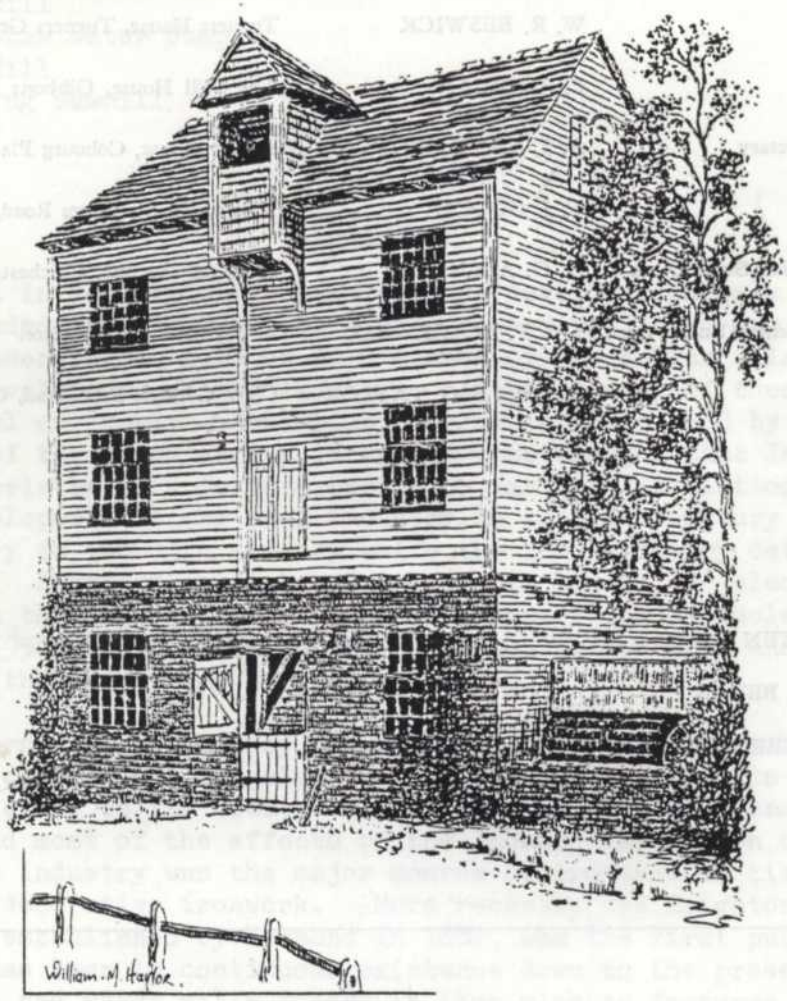
SUSSEX INDUSTRIAL HISTORY

No. 8

1978



IFIELD MILL

PRICE £1.20

SUSSEX INDUSTRIAL ARCHAEOLOGY SOCIETY

Founded, as the Sussex Industrial Archaeology Study Group in 1967

OFFICERS 1977-78

Chairman	W. R. BESWICK	Turners House, Turners Green, Heathfield
Vice-Chairman	P. ADORIAN	The Mill House, Gibbons Mill, Billingshurst
Hon. General Secretary	A. J. HASELFOOT	Albion House, Cobourg Place, Hastings
Hon. Treasurer	T. J. GOODE	'Gorse,' 30 St. Peters Road, Seaford
Hon. Secretary—West Sussex Area	A. G. ALLNUTT	23 Beech Avenue, Chichester
Hon. Secretary—Central Sussex Area	J. S. F. BLACKWELL	21 Hythe Road, Brighton
Hon. Editor	Professor E. O. TAYLOR	Clare Cottage, Pett Road, Guestling

COMMITTEE

B. AUSTEN

J. H. M. BEVAN

F. W. GREGORY

E. W. HENBERY

E. J. UPTON

The Annual Subscription to the Society is £3.00, payable on 1st April. Life Membership is available for a single payment of 15 times the current annual subscription. Annual and Life Membership includes the annual issue of 'Sussex Industrial History' and the quarterly 'Newsletter'.

The Society is registered as a Charity, registration no. 267159.

SUSSEX INDUSTRIAL HISTORY

Journal of the Sussex Industrial Archaeology Society

No.8 1978

CONTENTS

EDITORIAL

Interest in Industrial Archaeology has developed largely during the last two decades and involves the study, recording, surveying and, where possible, preserving on site or in a museum of any relics relating to the industrial development of the country. Although many of these date from the industrial or 'power' revolution ushered in about 1780 by Watt's development of the steam engine it must not be thought that Industrial Archaeology relates only to this period. Earlier 'revolutions' occured with the development of the coal industry in the 16th century and of the cloth industry in the 13th century while the iron industry dates back to Roman times. Furthermore, later developments led to an 'electrical' revolution in the latter part of the 19th century and a 'nuclear' revolution in the 1950's both of which are now becoming historic and worthy of attention by the industrial archaeologist.

This Journal, published by the Sussex Industrial Archaeology Society, records work carried out largely, but not exclusively, by its Members, within or relevant to the County of Sussex. Having no natural coal resources Sussex escaped most of the effects of the 'power' revolution but previous to that its iron industry was the major source of ordnance in time of war and also of much decorative ironwork. More recently the Brighton Electricity Undertaking, established by Hammond in 1882, was the first public electricity supply that has been in continuous existance down to the present day. With the many wind and water mills Sussex is thus rich in features relating to industrial archaeology.

The Sussex Industrial Archaeology Society, together with associated organisations, will therefore welcome encouragement, support and assistance in carrying out work in and around the County as a part of the National effort to preseve what is still available of our industrial hereitage.

Published by the Sussex Industrial Archaeological Society.

MUNTHAM WELL, FINDON

By T. P. Hudson.

Arrangements for supplying water to country houses in Sussex before the advent of the mains were often elaborate and ingenious. At Muntham House, Findon, now destroyed, the successive methods used over two hundred years are well documented, and make a complete and interesting story.(1)

The chalk downs surrounding the house were inhabited from early times, and have yielded many traces of prehistoric settlement.(2) There are no springs anywhere nearby, and dew-ponds like Tolmare pond, a quarter of a mile south of the house, now dry, would have been the main source of water apart from rain-water. A few years ago, however, a Romano-British well three hundred feet deep was discovered between Muntham and Tolmare pond.(3) The manor of Muntham was mentioned in 'Domesday Book',(4) and settlement continued in the area throughout the Middle Ages.(5)

In 1743 the estate was bought by the 6th Viscount Montague (6), who by 1754 had 'brought water with great expense to the house'.(7) This seems likely to refer to the sinking of the present well, for Gilbert White noted in 1773 that there was a well at the house 350 feet deep.(8) The source of power may have been a horse- or donkey-engine, as used elsewhere on the Downs, for instance at Patching or Saddlescombe near Brighton.(9) The water must have been laboriously raised by buckets, unless pumps were installed, as was apparently done at Uppark near Petersfield in a similar situation in the previous century.(10)

The next owner of the Muntham estate, William Frankland, bought it in 1765 and lived there until his death forty years later.(11) His chief occupation, according to Dallaway and Cartwright, was 'to collect and employ every newly-invented machine' (12), and he made the house into a kind of contemporary industrial museum, the description of which, in a guide-book to Worthing of 1805, is worth quoting at length:

> 'The first room we entered was full of lathes, which work by means of a large jack, the direction of the graver or chisel being also a part of the machinery. Thus no human being is necessary during the operation ... The production of medals of hard wood, with heads and figures, some of which are even complicated in their nature, surpasses my comprehension ... The second room was furnished with machines for spinning, winding, etc., and other instruments to be found in our celebrated manufactories. Here are also printing-presses of various constructions, which illustrate the nature of the wonderful art of typography, by which intelligence, natural and moral, political and religious, is wafted with ease to the most distant regions of the earth. Another apartment is crowded with time-pieces of every form and dimension, together with electrifying machines and optical instruments in an almost endless variety ... Musical instruments were to be found of almost any description and most of them played by ... machinery. Nor must we forget to mention that we saw implements of agriculture, many of which seemed admirably calculated to answer the ends for which they had been intended, by improving and extending the advantages which Nature has placed in our possession.(13) But what renders the examination of these objects interesting is that they are put together on a plan suggested by the venerable proprietor, who formerly kept many workmen, even some from foreign parts, in constant employ.'(14)

The whole extraordinary collection, on which Frankland is said to have spent at least £20 000, was dispersed at a sale after his death.(15)

Frankland's mechanical ingenuity was also applied to the well at Muntham, where apparently by 1794 (16) he had replaced the existing mechanism with a horizontal windmill. This most unusual idea, the equivalent for wind power of a 'Norse' watermill, consists of a tall central shaft with shutters or vanes attached all round. It had never previously been very popular, for practical reasons, but it had been revived towards the end of the 18th century by a Captain Stephen Hooper of Margate, who built at least three examples. Two of them, at Battersea and on Hooper's estate at Margate, had shafts respectively 80 and 48 feet high, the shaft of the Battersea mill having 96 shutters. The third example, at the naval station at Sheerness, was explicitly compared to the Muntham windmill by the author of the above-quoted description of Frankland's collections. A contemporary drawing shows the Margate mill as conical in shape;(17) the Muntham mill, of which no visual record exists, was probably similar, and was perhaps even designed by Captain Hooper. The regular and copious supply of water it provided enabled Frankland to enlarge the fishponds at the house,(18) and shortly before 1839 a later owner laid on fountains as well.(19)

In 1850 the Muntham estate was bought by the dowager Marchioness of Bath.(20) The present brick-and-flint well-house (32 feet by 20) was apparently built in 1868 to house a steam-engine installed by Kittoe and Brotherhood, Engineers, of London in that year.(21) The engine has gone but what might have been the frame it stood on remains, now supporting two cooling-tanks, and the chimney can still be seen against the outer south wall of the building.

In 1927 the steam-engine was replaced by a 5- or 6-horse-power Ruston-Hornsby slow-speed petrol/paraffin engine (type 34 IP, no. 140462), operating a three-throw pump and cooled by rainwater from the two cooling-tanks already mentioned. An extension (20 feet by 12) was built at the west of the well-house, to house a saw-bench powered directly from the engine when the pumps were not working. The Ruston-Hornsby engine was rescued from dereliction in 1973 by Mr. M. A. Pierce of Storrington, who is at present restoring it.(22)

In 1958 the water was being stored in two underground cisterns, one, holding about 12 000 gallons, on the open down above the well-house to the south, and the other, fed from it, at the well-house itself. Water was supplied to the house and outbuildings and also, from the upper cistern, to a number of field-troughs on Muntham farm. The system was connected to the mains in two places and could thus be augmented when necessary.(23)

Maintenance of the well in the present century was carried out by Paine Mainwaring Ltd. of Broadwater and later by Overingtons of Durrington, the workman being originally lowered down the shaft in an open seat by means of a hand-operated winch. The seat was later replaced by a less hazardous cage.(24)

After the death of Colonel Ulric Thynne (grandson of the Lady Bath who had bought the house) in 1957, the estate was sold. Worthing Corporation bought Muntham House and grounds, including the well-house, and Muntham House was demolished soon afterwards. The well thereupon ceased to supply water, and the shaft was concreted over for safety.(25) An electricity sub-station was at one time erected in the building,(26) The reservoir on the down continues to supply troughs on Muntham farm, but is now fed from the mains supply only.(27)

NOTES

(1) TQ 10870959. The Author would like to acknowledge help received from the following people: Mr. Alan Allnutt, Mr. Michael Palmer, Mr. M. A. Pierce, and Mr. E. C. Turier, Worthing Borough Planning Officer.

(2) See for instance Sussex Notes and Queries, xiv. 69, 196-8, 232-3.

(3) H. L. Reeves, Findon (1968), 10, 23.

(4) Victoria County History, Sussex i. 450.

(5) Sussex Notes and Queries, xv. 315; Chartulary of Sele Priory, ed. L. F. Salzman (1923), pp. 20-5.

(6) The Cowdray Archives, ed. A. A. Dibben, i (1960), p. xiii.

(7) Pococke's Travels (Camden Society, 1889), ii. 106-7.

(8) The Journals of Gilbert White, ed. W. Johnson (1931), 76.

(9) Sussex Industrial Archaeology, a field guide, ed. J. Hoare and J. Upton (1972), p. 24.

(10) M. Meade-Fetherstonhaugh and O. Warner, Uppark and its People (1964), 16, 18.

(11) Sussex Archaeological Collections, xxvii. 19.

(12) J. Dallaway and E. Cartwright, History of West Sussex ii (2), 90.

(13) One of them apparently was 'a plough with which one man can plough, harrow and sow all at once': Sussex Archaeological Collections, lxvii. 198.

(14) J. Evans, Picture of Worthing (1805), 72-4.

(15) T. W. Horsfield, History of Sussex, ii (1835), 203.

(16) Sussex Archaeological Collections, lxvii. 198.

(17) R. Wailes, The English Windmill (1954), 84-5 and pl. vi.

(18) H. R. P. Wyatt, Fragments of Findon (1926), 30.

(19) West Sussex Record Office, SP 250, f.2 (Sale catalogue, 1839).

(20) Sussex Archaeological Collections, xxvii. 20.

(21) Information from Mr. K. C. Leslie.

(22) The Author owes the information in this paragraph to Mr. Pierce, who would be glad to hear of any member willing to help him complete his restoration project. A suitable cylinder head is required.

(23) Muntham Court Estate Sale Catalogue (1958), pp. 24-5.

(24) Information from Mr. Pierce.

(25) Information from Mr. E. C. Turier, Worthing Borough Planning Officer.

(26) Information from Mr. Pierce.

(27) Information from Mrs. J. Heath, Muntham farm.

THE OLD BRIDGES AT NEWHAVEN

By A. J. Haselfoot.

From the 13th to the 18th Century the only means of crossing the River Ouse at Newhaven was by a ferry, from the bottom of High Street across what is now the old arm of the river, to the West of Denton Island. In 1783 the inhabitants petitioned for a bridge to be built and an Act was passed by Parliament in 1784 authorising the building of a bridge on the site of the ferry. Thirteen Trustees, headed by the Earl of Surrey, were appointed and allowed to charge a toll on the bridge. The owner of the ferry, Henry Bates, was willing to the bridge to be built and was handsomely compensated for the loss of the ferry dues.

As the Ouse was navigable above Newhaven and there were several shipyards above the site of the ferry it was decided to make a wooden drawbridge with a 40ft (12.2m) opening in the middle. The fixed approach bridges were 35ft 5 ins (9.9m) on the West side, where a toll house was erected on the quay. amd 60ft (18.3m) to the bank on the East side. The two leaves of the centre section were lifted up towards the sides to open the channel for shipping. A sketch of the bridge, which also shows the toll house, is in the Burrell Collection at the British Museum.

In 1847 the L.B. & S.C.R. reached Newhaven by way of a branch from Southerham Junction on the Lewes - Eastbourne line. As the railway was on the East bank of the river, while Newhaven was on the West bank, this resulted in a considerable increase in traffic over the bridge and in 1863 plans were prepared for a new bridge lower down river. This was to be a swing bridge and would be built in conjunction with a new cut across the large S-bend through Denton which would straighten the channel and improve the scour at the harbour mouth. The works were estimated to cost £31000, of which the Railway Company would contribute £5000. In 1864 the old drawbridge was purchased for £4000 by the Trustees of the Newhaven Harbour Board and the Lower Ouse Navigation, and work was started on the new bridge with Henry Grissell as civil engineer and Mr. Jacomb as the Railway Company's engineer.

Design of the Swing Bridge

The layout of the bridge, at the time of its demolition in 1976, is shown in Fig:1, the swinging portion being 150ft (45.7m) long and 27ft (8.2m) wide overall, with a 22ft (6.7m) roadway and a walkway on the South side (Plate 1). The supporting structure for the swinging portion consisted of 8 iron cylinders, 5ft 2¼ins (1.58m) outside diameter and 1in.(25mm) thick with their centres on a circle of 32ft 2 ins (9.8m) diameter, and a similar cylinder at the centre of the circle. These were driven down 42ft (12.8m) below the river bed, which consisted of 10ft (3m) of shingle resting on a sandy, plastic clay, and filled with concrete. The 9 cylinders were braced together, both radially and circumferentially, at the top and also about 5ft (1.5m) below the top; 12in.(30.5cm) I-beams and 2ft (61cm) x 1ft (30.5cm) box girders being used. On top of these was constructed a saucer-shaped heavy iron dish, about 40ft (12.2m) in diameter, braced by radial girders below, which contained the machinery for swinging the bridge. (Plate II). The approach roadway on the West side was supported by 6 similar girders, in 2 rows of 3, the outer row being driven down to 42 ft (12.8m) and the inner row to 30ft (9.1m), while on the East side an abutment was built on the river bank to connect with the end of the swinging portion. All the girders were made at the Phoenix Iron Works, Lewes, and the bolts used in the construction were hand-made.

The central bearing of the bridge consisted of a 1ft 2 ins (35.6m) diameter tubular spigot rotating on a 10 ins (25.4cm) diameter shaft. The weight was carried by 30 rollers, 1ft 6½ins (47cm) diameter x 1ft 4ins (40.6cm) wide, rotating on 1¾in. (44.4mm) diameter shafts, and running on a track on the base of the iron dish. Outside these was a heavy iron ring, about 36ft (11m) in diameter, externally toothed with about 390 teeth (Plate III). Engaging with this was a pinion of 77 teeth, the shaft of which projected upwards to just below the decking of the bridge. To operate the bridge a capstan with 8 removable wooden arms was put over the end of this shaft and turned by a team of men, about 5 revolutions of the capstan being needed to open the bridge. There was also an auxiliary pinion, of 14 teeth, meshing with the main pinion, to the shaft of which the capstan could be attached for emergency operation with only a few men, but needing about 27½ revolutions to open the bridge. The capstan and capstan bars were kept in a locker in the side of the bridge.

The roadways on the bridge and on the West approach were supported on longitudinal and cross girders, with 4 ins (10.2cm) planking and 3ins (7.6cm) cross planking. Fabricated side girders, about 5ft (1.5m) deep, were erected on both sides of the roadways. On the centre of each of these girders on the swinging portion there was an elegant cast iron structure about 10ft (3m) high surmounted by a ball and spike finial (Plate IV). To the tops of these were attached iron stay rods, the lower ends of which were fastened to the main bridge girders about 25ft (7.6m) from each end. These helped to carry the weight of the cantilevered portion, and adjusting nuts in the centre of each stay rod enabled the extreme ends of the bridge to be varied slightly in height to ensure proper alignment with the fixed approaches. A gas main was carried across the bridge on the outside of the girder on the South side, having shut-off valves and flexible connections at each end which were disconnected before the bridge was opened. A handsome street lamp was erected on the South side girder over the centre of the channel (Plate V), and supplied from the gas main; the gas trapped in the section of pipe on the bridge when the shut-off valves were operated was just sufficient to keep the lamp alight during the period when the bridge was opened to permit the passage of a vessel.

Details of the Construction Work.

Some interesting figures can be culled from the hand-written official records kept during the construction of the bridge in 1866. There are no detailed figures for the time taken to drive the cylinders; they seem to have gone down at the rate of 2ft - 2ft 6ins (61cm - 76cm) per day for the first 20 - 30ft (6.1 - 9.1m) but after that the work became much harder and with three of them much trouble was encountered with sand welling up inside which had to be excavated before concreting could start. A weight of 14 tons is mentioned but it is not known whether this was the weight of the cylinder or an additional weight put on to drive it, probably the former. It is probable that each cylinder took between 4 and 6 weeks to drive it to its full depth. The average time spent in pouring concrete was about 5½ days per cylinder with a range of 4 to 7 days. The average amount of cement used was 42½ bags, ranging between 41 and 45 bags, except for the 3 cylinders supporting the outer end of the West approach which needed an average of 52 bags each. After each of the main bridge support cylinders was driven to its full depth it was tested with a heavy load of stone and iron. Most of them were tested with 73 tons but two were tested with 77 tons and one each with 60 tons and 70 tons. The test load was maintained for an average of 8-9 days (range 3-14 days) with an average sinking under compression of 1in. (2.5cm), ranging from ½in. (1.25cm) to 2ins.(5cm). Testing continued until there was no further movement with the test load in

position for several days, sometimes up to a week or more. There is no record of the three cylinders at the inner end of the West approach having been tested and it is stated that the central cylinder of the three at the outer end was never tested.

Concreting of the West approach cylinders went on from the end of January to the end of May, the girders were placed at the end of June and the 4in. planking at the end of July. For the main bridge supporting cylinders concreting took from the end of May to the end of September, the iron-work on top of these was placed at the beginning of October and the machinery for operating the bridge at the end of October. The main and cross girders were erected during November, the 4 in. planking laid at the beginning of December and the cross planking on the bridge and West approach was all laid by the middle of December. After tarring and sanding the roadway the bridge was opened to traffic, free of toll, on 22nd December, 1866 (Plate VI) when the last toll on the old bridge was taken, the original bridge being demolished in 1867.

For the abutment on the East bank 54 piles were driven and 12 tons of chalk, 45 tons of ballast and 57 bags of cement were tipped between and around the piles. Elm blocks and planks were then placed on these and a further 3 tons of ballast and 4 bags of cement placed around and under these. Brickwork was then laid on the planks up to the level of the approach road (Plate VII). When the bridge was in the closed position it was locked by wedges at the four corners which were lifted by cams operated, through worm and spur reduction gears, by a detachable handle fitted to the end of the drive shaft at about chest level on the side girders of the West approach and the brick pillars of the East abutment.

Water had been let into the new cut from the South in January 1867 but in May much difficulty was experienced in shutting off the lower end of the old river. Soil from the excavation of the new cut had been dumped there and 400 tons of chalk tipped in as well. The greater part of this was washed out by a high spring tide but by June 25th the dam had reached a height of 8ft (2.4m) and on 30th June it was up to 13ft (4m). The upper end of the old river was shut off during September, October and November, 293 tons of chalk and 145 tons of beach being placed in the first two months and a further 57 tons in November.

Between December 1866 and August 1867 much stone, chalk and ballast was placed round the cylinders of the central support, in all some 782 tons. In October it was found that the ground round and between the cylinders was dry at Low Water Springs so the work had been beneficial. Between August and September 1867, 61 tons of stone was placed under the centre span of the West approach with a further 219 tons of chalk in November and December; 28 tons of limestone was also placed round the three cylinders at the outer end of the approach, which were then dry at low water. Further tipping occurred during January and February of 1868 - 292 tons between June and November - 252 tons and 28 tons in September 1869. In all some 880 tons were placed. This extensive programme of tipping was plainly to consolidate the shelving sides of the river bed and prevent the scouring out of shingle round the bases of the cylinders.

An interesting note refers to the tarring and sanding of the roadway in 1869. In April two coats of tar and sand were applied, the first with 5 barrels of Stockholm Tar and the second with 5 barrels of hot Coal Tar. In August a third coat was applied with 5 barrels of hot Coal Tar mixed with 4 bushels of lime, and in September a fourth coat was put on with cold Coal Tar and 2½ barrels of sand.

Newhaven Harbour

The work of dredging the harbour figures largely in the records kept from 1866 to 1878. This started towards the end of April 1870, when 7,361 tons were taken out in the first month and 21,016 tons in the year. The next year 10,915 tons were removed and dredging continued at the rate of about 9,000 - 9,500 tons per year. Throughout the period the cost of transport by barge and steam tug remained steady at 2d (0.83p) per ton, while the cost of labour, which was 10d (4.2p) per ton in 1870, increased to 11d (4.6p) per ton in 1875 and to 1/- (5p) per ton in 1876 and remained at this level for the remainder of the period. It is of interest that lower rates are occasionally quoted, 7½d and 8½d (3p and 3.5p) in 1870 and 9d (3.75p) in 1876; possibly these were rates for youths.

The accounts of the Harbour Commissioners for 1874 make fascinating reading. 'Purple Brown' @ 8d per lb. (7.35p per kg) and 'Boiled Oil' @ 3/8d per gallon (4p per litre) are prominent in July - were these for mixing their own paints? Most of the items relate to timber, ironmongery and typical ship chandler's stores, but in September 8/-d (40p) was paid for repairing the ceiling of the Pilots' Watch-house, 2/6d (12.5p) for cleaning and repairing the telescope, and £1/13/9d (£1.69p) to a butcher in July and August - was this also for the pilots?

Troubles in Operation

In April 1867 trouble was experienced due to the West end of the swinging portion bearing hard against the end of the West approach. Apparently attempts were made to ease the cross girder on the end of the approach but it is probable that the trouble was finally cured, in May, by setting up the adjusting nuts on the stay rods to lift the West end by ½in. (12.5mm). In very hot weather in June trouble was experienced due to the expansion of the swinging portion, quoted as ½in. (12.5mm). Efforts were made to overcome this by altering the adjusting nuts on the stay rods but in December the girder on the West approach was set back 1in. (2.5cm). In January 1868 the bridge appears to have moved towards the West, causing jamming on the West approach, possibly the cylinders of the central support had tilted slightly. Men were sent down from London and cut 6 ins (15cm) off the main bridge girders and set the girder on the West approach back by 6 ins, giving a clearance of 6 ins between the girders and 1¼ins (32mm) between the top plates of the bridge and the approach. In September 1867 one gate lock at the East end was found broken and the remaining three were found broken in October. This is not necessarily an early example of vandalism but was probably associated with the movement of the bridge noted above.

Operating Procedure

The procedure for operating the bridge is of interest. On a request signal from a ship the bridge attendant closed the road gates and then operated the shut-off valves (4 in all, 2 at each end) on the gas main, and disconnected the flexible pipes by undoing 4 nuts on each pipe on the bridge side, the pipes being left hanging on the shore sides (Plate VIII). Meanwhile 2 men at each end operated the bridge locking gear to free the bridge from its approaches; they then walked along the bridge to join the 4 men who had set up the capstan and the 8 of them swung the bridge open (Plate IX). The opening time was about 3 minutes and the time of closure to road traffic about 9-10 minutes, as the ship started to nose ahead as soon as the bridge started to move. If, by accident, the ship touched the bridge before it was fully open it merely pushed it into the fully open position while the

men on the capstan bars sprang clear. Ships dare not risk this manoeuvre with the present swing bridge.

In addition to road traffic the bridge carried rail traffic, a single line freight tramway having been laid across it by the Railway Company (hence their contribution to the cost of the bridge). This was primarily for the building of the 28000ft (853m) breakwater on the West side of the harbour but it also enabled them to serve the various installations and stores on the West bank on their way to the breakwater. The service was operated by small tank engines (Plate X), of which the most famous, "Fenchurch" the first of the Terriers, built in 1872, worked the line from 1898 to 1955, always preceded across the bridge, where it had a right of way over all other traffic, by a man with a hand bell and a red flag. After over 100 years of service "Fenchurch" is still running on the Bluebell Railway between Sheffield Park and Horsted Keynes in West Sussex.

The End of the Old Bridge

So we come to the end of the road. Although the bridge was strengthened in about 1900 and again in 1939, the rapidly increasing number and weight of road vehicles after the end of the last war made it essential that this bridge, on the main coastal road in East Sussex, would have to be replaced by a modern swing bridge designed for present-day traffic. The new bridge was opened and the old one closed in November 1974 after nearly 108 years service. It is ironical that the time of closure to road traffic on the passage of a ship is the same with the new bridge as with the old one, which remained in the open position as an emergency standby until 1976 when it was finally demolished (Plate XI). Before this happened, however, the Sussex Industrial Archaeology Society, through the courtesy of British Railways Chief Civil Engineer at Newhaven, Mr. R.S.J. Martin, were enabled to inspect the bridge and make a full photographic record of it. The Victorian gas lamp from the bridge is now in the Newhaven Museum and various smaller bits and pieces have been preserved in private collections. The iron cylinders supporting the bridge could not be extracted but were cut off 6ft (1.8m) below mud level. They were found to be filled with a mixture of concrete, chalk and shingle.

Acknowledgements

In preparing this article the Author would like to express his grateful thanks to the following:

Mr. R. S. J. Martin, British Railways Chief Civil Engineer at Newhaven, for allowing him to crawl all over, and under the bridge and photograph every part of it. He also answered all questions with unfailing courtesy and gave many interesting sidelights on the operation of the bridge.

The Archives Dept. of British Railways and Mr. J. Saunders of the Bridge Section at Southern House, Croydon, for allowing him to inspect the drawings of the bridge.

The Central Photographic Unit of British Railways for permission to reproduce a photograph taken during the demolition of the bridge.

Mr. R. C. Riley for permission to reproduce photographs of the bridge from his collection.

Mr. A. S. Payne of the Newhaven and Seaford Historical Society for his continuing help and encouragement; for permission to reproduce a

photograph of the hand operation of the bridge; for the loan of an invaluable book of hand-written notes from the Official Records made in 1866 during the construction of the bridge; and for his authorship of the historical details in "A History of the Newhaven Bridge; 1784 - 1974", a commemorative booklet issued when the new bridge was opened.

The Author has drawn heavily on these two documents in preparing this article.

A WATER-DRIVEN ESTATE-WATER PUMPING PLANT AT BUCKHURST PARK, WITHYHAM

By Haywards Heath District Scouts Camp 1976

Summary

During August 1976 permission was kindly given by Earl De La Warr, for Scouts of the Haywards Heath District, to survey a water-driven pumping plant at Buckhurst Park, Withyham, where a camp had been established. This report describes the machinery, its housing and the water supply (Plates XII, XIII and XIV). The survey was carried out under the guidance of the Sussex Industrial Archaeology Society.

Location and Environment

The pumping plant is inside the confines of Buckhurst Park (Nat. grid. ref. TQ 49893530) where a surfaced private carriage way runs past the site and two nearby houses. At this point also, there is a chalybeate spring covered with an attractive pavilion. There are a number of water courses and records show that here was a water-mill for grinding corn - probably Mousehall Mill which is shown on the map of the 1598 Buckhurst Terrier(1).

The Machinery

Dated 1876 and supplied by the still existent firm of Hayward Tyler Ltd. of Luton, the machinery consists of a three-cylinder vertical pump driven through gearing by an overshot water-wheel of 2.54m dia. and 0.95m in width. There are 24 thin-gauge sheet zinc buckets fixed by bolts to the cast iron shrouds or rims which in turn are in six sections fixed to the wheel spokes by bolts, the whole being mounted on a steel shft of 75mm dia. A normal speed for the wheel would be about 12 revolutions per minute and it drives the pump through a train of gears. The resultant speed of the pump is about that of the wheel itself but the interposition of a layshaft makes possible the fitting of a sliding dog clutch as well as of a flywheel running at twice the pump speed. The actual gear ratios are 1st train 78/40 and 2nd train 25/52. Brass bearings are fitted throughout with housings which for the most part are mounted on heavy timber beams as is the cast iron frame of the pump assembly itself.

The three pump cylinders are in bronze having a diameter of 70mm and the pistons a stroke of 400mm each linked to an overhead open crankshaft set to give a phasing of 120 degrees. All gears and shafting are open and have individual point lubrication by hand. The dog clutch allows the pump to be released from the prime mover so that the flywheel can be used to turn the pump over through the low set of gearing for maintenance purposes. See Plates XII and XIII for layout and details of machinery.

The Water Supply

Water for driving the wheel had been taken from a lake some 2/300m distant and which had been the original mill-pond for Mousehall Mill. The leat is still discernible, it finishes in a ractangular head race in what is now a private garden and it was from this, that the penstock led water to the top of the wheel. Today there is no flow through the lake since to avoid silting, the stream has been by-passed altogether and at the same time the sluice gate feeding into the leat was filled in. There is at present no convenient source of water to feed the wheel.

The suction side of the plant was not excavated, hence the source of that water supply remains unknown but there are two possibilities, one would be the chalybeate spring (Plate XIV) and the other, the admission of water from the nearby stream to a suction sump below the pump house. On the pressure side of the pump, a central flange provides the delivery outlet but a surge vessel on the outgoing main appears to be missing. During its active life, the plant pumped water to the gardens of Buckhurst Park and other non-potable uses.

The Pump-house Building

The pump-house itself is of brick with tile roofing and covers the whole of the machinery including the water-wheel. The flat clay tiles are pegged to battens and this tiled construction extends to a hipped end at the north but on the south end, the brick walling is carried up to the eaves from which the gable is flat and filled in with boarding. The front face of the house has a single access door and at the rear there is a hatch to allow the water-wheel bearings to be serviced. The penstock is supported by the south wall and race water from the wheel leaves through an arch in the north wall below floor level.

Condition of Plant and Building

The buckets of the water-wheel have corroded away but the shrouds, shaft, spokes, gearing and bearings are intact. The pump cylinders were partially seized, they were not dismantled but probably the valves would require attention and the whole unit removed for overhaul. The provision of an up-stream leat of mill race together with a control sluice is required if the machinery is going to work again.

Several of the rafters at the south end of the roof are rotten and these together with tile battens need taking out altogether and replacing as do also a number of broken tiles. There is at present no floor of any kind and a new door and a new access hatch complete with fittings are required.

General

During the course of the camp, the Scouts, who were between the ages of 11 and 16, worked each day clearing away much overgrowth from the building and its surrounds, the wheel pit was dug out and similar silt and debris removed from the downstream mill race. The whole installation was surveyed and drawings prepared from which work the material for this report was prepared. The whole is the work of members of the District Scout Camp. One main theme of the camp was industrial archaeology and in addition to the work outlined in this report, visits were made to windmills, disused railway sites and ancient iron making locations.

Lectures on aspects of the theme were given.

References

(1) E. Straker. Lost Mills of Ashdown. Sussex County Magazine vol. xii 1938 p.203

See also Budgen's map of Sussex (1724)

THE RECONSTRUCTION OF IFIELD MILL

Part 1. HISTORICAL BACKGROUND *

By J. Gibson-Hill and E. W. Henbery.

With Historical Research By P. Bracher.

Location

The Weald is composed of two main geographical zones, a central area, the High Weald, consisting of ridges and valleys on outcrops of inter-bedded sandstones and clays (Hastings Beds), surrounded by poorly drained clayey soils on the outcrop of Weald clay, known as the Low Weald. The distinction in relief is quite apparent to anyone travelling on the A264 between Horsham and Crawley. The Upper Tunbridge Wells Sand forms the high ground of St. Leonards Forest, rising more than 130m above O.D., while the Weald Clay outcrop forms a vale, 1-2km wide. This vale is bounded to the south by the forest and to the north by an east-west ridge of lesser height (100m O.D. approx.), and is formed by an outcrop of thin shelly limestone beds within the Weald Clay. The area is drained by head-streams of the River Mole that rise in St. Leonards Forest and converge on Ifield Mill Pond, where they unite before crossing the ridge north of the vale via a narrow gap, at the exit from which is sited Ifield Mill and previously Ifield Forge (TQ 245365).

The Development of the Wealden Iron Industry, in the Locality of Ifield Mill

Early mining is evidenced by minepits dug to obtain ironstone that underlies a Horsham stone horizon in the Weald Clay. The ore was used in the shaft furnaces (1)of late Iron Age and Roman settlement at Broadfield. (2)Other narrow belts of minepits that follow an outcrop of ironstone in the Upper Tunbridge Wells Sand are thought to have provided ore for the 16th-17th century blast furnace industry.

(3)Early prospectors were probably attracted here by a good quality ore, that was (bearing in mind the primitive mining techniques involved) easily accessible. A series of carbon 14 determinations, starting at 2010 $\pm$ 60 b.p., and other evidence from recent excavations indicate a thriving blooming industry operating in the vale during the Iron Age and throughout most of the Roman occupation. (4,5)Little is known of the area after this period, but it is reasonable to conclude that the forest reclaimed most of the land and later it formed part of Beaubush (Bewbush) park until local iron-working was resumed.

(6)This post-Medieval phase of the Wealden Iron industry brought with it a new technology, using the more elaborate blast furnace to produce malleable iron by the indirect process. It is in fact a two stage process,

* Part 2 on the actual work of restoration of the Mill will be published in the next issue (Plate XV).

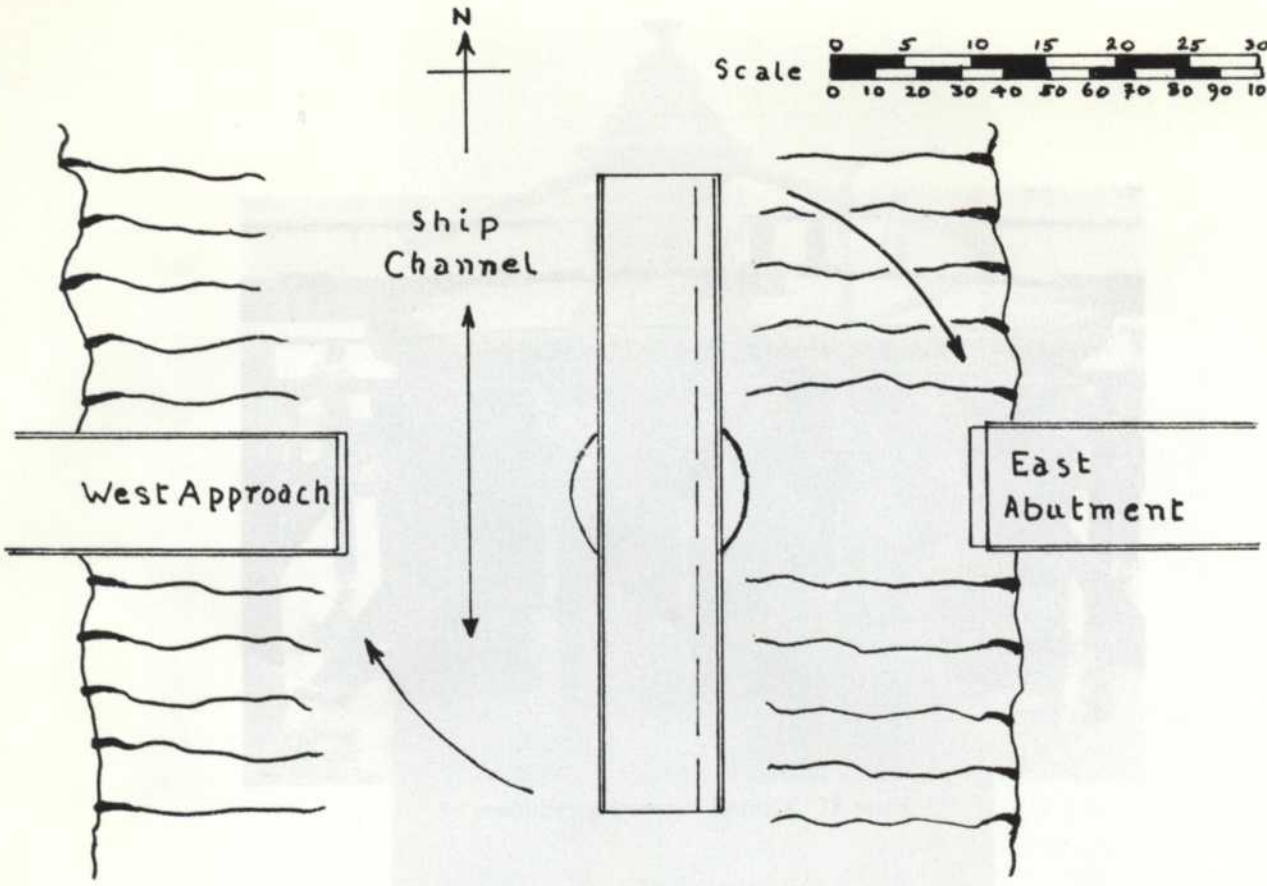


Fig. 1. Lay-out of swing bridge in open position.

Plate I View of bridge from above.

Plate II Central supporting cylinders.

Plate III Supporting rollers and toothed ring.

Plate IV Central iron structure for tie rods.

Plate V Gas lamp on bridge.

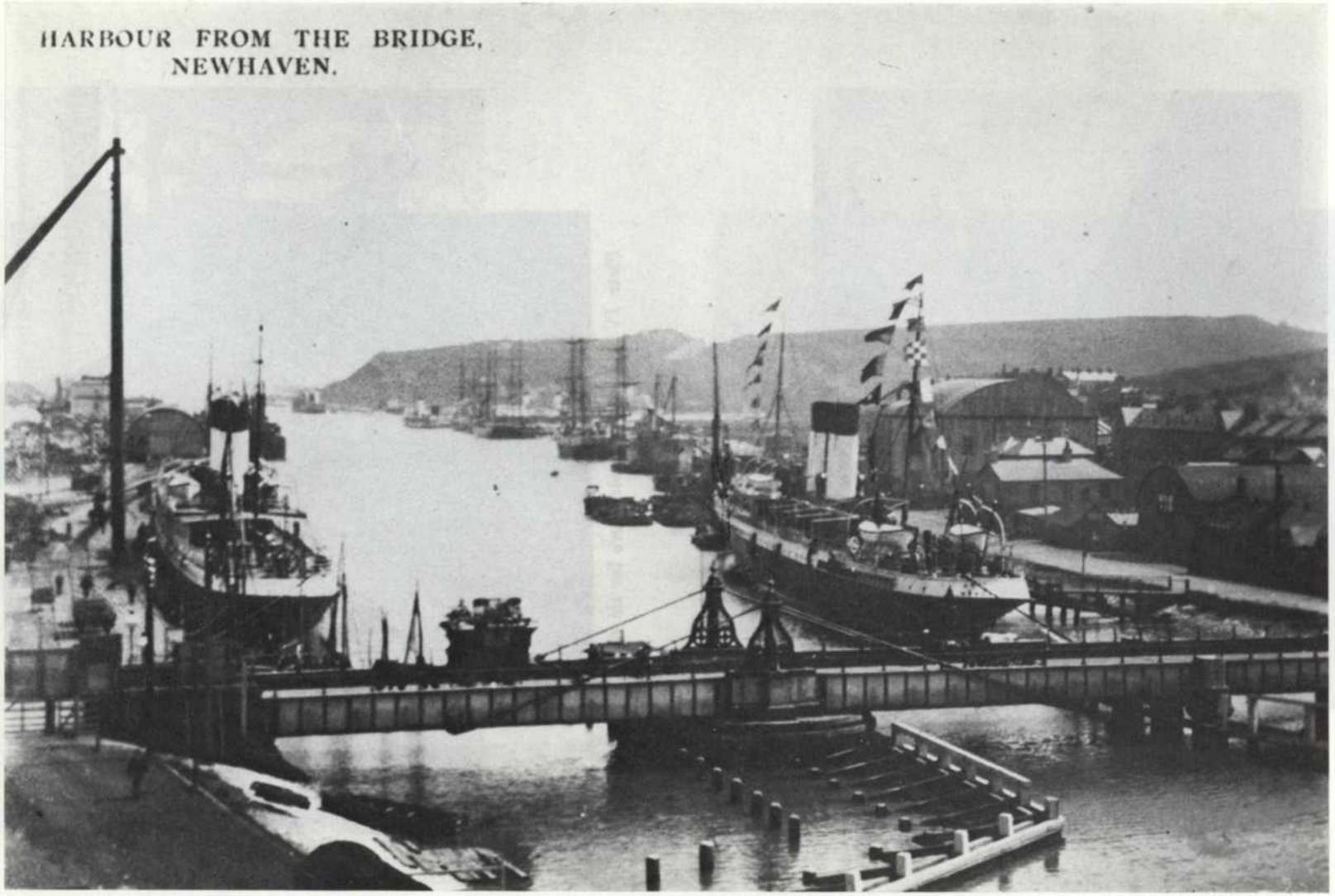


Plate VI Bridge in closed position from old postcard (R. C. Riley).

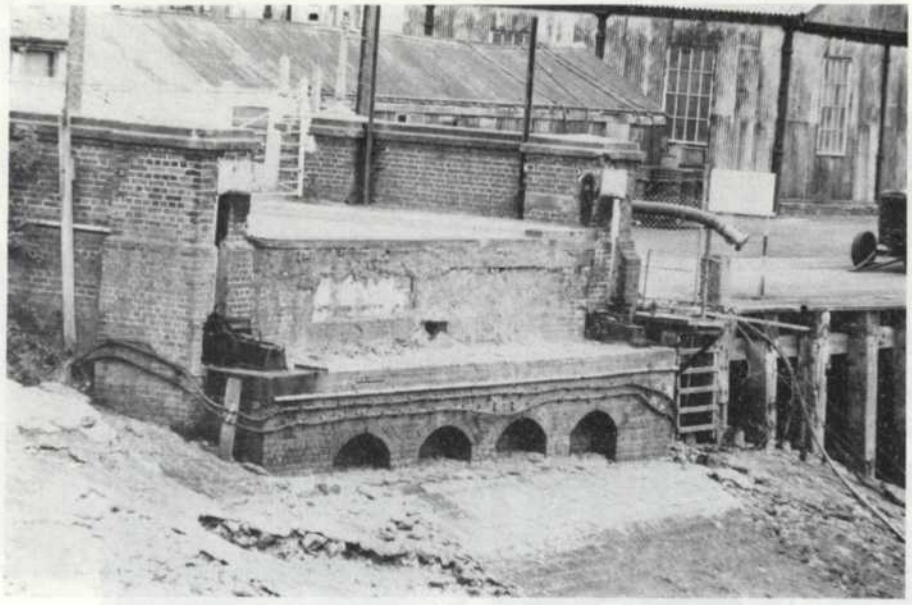


Plate VII
Bridge abutment on East bank.

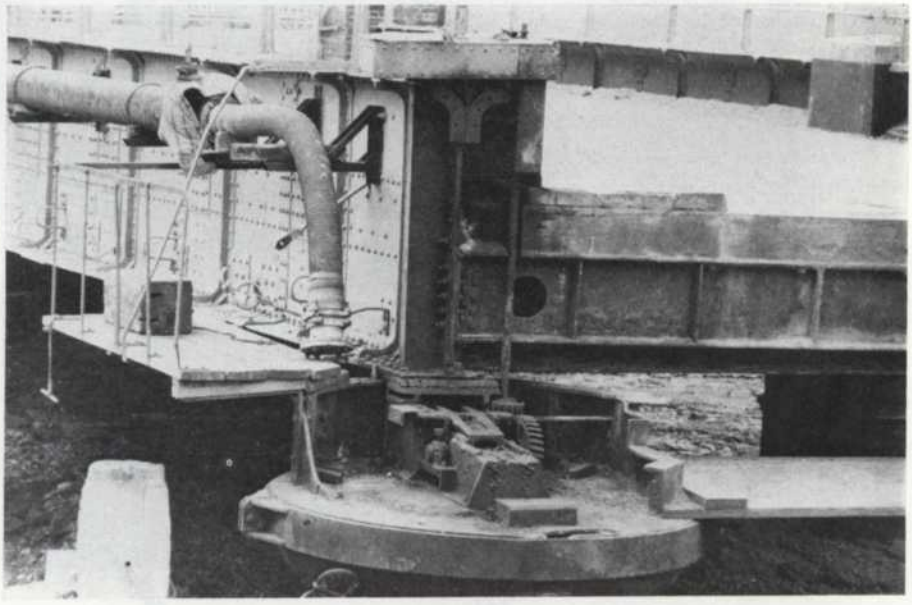


Plate VIII
West approach showing locking gear and flexible gas pipe.

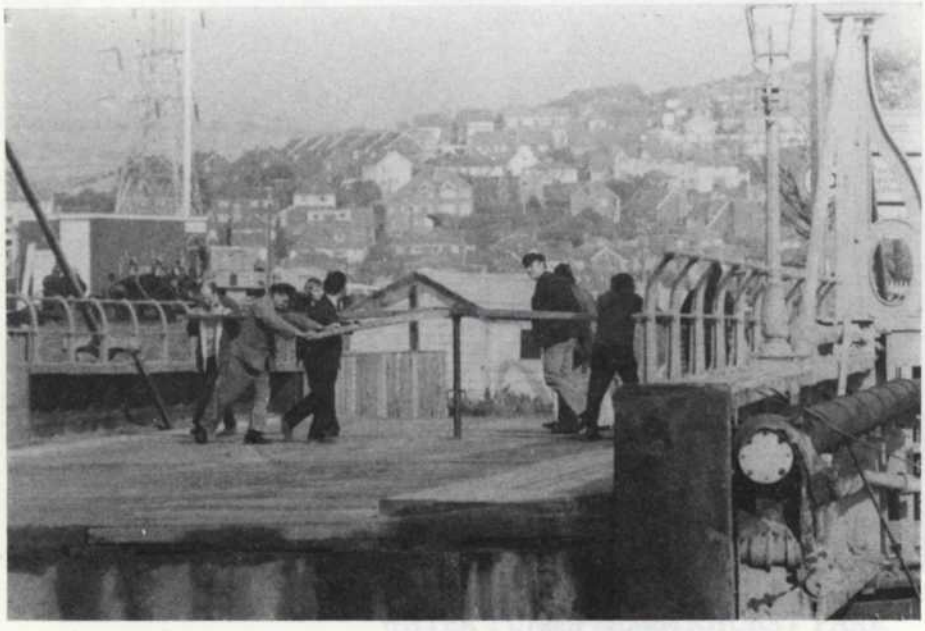


Plate IX
Operating the capstan on the bridge (A. S. Payne).

Plate X Freight train crossing the bridge (R. C. Riley).

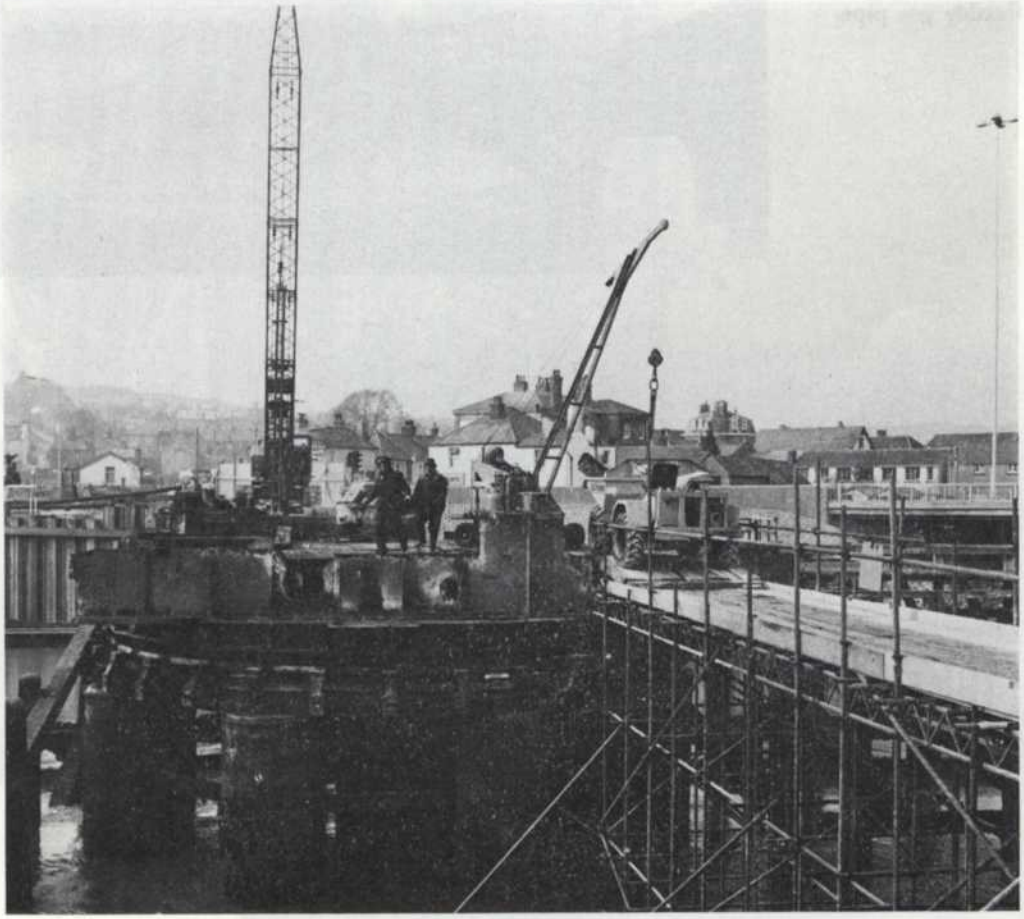


Plate XI The last stage of demolition; only the central support piers remaining (British Rail).

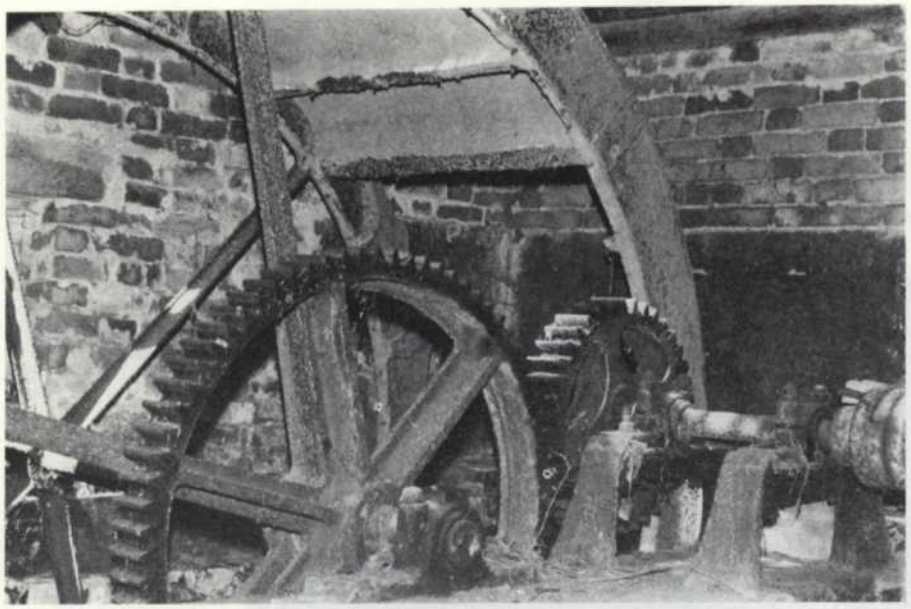


Plate XII
Water-wheel, first gear and clutch.

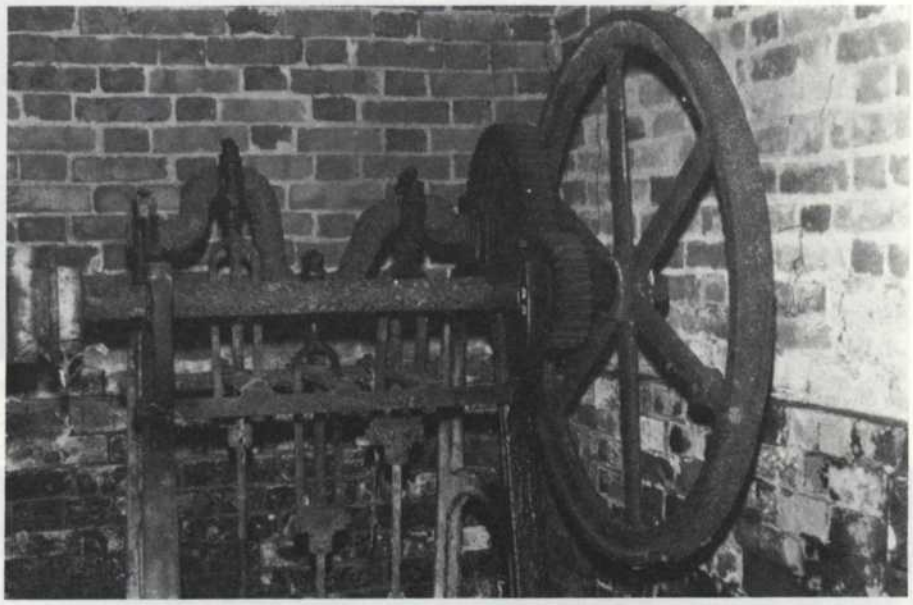


Plate XIII
Pump with flywheel.

Plate XIV
Chalybeate spring.

WATER PUMP AT BUCKHURST PARK

Plate XV The derelict mill prior to start of restoration in 1974.

Plate XVI Stone tablet, probably from the original mill, bearing the initials M.T.M. and the date 1683.

the first stage involving the reduction of the ore within the blast furnace to produce a liquid carbon alloy, that was cast into either moulds or as "sows" and "pigs" for later conversion to malleable iron at the forge. (7)Water-power was provided by the construction of dams (called bays) on streams to form the 'furnace' and 'hammer' ponds. Commonly the blast was maintained by using an overshot wheel to operate the bellows. (8)The second stage of the process involved reheating and working the cast-iron pigs with a water-powered forging hammer. The forging complex with finery, chafery hearths and power hammer, required its own supply of water-power, and is frequently situated on another 'man-made' pond (hammer-pond) downstream from the blast furnace.

The blast furnace at Bewbush and Ifield forge probably functioned as described above. The furnace is first recorded in 1574 when it was leased by Roger Gratwick an Ironmaster, who also operated several similar sites in St. Leonards forest for Queen Elizabeth. (9)Ifield Forge was probably constructed at the same time as the furnace; certainly it was also owned by Roger Gratwick, although it is not mentioned before 1599.(10)

Subsequently, both were leased by their owner Sir Thomas Sherly, Lord of the manor of Ifield, to Arthur Middleton of Beaubush. He also owned Maynards Gate Furnace at Rotherfield, Huggets Furnace at Mayfield and Little Forge at Buxted. Arthur was succeeded by John, who moved the family's home to Hills Place, Horsham, and also acquired the iron-works at Buringfold and Warnham. By the time Thomas inherited his father's estate the Wealden Iron industry was in decline, (11)the blast furnace at Bewbush had closed down by 1642, and is reported as a derelict in the 1653 lists. (12)Towards the end of 1642, there were several exchanges between Royalist and Parliamentarian forces along the Sussex-Hampshire border. The fighting was resolved, locally, when Arundel Castle surrendered to Colonel Sir William Waller in 1643(13). A force was then dispatched with instruction to destroy the Crown or Royalist owned iron-works in St. Leonards forest and the forge at Ifield. Since these sites were of little strategic importance, their destruction may be seen as an attempt to disrupt the economy of West Sussex (several Sussex royalist fortunes had their foundation in the Iron Industry).

Thomas Middleton had represented Horsham in the Long Parliament, and was a sequestrator for Sussex during the Civil War. (14)However, he and his son John were involved in the Royalist rising of 1648, and consequently fined by the Commonwealth. To meet the fines and debts Thomas was obliged to sell much of his property, including his home at Horsham. Thomas experienced considerable hardship before the restoration, when he was able to reclaim the site at Ifield, which was to remain in the hands of the family until 1715.

The First Ifield Water-mill

The ownership of the land surrounding Ifield Forge passed to another Thomas Middleton, and it was during his time that the first mill was probably constructed. He married Mary Goring of Highden and settled at Muntham close to his wife's family home on the downs near Findon. A stone tablet incorporated within the brickwork of the present structure belongs to this period; it bears the initials M.T.M. and the date 1683 (see Plate XVII). Unfortunately, nothing of his original mill survived subsequent alterations to the site.

Early mills were comparatively small establishments with little if any storage facilities. People kept their own corn, and brought it to the miller in quantities sufficient for their immediate needs. By the

17th century, commercial bakeries were becoming popular. To meet growing demand, mills were enlarged to provide storage facilities, the corn was ground in batches and milling was more specialized.(15)

The first details we have of a professional miller connected with Ifield Mill, date from this period. Prior to the end of religious persecutions in 1685, many local Quakers, including the miller William Garton were imprisoned in Horsham Jail(16). The Quakers first met at Ronwycks Place before the construction of the present Meeting House in 1676(17). While William was serving a sentence for non-payment of three year's tithes on his property at Bewbush Farm, his landlord, Thomas Middleton, "did stop of the said Williams money which he had laid out in building the sum of £19.10s which is £1.10s above the trouble damages". This occured in 1683, and may represent an expense incurred in the building of Ifield Mill; if so it would indicate that the tenant rather than the owner was the instigator of the construction work. Despite all difficulties William made a substantial settlement on his wife and children(19). His third son, John became the next miller and continued to live with his mother at the mill-house until 1742.

Meanwhile the ownership of the mill changed hands, when John Middleton sold it and other lands to Leonard Gale. He had previously owned a blacksmiths at Sevenoaks, and later went into partnership with the iron master Walter Burrell. Locally they worked Worth Furnace and Tinsley Forge. When he died in 1750 his property was divided between his three surviving daughters, Ifield Mill and the neighbouring Lyons Farm passing to Sarah and her husband Samuel Blunt.

In 1759 John Leake purchased the mill. He had other business partners during his period of ownership (1789-1809) including James Camfield, the miller, and William Bryant.

Probable Date of Present Ifield Mill

Early in the 19th century the old Mill was demolished and the present building erected. Some idea of the size of the new mill in relation to its contemporaries in the area can be gained from a survey that was carried out when the County was 'threatened' by invasion during the Napoleonic wars. Mills were recorded and asked how many sacks of flour they could supply in any twenty-four hours, - Balcombe Mill could produce 4, Tilgate 3, Hazlewick 1, Copthorne 3, Crawley had no mill, Bewbush was a grist mill, and Ifield a staggering total of 16. The survey also records that Ifield's seven privately owned ovens and two public bakeries could produce one hundred and twenty 3lb loaves every day.

Abraham Goldsmid became the next, and most unlikely, owner of the mill. He was a merchant in the city, and friend of both Nelson and the Hamiltons. Apparently a man of influence who was instrumental in securing prize money from the Admiralty on Nelson's behalf. When Nelson's relatives, the Matchums, purchased Ashfold Manor in Slaugham, Goldsmid rented a property nearby and in 1809 purchased Ifield Mill(20). He died in debt a year later, and for the next seven years the mill was in the hands of his executors.

The First Owner-Millers

The mill was finally purchased in 1817 by Thomas Durrant, the first owner-miller, for £1 800. Difficulties in maintaining a sufficient head of water for running the mill are first noted at this time. A situation that can hardly have been improved when the pond was bisected by the Horsham Branch

Railway; at first the rails were carried on a trestle bridge and later replaced by an embankment. By 1837, James Bristow had completed the construction of a windmill on Ifield Green, obviously in direct competition with the watermill and adding to its economic decline.

Richard Harding started work at Ifield Mill in 1875, and ten years later he purchased it. His family continued until labour shortages during the first World War reduced output. The mill never worked at full capacity again and gradually ceased production. In 1934 the mill house was advertised as a "gentleman's residence with a picturesque disused watermill". So it remained until purchased by Crawley Borough Council, who were aquiring land for housing development. The derelict building, deteriorated more rapidly over the next three months than it had in the previous fifty years, due to the attention of vandals.

Discussion

Despite extensive research the exact date for the rebuilding of the watermill is not known. Both Straker and Simmons(21) give the date as 1817 but do not quote their source. A meeting with Richard Harding's grand-daughter, the late Mrs. Frances Hoare, did little to clarify this situation (regretably she had recently burned documents etc.,belonging to the family). Nevertheless, she provided many intimate details of what it must have been like to live and work around the matermill when it was sill operational. One interesting fact to emerge was how her father ahd worked the steam-engine when there was not enough water to turn the wheel. She was quite adamant that the mill was rebuilt in 1817 for approx. £3 500. While there is nothing in the architectural detail discounting subsequent alterations and repairs that is in anyway inconsistent with the date she suggests, it is a most improbable sum.

Acknowledgement

The Crawley and Mid-Sussex Archaeological Group was formed in 1969 with four main objectives. The situation dictated priorities as follows:-

1. To carry out a series of rescue excavations in advance of extensive housing development.
2. To co-operate with local authorities in planning for the preservation of archaeological sites and historical buildings as amenities within new housing schemes.
3. To campaign for local museum facilities.
4. To publish the result of its fieldwork.

In 1978, when the current restoration of Ifield Mill is complete the Group will have achieved its third objective. It remains for us to express our sincere thanks to a dedicated band of volunteers, in particular:

D. Bracher, K. Clements, G. Denmark, C. Martin, R. Kitchen, D. Nesbitt (Plate XVI), C. Pratt, H. Vokes, and participants in both the Job Creation and Community Service Schemes, and also to Miss S. A. Bray who helped prepare this report. We are especially grateful to Mr. G. Wood, without whose support this work could not have been started. Finally we owe a considerable debt to local industry who have offered us assistance, especially J. Longley, B. J. Newman, SEEBoard, Stone-Platt, and W. C. Youngmans.

Bibliography

1. J. Gibson-Hill: Forthcoming. Cylindrical Shaft Furnaces of the Early Wealden Iron Industry. Sussex Archaeological Collections.
2. J. Gibson-Hill and B. C. Worssam: 1976. Analyses of Wealden Iron Ores and Their Archaeological Significance. University of London, Institute of Archaeology Bulletin, No.13. pp.247 - 265.
3. B. C. Worssam and J. Gibson-Hill: 1976. Analyses of Wealden Iron Ores. Journal of the Historical Metallurgy Society, No.10.2 pp.77-82.
4. J. Gibson-Hill: 1975. 1st Interim report, The Excavation of a Roman-British Ironworking Site at Broadfields, Crawley, W. Sussex. P. Drewett. Ed. University of London, Institute of Archaeology Bulletin No. 12, 1974
5. J. Gibson-Hill: 1976. 2nd Interim Report, Further Excavation at the Roman-British Ironworking Site at Broadfields, Crawley. University of London, Institute of Archaeology Bulletin No. 13. p.197. 1975
6. P. Bracher: 1976. Ifield Mill, its Owners and Occupiers. Sussex Family Historian, Vol. 2. No.7. pp. 222 - 228.
7. S. J. Bracher: 1976. Iron Working Sites in the Crawley Area. Undergraduate Dissertation, Southampton University, unpublished.
8. H. R. Schubert: 1952. The First English Blast Furnace. Journal of the Iron and Steel Institute. 170. pp.108-110.
9. Dallaways: 1815. West Sussex, Preliminary History, Volume 1, London.
10. E. Straker: 1931. Wealden Iron. pp. 458-460.
11. A. Fletcher: 1975. A County Community in Peace and War, Sussex 1600-1660. Longman, London and New York
12. J. L. Parsons: 1882. The Sussex Iron Works. Sussex Archaeological Collections 32, pp. 19-32.
13. C. Thomas-Stanford: 1910. Sussex in the Great Civil War and the Interegnum, 1642 - 1660. Chiswick Press, London.
14. W. Albery: 1925. A Parliamentary History of Horsham, Longmans.
15. D. Jones: 1969. Transactions of the Second Symposium of Molinology.
16. W. Allery: 1947. A Millenium of Facts in the History of Horsham in Sussex.
17. Kenneth H. Southall: Our Quaker Heritage, Early Meeting House. York.
18. Book of Sullering, No. 187, Quaker Meeting House, Dorking.
19. P. Bracher: 1976. See above. (6)
20. M. Eyre-Matcham: 1911. The Nelsons at Burnham Thorpe.
21. Simmons, H. E. S. - Unpublished. Sussex Watermills.

SHIPOWNING AT NEWHAVEN IN THE LATER 19th CENTURY

By John H. Farrant.

Newhaven harbour, at the mouth of the River Ouse in East Sussex, has been best known for over a hundred years as a cross-Channel port with services operated by the English and French railway companies. But the harbour has always had other activities and this article looks at one of these, shipowning, in the later 19th century.

The records on which it is mainly based are the statutory register books for the Port of Newhaven, 1856-1913, which are kept at the Custom House (1). Comprehensive registration of British Shipping was introduced in 1786. Each vessel of British Ownership, British built, and of 15 or more tons was to be registered at 'the port to which she belongs' (i.e. where the vessel, her owner(s) and her master were best known - hence on being sold a vessel might be deleted from one Port's register and added to another); once registered the vessel and her owners acquired certain privileges. Registration was (and still is) effected by specified information, duly certified, being entered in the register book (2). The Merchant Shipping Act of 1854 led to a new format of register book being introduced, and such books are the earliest to survive at Newhaven. Books used under the 1786, 1824, and 1836 Acts have been lost, though it might be possible to reconstruct the greater part of the information in them for 1814 onwards from the transcripts which were sent to the Custom House in London and are now in the Public Record Office (classes BT 107, 108). Bare lists of vessels on the register in each year from 1786 may be found in class BT 162.

Table 1. Vessels Registered in the Port of Newhaven 1790-1905 (3)

	Sail		Steam		Total	
	No.	Ton.	No.	Ton.	No.	Ton.
1790 (30th Sept.)	18	1418			18	1418
1802	20	1447			20	1447
1815	13	814			13	814
1825 (31st Dec.)	12	822			12	822
1835	20	1476			20	1476
1845	17	1219			17	1219
1855	26	2983			26	2983
1865	32	3136	6	1066	38	4202
1875	24	2634	11	1893	35	4527
1885	12	3411	17	3210	29	6621
1895	17	2847	14	3643	31	6490
1905	8	1061	14	2188	22	4249

The total number and tonnage of vessels on the register at Newhaven over a period of 115 years are given in Table 1.

Registrations reached as low as 11 vessels in 1813 and 8 in 1824. The highest number was 46 (38 sail) in 1869. Steamships first came onto the register in 1862 when the London, Brighton & South Coast Railway (L.B.S.C.R.), having taken on the direct management of the cross-Channel

services, purchased its first new vessels. These railway steamers accounted for most of the steamers registered at Newhaven but did not constitute all of the fleet operating from there, because in 1889 some were transferred to the French flag and of all new vessels thereafter some were registered in France. In all 49 steam vessels came onto the Newhaven register between 1862 and 1913. Of these 35 were owned by the L.B.S.C.R., and the remainder comprised four tugs, four fishing boats (all registered by one man in 1888 and after a couple of years not apparently employed locally), a private yacht, and five excursion boats based at Hastings.

The rest of this article is about the cargo-carrying, seagoing, sailing ships(4). This definition excludes all registered vessels less than 73 tons: they were fishing boats, yachts, or river barges, and can only be properly considered along with vessels of less than 15 tons which were not on the register (a separate register of fishing boats was introduced in 1894). The larger vessels were between 77 and 367 tons, and 40 of them came on to the Newhaven register between 1856 and 1913. But vessels first registered before 1856 were still 'live' until 1893, and the earliest list locally available of all vessels currently registered dates from late 1872(5). With the help of the register and other information this list can be continued to give the vessels registered at later dates. Though the numbers of vessels tally with those in the published returns (and used in Table1), there are minor discrepancies in the aggregate tonnage. The amended figures for sailing vessels of more than 72 tons are in Table 2.

Table 2 Sailing Vessels of 73 or More Tons Registered in The Port of Newhaven 1872 - 1905

	No.	Tonnage	Average Age (years)	Since Previous Date Added	Deleted
1872	17	2920	22	-	-
1875	13	2372	23	0	4
1885	10	2361	20½	6	9
1895	13	2980	30	8	5
1905	6	1145	40	0	7

The last two columns relate only to vessels included in the previous columns and ignore five vessels which were both added to and deleted from the register within a ten year period. The information in these columns along with the average age of the vessels, shows that although there was considerable turnover between 1876 and 1895, those added to the register in 1886 - 95 were on average no younger than those deleted.

Property in a British ship is divided into 64 equal shares. Nowadays all the shares in one vessel are usually owned by one person or by a corporation (e.g. limited company), but in the 19th and earlier centuries, it was common for several people to own shares in one vessel and thereby to form a partnership. (Shares could also be jointly owned by up to five people, though in the Newhaven register there were never more than two and then often as executors for a deceased shareholder) Either a shareholder was designated as 'managing owner' or someone else was appointed as agent, and if not himself the master gave directions for the ship's operation. The register records the owners' names, occupation or status, place of

residence, and size of shareholding; sometimes the managing owner is indicated. Table 3 gives the managing owners and agents, tonnages and crew sizes of the 17 vessels on the register in 1872.

Table 3 Managing Owners and Agents of Newhaven Sailing Vessels 1872 (6)

John Appleby of Seaham, shipowner	Ino (224 tons)
William R. Bennett of Newhaven, shipbroker.	Sussex Maid (182 tons)
Edward Chatfield of Lewes, timber merchant.	Wallands (99 tons; 9 crew)
Robert Hillman of Lewes	Galway Lass (201 tons),
	* Henry Benness (186 tons; 6 crew)
	Topsy (159 tons)
Henry Lea of Holloway, Middx. shipbroker.	Richard & Emily (82 tons)
George Newington of Lewes, merchant	Tagus (201 tons)
George Norman of Brighton, gentleman	South Downs (178 tons)
William D. Stone of Newhaven, grocer	* Harriett (142 tons: 8 crew)
	Newhaven (168 tons; 8 crew)
Stephen Tanner of Lewes, watchmaker	Olato (188 tons; 9 crew)
	Zenobia (190 tons)
William H. Tanner of Lewes, shipowner	Merchant (232 tons; 8 crew)
Henry Towner of Newhaven, butcher	John Gray (170 tons)
Thomas E. Watson of West Hartlepool	Mary Ann (134 tons)
William Winter of Newhaven, merchant/ master mariner	Warblington (201 tons; 9 crew)

* managed by agent.

Of the non-local managing owners, Henry Lea had the Richard & Emily on his hands between buying from local owners and selling to the Somerset and Dorset Railway Co. The other two presumably ran their ships to Newhaven. In the 13 vessels on the surviving register book, 22 individuals or pairs held shares. Five had only one owner, two had four owners, none had more. Four owners had shares in two ships, one in three, and 17 in only one. This simple pattern, with little overlap of ownership or concentration of management, contrasts with that which developed during the 1880's.

This change was wrought by the activities of John Henry Bull and his cousin Neil Campbell Bull. At the end of 1885 they were managing owners of five out of ten cargo sailing boats registered at Newhaven, and at the end of 1895 (Neil having died in May) John was owner of ten out of thirteen. They seem to have had a highly efficient means of raising the capital for the vessels with which they built up the 'Bull Line'. Their first vessel, Commerce, was transferred from the Shoreham register in July 1881 and entered in the Newhaven register as jointly owned by the two Bulls. But in fact they had already (as was later recorded in the register) sold off four blocks of nine shares, leaving themselves with 28. The second vessel was purchased about eight months later and 40/64ths sold to six others (two of them shareholders in the first). Six of the eight shareholders (other than the Bull cousins) took up shares in the third vessel early in 1883, along with two new shareholders, and so it went on. Table 4 shows

the position in October/November 1887, when it was still relatively simple, none of the shareholders having died and been replaced by heirs or executors. There were 16 owners of 7 ships, a similar ratio of owners to ships as in 1872, but each ship averaged 9½ owners. Of the Bulls' shareholders, Henry Bull was presumably a relative; the Tanners and Bannister had previously invested in Newhaven shipping; Shaw, Hobbs, Hemmings, and Tolman were also local; Strickland traded in Lewes; we can only guess how Widow Jeffrey and Mr. Fisk were recruited. The only known prices paid for shares are £14 and £26 in 1886. If the average share was, say, £18, a typical holding of 30 shares in 1887 represented an investment of £540 and the fleet cost £8000. Of the other five cargo vessels on the register at that time, three had single owners (Sussex Maid and Warblington, George Robinson of Newhaven, shipchandler/sailmaker; Harriett, Thomas Fieldgate of Newhaven, Master mariner); Conflict was owned by two coal merchants of Lewes and Brighton; the fifth, Wallands, had three owners in Whitstable.

Table 4 Ownership of the Bull Line in 1887 in 64th Shares

	COMMERCE	EMILY SMEED	CARBONARIA	FANNIE C	PENNINE	EURUS	DIONE
tons	254	286	301	332	296	327	278
J. H. Bull, Newhaven, Lloyd's Agent)			6	15	6	6	24
N. C. Bull, Newhaven, shipbroker)	19	18	6	5	6	6	6
Henry Bull, Eastbourne, lodging hse prop.	9	6	6	5	6	6	6
James Bannister, Newhaven, provision merchant	9		6	5	6	6	
James Bannister)							
Wm. Henry Tanner, Lewes, jeweller)	9	6	6		5	6	
Wm. Henry Tanner		8	6	5	6	6	6
Stephen Tanner, Lewes, jeweller		8	6	5	6	6	6
John Fisk, Middlesex, clerk	9			5	5		
Henry Wm. Hemmings, master mariner				4			
Wm. Hobbs, Newhaven, farmer		6	6	5	6		
Charlotte, wife of Wm. Hobbs						6	6
Jane Jeffrey, Haywards Heath, widow		6	6	5	5	5	
J. B. Shaw, Newhaven, engineer			6	5		6	6
Geo. Strickland, Hailsham, corn merchant			4		7	4	4
J. C. Tolman, Newhaven, shipbuilder	9	6					
Number of owners	6	8	11	11	11	11	8
Size of crew			9	7	7		6

The context of the Bull Line's establishment can be explained by looking first at the trade of the sailing vessels in the register. For information we can look to other records of the Register General of Shipping and Seamen: the Log Books, Agreements and Crew Lists, and Accounts of Crews and Voyages, some or all of which (according to the ship's size and trade) the master was required to complete and return under the 1854 Act. These records prior to 1914 were disposed of by the Registrar General in 1971. The Public Record Office took all records up to 1860 and of the rest a 10% random sample for the whole country (BT 99, 100): the National Maritime Museum took all the records for 1861, 1862 and every tenth year beginning with 1865, and, after local record offices had taken what they wanted, the Memorial University, St. John's, Newfoundland took the rest(7). East Sussex Record Office (Acc.1239) made a small sample (unfortunately biased towards the railway steamers although they were already better documented than the sailing vessels) which has been used here. Not only are there many more of the same types of records which might have been used, but there are also summaries of shipping movements in the Sussex Advertiser and Sussex Daily News which can, labouriously, be extracted and analysed(8).

On the limited information collected, it is fairly clear that the Newhaven vessels under discussion in the main traded to Newhaven with a single cargo, coal. A good year's work was ten cargoes from the North East (usually Sunderland or South Shields) or less often from Llanelly in South Wales. Thus Harriett brought seven from Sunderland and three from Llanelly in 1878, all to Newhaven; Prosperous's ladings were precisely the same in 1876, but she landed two at Littlehampton and one at Southampton. Conflict brought nine cargoes from South Shields in 1882; Carbonaria eight from South Shields or Newcastle in 1886 landing three at Plymouth and the rest at Newhaven. Almost invariably there was no return cargo, but one notable and explicable exception was Wallands owned by Lewes timber merchant Edward Chatfield which (in 1866 and 1870 at least) bore timber to the Tyne.

The beginning of the final (though protracted) decline of coastal sailing vessels in Sussex began in the mid-1860's when link lines were opened between the railways north and south of London. These lines made possible through running of coal from 'landlocked' Midland fields which could now compete on equal or better terms with seacoal from the North East. The full impact of competition was probably delayed for a few years at Newhaven because of the railway company's own activity as distributor of coal landed there. But 1874's coal imports were only half those of 1868 and 1881's were still lower - the year in which the Bulls purchased their first vessel(9). Table 2 shows how much the cargo sailing vessels on the register fell between 1872 and 1885. Why then did the Bulls try to turn the clock back and succeed enough to encourage their shareholders to invest in more ships? A possible explanation is ironically linked with the railway. First, whereas the decline of the coal trade caused facilities at other south coast harbours to stagnate and even deteriorate, Newhaven harbour was effectively (if not actually in law) acquired in 1878 by the L.B.S.C.R. which started a major development programme to improve the cross-Channel service. Already in 1880 the depth of water was greater, allowing quicker crossings by the steamers - and access by larger vessels. Comparison of Tables 3 and 4 shows that the Bull's vessel were substanially larger than those operating in 1872. Secondly, although the facilities for unloading coal onto the railway were limited until the North Quay was opened in 1892, rail distribution was more feasible than from other local harbours, and the Bull Line was able to win a contract for coal for the Eastbourne Gas Co. (probably up to 1889)(10). Furthermore the L.B.S.C.R. consumed coal at Newhaven in its steamers and this seems to have come from

South Wales which did not become reasonably accesible by rail until the Severn Tunnel was opened in 1886 (the company transferred this traffic from sea to rail in 1889)(11). Thirdly, the larger vessels were readily available (and presumably relatively cheap). Seventeen vessels were part of the Bull Line. Eight, built on the neighbouring harbour of Shoreham between 1862 and 1871, had operated in medium distance trades (e.g. the Mediterranean and the Americas) but by the 1880's were too small and slow to compete with steamships. The only indication of capital values is the share prices of Carbonaria and Pennine in 1886, giving about £1400 and £800 respectively.

But the Bull vessels were old: as Table 2 shows they were on average as old when transferred to the Newhaven register as the vessels coming off it, and the Line as it grew up in the 1880's had no long term prospects. It usually comprised eight vessels until 1899 when vessels began not to be replaced. When J. H. Bull died in 1907, only the John Bull remained, to be sold by his executors two months later. Immediately prior to the date when the fleet began to shrink, in March/April 1899, there were nine vessels with 19 shareholders. But three of the four vessels acquired after 1890 were entirely owned by John Bull: perhaps following the loss of the Eastbourne Gas contract and of any carriage from South Wales for the railway company his sources of capital dried up(12). What was happening was that the same deepening of Newhaven harbour which favoured Bull also attracted steam colliers which were not locally owned and were trading to Newhaven from the late 1880's. The steamers took traffic in coal both from the railway and the sailing ships. Between 1880 and 1905 the aggregate tonnage of vessels entering Newhaven coastwise with cargo more than tripled, from 34,000 to 114,000, but the tonnage of sailing vessels within those totals fell from 33,000 to under 8,000(13). In December 1905 there were six sailing vessels on the Newhaven register and five years later only two (John Bull and Sussex Maid, then 54 years old). The era of the commercial sailing ship had passed.

This article makes no claims to be a comprehensive treatment of its subject; as stated in the text there are other records which could be used. But it will serve its purpose if it indicates some of the ways in which the local historian can exploit the shipping records now available. Similar analyses for other Sussex Ports would be interesting as would work on other aspects such as the crews.

References

1 The Author is grateful to the Librarian, H. M. Customs & Excise, for permission to consult the registers and to the staff at Newhaven for enabling him to transcribe them in 1970. A copy of the transcript is at the National Maritime Museum, Greenwich.

2. R. C. Jarvis, 'Ship Registry - 1786', Maritime History, iv (1974) 12-30. Grahame Farr, 'Custom House Ship Registers', Mariner's Mirror, lv (1969), 3-15.

3. 1790: British Library, Add. MS. 38431. 1802: National Maritime Museum, ADL/4/A/6. 1815, 1825: Customs Library, Customs 36/5. 1835: Customs 32/109. 1845-1905: British Parliamentary Papers, 'Navigation and Shipping Returns' (annual).

4. Michael R. Bouquet has written on the same subject, but with emphasis on the history and type of individual ships; I have therefore avoided those aspects. Little new information is added to his 1930's articles by his later publications: 'Sussex Sailing Ships', Sussex County

Magazine, x (1936), 198-203 No.2, 'The "Bull Line" of Newhaven'), pp.313-15 (see also p.439) (No.4, 'The Loss of the Brig. Galway Lass of Newhaven'); xiii (1939), pp. 174-8 ('Ships of Lewes'), pp.220-3, pp.320-3 ('Ships and Shipbuilding of old Newhaven'); 'Vanishing Ships of the Little Ports', Country Life, cxix (1956), pp.1110-11: 'Tall Ships Beneath the South Downs', cxlvii (1970), pp.92-4; 'Sailing Ships in the 19th Century Newhaven', Model Shipwright, i, no.i (aut. 1972), pp.50-54; No Gallant Ship (1959), ch. 8; South Eastern Sail, (Newton Abbot, 1972), pp.41-57. The most relevant general survey is Basil Greenhill, The Merchant Schooners, 2nd ed., 2 vols. (Newton Abbot, 1968) which include recollections of Capt. Robinson of Newhaven.

5. Burton Green, The Shoreham and Sussex Ports ... Shipping Directory 1873 (Shoreham, 1873), pp.38-9. The Newhaven list seems to have been extracted in October 1872.

6. Green, pp. 38-9, with occupations from the register and crew sizes from East Sussex Record Office, Acc. 1239.

7. K. Matthews, 'Crew Lists, Agreements, and Official Logs of the British Empire 1863-1913', Business History, xvi (1974), pp.78-80.
D. J. Butler, 'Sussex Shipping Records', Sussex Industrial History, no.3 (1971-2), pp.30-31.

8. The Author's use of the statutory records, newspapers and harbour master's journal for 1880 in Mid-Victorian Littlehampton: The Railway and the Cross-Channel Steamers, Littlehampton Papers No. 4 (1972), pp.15-20.

9. See J. H. Farrant, The Harbours of Sussex 1700-1914, (Brighton, 1976), pp.17-19, 25-26, for a fuller exposition of these points.

10. G. W. Buckwell, 'History of the Newhaven & Dieppe Service', repr. from Trans. Inst. Marine Engineers Session 1891-2.

11. Farrant (1976), pp.11-18

12. He was also sole owner of the tug Tipper, 1901-6.

13. Farrant (1976), p.24.

A NOTE ON EARLY IRON MAKING IN SUSSEX

By W. R. Beswick

Of all the manufacturing industries in Sussex, iron making stands out in the attention which it has received from historians and archaeologists. Much work has still to be completed on the very early phases but already it can be said, that the extent of those early operations must have been very considerable indeed. It follows, that the iron bearing district would be quite well populated, not only by iron makers, miners and forest workers, but also by the related domestic and farming communities.

Our own team covering the industrial history of Warbleton Parish, had occasion to examine an iron works which by C 14 dating would seem to have been in operation during the second half of the sixth century, thus the site may mark a point in that fascinating but enigmatic "overlap" period which followed the withdrawal of Imperial Roman authority.

This site is one of at least ten bloomeries which lie close to the alignment of the Netherfield - Cross-in-Hand trackway said to have been used by the Romano-British. It consists of three iron smelting furnaces arranged along one side of a shallow trough on the other side of which runs a stone sill supported on dry stone walling. At one end of this sill there was evidence of bloom refining and at the other end a smithy had operated. The furnace design is of some interest since it has a low dome with flat rear extension, this type has not so far been found in Sussex and appears to bear Frankish influence. Within a hundred metres are three outlying bloomeries. A timber and wattle structure which underlies part of the main site awaits attention as soon as our timber preservation tank becomes available from work on other Sussex sites and when experts in that kind of excavation can be found to deal with the matter.

FIELD PROJECTS

Although the restoration work of the Sussex Industrial Archaeology Society is the more spectacular part of its work, Officers and Members are also active in many other ways. These include formal recording of items of interest, giving of advice on the archaeological value of equipment, salving small items for storage or lodgement in local museums, carrying out relevant research, co-operation with similar organisations and maintaining contact with official bodies. The work is extremely rewarding and the Society will welcome as Members any persons interested in maintaining our valuable industrial heritage.

Ifield Watermill (TQ 245365)

Restoration work (S.I.H. No.7) is almost complete and it is hoped that the mill will be opened to the public in late 1978. Preliminary agreement has been reached with Crawley Borough Council for its use as a local museum and a Crawley Museum Society has been set up.

Coultershaw Bridge Water Pump (SU 972194)

Restoration of the pump and waterwheel (S.I.H. No.7) is well advanced. As the installation is below ground level a barn has been obtained and will be re-erected over the site to act as a display centre.

Burton Mill (SU 980180)

The mill has recently been purchased by the W. Sussex County Council who hope that it, together with the lake that feeds it, can be made into an attractive amenity. Although the original machinery, except that on the bin floor, has not survived there are two water turbines occupying the original wheel pits; one, dated 1929, has been restored by the Society with help from naval working parties and is now in excellent running order.

Brightling Sawmill (TQ 686201)

The Sussex Heritage Trust has taken a two-year lease on the mill (S.I.H. No.7) and has undertaken to carry out emergency repairs to the structure. The Society then hopes to restore the machinery and put the mill into working order.

Southern Industrial History Centre

The Centre is about to sign, with the W. Sussex County Council, a long-term lease on the Amberley chalk pits (S.I.H. No.7). The Society keenly supports the project and is working in close co-operation with the Centre. Some equipment is already available for ultimate display so that it is hoped to open it to the public in 1979.

Index of Research Articles in Issues 1-7

A few copies of the above issues are available from the Hon. General Secretary, price £1.00, including postage. Copies are also available in the Reference Sections of the chief Sussex Public Libraries.

Index of Research Articles in Issues 1-7

A few copies of the above issues are available from the Hon. General Secretary, price £1.00, including postage. Copies are also available in the Reference Sections of the chief Sussex Public Libraries.

Printed by W. A. GUY & JONES LTD., High Street, Hastings. Tel. 433241 (0424)