, and were most extensive in the Arun valley where a canal linked it, via the Wey, to the Thames. The Wey and Arun Canal seems not to have constituted serious competition for Littlehampton harbour, but rather only for the coastal trade with London, as 3,750 tons a year in 1837-40 passed by it between Arundel and London.⁽⁵⁾ Another effect was to reduce the

SUSSEX: TRANSPORT in the 18th. and 19th. CENTURIES

2. Turnpike Roads authorised up to 1777.



proportion of ships which went up river to berth at Arundel rather than Littlehampton. Otherwise, the navigations did enlarge the harbours' hinterlands for bulk goods which, of course, comprised mainly coal. Around 1800, coal replaced furze in downland limekilns: the tripling of coal imports at Newhaven between 1794 and 1805 was attributed principally to the general use of lime as manure, which was distributed up the Ouse from the Lewes area. Littlehampton's hinterland for coal in the 1830s was up to 30 miles as the crow flies, Shoreham's and Newhaven's, 16 miles, and Rye's, 12 miles. The second phase of harbour improvement was roughly contemporary with the improvement of river navigation but in the local instances, tended to follow rather than precede it.

The conclusion for the pre-railway age is that only towards its end did harbour works become essential to meeting the demands of coastal vessels, that the harbours did not encounter significant competition from other modes of inland transport, but rather the river navigations increased the demand for coal imported through the harbours.

The Railway Age

The more plentiful information for the second half of the nineteenth century allows a connected narrative and the years in Table 1 to reflect the main phases of change.

In the second half of the nineteenth century, the railway and the developments associated with it had a more profound impact on maritime trade in Sussex than contemporaneous changes in shipping technology or in harbour engineering. The railway constituted much more effective competition than roads and navigations had been, by capturing existing traffic, by opening up land-locked sources of supply to compete with traditional coastal sources, and by more effective distribution of seaborne goods from the place of landing. This third factor favoured concentration of shipping activity in fewer harbours with better facilities, as also did the use of larger vessels which could better compete for long distance carriage.

The railways in Sussex which were most directly to affect the maritime trade were opened within the short period of a dozen years, between 1840 and 1851, and at the latter date were nearly all operated by the London, Brighton and South Coast Railway; see Map 3. By 1852, there was rail access to Rye, Hastings, Eastbourne, Newhaven, Brighton, Shoreham, Worthing, Arundel and Chichester. Branch lines reached Littlehampton and Bognor in 1863 and 1864.

The railway's competition was first felt in the distribution of goods from the harbours. Thus the main benefit which was expected from the Brighton-Shoreham line was the removal of the constant procession of coal wagons along the seafront. Despite poor facilities at Shoreham eight years after the line was opened two thirds of the coal entering the parish of Brighton came by rail. In the same year of 1848, five months after the Lewes-Newhaven line was opened, the harbour commission halved the dues on coal carried up the lower Ouse Navigation.

But as the network expanded, the railway began to take traffic away from shipping. Much as the stage coach services collapsed in the face of the competition, so the regular sailings to and from London faded away in the late 1840s and early 1850s. Not only were the coastwise imports of general goods lost, but also exports of wheat, hops, etc, and foreign imports such as Dutch cheese were concentrated at major ports and distributed from there.

Hence the relative importance of the coal trade to the harbours was further increased: this is reflected both in the increase, between 1841 and 1851, in the imports of coal and the decline in tonnage of vessels, and in the greater proportion

of inward tonnage. But the coal trade was immune from railway competition only until 1849 when the LBSCR's branch line to Deptford wharf, on the river Thames, was opened. The company was soon landing coal from the north east for distribution over its system, helped by the partial repeal in 1851 of the dues levied on coal brought to London but then carried more than 20 miles from it. The harbour most affected was Shoreham, and the commissioners now acted with greater timeliness than they had when the railway had sought facilities earlier in the decade. In 1851-5 they made the eastern arm of the harbour into a 'floating canal', with a lock at the west end and wharves at the east end, two miles nearer Brighton than the existing wharves. In 1858/9, the harbour recovered its 1847/8 level of coal imports and on the south side of the canal, towards the sea, what became Sussex's largest gasworks was started in 1874 and the largest electricity generating station in 1906.

The next phase of railway penetration came with the opening, in 1863-9, of the three link lines across or round London which allowed through running by rail to the LBSCR system of 'inland coal' from the Midland fields. In 1862, the LBSCR carried, for distribution throughout its system, 208,000 tons of coal, probably almost wholly from its own wharves; in 1867 it carried 491,000 tons most of the increase being run through from the Yorkshire and Midland coalfields. Later figures are not available, but the tonnage can be estimated at perhaps 1,200,000 tons a year in the early 1880s. In 1886, the opening of the Severn Tunnel gave a more direct route from the South Wales field.

Through running from the coal fields spelt the end of regular shipping at Hastings; the last of the town's coal brigs was wrecked on the beach in 1879. Rye's traffic in the 1880s was perhaps half that of the 1840s, and remained at or a little below that level until the First World War, though latterly, besides some coal, comprised no more than locally collected shingle which was landed and re-shipped. The war marked the end of its history as a commercial port. At Littlehampton and Chichester the decline, which had been only gradual since the 1840s (though masked at Littlehampton by the LBSCR's running an unprofitable steamer service across the Channel between 1863 and 1882), was accelerated.

The final phase of rail/ship competition in goods carriage before the First World War opened in the 1880s. The earlier phases had affected all the Sussex harbours similarly, though to different degrees. In this phase some harbours continued to lose trade but others saw increases; a greater proportion of trade was therefore concentrated in fewer harbours. The principal cause was the introduction of steamships. These had been used in the cross-Channel passenger traffic since 1822, but although cargo steamers were operated by the LBSCR to and from France, and although steamers were bringing coal down the east coast to London as early as 1845, only from 1884 did they come regularly to Sussex in the coasting trade. Economic operation of steam colliers in competition with the railway required a good depth of water in the harbour and cranes on the wharf, and only where the former existed did the steamers go. Those harbours were Shoreham and Newhaven. At the former the canal guaranteed a constant depth of water while ships unloaded. At the latter the harbour works designed for the cross-Channel boats and financed by the LBSCR (which in effect if not in law owned the harbour from 1878) were taken advantage of by the steam colliers as soon as they were completed in the late 1880s. The results were that Shoreham recovered the ground previously lost, while Newhaven saw a spectacular four-fold increase in coastal tonnage between 1885 and 1895. Table 5 suggests that in 1910 the volume of goods moved coastwise through the ports was roughly the same per head of population as in 1851 and about 80% of the 1841 level.

By the First World War there were thus only two commercial harbours of any significance remaining in Sussex and, indeed, their main characteristics persisted

until the 1960s. Newhaven was a cross-Channel port owned by the railway which did not encourage lorry traffic, so coastal and general foreign traffic remained at much the same volume as in the 1880s. Shoreham was part of the industrial and service zone of the Brighton conurbation and was improved so as to supply the power stations which consumed most of the coal imports; hence the harbour's poor rail and road connections tended to be ignored.(6)

With reference to the questions posed above, this section has argued that the changes in the nature and volume of seaborne traffic between 1841 and 1914 arose principally from competition with the railway, especially in the carriage of coal; and that harbour works were a major factor in the ability of shipping to compete.

TABLES

Port	1701	1789-90	1841	1851	1880	1910
1. Tonnages of vessels entering or clearing in coastal trade with cargo (tons)						
	Burden	Registered	←———— Net registered ———→			
Rye	2116	12540	53047	49700	20850	16989
Newhaven	1264	10436	37192	37056	39560	198882
Shoreham	2897	15441	78365	86068	36742	83686
Arundel	2032	16787	29229	30554	} 34866	22086
Chichester	4275	31090	35398	21632		
Total	12584	86264	233231	225010	132018	321643
2. Percentage of tonnages in 1. which were <u>inward</u> .						
Rye	35	67	74	87	81	59
Newhaven	71	71	79	82	57	68
Shoreham	39	63	91	91	80	88
Arundel	17	39	70	70	} 85	84
Chichester	27	45	71	81		
Overall	34	53	80	85	84	74
3. Average tons per vessel						
Rye	30	40	56	64	75	97
Newhaven	33	49	99	111	138	294
Shoreham	28	69	93	115	88	184
Arundel	28	60	82	90	} 63	58
Chichester	22	73	52	54		
Overall	26	58	73	86	86	191

TABLES (contd.)

4. Estimated seaborne imports of coal (tons)

Rye	500	10000	38000	40000	20000	10000
Newhaven	600	7000	32000	39000	49000	128000
Shoreham	800	10000	82000	100000	71000	140000
Arundel	70	4000	25000	25000	} 35000	25000
Chichester	530	9500	25000	25000		
Total	2500	42500	202000	229000	175000	303000

5. Ratio of tonnage to population of Sussex

Population, '000	100	135	300	336	483	660
Ratio, NRT:DWT*	1:1	1:1	1:1.5	1:1.5	1: 2	1: 2
Ratio:DWT per 1000 population	126	639	1166	1005	547	975

* Net registered tonnage:deadweight tonnage.

References

1. This paper is based, unless otherwise stated, on J.H. Farrant, The harbours of Sussex 1700-1914 (Brighton: author, 1976), and 'The seaborne trade of Sussex, 1720-1845', Sussex Archaeological Collections, 114 (1976), 97-120. For the principal and secondary works on Sussex transport see J.H. Farrant, Sussex in the 18th and 19th Centuries: a bibliography 4th edn. (Brighton, 1982) pp 35-39.
2. I will welcome suggestions as to a more refined multiplier.
3. G.J. Fuller, 'The development of roads in the Surrey-Sussex Weald and coastlands between 1700 and 1900', Trans Inst Brit Geog, 19 (1953), 37-49; H.C. Tomlinson, 'Wealden gunfounding: an analysis of its demise in the eighteenth century', Econ Hist Rev, 2nd ser, 29 (1976), 383-400.
4. Sussex turnpikes have yet to be analysed, as those elsewhere have been e.g. M.J. Freeman, 'Turnpikes and their traffic: the example of southern Hampshire', Trans Inst Brit Geog, new ser, 4 (1979), 411-34.
5. West Sussex Record Office, IN/Arun/F5/1; whether the tonnages are of goods or of barges is unclear.
6. H.C. Brookfield, 'Three Sussex ports 1850-1950', J Transport Hist, 2 (1955), 41-46.

Sources for Tables

Tables 1, 2, 3: 1701-1851: Farrant, 'Seaborne trade', 100.

1880, 1910: Annual statement of trade and navigation, British Parliamentary Papers, 1881 (C.2920), lxxxvii; 1911 (Cd 5840), lxxix.

Table 4: 1701: Port Books as cited for Tables 1 - 3.

1789-90: estimated from Universal British Directory, 1 (1790), xxviii.

1841, 1851: estimated from BPP, 1847-8 (728), 1i; 1854 (11), lxxv; Minutes... Select Committee of the House of Lords on the New Shoreham Harbour Bill, April-May 1873, 100*-101*.

1880: BPP, 1881 (191), lxxxiii.

1910: East Sussex Record Office, DP box 67, for Rye. British rail (Newhaven), ledger of imports and exports. Shoreham Port Authority archives. Littlehampton and Chichester estimated from Table 1.

R. G. MARTIN

The Offham Chalkpit Tramway and Incline - A Survey and Description

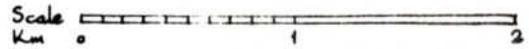
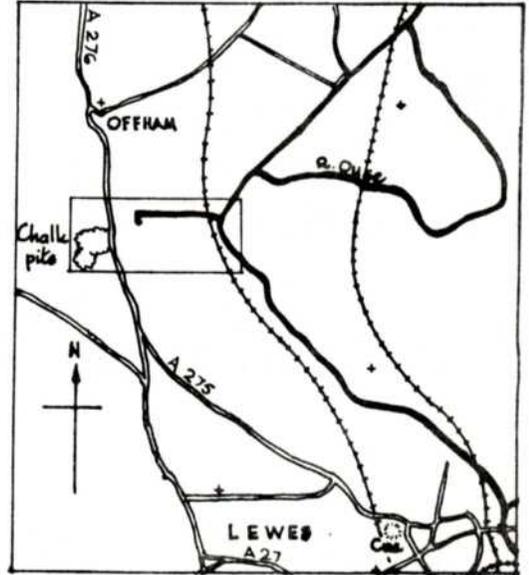
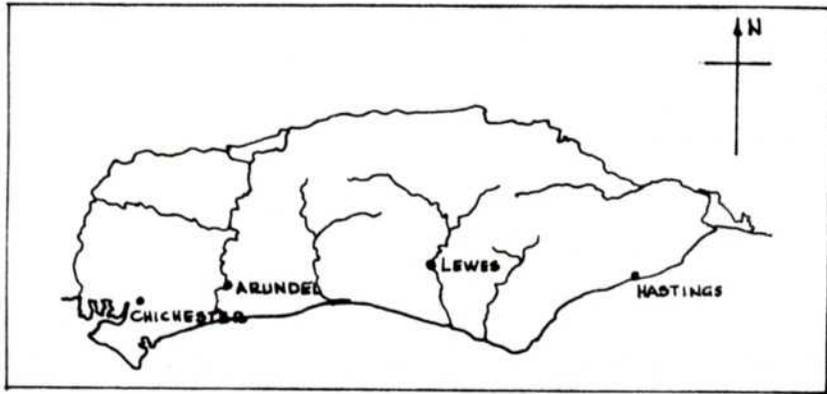
The tramway at the Offham Chalkpit extended from the chalk pit base level down to a branch off the Upper Ouse Navigation known as Chalkpit Cut. It was built in 1809 and is shown on the First Edition of the 25 inch Ordnance Survey map published in 1873, but on the Second Edition, dated 1898 there is no sign of the tramway and the chalk pit is described as "disused".

The physical remains comprise two parallel tunnels 22 metres long constructed in redbrick with slightly flattened semi-circular barrel vaults and separated by a 450 mm thick wall. The level at the top of the tunnels is about 1.5 metres and at the bottom about 8 metres from ground level down to the crown of the vault with an incline of 1 in 3.5. The height of the tunnels is about 2.1 metres above track bed level to the crown of the vault although the southern tunnel and the upper part of both tunnels are partly filled with earth.

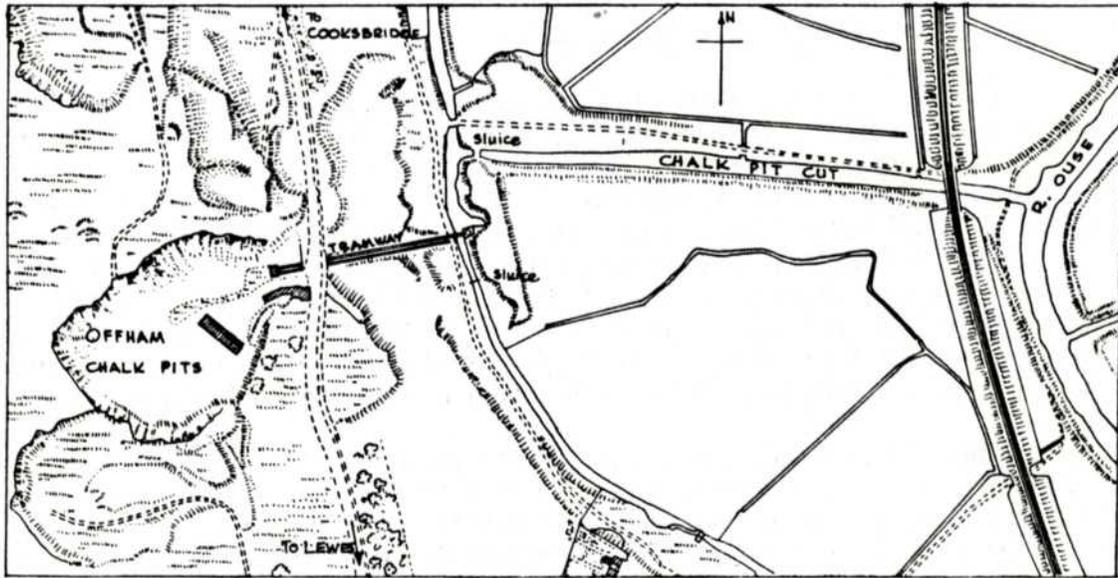
The faces of the walls above the tunnel entrances are battered to about 13° from the vertical, and the one at the west end being built of red brick in English bond and in a rather ruinous condition. At the east end, the wall is in header bond and is in good repair with flanking retaining walls of mixed construction. The lowest part is of flint rubble work and probably pre-dates the tramway as it is battered to a much steeper angle than the tunnel end. These retaining walls are extended at both north and south ends and the whole is surmounted by later brick construction in English bond with a 510 mm thick parapet wall and moulded brick-on-edge coping. Also of later date are three battered brick buttresses built against the east tunnel ends and various areas of concrete underpinning and retaining walls.

There is no evidence of any track or sleepers and the line of inclination of the track bed from the tunnel exit down the slope towards the cut can be determined. It is interesting to note that this slope approximately lines up with the crown of the tunnel vault which would suggest that there would have been a level or less sloping section of the track and adjacent to the lower tunnel exit, with a similar change of gradient at the bottom where there is a lane beside the cut.

The 25" Ordnance Survey map clearly shows a building at the top of the

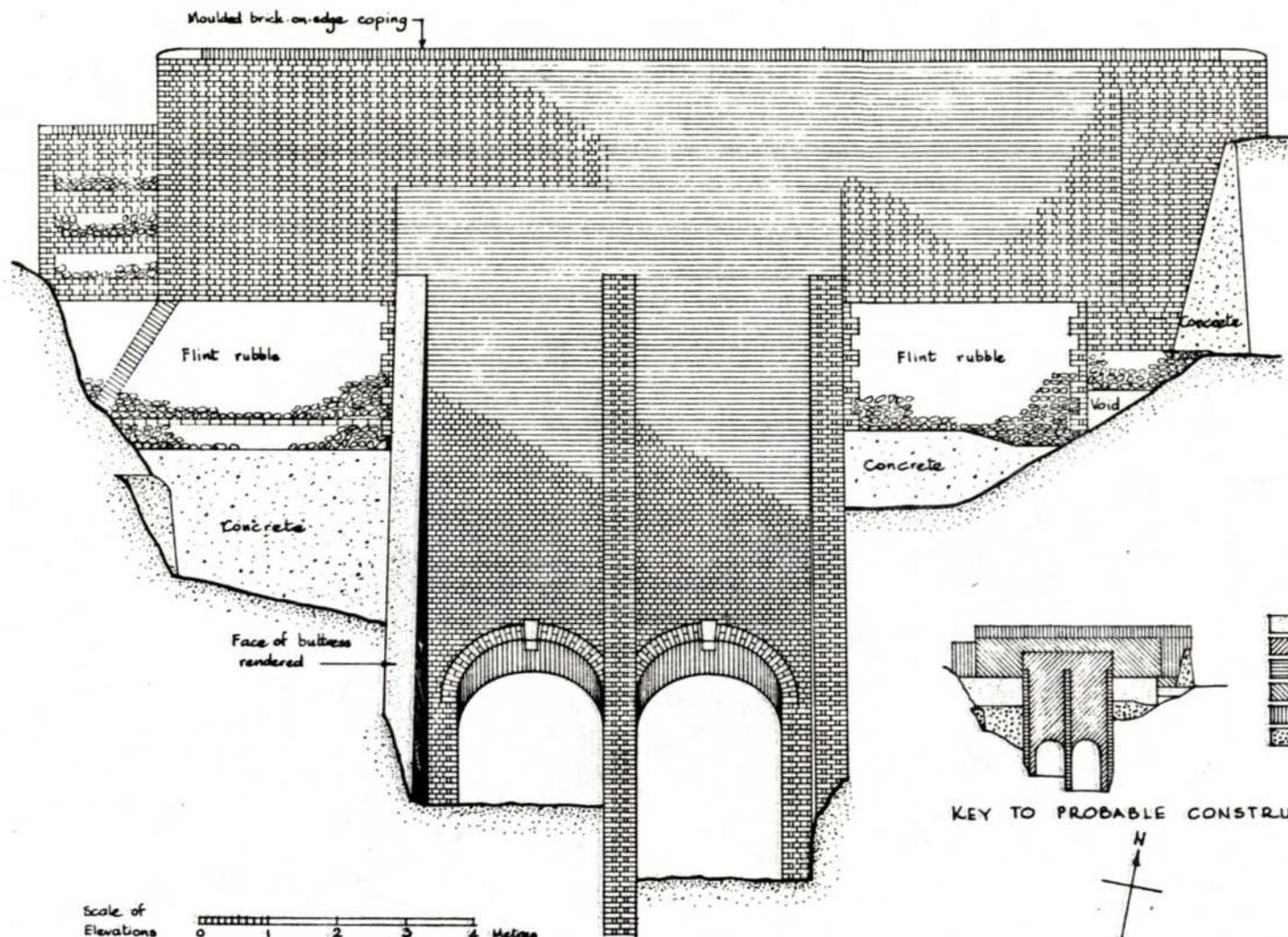


Location Plan



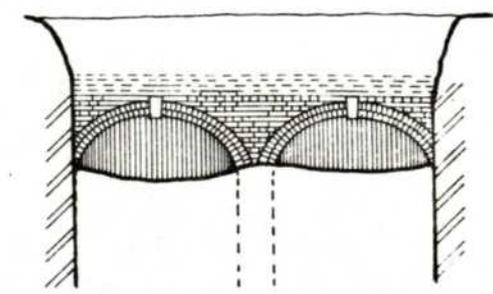
Site Plan

Reproduced from 25 inch O.S. map, Sheet LIV, 1st Edition, 1875

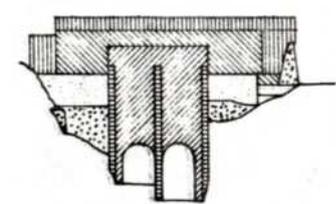


Scale of Elevations
0 1 2 3 4 Metres

East Elevation

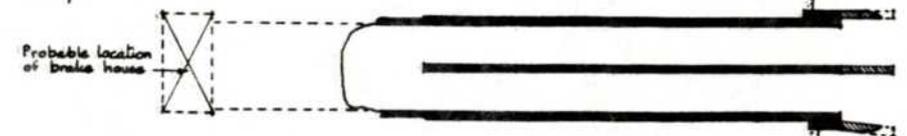


West Elevation



KEY TO PROBABLE CONSTRUCTION DATES

- Pre 1809 construction
- 1809 Tunnels
- Post 1809 buttresses
- Post 1809 brickwork
- Later brickwork
- Recent concrete walls



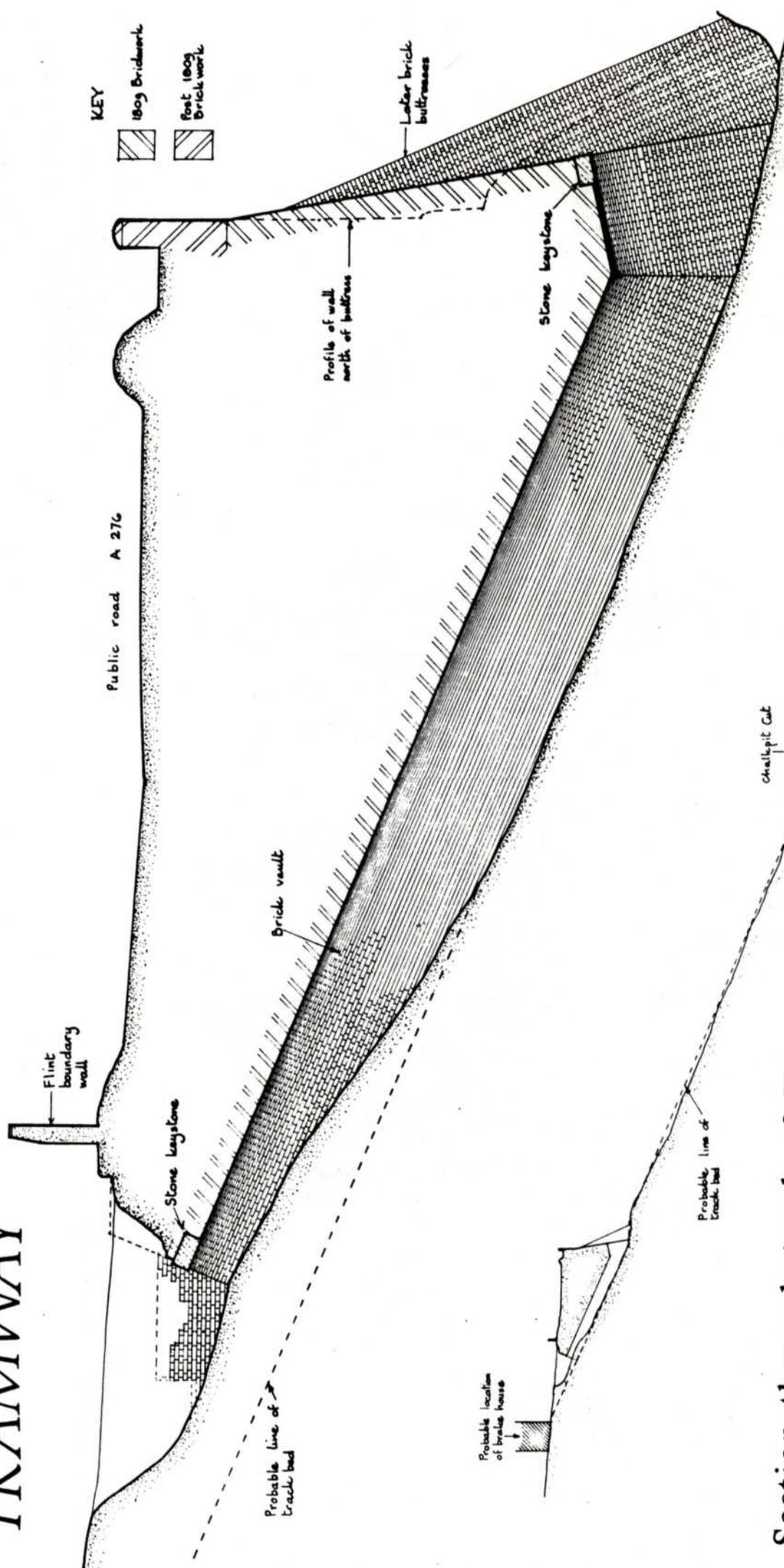
Scale
0 5 10 15 Metres

- Pre 1809 flint rubble
- 1809 Brickwork
- Later brick buttresses
- Recent concrete

Plan of Tunnels

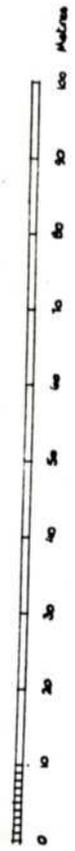
OFFHAM CHALK PITS, HAMSEY

TRAMWAY



KEY
 1809 Brickwork
 Post 1809 Brickwork

Section through track of Tramway



Section through Tunnels



incline plane and two tracks. The southernmost track is showing stopping at the lane but the northernmost track is shown continuing across the cut to a circular shape on the east bank. It is probable that this track was carried over the cut on staithes to facilitate loading of barges and the circular area shown on the map is a support to the end of this structure.

It is not known how the system worked but from the evidence of the map and the site it could be presumed that the loaded trucks ran on the northernmost track and the rope passed around a pully or pullies situated in the brake house and connected to the fly or vanner referred to in the article by Tom Evans. The loaded trucks would have been counterbalanced by trucks on the southernmost track weighted to exceed slightly the weight of the unloaded trucks.

Hopefully the upper end of the tunnels and the track bed can be excavated and the brickwork repaired in the near future in order that the tunnel entrance may be more easily viewed than at present.

My thanks are due to various members of the Society who assisted me on the site and to Mr. Peter Hinton, the owner of the chalk pit for permission to gain access to the site.

TOM EVANS

George Shiffner and the Offham Chalkpit Tramway

A recent re-examination of the Shiffner manuscripts at the East Sussex Record Office, Lewes has been undertaken with special attention to those that throw light on the sources of supply of materials for plateways in the South of England in the early years of the nineteenth century.

George Shiffner was an industrialist with Russian origins, a military background and was later M.P. for Lewes, (1812-1826). (1) He lived at Coombe Place, Offham just north of Lewes and operated a business at the Offham chalk pits. During the "canal mania", when the River Ouse above Lewes was being canalised under the direction of William Jessop Jnr., George Shiffner had the intention of supplying chalk by means of a "cut" from the Ouse and an inclined plane with a plateway to transport the chalk to barges moored at a wharf and possibly with limekilns near the foot of the incline.(2) In 1807 this must have been quite a revolutionary project for rural Sussex. A local civil engineer Cater Rand appears to have drawn up the first scheme for the undertaking and he may also have had experience in projecting an inclined plane for Shoreham harbour.(3) The cut was to be surveyed by "Mr. Hodgkinson" (Jessop's surveyor) and concern was shown about the means to secure the land from damage from flooding as early as 1793.(4) There are also later references to reinforcing the water supply to Molineaux's paper mill by means of the cut.(5)

Shiffner's first practical step towards implementing the plateway scheme appears to have been to contact an iron works in Southwark - Bailey Ward & Co.,

whose address was the "South foot of Blackfriars Bridge". Their reply dated 7 July 1807 offered new rail at 10 guineas per ton and "damaged" rail at £8 per ton. They also referred to oak sleepers "as generally used in chalk pits", a practice apparently general by 1807. Only four years earlier the Surrey Iron Railway had opened and it is at least possible that Bailey Ward or their predecessors supplied rail material to this venture. Chalk quarries were an important reason for the extension of the Surrey Iron Railway to Merstham.

Another longer letter to Shiffner dated 10 Dec. 1807 contained an offer of "the waggons you saw in our yard" but declined to advise on "a person fitt to undertake the tunnel" or to supply "stones fitt for the railway".

At about this time Shiffner appears to have decided to seek the advice of the Jessops. He forwarded Cater Rand's scheme which on 28 December 1807 was scathingly rejected by W. Jessop Jnr. after consultation with his father.(6) Instead he offered to undertake the whole operation. The price of rail was quoted at £13 per ton delivered to Newhaven. Jessop was clearly anxious to secure the supply of all the ironwork for the Offham tramway and thus was very scathing about a source in Yorkshire which he claimed was used by Bailey Ward for their supplies. Jessop made it clear that there had been no connection up to that time between Bailey Ward and the Butterley Ironworks, an Outram-Jessop enterprise in Derbyshire. This correspondence does however suggest that although Bailey Ward described themselves as brass and iron founders, they bought in their supplies of railway material.

Bailey Ward appear to owe their origin to the firm of Bailey Pocock & Co. ironfounders of Bankside, Southwark listed in the London directories as early as 1790.(7) Bailey Ward are shown at Upper Ground, Blackfriars in directories of 1811 and 1817 and were clearly a well established firm in the iron trade.(8) Although there is no evidence that they supplied materials to the Surrey Iron Railway, they were in a convenient position to do so, either by the Thames to the terminus at Wandsworth or via the Grand Surrey and Croydon Canals from Rotherhithe.

Another London iron merchant listed in the 1817 directories was Henckell & Du Buisson of Lawrence Pountney Lane, Cannon St. who had their works at Garret Lane, Wandsworth convenient to the line of the Surrey Iron Railway and where, on the River Wandle, there is earlier reference to iron mills.(9) It has been stated in the Transactions of the Newcomen Society that the material for the Surrey Iron Railway originated with the Ashby & Ticknall tramway in Leicestershire and Derbyshire, but whether Bailey Ward or any other firm acted as an agent or intermediary is not known to the writer.

Amongst the ironwork supplied to the Offham scheme was a large wheel weighing $1\frac{1}{4}$ tons which was referred to in a letter from Jessop to Shiffner dated 3 December 1808.(10) This was made by the Butterley ironworks and the route specified for delivery was via the "Gainsborough wharfinger" and presumably the coastal route from the Humber to London. Further transport was to be either by land carriage ("50 miles for £5 or less") or "fetched from Croydon". This would suggest transport via the Croydon Canal which was not officially opened until 1809 so the wheel would, if it was possible, have been one of its first cargoes. Transshipment to the Surrey Iron Railway at Wandsworth would have been another possibility since a single wagon could easily carry a load of $1\frac{1}{4}$ tons.(11) However a postscript to the letter says "The wheel will be consigned to Anderson & Eades(12) care, Bridge Yard Wharf, Tooley Street. We have written them to forward it per fast vessel to Newhaven - if you determine to have it by land we will advise them to inform you immediately on its arrival in Town" - (the actual route from London-Lewes is not revealed).(13)

The use of this wheel is probably indicated in a letter of 20 Nov. 1807 where

Jessop refers to a "fly or fanner" to brake the waggons when travelling down the incline under gravity.(14) Although no precise details of the wheel appear in the Shiffner manuscripts it seems likely that the wheel was in effect a reversible pulley or cable drum combined with an air brake at the top of the incline. Waggons would be coupled to the cable (or chain) travelling, when loaded, down either of the two tracks, each passing through its own tunnel under the turnpike. Both tunnels still survive passing under the A275 road.(15) The empty waggons would of course be drawn to the top of the incline during the descent of the loaded waggons so that no motive power would be required. Presumably there was also some simple signalling system to indicate at the chalk pit when waggons at the bottom of the incline had been unloaded.

NB A later Ms. listed in the index refers to a newly invented engine for drawing water by wind, but this remains to be investigated.(16)

There is also a considerable amount of material in the MSS. concerned with land problems including unauthorised dumping of chalk. This goes back to 1793 in correspondence between the Canal Undertakers and Sir John Bridger (Shiffner's father-in-law) and with one Joseph Mighell who was "Proprietor of the Hill or Sheep-down lying above but adjoining". Also land above the road was owned by the Duchess of Dorset and Lord Abergavenny. Shiffner offered 2d per ton to all land-owners with chalk. An indication of Shiffner's holding is given by the statement "Mr. Partington has the pit, I have the wharf".(17)

(To unravel the complications of land ownership and wrangles over trespass etc., some concentrated effort is required in ESRO which could best be dealt with by someone with special interest in legal matters!)

References

1. Catalogue of the Shiffner Archives p xii.
2. ESRO Shiffner MSS 1960-73, 2019-20, 2032, 2813; Michael Robbins, "The First Sussex Railway", The Railway Magazine July 1971 355-7.
3. John H. Farrant, "Civil Engineering in Sussex around 1800 and the Career of Cater Rand", SIH 1973-4. There is a reference to the projected railway based on the Haytor granite tramway, to link Shoreham with Brighton and Worthing. A later inclined place for Shoreham harbour may owe its origin to early proposals by Cater Rand.
4. Shiffner MSS 1960, 2032.
5. Shiffner MS 2032.
6. Shiffner MS 1967.
7. Universal British Directory (1790).
8. Post Office Directory (1811); Johnstone's Directory (1817).
9. Derek A Bayliss, Retracing the First Public Railway (Croydon 1981) 46 based on David Hughson, History of London (1808).
10. Shiffner MS 1968.
11. Bayliss op cit 20.
12. Anderson & Eade is probably the firm described as "Merchants" with an address at 104 Leadenhall St. in Holden's Directory 1805-7.
13. Shiffner MS 1968.
14. Shiffner MS 1967
15. Robbins op cit

16. Shiffner MS 2028.
17. Shiffner MS 1960, 2032.

WILFRED BESWICK

The Ashburnham Limeworks at Glaziers Forge Burwash

The limeworks of the Ashburnham estates were important during the eighteenth and early nineteenth centuries, not only as a source of family revenue but as a supply of lime to the surrounding Weald. At this time, the iron smelting industry was beginning to phase itself out so that wood fuel for such operations as this, would once more become available and at an economic price. It therefore made good sense to exploit the limestone of the Purbeck bed which ran in a north-westerly direction, across part of the estate from Orchard Wood near Battle, to Poundsford Farm in Burwash Parish.

Geologically, the Purbeck underlies the Hastings beds and outcrops can be seen in a few places such as Darwell Hole, extraction however, involves relatively deep mining as distinct from the open face quarrying of chalk which is the most usual method obtaining calcium carbonate in Sussex. Today, the Gypsum Mines at Brightling mine the beds for road-stone.

The Glaziers Forge limeworks site is of interest, since it is yet another of the numerous Sussex locations, where one type of industry succeeds another of a different nature. Briefly, at Glaziers, we had the early building of a hammer-mill by Nicholas Pelham for the purpose of converting to wrought iron, the pig-iron which he was producing in two blast furnaces some miles away.(1) This was all part of a planned iron industry to be extended further, by a third blast furnace built by him about the same time of 1547, at Penshurst.(2) At this time both Thomas and John Glazier were known to be concerned in iron-making matters in the locality, but other than to give their name to the forge, there is no firm record so far found which links them to its operation.

As a hammer-mill, Glaziers continued with the Pelham family until early 1768 when together with the Manors of Burwash, Burghurst and Dallington, it was transferred to Ashburnham ownership.(3) A new lease to James Bourne finally expired in 1792. From any industrial standard, its continuous life as a forge of two hundred and fifty years is remarkable and under the ownership of one family for almost all of that time.

The Ashburnham Estate appears to have carried on a lime burning business on the family account from at least 1786 until 1815(4) and the limeworks accounts show local sales of lime at six pence per bushel and as far afield as Benenden, Goudhurst and Brede with some shipments being made to London. There were already both mines and kilns at Orchard Wood on an extensive scale and Darwell Wood is also mentioned for kilns in some reports(5) but there is some evidence that the operations around Glaziers were established about 1795 and run by the Ashburnham family until 1815 after which they were leased to John Westover who paid a royalty of £1.15s for every 600 bushels of limestone raised. His maximum payment in any one year was £113.5s which gives some indication of the scale of operations - about 39,000 bushels maximum per annum or say 3,000 tons of stone from the mine. On a 250 days working year this is about 12 tons of stone per day. Some years were as low as a royalty payment of £22.10s. Driver in his report on the estate of 1830 speaks of this "being an operation on a modest scale" but of Orchard Wood

he says "had been extensive but some time disused".(6) Westover left Glaziers in 1833(7) and no subsequent record of lime burning has so far come to light.

There are three more or less contemporary descriptions of these operations at Glaziers and in the surrounding fields, first the "Driver Report" mentioned above and secondly the well known book by Gideon Mantell The Geology of South East England (1833). The third is General View of the Agriculture of the County of Sussex by Rev. Arthur Young (1813). From these it is fairly clear that the mines were first on Westdown Farm - fields 27 and 28 as well as the kilns and at a later stage, the mines were on the south side of the Dudwell stream on Watkins Down with kilns at Glaziers - "fields 23 and 24 used with the limeworks". See maps and schedule(8). Mantell writes of "shafts dug from under the shale, props of limestone being left to support the strata over an area of several acres".

As to the kilns, it is very clear from Young that these were of the "flare" type. Unfortunately the David and Charles reprint of his book which is available at most libraries in Sussex, omits a drawing quoted in his text. However the description points to a kiln or kilns of the flare design which consists of a brick lined structure built into a bank quite shallow but probably some 15 feet long horizontally. Along each side and probably down the middle, a low bench was formed in brick or stone and from this right up to the open top a brick lining was formed with an outwards batter. The method of charging the kiln was to first form an arch or two arches made from large blocks of limestone along the length of the kiln and then to build on these arches with smaller pieces until top level was reached which was about at ground level. The top was covered with old bricks, sods etc. The single or twin firing tunnels thus formed along the kiln with their arches sprung from the benches, were used to feed faggots of wood or furze as fuel. The burning time was said to be 15 hours to maximum temperature and three days to cool down. Any firing adjustment was apparently a matter of removing the top cover as and where required. Stress was placed on very adequate drainage, an obvious point with kilns of this size, built into the earth and subject to both seepage and flooding. Water in a kiln full of quick-lime would create a disaster. In the various reports there is some inference that kiln capacity was 600 bushels. Mantell writes of that amount per 24 hours but at least a week would be required to charge, fire and cool down and empty one kiln and this comes more closely to Westover's maximum.

Just such a kiln was discovered and excavated by the Robertsbridge Historical Society in Northiam Parish and reported in Recollugia July 1977. I am grateful to the author of the report, Mrs. G. Jones, who arranged inspection at site. (fig.1) Attached to an old brickworks of probably eighteenth century

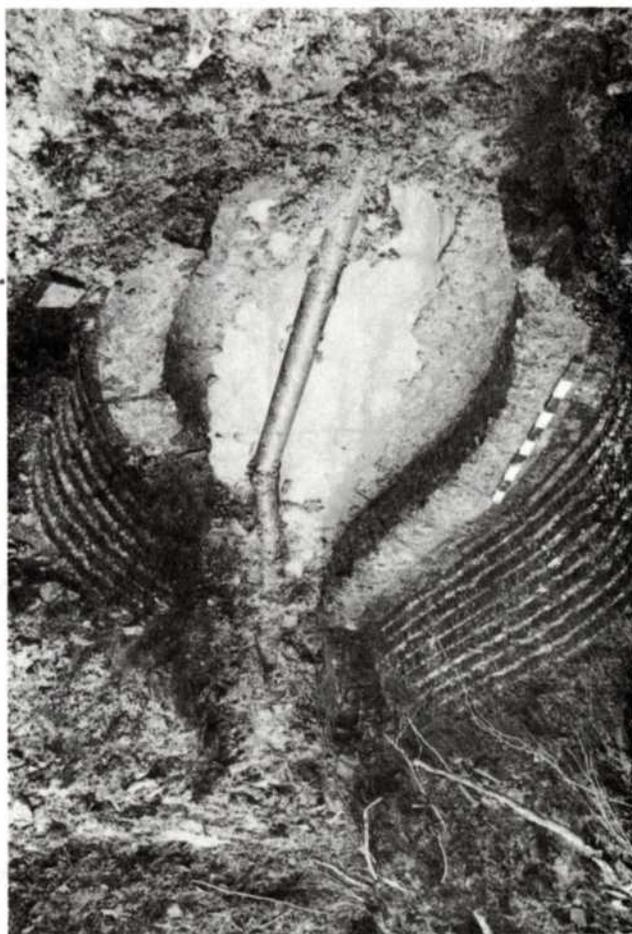
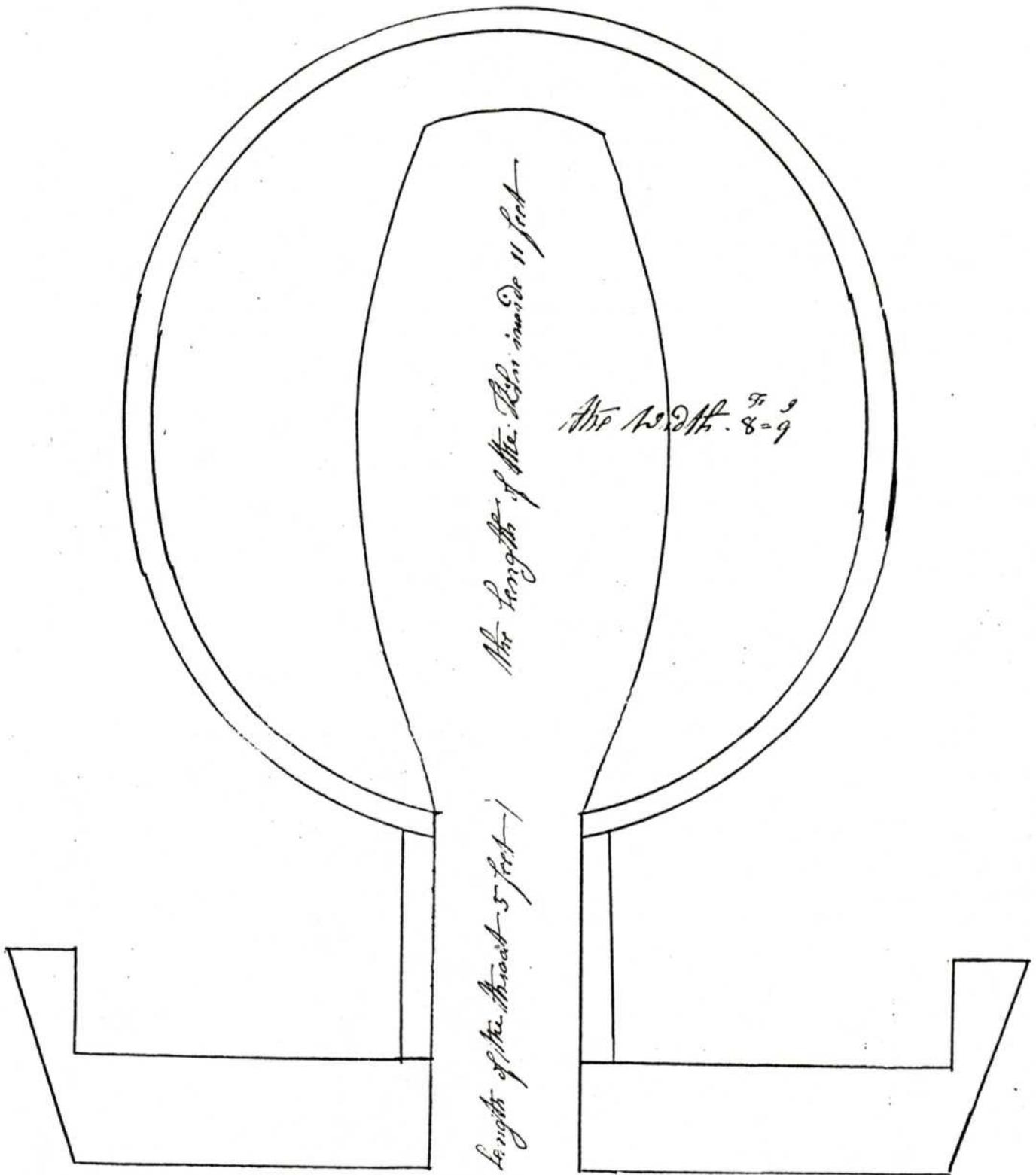


Fig. 1 Flare kiln at Northiam - the drain pipe is modern (John Martin)



The Breast of the Kiln 12 feet
 The Kiln will take 7500 Bricks
 30 Bushell of Lime ---
 Labour for Building the kiln will be £4-10-0
 Without Digging out-Hole
 John Blackman

Fig. 2 Plan of flare kiln proposed for Ninfield

date and certainly much earlier than an 1831 estate map of the area(9), this kiln closely follows Young's description. Of single arch with a bench along each side, it is 3.7m long, 2.0m width at widest and 1.03m high. The benches are of brick and each has a well built culvert behind it to lead any seepage away, there is a long drainage channel leading at floor level through the firing hatch and away to a disused clay pit. Generally, this design of flare kiln provides an exceptionally large flame to stone surface contact but is very shallow and would be prodigal in its fuel consumption by modern vertical shaft kiln standards.(NGR TQ 812232)

The plan given here is contained in some Fuller papers relating to a farm in Ninfield, E. Sussex.(10) The main dimensions are shown, but exclude the height, and some materials of construction are listed. The capacity of this kiln would have been about 300 bushels of lime and very similar in this respect to the Northiam example.(fig.2)

Returning to Glaziers site, the writer found no remains save some uneven ground and a well built stone bridge which would have served to bring stone from the mines and across the Dudwell stream.

For further notes on limeburning in Sussex see "Lime Kilns in Central Sussex" by Mrs. M. Holt SIH. No.2 1971 and "Mining and Subterranean Quarrying in Sussex" by P.W. Sowan SIH. No.14 1984/85.

A note on lime may not be out of place. Both chalk and limestone CaCO_3 are the carbonates of the metal calcium. The carbon dioxide CO_2 is driven off by simple heating at about 890 deg. C or less. The resultant oxide - quicklime - can be slaked with water to give the hydroxide Ca(OH)_2 . Mixed with sand, this hydroxide once provided the mortar used in brickwork construction. It slowly hardens by the combination with atmospheric CO_2 . It is therefore quite usual to find relatively small limeburning operations attached to some of the eighteenth and nineteenth century brickworks as at Northiam.

References

1. B.G. Auty, "Aliens in the Ironworking Areas of the Weald", WIRG Bull. 4 1984.
2. PRO C3/73/58 For which I am indebted to Dr. J.J. Goring.
3. ESRO Ashburnham L202.
4. ESRO Ashburnham 1836.
5. ESRO Ashburnham 1173 This is Driver's report of 1830. Mention of Darwell Wood is made by Mantell.
6. Driver writes of the Westover lease going back for 14 years (from 1830), this would make a starting date of 1816.
7. B. Short "The Turnover of Tenants on the Ashburnham Estate 1830-1850" SAC vol 113 1975.
8. ESRO Ashburnham 1171/ map 1V.
9. ESRO Microfilm XA 16/1 Map of Frewen Estate in BM.
10. ESRO RAF/F/6/4 Plan of kiln.

*The North Laine of Brighton -
The Study of an Area*

The North Laine of Brighton is an area bounded to the south and west by Church Street, Queens Road and the railway line and, to the north and east, by New England Road, Viaduct Road, Ditchling Road and the Old Steine. The area was divided roughly into furlongs bounded by "leakways" that have become the present east-west roads like Trafalgar Street and North Road. Development commenced in the late 18th century in the south east corner and was completed by the 1860s. What began as crofts and farmyards changed at an early date acquiring a manufacturing role which has been retained to the present day. A mid 1860s block of model dwellings for the poor(1) still stands at number 10 Church Street which provided cheap accommodation for artisans. The Excise office was once situated next to the "King and Queen" in Marlborough Place.

The pub(2) makes a convenient starting point for a walking tour as there is street parking nearby. Turning up Church Street past the former Court House(3) the present Music Library(4) was once the show-rooms of the Brighton & Hove Gas Company, although gas was produced initially at Black Rock and at works next to St. Andrew's Church in Hove until the 1870s when the works at Portslade were built.

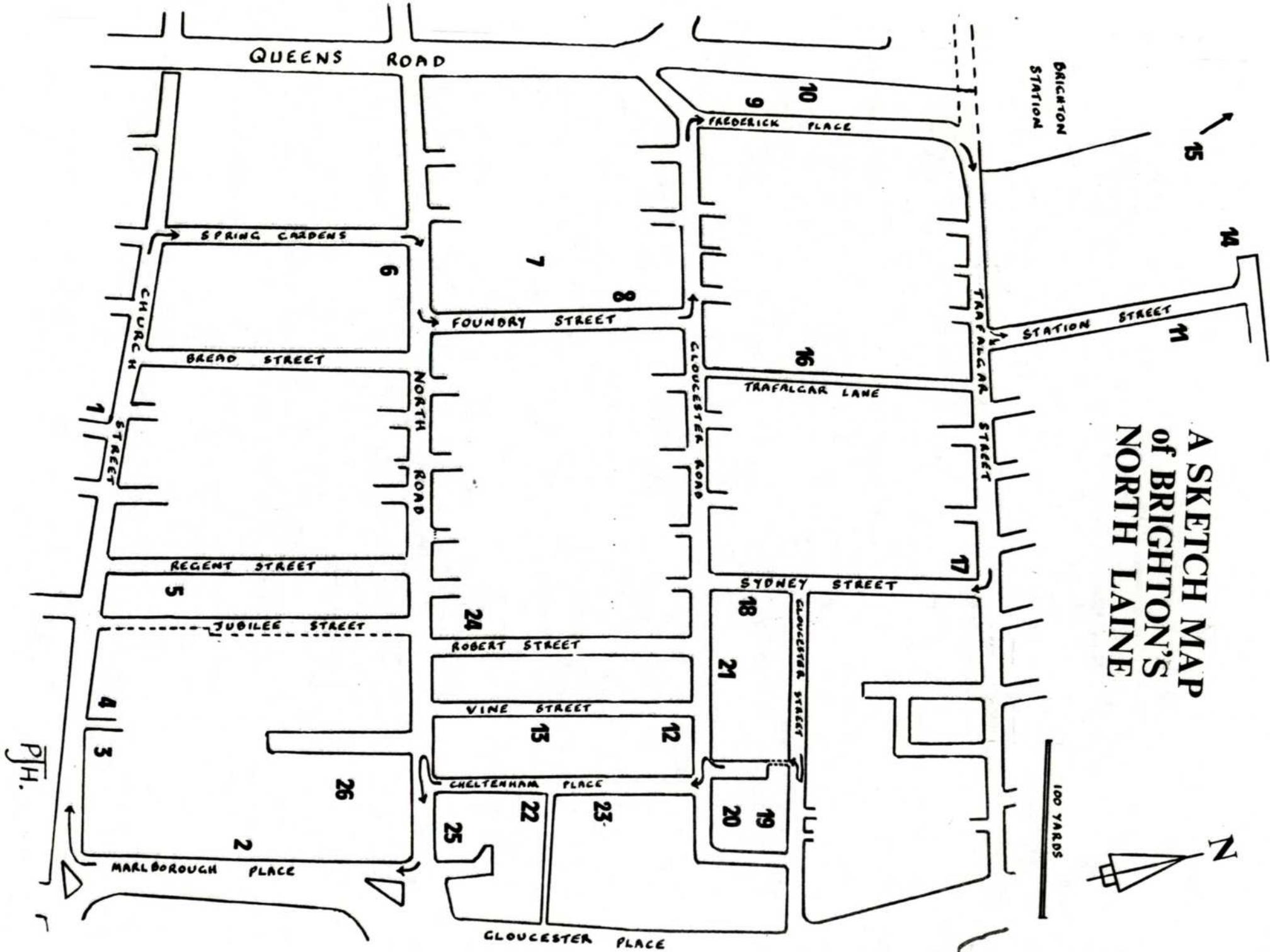
Nothing remains of Jubilee Street, now a car park. The 1848 directory lists a stay and corset maker, a blacksmith, coal merchants, a rope and twine maker, the blind asylum, a horse infirmary and even the Town Crier. Here also from 1863 to 1893 was the Crown Brewery, the premises existing until the 1960s as the "Crown Shades" pub although part of the building became auction rooms.

In 1896 Thomas Harrington built horse waggonettes, flys and landaus at premises in Regent Street. The company continued in Hove as motor body-work specialists until the 1960s. A former furniture depository and store house(5) was recently destroyed by fire having been used by a manufacturer of reproduction furniture. The premises adjoined the Rev. Wagner's National School that was unnecessarily demolished in 1971.

At number 85 Church Street between Bread Street and Spring Gardens was the "Star Foundry" whose name can be seen on many old iron coal hole covers set in Brighton pavements. The foundry closed in the 1900s the site being covered by the corporation electricity works. The area was once known as Hicks Gardens, the Hicks family being Brighton land-owners. Here were the stables and malthouse of George Wigney, the Ship Street brewer, whose brother, Isaac Newton Wigney, had the bank in North Street that failed in 1847.

Brighton's first electricity generating station was in fact in a shed in Reed's foundry in North Road operated by the Hammond Electric Light Company. The small plant is thought to have been the first in the country to generate electricity away from the customers' premises. It unfortunately went into liquidation in 1885. The town's second station opened in 1891 on a site still owned by Seaboard as a store and transformer station with the original office at 39 North Road(6). Much of the old buildings remain awaiting demolition and can be viewed from the car parks either side. The plant was badly situated to receive supplies of coal and

A SKETCH MAP of BRIGHTON'S NORTH LAINE



closed in 1908 after the Brighton "A" power station had taken over in Shoreham Harbour.

Opposite in North Road was Palmer and Green's later Reed's "Regent Foundry" that cast the chains of the Brighton Chain Pier and whose name appears on the railway arch over New England Road. The company specialised in domestic iron work, stoves and railings, closing in liquidation early this century. The G.P.O. sorting office(7) now occupies the site. To the east is Foundry Street with "Foundry Cottage" at number one. At number 32 the name of J. Evershed & Son(8) can be made out on the wall, a soap manufacturer whose company exists today as a grocery wholesaler in Shoreham. Other trades carried on in the street were lead-pipe makers, engineering, leather working and bootmaking.

Pass now to Frederick Place, a street that seems to have housed many small industries, examples being a laundry, a cooper, a boot and shoe manufacturer and a small brewery that was recorded as empty in the Rates Book for 1854. In the 1880s Reeves, a grocer, opened a bonded warehouse for the storage of wines and spirits free of duty at number 4. The establishment continued until the 1960s when the later owners, Messrs. Edlins, transferred their business to Shoreham Harbour. The wording "Central Duty Free Warehouse"(9) can still be deciphered on the wall. Fronting on to Queens Road but extending back to Frederick Place was Hudson's furniture depository(10), dating from 1879 and now awaiting demolition. The company had been formed 20 years earlier to store and handle furniture brought down mainly by the Brighton railway. They had stables and storage in other parts of the town, the present Comet warehouse (11) in Station Street being the most noticeable example.

Station Street once housed a soap maker (Evershed whom we met in Foundry Street), an iron founder and a brewer all on the west side before the goods yard was extended on arches up to the street at the end of the last century. The brewer, a William Carter, a former corn merchant, once owned the "Coachmakers" pub nearby and transferred his brewery to premises still intact at number 24 Vine Street(12), ceasing trading in 1890. The coachmakers probably refers to the nearby railway carriage works. Today the pub is owned by the little Raven Brewery whose modern plant brews real ale in a former slaughter house at 35, Vine Street(13).

From the north end of Station Street you can see the site of the railway goods yard(14), all buildings now demolished. Further north and close to the station was the Brighton Locomotive Works(15) that were rebuilt on the site in 1870-3 under the direction of William Stroudley, the locomotive and carriage superintendent of the London Brighton & South Coast Railway. Once over 2,000 men were employed building and repairing locomotives. The works were run down by the Southern Railway who transferred work to Ashford and Eastleigh although they took on a short but important fresh lease of life during the second World War, again building locomotives. Final closure came in 1958 and demolition in 1969, the premises having been used to assemble Isetta bubble cars. The site is now a car park. Even the former "South Coast Tavern" at 38, Trafalgar Street is now a printers.

Trafalgar Lane had a saw mill last century and the premises formerly owned by John Ede Butt survive in the ownership of Travis Arnold(16).

Turning down Sydney Street, the premises now owned by Rayfords(17) were formerly a clothing store and later owned by the Co-op. Number 42 bears the legend "Dyeing and Cleaning Works"(18) and became later the receiving office for the Sun Ray Laundry.

Gloucester Street in 1848 had a female orphan asylum at number 12 and more recently a commercial school at number 28. The premises at number 6 and 7(19)

gave more trouble to research being, at various times last century, recorded under different owners as millers, corn dealers and forage stores. The wording on the wall is now broken by the insertion of windows but possibly reads "A. Wood & Son, Corn Chandlers", a firm who in 1903 leased the Clayton windmill "Jack".

Passing through Gloucester Passage the building at number 127 Gloucester Road(20), bearing the inscription "W.W.1865" on the wall was once owned by William Wood, a miller and corn factor. Nothing remains of the Gloucester Brewery where at number 121 the Dowling family brewed first ginger-beer then later proper beer up until the end of the last century. Surrige & Dawson now occupy the premises(21) that were formerly the Drill Hall of the 1st Sussex Volunteer Artillery which had earlier replaced the Eagle Foundry in the 1860s. Opposite was the "Canteen" pub used by the military after their drill. The "Eagle" pub survives at number 125, the "Rock Ales" etched in the window showing former ownership by the old Rock Brewery, recently demolished in St. James Street.

The malt-house(22) at 40 Cheltenham Place was built in the 1850s by Ashby & Co. Brewers who owned the Bedford Brewery in Sillwood Street. In 1906 the malt-house and pubs were taken over by Smithers, another brewer whose premises near the Clock Tower have only recently been demolished. Mr. L.C. Ashby became a director and later chairman of Smithers. The malt-house was sold in 1913 to a wholesale grocers and is now owned by a manufacturer of T-shirts. The site for a maltster is a little strange being near neither brewery nor barley fields. The quite large two storey house would have produced more than enough for Ashby's needs so it is likely that they supplied the many other small local brewers. Number 36A(23) was owned by a mineral water manufacturer in 1902-11 who had moved from numbers 1-2. The premises were later used by the Stanmer Park Laundry. The location of these trades all dependent on water would suggest an abundant underground supply.

Most of Robert Street is taken up by Southern Printing Co's printing works(24) producing the "Evening Argus". Prior to 1911, the works were in Spring Gardens.

Continuing eastwards down North Road we pass a motor cycle dealer at number 103 that was once the Edwardian cinema, the "Troxy"(25), closing in 1939 as the "Rex". Crossing the road we see the site of the Corporation Baths(26) opened in 1895 on the site of the former army barracks that stood behind the "King and Queen" pub, our starting point.

Our thanks are due to the Brighton and Hove Reference libraries and to Sue Farrant who assisted us in this study.

JOHN EYRE & ALAN ALLNUTT

The Water Supply to Uppark

Uppark is a fine late seventeenth century mansion standing near the crest of the South Downs, 1¼ miles south of Harting at 560 OD NGR SU 779 177. It is National Trust Property and open to the public.

There was certainly an earlier house in Harting lived in by the Ford family and possibly one in the park. Edward Ford was born in one of these houses in 1605. After a chequered political career, during which he was knighted in 1643, he

turned his attention in the 1650s to the problem of London's water supply. With Cromwell's encouragement, and in collaboration with Thomas Toogood, he constructed in the grounds of Somerset House an "engine" for raising water from the Thames to serve streets in the vicinity of the Strand. This was patented in 1655 but the only clear account of it surviving was made by a Frenchman, Balthasar de Monconys, who visited London in 1663; he drew a sketch showing that it was horse driven and operated by suction only. There were four stages with four horses, one above the other. Thus the water was delivered at the top at atmospheric pressure and the total lift if the sketch was correct could not have been 120 ft. as claimed. Sir Edward Ford was later involved in schemes to bring water to the City via navigable canals from Hertfordshire. He died in 1670.

In c 1690 his grandson Ford Grey built the present Uppark House, apparently relying on deep wells for water supply as before. Later the supply was evidently found inadequate, not surprisingly for such a large house, and a water wheel driven pump was installed a mile north of the house at 250 OD SU 785 151. Near this point there were several ponds fed by springs from the junction between the chalk/upper greensand and the gault clay. Thus the pump had to work against a difference of level of 310 ft, the storage tanks being in the basement of the house, giving a static head of 135 lbs per square inch (approx).

The date of installation is uncertain, but a painting by Tillemans dated c 1710 on display in the house, depicts the view looking north over Harting and shows the pond and a small building in the position of the pump house looking like the oldest part of the pump house as it is today.

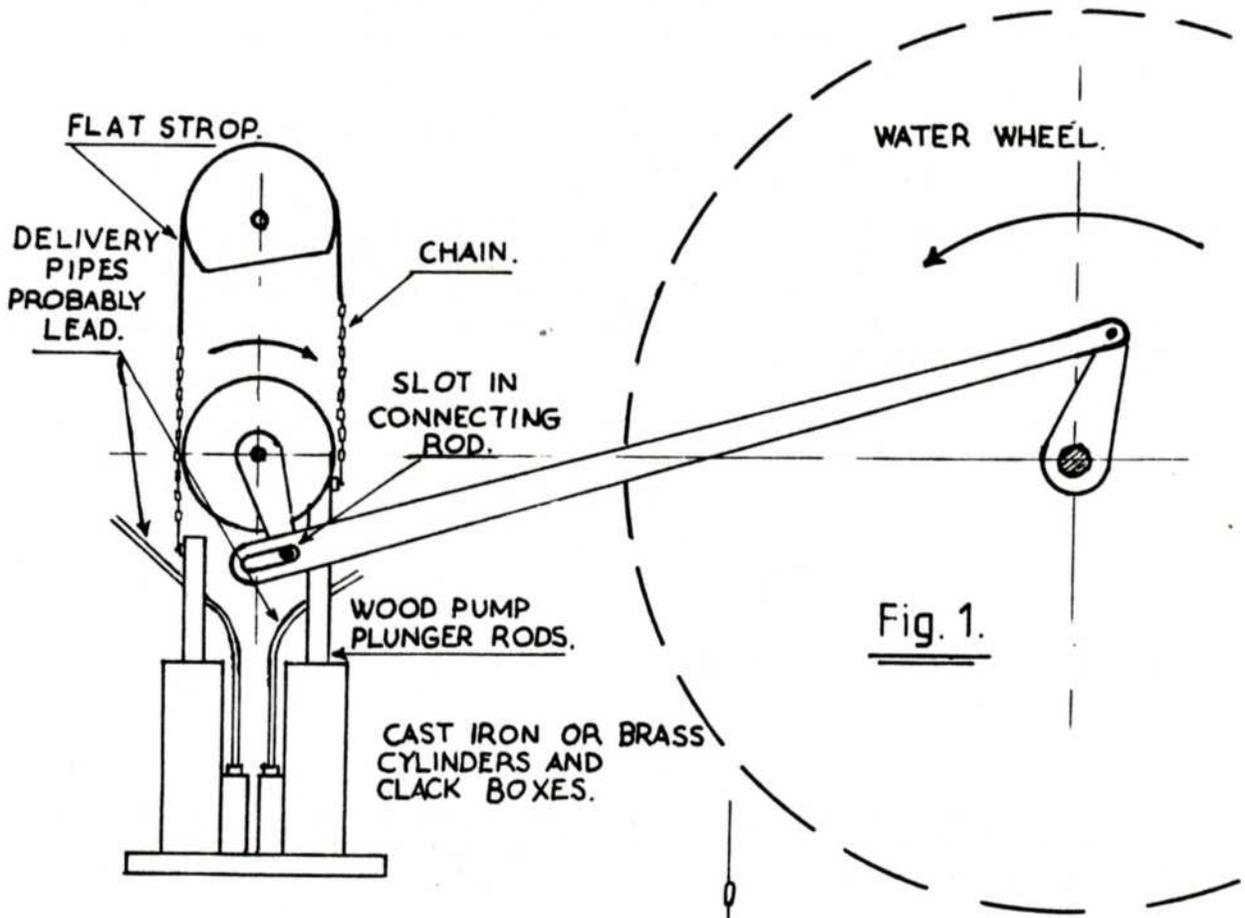


Fig. 1 Based on an illustration in Bate, *Mysteries of Nature and Art* (2nd Edition 1635) information in W. Maitland *History of London* (1781) Vol. I, 51

It has been suggested that Sir Edward Ford advised his grandson on water supply for the new house and that the "engine" was based on his installation at Somerset House, but that installation was clearly unsuitable and the house was built 20 years after Sir Edward Ford's death.

However, Ford Grey may well have known whom to approach for advice; all water engineers in London would be aware of the pumping installation at London Bridge. The original pump was installed under the northern arch by Peter Morice or Morris in 1582 to deliver water into adjacent areas of the City. (fig. 1) He demonstrated the pressure his pumps could develop by training a jet over the steeple of St. Magnus Church, much to the amazement of the populace. By the end of the seventeenth century his installation had fallen into disrepair and a new water company was formed, which employed George Sorocold, already well known for his water supply installations at Derby, Leeds, Norwich, Exeter, Bristol and Sheffield, to install new machinery. He used an enormous undershot water wheel to drive through gearing two four throw beam pumps, (one of which was probably the prototype for Coultershaw pump)(1) (fig. 2) The level of the water wheel was adjusted to suit the changing tidal level by hand winding a mechanism which raised or lowered the wheel. According to when it was installed the Uppark pump might have been a copy of either of these.

An indenture of sale dated 7 May 1747(2), when Uppark was to be sold, refers to the "engine" and the lead pumping main to the house, 'sometime since erected'. Unfortunately the pipe line was taken up and sold for scrap about 30 years ago, but a short length was found in the house, evidently the discharge end over one of the storage tanks which were in the basement and held some 3000 galls. or more. Surprisingly it is very thick, 2 5/16" outside diam, 1 9/16" inside diam, apparently seamless. Such a heavy pipe would obviously be unnecessary at the level of the house, but if it is assumed that a uniform size was used throughout, the static stress in the lead at pump level would be 360 lbs sq. in. (Lame Theory), a not excessively high stress if the joints were well made, even allowing for a slightly higher pressure during pumping.

The estate account books for 1818 record payments to Robert Chorley of Cocking Foundry for repairing the "engine", and subsequently he replaced it with a new pump, gear driven from an overshot metal wheel about 12 ft diam. and 4'3" wide. There are some remains of the wheel and his name is cast in the sluice gate controlling the launder. It is not clear whether he laid a new cast iron pumping main or used the one laid by Michell in 1792. The pipes found were 2½" internal diam. with 1" thick walls. Two Uppark Account book entries of 1791 also seem to refer to the installation of iron piping.(3)

At about the turn of the century the pump house was extended and it seems likely that a Tangye pump and oil engine were installed since a Tangye air vessel remains. In the 1930s the pump house was extended again and two Green and Carter (Winchester) electrically driven reciprocating pumps were installed. In 1965 these were superseded by a deep bore-hole at the house thus eliminating the long and vulnerable pumping main, which however, is still occasionally used as a standby.

References

1. SIH 9 "Petworth Water Supply" for details of the Coultershaw pump.
2. WSR0 K510.
3. Uppark Account Book 18 June 1791. "Luken Ironfounder - £200", 9 July 1792
"Michell - for laying down iron pipes £83.14s.

Additional Sources of Information

Dickinson, *The Water Supply of Great London* (1954).

John Stow, *Survey of London 1603* (1849 ed.) 71.

Rhys Jenkins, "A Chapter in the history of the water supply of London; A Thames side Pumping Installation and Sir Edward Grey's Patent from Cromwell". *Transactions Newcomen Society* IX 143.

Journal des Voyages de Monsieur de Monconys (1666) Vol. II 29

WSRO K 497 - K511 (Lewes Papers) for sources on sale of house and machinery.

Appendix I Peter Morice's Pump at London Bridge 1582

No description has been found as to how this pump worked, but an illustration appears in the two references, fig. 1. The illustration was labelled with the materials of which the external parts of the pump were made.

An undershot water wheel drove the pump by a crank and connecting rod arrangement but the pump crank pin worked in a slot so that it did not revolve but oscillated to and fro probably not much more than 90° .

Fig. 3 is conjectural. It shows a sectional elevation and end view of the pump. On the downward moving side of the drum the iron bar pushed the pump plunger down for the pumping stroke, while on the other side the chain pulled the pump plunger up for the suction stroke. Restraint needed to keep the pump plungers vertical throughout the motion would not be difficult to provide externally, and would be partially given by the wooden drum and the tension in the chain.

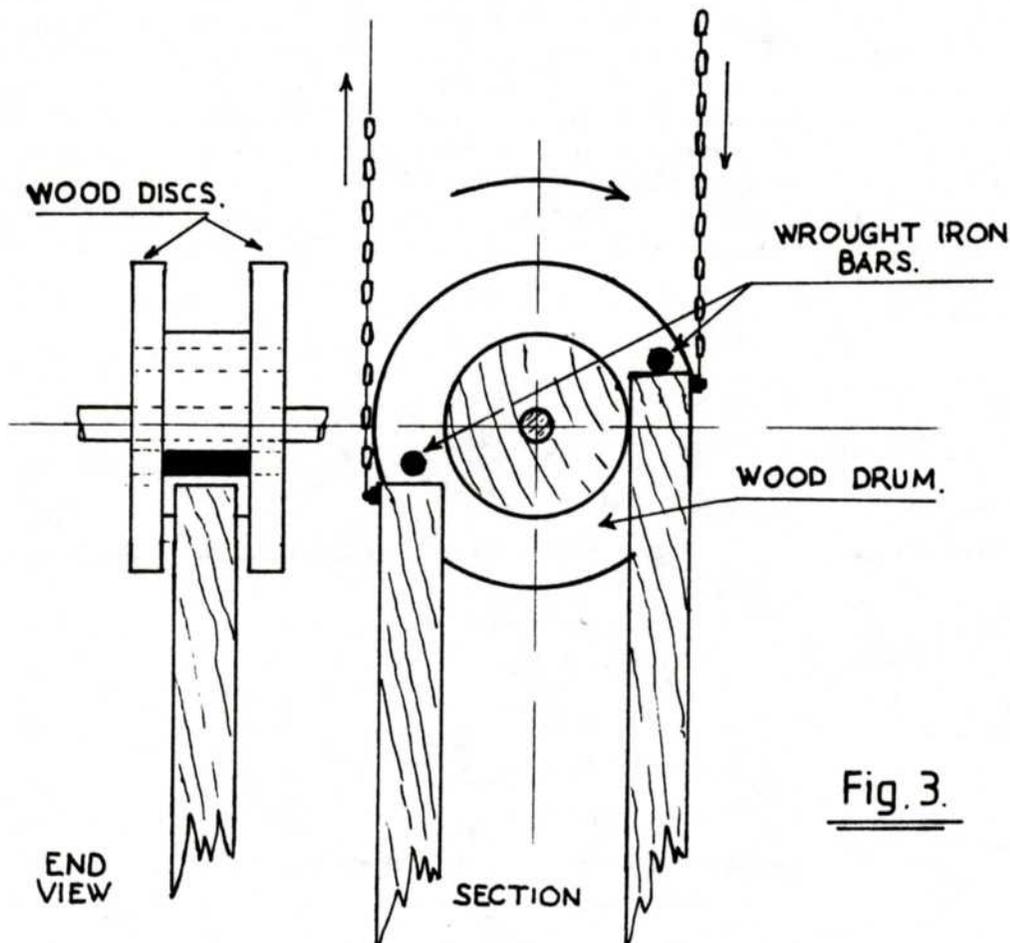


Fig. 3.

The pump plungers were probably two leather cup washers back to back, and the clack valves may well have been brass discs with leather hinges. Both these features are present at Coultershaw.

An alternative type of mechanism which Fig. 1 could represent might have been based on that used for clock drives at the time, i.e. a chain engaging radial spikes on a wheel. The difficulty would be the enormously greater torque to be transmitted in the case of the pump. Thus with say 4" diam. pump plungers and a pumping pressure of 50 p.s.i. (to pump over St. Magnus Church steeple taken to be about 100 ft. high) the spikes would have to be about $\frac{3}{4}$ " diam. It would have been difficult to avoid bending if all the load came on one spike. Fixing the chains to the plunger rods so that the downward working stroke load was transmitted to the rods without interference with the spikes would also be a problem.

Appendix II Water Level Recorders in the House

There are two interesting water level recorders to be seen, but neither now works.

One, late 18th century, on the wall just outside the room containing the dolls' house, is a dial with a float operated pointer. It registered the water level in a large tank, now removed, which was behind the wall. The dial is calibrated from 0 to 5 so the tank may have held 5000 gallons. There was a similar tank and gauge in the corresponding position behind the portico on the west side.

The other, (fig. 4), probably installed early this century, is an ingenious repeater on the mantelpiece in the butler's pantry. It is a little glass fronted tank which contained water to a depth proportional to the depth in a supply tank in the roof void. Air was trapped in a tank of the same size upside down on the bottom of the main tank and with a small opening at bottom of main tank level. A pipe joined this small tank to the closed limb of a U tube level with the glass tank in the pantry, and the other limb of the U tube was connected to this tank which was sealed at the top. Thus the air pressure in both small tanks was the same.

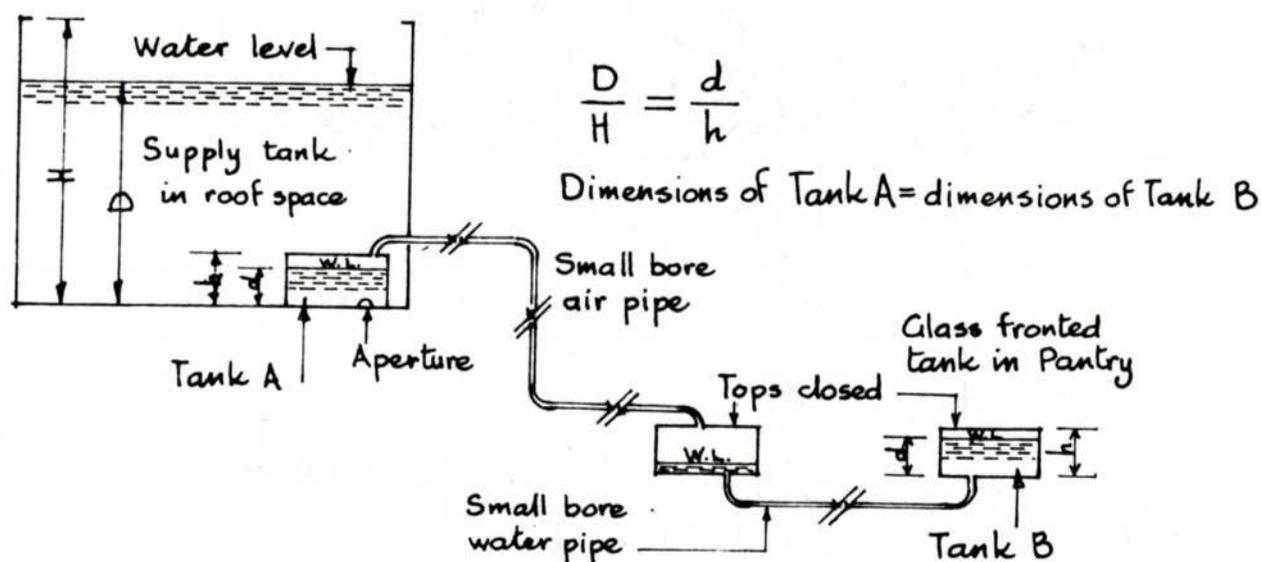


Fig. 4

Once the water level had been adjusted in the repeater tank (by filling the U tube) to correspond with the level in the roof tank, the change of air volume in the little tank, would cause proportional changes in the repeater tank.

TOM EVANS

The Coastal Trade in Iron Ore for Sussex and Hampshire in the Eighteenth Century

A curious statement in the Fuller family records leads to speculation about the source of the "Lancashire mine" (iron ore) that John Fuller, Gunfounder of Heathfield mentions in 1738 in a cost comparison with local Sussex Mine.(1) He discussed the relative merits in a rather obscure calculation of quantities and prices at the furnace.

The statement referred to is "the best Abgarly sort" (meaning mine) at 14s per ton and reference to the O.S. map shows Stainton with Adgarley as the most likely location in Furness, then, as until recently, a northerly part of Lancashire.(2)

Alfred Fell(3) mentions Adgarley in early mining records for Furness and there are many references to voyages as far South as Hampshire in the middle to late 18th Century from ports in the Barrow Peninsula.(4)

Haematite occurs as an intrusion in the Carboniferous limestone formations(5) of Furness and extending into N. Wales where there are later references to Haematite mining in Denbighshire and Flintshire although there do not seem to be records of a widespread export trade from these sources.

(A haematite mine in "Abergele" (Rural) in North Wales has led to some confusion as a candidate for Fullers "Abgarly", but the recorded date is considerably later).(6)

The speculation about sources of imported ore to Sussex is part of a general investigation which has provided other interesting facts about the 18th Century coastal trade and this extended as far north as Argyllshire on Scotland's west coast, with cargoes of pig iron to Hampshire from as far distant as Bonawe on Loch Etive (Lorn Furnace).(7)

Considerable quantities of shot were also exported from Furness & Scotland to Portsmouth and Woolwich as recorded by Fell.(8)

Pigs (cast-iron) for Sowley (Hampshire) shipped from Scotland are mentioned in one reference source.(9) Furness haematite is mentioned in another as being supplied to Darvel furnace (E. Sussex) in 1737 - and to a Mr. Brown, mentioned by John Fuller in 1736 without recording the location of the furnace.(10)

The Darvel haematite, not surprisingly, was found to be superior to the native (sideritic) ore. However, a claim that imported haematite was cheaper, even allow-

ing for the greater iron content is open to doubt, and the statement that the wood in Furness was exhausted is quite incorrect as will be seen later (in fact charcoal supplied a local Cumbrian furnace as late as 1920!).(11)

No indication in the sources of imports of ore to Darvel or the Fuller furnace at Heathfield earlier or later than ca. 1737 is provided however; but Fuller quotes Newhaven as the delivery port and Brown quotes London for his supplies, both at the same freight of 15s.0d per ton(12) - rather surprisingly considering the additional distance round the Kent and Sussex coasts. (The second half of the 18th Century from 1742 in fact, was a period of frequent war with France and sea trade was probably much restricted which could explain the absence of records for further imports to Sussex.)

The early 1740s were also a period of great change in the Furness iron trade - not because of timber shortage, but due to a disagreement between Wood Owners and Iron Masters over charcoal prices, so that most of the local furnaces were temporarily in difficulties.(13) The result of this was a transfer of the centre of activity of the iron trade to Scotland and even with export of ore from Furness for the new Scottish furnaces, there was apparently a surplus to encourage an export drive at competitive prices. The establishment of a "mine floor" at Barrow in the latter part of the 18th Century resulted in exports in quantity from 1776,(14) but not apparently to Sussex.

Particularly during peaceful years, this sea trade would have prospered, but the activities of French privateers in time of war was a serious hazard to shipping, causing high insurance rates, particularly towards the end of the Century. Freights to London increased from 15s.0d per ton in the early part of the Century to 30s.0d when France joined America in war against Britain in 1778(15) and the absence of further records of imports to Sussex by Fuller (as already mentioned) may actually be due to these high rates.

However there is mention by Fell of passages from Furness to the Baltic via the N. Coast of Scotland,(16) which suggests an alternative route down the E. Coast to London to avoid the more hazardous Channel passage. Whether "Mr. Brown" continued to receive his supplies by this route does not seem to be recorded.

Fell gives some interesting details of trade with Sowley at the very end of the 18th Century and we can assume that iron was being manufactured under the impetus of the Napoleonic war for the shipbuilding industry at Bucklers Hard on the Beaulieu River (Hants). The use of the "air" i.e. reverberatory furnace as referred to by Brown in the Fuller transcript was by this time well established, so that the "pigs for Sowley" mentioned in a voyage from Lorne in 1799(17) would be processed by the new method as used at Carron (Scotland) and elsewhere for re-casting as well as for forging into bars.(18) (Henry Cort, further along the coast near Gosport used this method and may have used imported ore).

An interesting glimpse into the personal problems of the iron worker is provided by Fell in the details of transporting a worker from Sowley as return cargo to a new job in the North.(1751)(19)

In later correspondence the need for convoys in 1799 is indicated when Captain Cannon during his voyage from Lorne to Sowley, reveals that there was no convoy from Milford Haven and he proposed to sail alone!

Other evidence of the hazards of the coastal trade is provided by Fell and Willan in records of vessels bound for London from Furness in 1743, 1745 and 1746 with water pipes and other cast iron wares, all being taken by privateers.(20) One wonders how much the decline of the iron industry in the South East was accelerated

by the difficulties of obtaining iron ore supplied at realistic prices due to the wars, as well as the competition in the supply of finished products - and not only apparently from the Midlands furnaces.

Footnote

The collection of data relevant to the coastal trade with the Wealden iron industry continues and any information from interested sources would be welcome.

An article in Country Life of 25.10.84 describes the preservation of one of the 18th Century Scottish furnaces at Bonawe, Argyll (Strathclyde) and now opened to the public.

A Cumbrian furnace has also been preserved at Dudden Bridge by the Lake District Special Planning Board who provide (restricted) access. This typifies the Furness industry.

Visible remains of the Sussex industry are limited mainly to the hammer and furnace ponds with associated "bays".

References

1. Herbert Blackman, "Gunfounding at Heathfield in the Eighteenth Century" SAC vol 67 31.
2. NGR SD 2472.
3. Alfred Fell, The Early Iron Industry of Furness and District (1968) 37,81, 88, 91.
4. Ibid 289. "Myne" ships from "Peelafodre" to Sowley, Hants 1751.
5. Ibid 89
6. D.C. Davis, "Metalliferous Deposits of Flintshire & Denbighshire" Y Cymmrodor Jan 1883 vol 6
49.
7. Fell op cit 390-414.
8. Ibid 244-6.
9. Ibid 327.
10. E. Starker, Wealden Iron (D & C reprint 1969) 108; Blackman op cit 31
11. Blackman op cit 31; H.R. Schubert, History of the British Iron & Steel Industry (1957) 194.
12. Blackman op cit 31.
13. Fell op cit 145-6.
14. Ibid 323.
15. Ibid 325.
16. Ibid
17. Ibid 327.
18. Bulletin of the Wealden Iron Research Group (2nd series) No.1 (1981) 30.
19. Fell op cit 288-90.

20. Ibid 326-8; T.S. Willan, The English Coasting Trade 1600-1750 (1938) 30.

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