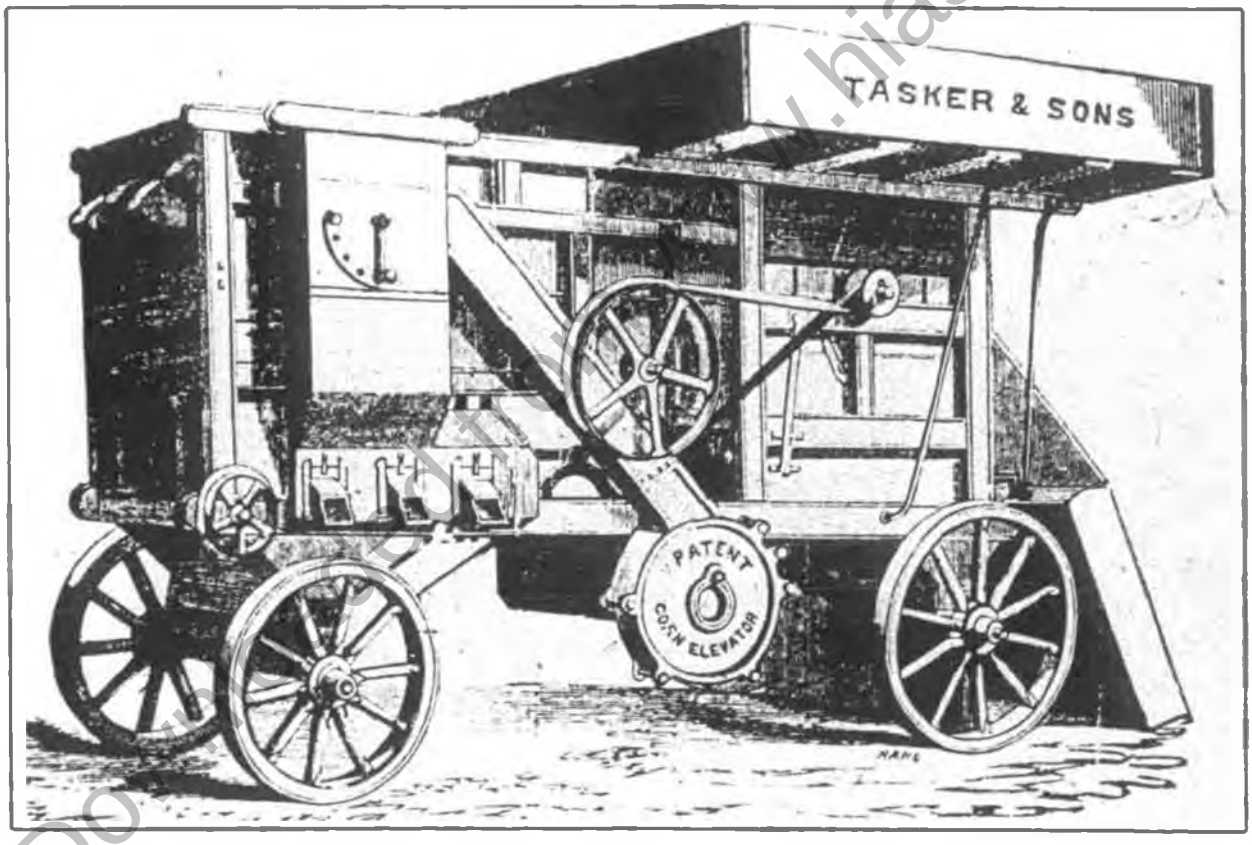
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Southampton University Industrial Archaeology Group

Journal



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Contents

Contributors i

Editorial and Acknowledgements ii

Bearwood Estate Sawmill *by John D. Asteraki* 1

Railway Steamers at Southampton *by Bert Moody* 8

The Sheerness Boat Store *by James Paffett* 12

The Steam Hammer *by Dr. J. Martin Gregory* 14

Engineering in Rural Hampshire *by Dr. Edwin A. Course* 21

Southampton, and a First Industrial Revolution *by David J. Plunkett* 27

SUIAG Publications 30

The Contributors

John Asteraki
After graduating from Cambridge, John Asteraki joined the staff of the Royal Aircraft Establishment at Farnborough. For most of his career he undertook research into guidance and navigation systems for aircraft and guided weapons, spending the last 11 years of his service as Head of the Electro-optics Division. Since his retirement in October 1990 he has been able to pursue his interest in the IA of Berkshire and is currently gathering information for a guide to that county's IA relics. With John Bagley he is also currently active in surveying Hampshire's airfields.

Bert Moody
Bert Moody was born in 1921 in a suburb of Southampton and has been studying its shipping and railways almost ever since. His career in the railways, with an interruption for war service, lasted for 37 years. He has been Chairman of the Southern Counties Railway Society for 40 years and Editor of their Newsletter for 35 years. For shipping, after holding positions in the World Ship Society, he helped establish the Solent Maritime Society in 1968, and since then has been its Secretary and Editor of its Newsletter. In his retirement he continues to lecture and write on railways and shipping with special reference to the Southampton area.

James Paffett
James Paffett began his working life in Portsmouth Dockyard. His career as a Naval Architect included various appointments in the Ministry of Defence and the DTI and as Professor of Naval Architecture at the Naval Academy in Greenwich. He later served as head of the civil ship research establishment at Feltham. Now retired, he is Vice President of the Royal National Lifeboat Institution and of the Royal Institution of Naval Architects.

Dr. Martin Gregory
Martin Gregory's interest in the history of steam and the steam engine goes back over 40 years. It has led him to research and build models of many varieties of steam plant; the steam hammer is one chapter in this ongoing programme. He has been a member of SUIAG for over 20 years and also works on the history of Stirling Engines and Sewing Machines.

Dr. Edwin Course
Edwin Course taught at the University of Southampton from 1956 to 1988. His research and writings have been mainly in the fields of transport history and industrial archaeology. He is currently President of the Railway and Canal Historical Society, President of SUIAG and Chairman of the Twyford Waterworks Trust.

David Plunkett
David Plunkett has a trade and professional background in masonry and of the preservation of ancient and historic buildings. He is a past SUIAG member and resident of Totton who moved to take up employment at Windsor Castle in 1991. David is a founder member of Eling Tidemill Trust, Hampshire Mills Group, Mills Research Group and English Heritage. He has had minor articles and letters published in England and the U.S.A.

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Southampton University Industrial Archaeology Group Journal

Editorial and Acknowledgements

This is the 1994 edition of the SUIAG *Journal*, the third to be published. We believe that we have finally worked out production methods which will enable us to produce an annual *Journal* within the budget available. The policy of publishing pieces about industrial archaeology, the history of technology and economic history in Hampshire or, alternatively, anything written by members of SUIAG, remains unchanged. The present issue indicates the range – from engineering works in the Hampshire countryside to industrial activity in Saxon Southampton.

May I remind any members who are considering writing for publication of the alternatives to the *Journal?* Shorter pieces may be more suitable for the newsletter, '*Focus*', while longer pieces could be published as monographs. The Publications Committee looks forward to hearing from you.

Once again we are particularly gratified to Angela Smith who set and designed the 1994 *Journal*, and to all our contributors. Acknowledgements for the provision of drawings and photographs are made as follows:–

John Asteraki (Figs 1 - 8); Martin Gregory (Figs 19 - 27); Bert Moody (Figs 9 - 15); Ordnance Survey (Figs 29, 31, 32); David Plunkett (Figs 34, 35); Philip Turner (Figs 16 - 18); Rolt - *Waterloo Iron Works* (Figs 30, 33); Taskers Waterloo Iron Works Catalogue (cover drawing); Whitehead *Wallis & Steevens* (Fig 28).

Edwin Course
November 1994

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Bearwood Estate Sawmill

Papers in the Berkshire County Record office show that the Walter family had been powerful landowners in Wokingham and in the neighbouring countryside from at least the 16th century, having acquired monastic lands at nearby Sonning following the dissolution of the monasteries in 1539. However, Bearwood was a late acquisition, being purchased by John Walter II in 1816. That John Walter died in 1847 and the estate was inherited by his son, John Walter III. For a while John Walter III lived in the relatively modest mansion which already existed at Bearwood but in 1865, with Robert Kerr as architect, he followed what was then the fashion for the rich and powerful, and demolished the old mansion, replacing it with a new one constructed in the grand style, and equipping it and the estate with the very latest technology.

The Walter family had long been in the forefront of employing new technology. For example, in 1814, John Walter II, the then owner of 'The Times', became the first newspaper owner to employ a steam engine as the motive power for driving newspaper printing presses. His son followed in his footsteps and the facilities built at Bearwood included an estate gas works, a sawmill, blacksmith's shop, and laundry, and the various estate farms were furnished with buildings of the very latest design. The industrial facilities were housed in a purpose-built complex of buildings at Mole Farm, National Grid Reference SU 770683. *Figure 1*, on the following page, is a sketch map of the site, which is based on estate maps, the 1911 & 1932 editions of the 1/2500 Ordnance Survey map, and other archive material. Most of the buildings are still standing, the exceptions being the retort house and gas holder of the gas works, which have been demolished. Although the retort house and gas holder were still standing in 1932, all that now remains of the gas works is the small store built in the acute angle of the north side of plot 102, and the gas-maker's house. The position of the footings of the retort house can, however, just be discerned after prolonged dry weather. In 1991, the sawmill was still almost complete with most of the original machinery still in place. However the building was in a dangerous condition and a planning application for its demolition prompted the author and Gerald Davies to undertake a survey of the site.

John Walter III died in 1894 and, although he was succeeded by his son Arthur Fraser Walter, the estate was sold piecemeal in the early years of this century. Unfortunately for the historian, most of the Walter estate papers were destroyed about that time with just a few papers, which were held by the family's solicitor, surviving. Eventually they were deposited in the Berkshire County Record office. The mill was evidently an important estate asset as the papers still extant do contain regular assessments of the value of the standing timber in the various parts of the estate.

Although known locally as the sawmill, the building did, in fact, contain all the facilities needed for taking in tree trunks and turning them into joinery of the highest quality. The local tradition is that the sawmill was one of the first buildings on the site and was used to produce all the woodwork, including the panelling, doors, window frames, etc, not only for the mansion and the various estate properties but also for "The Times" building in London. One of the surviving documents is an insurance schedule for Mole Farm dated 1896, which gives the following valuations:-

Mole Farm

Dwelling house, Mole farm	£200
Laundry and Dwelling rooms	£400
Cart horse stable	£250
Blacksmith's shop, paint shop & store room	£250
Carpenter's dwelling house	£180
Open cart shed used as carpenter's store room	£ 70
Joiner's shop near sawmill	£700
Machinery driven by steam	£400
Boiler and engine house	£ 50
Steam engine and boiler therein (was £500 to be increased to)	£700
Sawmill with carpenter's shop over (water power), joiner's shop and pump house adjoining	£200
Machinery, pumps and tools therein	£400
Workmen's mess room, 2 storehouses, 2 root houses, loose box, open shed, cowstalls, hogvault, meal house	£300
Cowman's cottage	£200
Large open shed across the yard adjoining stables to cow house	£300

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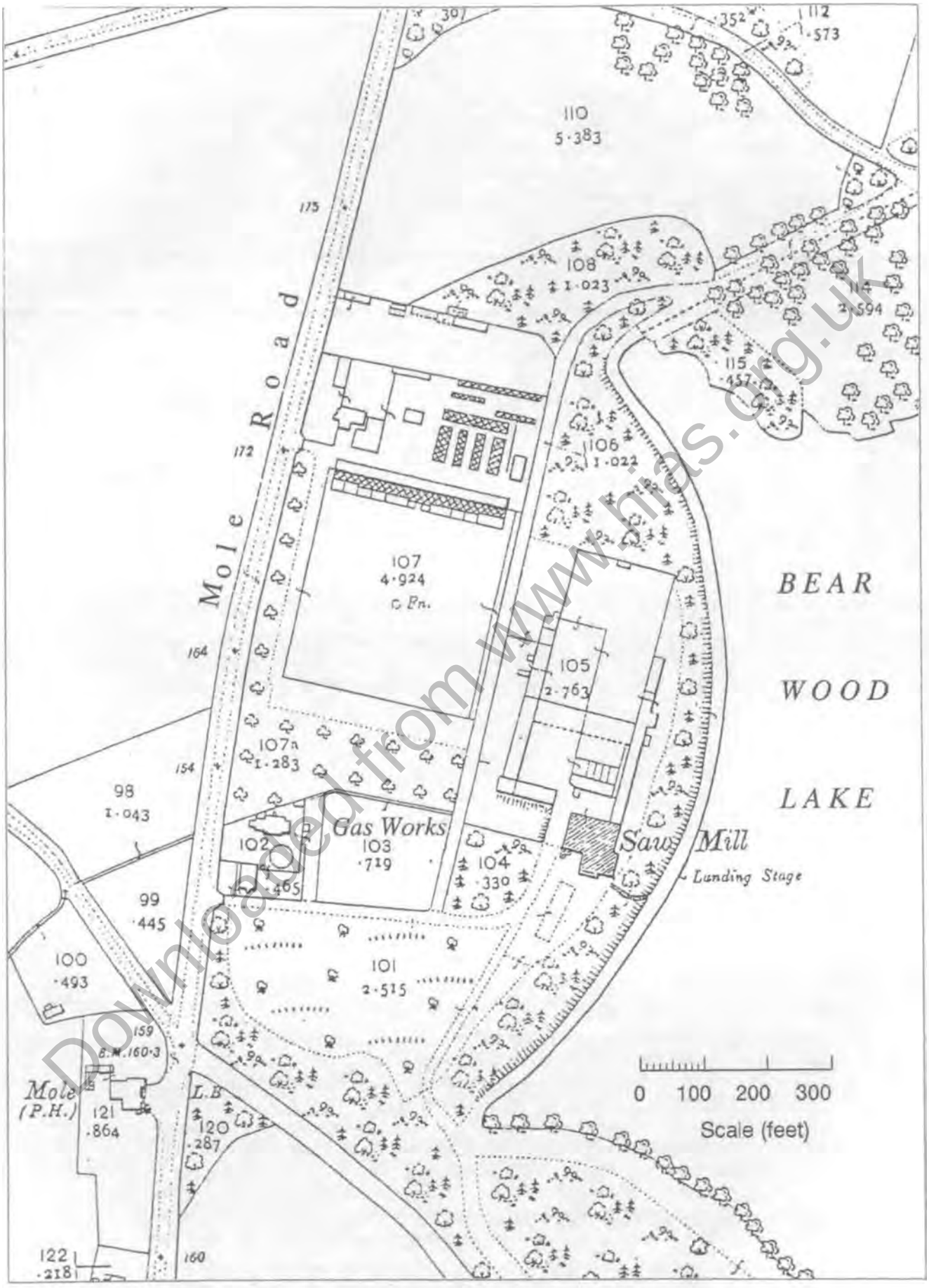


Figure 1 Site plan Bearwood Estate Works
(adapted from Estate plan and Ordnance Survey 1:2500 map, 1932 edition)

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Bearwood gasworks

Foreman's dwelling house	£350
Retort house, coal stores, pumping house, meter house, lean-to store shed	£600
Stationary gas meter therein	£ 75
Purifying Beds	£ 40
Governor House	£ 30
Contents thereof	£ 65
Lime house	£ 15
Gasometer in yard	£ 75

The relative valuations of the various workmen's houses provide an interesting insight into the relative pecking order of those times.The dwelling rooms above the laundry were for single men employed on the estate.

Although conclusive documentary evidence is lacking, it would seem that there were two power sources for the sawmill right from the start – a steam engine and a water wheel. The evidence for this is that the brickwork for the boiler chimney, which is still standing, does not show any discontinuity with the brickwork in the adjoining walls, and the pit for the water wheel is obviously an integral part of the building's design.

From the position of the launder and the power take-off, and the dimensions of the wheel pit, it is assessed that the water wheel must have been about 27 feet in diameter and 4 feet wide, and it could have provided about 30 horsepower. Water for the wheel was obtained from Bearwood Lake.The lake is entirely artificial and, in its present form, it was created at the time of the building of the mansion. To the east of the mansion there was already a shallow valley and its sub-soil proved to be a suitable material for brick making. From it, bricks were manufactured on site, not only for the construction of the main house and many of the estate buildings but also, as with the woodwork, for the construction of "The Times" building. An earth dam, just over 20 feet high, was then constructed across the end of the valley and the extensive clay workings were allowed to flood to form a lake having a surface area of just over 43 acres. The logic of employing a water wheel to drive the mill is not entirely clear as there are no large natural streams feeding the lake, and if it were hoped that the large area of the lake and the nature of the surrounding topography would ensure a plentiful supply of water, the hope could not have been fulfilled. Modern observations of rainfall and the water level in the lake, coupled with Victorian rainfall records, suggest that the water available could not have run the wheel for more than an hour or so a day, and certainly the water supply would not have been adequate to support a reasonably commercial operation on its own. However, the fact that it was still in use, and insured, more than twenty years after the completion of the estate works, does suggest that the estate found it a worthwhile power source.



Figure 2 The sawmill seen from the south. The chimney was originally the flue for the boiler for the steam engine. The two-storey wing towards the camera housed circular saws on the ground floor and a carpenter's shop above.

The southern side of the mill is shown in *Figure 2*. The trees on the right are growing on the face of the dam, which is now heavily overgrown. The top of the dam is level with the eaves of the building. *Figure 3* shows the ground floor plan of the mill, as it existed in April 1991. Built of brick, the sawmill was, for the most part, of two storeys with an 'L' shaped plan. The single storey lean-to along the southern side of the main block as far as the corner of the 'L' could not have been part of the original construction as it is not shown on the 1911 edition of the 1/2500 Ordnance Survey map, and in addition there is a marked discontinuity in the brickwork, when compared with the original building. It is not now possible to determine the nature of the small building attached

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to the southwest corner of the main block, shown in Figure 1, as its site is now covered by the current extension. That extension was probably built about the middle of the 1930s, specifically to house the Blackstone oil engine, which replaced the steam engine as the main motive power source. The lean-to annex on the foot of the 'L' and nearest to the camera was built in two stages. The room immediately to the south of the saw room is shown on the 1911 map. The one nearer the camera which houses the water pump for the now disused estate water supply, is not shown on either the 1911 or the 1932 map. It was probably built in the mid-1930s specifically to house the present water pump, which was bought at that time. Including the lean-to additions, the overall floor dimensions of the building are approximately 82 feet 6 inches from east to west and 97 feet from north to south. The main block, which is sideways-on in the photograph, is 21 feet 9 inches to the eaves, and 32 feet to the present ridge. Apart from the additions already mentioned, the building has evidently undergone several other alterations during its life, which have mostly been for the worse. The floors of the building are mostly of suspended wood construction. In places the floor has fallen away to reveal the shafts and pulleys for driving the machinery. In contrast to many Victorian factories, the driving belts are mostly in the cellars and enclosed when they come through to the working floors.

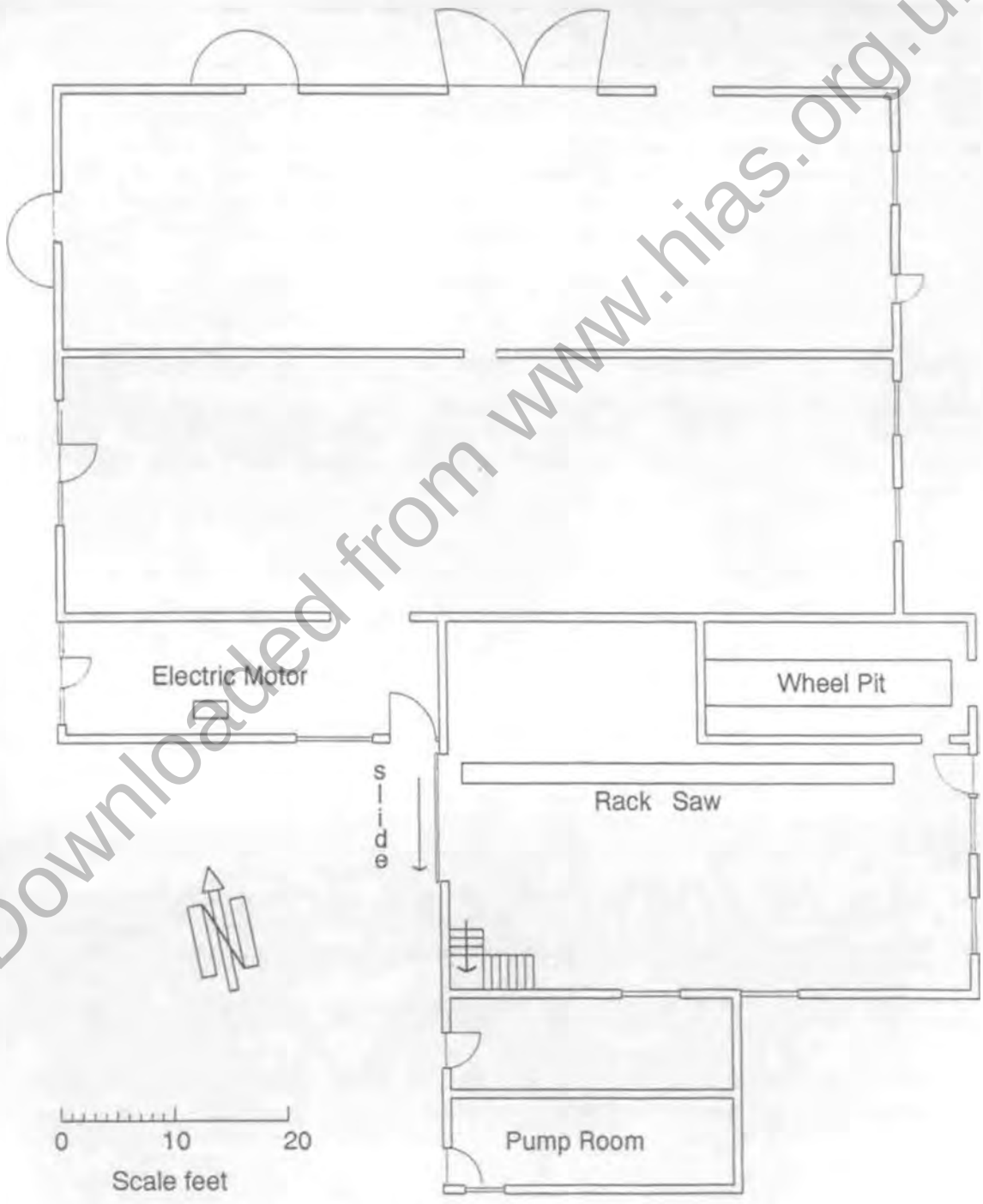


Figure 3 Plan of the ground floor of Bearwood Saw Mill

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The water-wheel was situated in the space between the two main blocks and its position is shown on the plan. The wheel was evidently pitch-back, with the water descending from the lake in a wooden launder. *Figure 4* shows the back (eastern side) of the building viewed from the top of the dam. The water wheel was housed in the flat-roofed extension in the centre of the photograph, and the launder entered the wheel chamber through the rectangular opening (now slatted), which can be seen in the rear wall of the extension. The used water ran into a tunnel and emerged into a drainage ditch at the front of the building. After the removal of the wheel, the wheel pit itself was partly covered by concrete blocks to form a floor, and the chamber was divided by an internal wall. The original walls of the chamber, however, still have wooden laths attached to them and it is believed that they were the means for supporting some form of waterproof covering to protect the walls from water splashed from the wheel. Certainly the walls show very little water damage. On the western end of the southern wall of the wheel pit, and at roughly the same height as the wheel bearing, a gear wheel protrudes. This was the power take-off from the wheel and it evidently meshed with teeth on the inside of the periphery of the wheel. The shaft of the gear wheel passes through the wall and reappears in the cellar below the main saw room. On the end of the shaft is a now disused pulley for a flat belt, the pulley being in-line with a similar pulley on the main lay shaft.

There are just four relics of the steam era. The first is the large chimney at the south-western corner of the main block, which was the flue for the boiler. As has already been said, the chimney appears to be part of the original building. The other relics are a series of hooks at the back of the building, which are believed to have supported iron pipes providing water both for the boiler and to condense the exhaust steam; part of the pipe which protrudes through the rear wall of the building, and finally a brick pillar on the face of the dam which provided support for the pipe between the water take-off point and the rear wall of the building. The positions occupied by the boiler and the steam engine are, however, something of a mystery. There is no obvious entry to the chimney for the boiler flue above ground level and the logical deduction is that both the boiler and the steam engine were housed in a basement which was subsequently filled in.

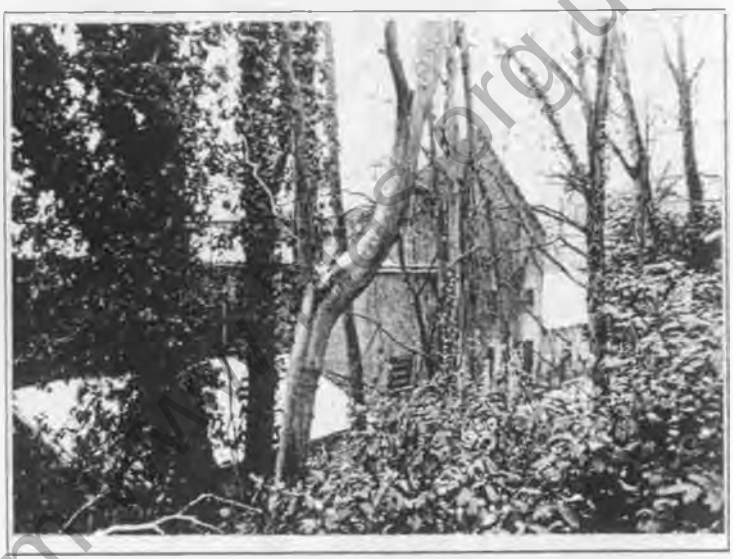


Figure 4 The eastern side of the building seen from the top of the dam. The launder for the water-wheel entered the building through the slatted opening, which may be seen in the centre of the picture. In its working days, the dam was grass-covered only, but has now become heavily overgrown with trees and shrubs

The steam engine was replaced by a Blackstone oil engine at an unknown date, but probably the mid-1930s, and it seems likely that the water wheel was removed at that time also. The oil engine was installed on a plinth in the purpose-built lean-to built on the southern side of the main block. In due course the oil engine was replaced by an electric motor, which was mounted on the same plinth, and which was still operational in 1991. The position of the electric motor is shown on the plan. From an operational point of view, the position of the oil engine and the electric motor is not ideal. The drive is via a long, flat belt, which passes through the floor to a pulley on the main lay shaft, the same pulley which was originally driven by a belt from the power take-off from the water wheel. However, for the oil engine and the electric motor, the length of belt needed is such that belt slip has always been a problem.

The western side of the main block is shown in *Figure 5*. This photograph shows clearly that the building originally had a double gable-end. However, as often happens, a leak developed in the valley between the two roofs, and the timber roof supports rotted. About 13 years ago a new steel roof structure having a single gable was constructed and this, and all the other roofs, were covered with corrugated aluminium. The old wooden roof timbers are, however, still in position, though in places they are sagging ominously. Leaking water from the original valley in the roof seems to have been the cause of the discoloration of the brickwork behind the now redundant rain-water pipe. In the original photograph the discontinuity between the brickwork of the main block and that of the extension is also clear.

The main block is effectively divided into two halves by a wall which runs east to west beneath the line of the original valley in the roof. Safety considerations permitted access to only the southern half of the block. The

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ground floor of that half is currently the scene of some chaos. Part of the floor has fallen revealing shafts and pulleys mounted beneath the floor which provided the power to the various wood-working machines. Machinery currently in the room includes a small circular saw, a router, a planer, a morticing machine and a saw sharpening machine. There are also several carpenter's benches. The ground floor of the northern half of the building opened onto the estate yard through the three doorways shown in Figure 3. The easternmost door was removed within the last few years and the space immediately behind used for the construction of two toilets. The form of the original door is not known.



Figure 5 The main part of the mill seen from the west. The ground floor was used as a wood-working shop. The rooms above are believed to have been used for drying/seasoning timber. The lean-to currently houses an electric motor which drives the machinery by a series of flat belts and lay shafts. Formerly it housed a Blackstone oil engine.

The floor above the southern ground-floor room has been divided into two by a north-south wall. The western room is the smaller and has only small windows at the front. In addition it has air-brick ventilators on the west and south faces. It is almost certain that that floor was used for drying and seasoning timber. The original purpose of the larger and eastern room is not clear but at the time of the survey it was a store for various redundant items including a large quantity of World War I Army stretchers! In the north wall of the room is a doorway which leads to the first floor of the northern half of the building. The first floor of the northern half may also be entered on its north side by an external, iron staircase. The upper floor does not have an internal ceiling and the rotting timbers of the old roof are in full view.

The primary sawing room is on the ground-floor of that part of the building to the south of the main block – on the right in Figure 5 – which is better illustrated in *Figure 6*. *Figure 7* is a photograph of its interior looking west. There are two, large, circular saws. The larger is a rack saw and the rack runs away from the camera. It is aligned with the front and rear external doors and its table is at floor level. The slot in the saw table is sufficient to accommodate a saw some 5 ft in diameter, and in its heyday would almost certainly have had a saw blade of that size. The saw currently in situ is a more modest, though still impressive, 41 inches. The saw blade may be seen edge-on in the photograph, just above the pieces of timber lying across the rack. At both the front and back doors, and set into the ground, are rollers to facilitate the handling of large baulks of timber. Those at the front were installed about 13 years ago but those at the back are believed to be Victorian. The original scheme was, apparently, to deliver the timber to the mill by floating it across the lake, and the direction of cut of



Figure 6 The two-storey part of the building in the centre of the photograph housed a rack saw and a large, table, circular saw on the ground floor and a carpenter's shop above

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the saw requires the timber to be fed from the lake (eastern) end. There was a derrick on the top of the dam to lift the timber from the water and deposit it at the base of the dam. A certain Mr Oates, who died about 8 years ago, and who had worked on the estate for most of his life, remembered the derrick from his early working days, but it was not marked on the 1911 map and no trace of it now remains. Subsequently, it was decided to abandon floating the timber to the site and to deliver the timber to the western side of the building using the estate roads. For the sawyer, that change made life very difficult because, in order to position the timber on the rack, he had to take it through the building, traverse it so as to bring it in line with the saw blade and then operate the saw with the timber moving in its original direction from east to west. Figure 7 was taken with the photographer standing in the single-storey extension at the back of the room. The evidence suggests that originally the back wall was in line with that of the main block but, for the ground floor, it was later moved back some 6' 6" to give more room. Even with the extension, space for the awkward operation of traversing the timber is extremely limited and the rollers originally provided outside the building are not now particularly useful.

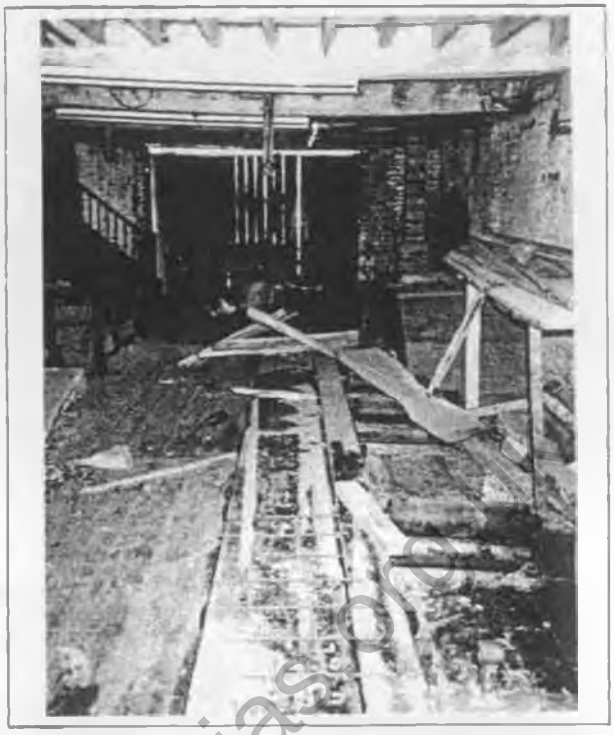


Figure 7 The interior of the main saw room, looking west. The rack saw is running away from the camera and the large, table, circular saw is on the left. The staircase in the far corner gave access to the carpenter's shop above.

The table of the other saw is at the left centre of Figure 7. It is at normal bench height and its position in relation to the walls restricts the length of plank which can be handled. Again it is a saw of substantial proportions. The table is capable of taking a saw of 48 inches diameter although the saw currently in position has a diameter of only 30 inches. The direction of sawing is opposite to that of the main saw, that is, it is from west to east.

Two other items of interest in the room are a large grinding wheel and a fairly primitive, but nevertheless effective, jig which held the circular saw blades at the correct angle for sharpening. The room originally had two windows on its southern side, and their position is shown on the plan. However they were both subsequently bricked up.

Having mentioned that the belts in the saw room were almost totally enclosed, giving a measure of protection to the machine operators, the cellar was an extremely hazardous place. Shafts, belts and pulleys almost fill the cellar space and when it became necessary to apply anti-slip compound to the belts, the unfortunate apprentice had to climb over the shafts and between the belts with great danger to life and limb. A further hazard was that all the saw dust fell into the cellar and it had to be dug-out, bagged and removed by hand at frequent intervals, doubtless with all the shafts still running.

In the south-west corner of the saw room is an internal staircase, which leads to a room above. As may been seen in Figure 6, that room has windows along the whole of the west side, the centre being occupied by a pair of glazed sliding doors, which give a 9 foot opening. The room was used as a carpenter's shop and in the northwest corner there is a crane, illustrated in *Figure 8*, to facilitate lifting timber from the paved area at the front of the building. This room has a door which gives easy access to the upper floor of the main block.

Piped water from a public supply did not come to Bearwood until 1952. Before that, domestic water was obtained from the lake. It seems that from the start, the mill motive power was used to pump water to the filtration plant near the house. As has already been mentioned, a new pump was installed in the mid 1930s in the southern-most extension to the building. The position, and the arrangements for driving the earlier pumps are not known. In 1991, a sluice at the top of the dam fed a cistern, from which several pipes diverged. The largest pipe, which was of glazed earthenware and about 1 foot diameter, descended on the slope of the dam to the mill building. The purpose of it and most of the pipes is not now clear, although one obviously carried the water which was pumped to the house for domestic purposes. The pump was last used about 10 years ago.

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Figure 8 The interior of the carpenter's shop. The sliding doors at the front provided an opening 9 feet wide and the crane facilitated the lifting of heavy baulks of timber

Taken as a whole, the complex of buildings is typical of many mid-Victorian workshops. However, its fate was effectively sealed following the piecemeal sale of the estate at the beginning of this century. After remaining empty for years, the mansion became a military hospital for Canadian troops during the First World War. Becoming empty again, it was purchased by two wealthy ship owners and was given to the Royal Merchant Navy School, who moved there at the beginning of 1921. While the complex of buildings at Mole Farm is of considerable interest, they now play but little part in the life of the school and in their present form contribute little, if anything, to the estate's income. Their position and condition is such that they are unlikely to be viable for a commercial user. Reluctantly it is concluded that there is not a case for preserving them and that it should be sufficient to supplement the survey already undertaken by further photography as the demolition proceeds.

The author is grateful to Mr T.J. Manzi and the administrators of The Royal Merchant Navy School Foundation for their permission to survey the site, and particularly to Mr J.A. Stevenson, the Forester of the Bearwood Estate, for his help during the survey and for the information on the operation of the mill which he was able to provide.

John D. Asteraki

Railway Steamers at Southampton

The very important part played by the Railway Steamers in the development of the port of Southampton is not always fully appreciated, being mainly overshadowed by the larger ocean-going counterparts. The railway was completed from London to Southampton in May 1940 and the first dock, the Outer Dock – later to become Princess Alexandra Dock and Ocean Village of today – was brought into use in 1842. The London & South Western Railway Company soon arranged for the railway to be extended across Canute Road to serve the Dock.

In the 1830s several ships were operating from the Royal Pier to the Channel Islands and to Le Havre, the principal companies being the New Commercial Steam Packet Company and the South of England Steam Navigation Company. Some of the directors of the L.S.W.R. soon realised that these ships could feed traffic on to their railway and they were keen to develop some control over the marine services. However, in the 1840s the railway companies were not permitted by Parliament to own vessels. In 1842 the L.S.W.R. appealed to its shareholders to subscribe towards the formation of a proposed South Western Steam Packet Company. The response was not great – investment in shipping in those days was considered by many to be a somewhat risky business. The directors decided to proceed and the South Western Steam Packet Company was formed in 1843, taking over some of the steamers operated by the New Commercial Steam Packet Company. The first vessel built for the new company was appropriately named *South Western* and, although built for the Le Havre service, it was mainly used to serve the Channel Islands and St. Malo. In 1845 she was joined by another paddler, the *Wonder*, which was placed on the Le Havre service.

In April 1845 the Steam Packet Company obtained the contract to carry mail to and from the Channel Islands and, in the following year, a reorganisation took place, a new company was formed – the New South Western Steam Packet Company – taking over the assets of the South Western Steam Packet Company and the South of England Steam Navigation Company. The L.S.W.R. was authorised in August 1848 to own and operate steamers, but the company was somewhat hesitant in taking this up and instead the ships of the New South Western Steam Packet Company were, in 1849, leased by the railway company. This lease expired on 1st July 1862 and the L.S.W.R. then took over, and dissolved the Steam Packet Company.

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At the time, the docks were owned by Southampton Dock Company and up to 1864 the steamers continued to use the Royal Pier to embark and disembark passengers, but in that year arrangements were made for the steamers to use the docks. The L.S.W.R. developed its own repair yard and workshops at a wharf on the River Itchen and a small drydock was provided there which carried a date stone '**L. & S.W.R. 1877**'. In 1892 the L.S.W.R. purchased the docks from the Southampton Dock Company and ten years later the repair yard on the Itchen was closed and the work transferred to the docks. Here the company established its own Marine Department workshops which, after the grouping of the railways in 1923, developed into a major repair yard for many of the railway steamers operated by the Southern Railway. The wharf on the River Itchen was subsequently taken over by the James Dredging, Towage and Transport Company, and the drydock remained in use until a few years ago. The wharf is now privately owned and has been in use as a private museum owned by Mr. W. Haydon-Baillie.



Figure 9 *P.S. "Southampton" as operating after being re-engined by Day Summers at Northam in 1880. Originally had two funnels.*

The L.S.W.R. developed its steamer services to the Channel Islands, and also to St. Malo, Honfleur, Cherbourg and Caen in addition to Le Havre. Many of the early vessels became well known for their long service – the paddler *Southampton* entered service in 1860 and lasted until 1898. The last cross-channel paddler was acquired by the Company in 1871 with the purchase of the *Wolf* from the Burns fleet of Glasgow – she was built in 1863 and operated mainly on the Cherbourg route until 1902 when she was withdrawn from service. The cargo vessel *Cherbourg*, completed in 1873, gave 57 years service, being withdrawn in 1930. The second *South Western* entered service in 1874, being used mainly on the Southampton - St. Malo. route. She lasted until March 1918 when she was torpedoed and sunk.

In 1890 a group of three passenger ships was completed by J. & G. Thomson of Clydebank for the Channel Islands service. They were *Frederica*, *Lydia* and *Stella*, having a gross tonnage of 1,059 and a length of 253 feet. They were the first twin screw vessels in the fleet. Unfortunately the *Stella* had a short life, being wrecked on 30 March 1899 on the Casquets with great loss of life. A stewardess on the ship – Mrs Mary Ann Rogers – gave her lifebelt up to a passenger and lost her own life. A memorial to her still stands near the Pilgrim Fathers monument. The *Frederica* was sold in 1911 and *Lydia* in 1920. The *Vera* was built in 1898, and the *Alberta* was completed in 1900 as a replacement for the *Stella*. 1894 saw the introduction of two new ships for the Le Havre service – the *Columbia* and *Alma*. These two ships were fitted with separate cabins, the first so equipped in the fleet ..... until then, passengers were accommodated in open type saloons. Another major disaster involving a railway steamer occurred on 18th November 1905, when the *Hilda*, built in 1882, was wrecked near St. Malo in a blizzard with the loss of 121 passengers and crew. In 1910 the first turbine driven vessel in the L.S.W.R. fleet, the *Caesarea*, entered service, followed by the *Sarnia*. Both were triple screw and had a gross tonnage of about 1,500. The *Sarnia* was lost in the Mediterranean during the First World War and the *Caesarea* was badly damaged when she went aground just after leaving St. Helier harbour on 7th July 1923. She was repaired and sold and entered the fleet of the Isle of Man Steam Packet Company as their *Manx Maid*, being finally scrapped in 1950.



Figure 10 "Stella", completed in 1890, wrecked on Casquets 30 March 1899.

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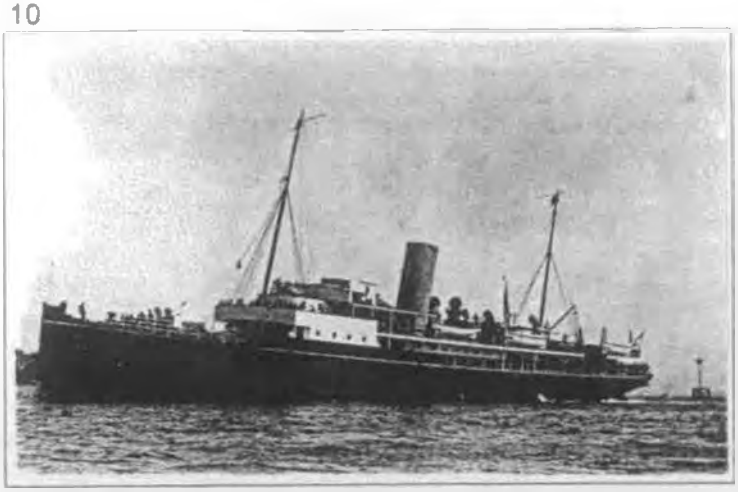


Figure 11 "Caesarea" built 1910 by Cammell Laird at Birkenhead - the first turbine driven vessel in the LSWR fleet.

The first two cross-channel steamers to be fitted with single reduction geared Parsons turbines in the fleet were placed on the Le Havre service in 1912. They were the *Normannia* and the *Hantonia*, both giving excellent service. The *Normannia* was lost off Dunkirk in May 1940, but the *Hantonia* lasted until 1952. The first Denny-built ship to enter the L.S.W.R. fleet was the *Lorina*, completed in 1918, and, after the formation of the Southern Railway in 1923, two more ships were ordered from Denny Brothers of Dumbarton – the *Dinard* and the *St. Briac* – which entered service in 1924. By then, seventeen vessels were attached to the Southampton-based fleet and practically the whole of the Outer Dock had been taken over for their operations. In 1925, a new Continental Booking Office was constructed to cope with the increasing passenger traffic. Part of that building was incorporated into the Canute Pavilion in the Ocean Village.

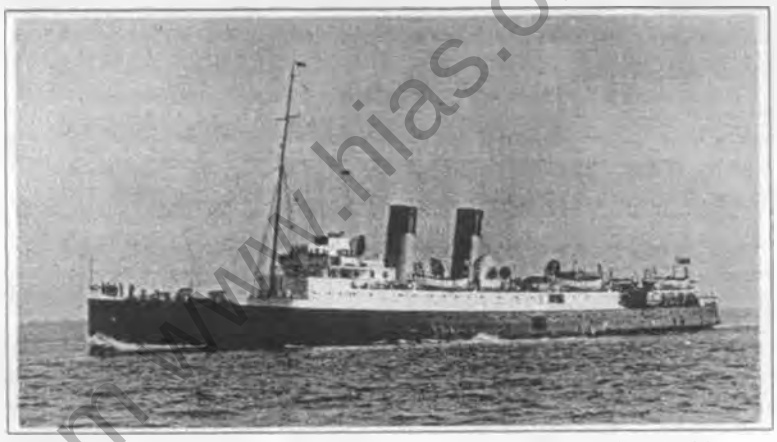


Figure 12 "Hantonia" as operating post 2nd World War with main mast removed

The freight side of the business was also very considerable. In 1905 a pair of cargo vessels, *Ada* and *Bertha*, entered service. They lasted until the early 1930s but, between 1926 and 1928, the Southern Railway ordered from D. & W. Henderson of Glasgow a group of nine cargo steamers, three of which were based at Southampton – *Haslemere*, *Ringwood* and *Fratton*. After the War some of the others, such as *Whitstable* and *Hythe*, were to be seen in Southampton. These vessels were all coal-fired, being fitted with triple expansion engines and twin screws, and accommodation was provided for the carriage of animals. They were used on regular cargo-carrying services to and from the Channel Islands and also to France. Thousands of tons of produce from the Channel Islands – in particular new potatoes and tomatoes – were brought into Southampton.

After the railway grouping of 1923, the Marine Department Workshops employed many local craftsmen for carrying out repairs to the steamers and these included the ships which operated on the ferry services to the Isle of Wight from Portsmouth and Lymington. Also major overhauls were carried out to several of the Dover/Folkestone based vessels, including the "Golden Arrow" vessel *Canterbury* and later the *Invicta*. In 1930 two ships, which were to become firm favourites on the Channel Islands services, appeared – the *Isle of Guernsey* and the *Isle of Jersey* – both built by Denny Brothers, and they were followed by a third vessel in 1932, the *Isle of Sark*, which was fitted with a maier-form bow. In 1936 the *Isle of Sark* was the first ship to be fitted with experimental stabilisers designed by Denny-Brown. During the 1930s *St. Briac* was used for short three or four day cruises, visiting Rouen, Le Havre and Cherbourg. The fare for the Easter cruise was £5, but the normal weekend cruise started at £3. Somewhat similar cruises were operated by the *Falaise* during the 1950s and the fare then was 9 guineas (£9 45p) and later 10 guineas (£10 50p).

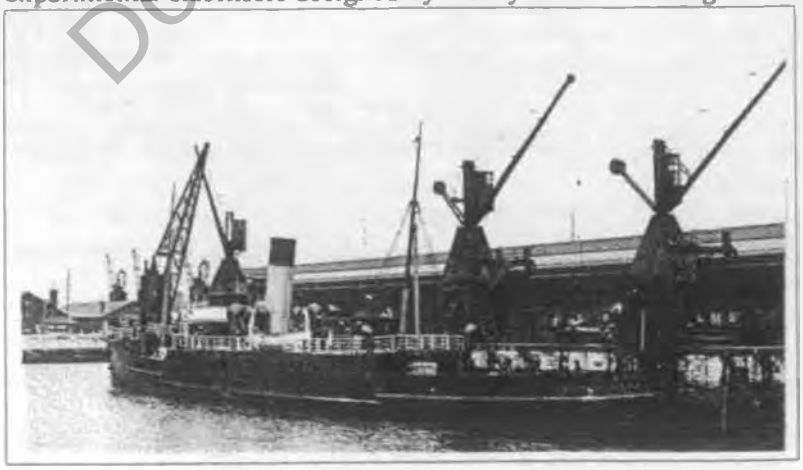


Figure 13 "Ringwood" in the Outer Dock at Southampton, one of a group of 9 cargo vessels built by D & W Henderson of Glasgow for the Southern Railway

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The Second World War saw many of the vessels being requisitioned for use as troop transports or hospital ships, while the *Haslemere* and *Fratton* were used as barrage balloon vessels and the *Ringwood* was an auxiliary net layer. The *Fratton* was lost as was the *Lorina, St. Briac and Normannia*. The *Isle of Jersey* was a hospital ship, while the *Isle of Guernsey* was eventually fitted out as an infantry landing ship and took part in the D-Day landings. This vessel reopened the Channel Islands service from Southampton on 25 June 1945. Immediately after the war, new ships were ordered from William Denny & Brothers of Dumbarton, the first being the *Falaise*, which entered service in 1947 – she re-opened the St. Malo service in July of that year. Another new ship in 1947 was the cargo vessel *Winchester* which was a motor ship. The *Normannia* was completed in 1952. She replaced the *Hantonia*, then 40 years old, on the Le Havre run, the latter being scrapped at Grays, Essex. In 1959 two more cargo vessels, the *Elk* and the *Moose*, were introduced.

During each year, many thousands of passengers travelled on the railway ships operating from Southampton – the Bank Holiday weekends were particularly notable. For example, on Friday 2nd August 1935, 4,790 passengers travelled in nine boat trains from Waterloo and joined six ships – the *Isle of Sark*, *Isle of Jersey* and *Lorina* all sailed direct to Jersey, the *Isle of Guernsey* left for Guernsey and Jersey, the *St. Briac* for St. Malo and the *Hantonia* for Le Havre. On Friday 1 August 1947, the *Isle of Jersey* and *Falaise* sailed direct to Jersey with 2,237 passengers, the *Isle of Guernsey* to Guernsey and Jersey with 949 passengers, while the *Hantonia* left for Le Havre with 200 passengers. On the following day the *Isle of Sark* and *Brittany* both sailed while the *Isle of Jersey* was back again to take more to the Channel Islands.



Figure 14 "Isle of Guernsey", the last railway passenger vessel to operate between Southampton and the Channel Is.

Boat trains to connect with the arrivals and sailings of these steamers were run for many years, the trains during the summer months being introduced before the turn of the century. One or two trains left Waterloo during the evening between 9.45pm and 10.30pm for the sailings to Le Havre and the Channel Islands. With the arrivals during the summer months there was always an early morning train from Southampton Docks to Waterloo to connect with the ships from Le Havre and St. Malo, and another in the afternoon for passengers from the Channel Islands. During the 1950s a feature of the Le Havre boat train on Sunday mornings – booked 7.03am from the Docks – was that ordinary passengers could join the train in the dock shed. For people living in the Southampton area this train, which included a Pullman buffet car, was the first fast train to London on a Sunday morning.

The *Isle of Jersey* was withdrawn in 1960 and was sold to Libyan buyers for service as a pilgrim carrier. The *Isle of Sark* was withdrawn in October 1960 and, after being laid up for the winter months, was sold, leaving Southampton for the last time on 5th April 1961 for Belgium, where she was broken up. It was left to the *Isle of Guernsey* to make the last sailing to the Channel Islands from Southampton on the 12 May 1961, thus severing a link which had existed for many years. The vessel was then transferred to Weymouth to join the new ships – *Caesarea* and *Sarnia*, built by J. Samuel White & Company Ltd at Cowes. In November 1961 the *Isle of Guernsey* was sold for scrap and was broken up at Ghent. On the 6th October 1963 *Falaise* made her final crossing from St. Malo to Southampton. At the end of that year she went to the Palmers Hebburn-on-Tyne yard of Vickers Armstrong Ltd for



Figure 15 "St Patrick", the last Railway owned passenger ship to operate from Southampton

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conversion to a stern-loading drive on/off car ferry. As such she made her inaugural trip between Newhaven and Dieppe on 31st May 1964. She subsequently operated from Dover and later Weymouth, before being broken up in 1975 in Spain. The *St. Patrick* of the Western Region of British Railways was transferred to Southampton to enable the *Normannia* to be converted to a drive on/off car ferry, and the Le Havre service was finally closed on the 10 May 1964 with the arrival of *St. Patrick*. She was then transferred to the St. Malo service on which she operated during the summer of 1964 and made her final crossing on that route at the end of September 1964.

This was the end of the various passenger services from Southampton operated by railway owned vessels, which had given excellent service to many people over the previous 120 years. The Le Havre service was never actually closed, for Thoresen Car Ferries commenced operating the *Viking I* to Le Havre on 11th May 1964.... but that is another story. The final link of Southampton with any railway operated service was broken on the 2 October 1972 when the Channel Islands cargo service was transferred to Portsmouth.

Bert Moody

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The Sheerness Boat Store

The members of SUIAG who visited the old Dockyard in Sheerness in April-May 1994 could, at first sight, see nothing remarkable in the Boat Store building. From the outside it looked like any other drab, slab-sided modern industrial erection. It is, however, far from modern, and it is remarkable in that it is over 130 years old. It is one of the first large iron-framed buildings to be erected in this country.

To put the matter of iron-framing into perspective, we should perhaps go back some thousands of years. After primitive men first emerged from their caves and began to erect their own dwelling-places, builders were limited for countless centuries by the materials they had on hand: stone, timber, straw and mud - the last including such variants as clay and cow-dung. Eventually bricks and tiles were added to the list, and the Romans brought in cement and lead. The technology was adequate within limits, and thousands of edifices built entirely from these materials, ranging from cathedrals to thatched cottages, are still in full use.

Only one of the materials listed, however, is capable of carrying a useful amount of tensile stress, and that is timber. Stone, bricks and tiles are entirely adequate in compression, and so can be used for walls, pillars and - with care - in arches. But if we need to load our material in tension we are restricted to timber. And this restriction includes bending, since any member subjected to bending inevitably has one surface in compression and one in tension.

Now, timber is only available in limited lengths and sections; trees grow only so big. Timber can be joined, but effective joints are laborious to make and they are still inefficient - that is, a timber member with a joint in it cannot approach in strength the strength of the uncut timber. Moreover, timber is somewhat unpredictable in its properties, not being manufactured under quality control, and it is subject to deterioration by various agencies such as fungal decay and worm. Such considerations severely cramped shipbuilding technology and meant that no ships much over 300 feet in length were ever built in wood.

In building operations ashore the technology was similarly restrained. The practical effect was to limit the length of any unsupported load-bearing surface, whether it was the deck of a ship, the span of a bridge or the upper floor of a house. If one wanted a really big upstairs room, one had to be prepared to support the floor with a forest of pillars, arches or walls underneath. Any alternative demanded a material other than timber. That meant that one had to wait for the industrial revolution and the production of iron in tonnage quantities.

Now to return to Sheerness. In the 1850s the Navy saw a need for a building in which its stock of sailing and pulling boats could be repaired, maintained and stored ashore out of the weather. The boats in question were up

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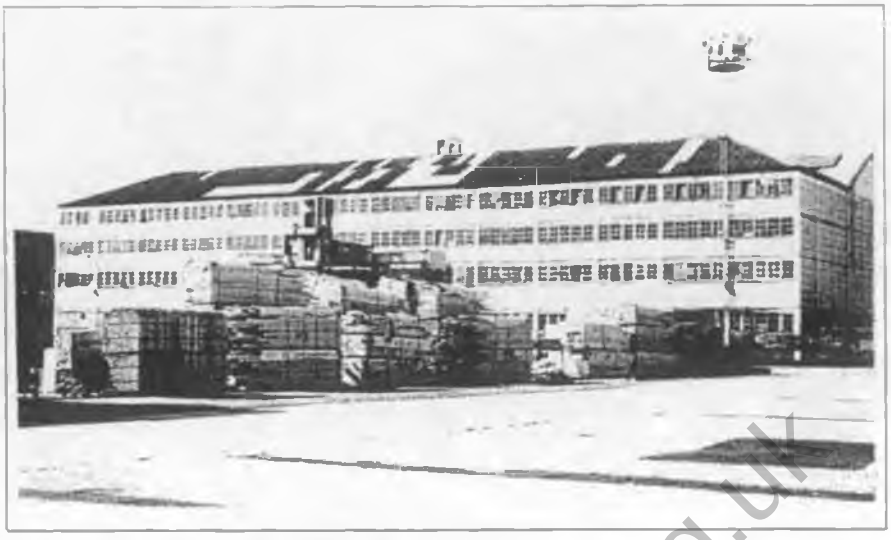


Figure 16
Sheerness Boat Store
Exterior from the south

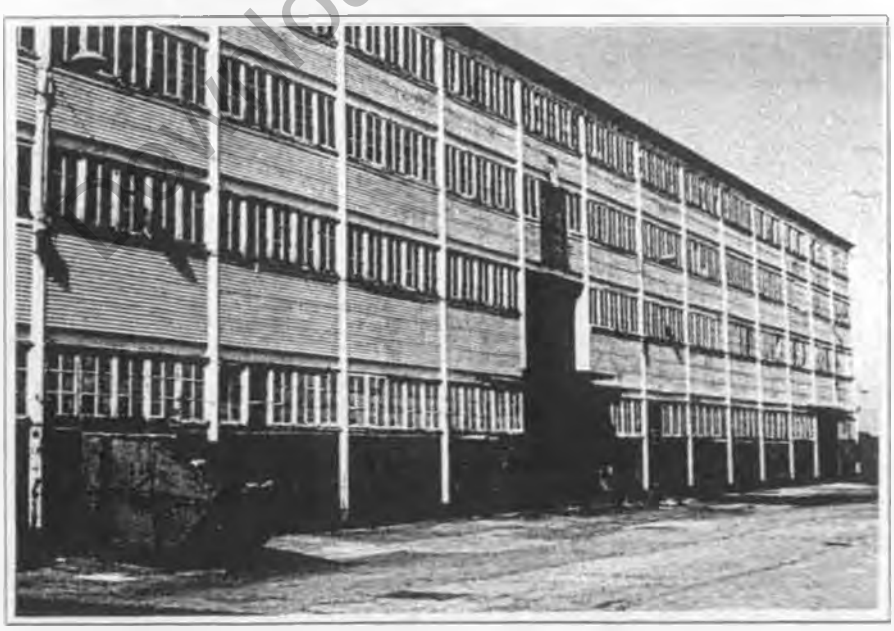
to perhaps 36 feet long, weighing 5 tons or more. It was desired to stow them on four levels in a single building.

But a boat such as a naval sailing pinnace, 36 feet long by nearly 10 feet wide, could not be manoeuvred about through a close forest of pillars. Pillar-free bays at least 15 feet wide by 30 feet long were considered acceptable. This meant that the three upper floors needed to be carried by horizontal members, loaded in bending, 15 feet long in one direction and 30 feet in the other. Beams of these lengths to carry the proposed loading would be at the limits of timber-based technology, so the Admiralty civil engineers turned to iron, not only for the horizontal members but also for the vertical pillars carrying them. The entire load-bearing framework of the building would, therefore, lie in the metallic members and not in the walls; this was a revolutionary feature in mid-Victorian days.

By the 1850s, casting in iron had been brought to a fine art, and all the vertical members were cast in 'I' or square section, with projecting lugs so that the beams and girders could be bolted in place. Cast iron is strong in compression, so that it was entirely satisfactory in this application.

The horizontal members were more of a problem. Cast iron could have been used, but the lower flange of a loaded beam is in tension. Cast iron was known at the time to be unreliable in tension, being liable to break, without preliminary bending, at hidden defects such as blowholes or cracks in the castings. When cast iron had to be loaded unavoidably in tension, large factors of safety had to be used to keep the stresses low, resulting in undesirably thick and heavy members.

To avoid this outcome the designers turned from cast to wrought iron. By the mid-century this was being produced in tonnage quantities and was being used for building ships and bridges. Wrought iron was, however, only available in small pieces, such as plates 8 feet long. It could be joined effectively by riveting, and it could be relied upon to behave well in tension. If overloaded it would yield and stretch considerably before fracturing. The 30-foot girders spanning the spaces between pillars were, therefore, fabricated from wrought-iron plates and angle-bars, forming 'I' sections 18 inches deep. The frequent joints can still be traced from the numerous rows of rivets.



The 15-foot gap between the pillars in the other direction gap still needed to be bridged. The designers here reverted to cast iron, the lower stresses over the shorter span being considered acceptable. The 12-inch deep 'I' section beams were cast with a lower flange somewhat fattened at mid span to accommodate the higher tension there.

Figure 17
Sheerness Boat Store
Exterior from the north

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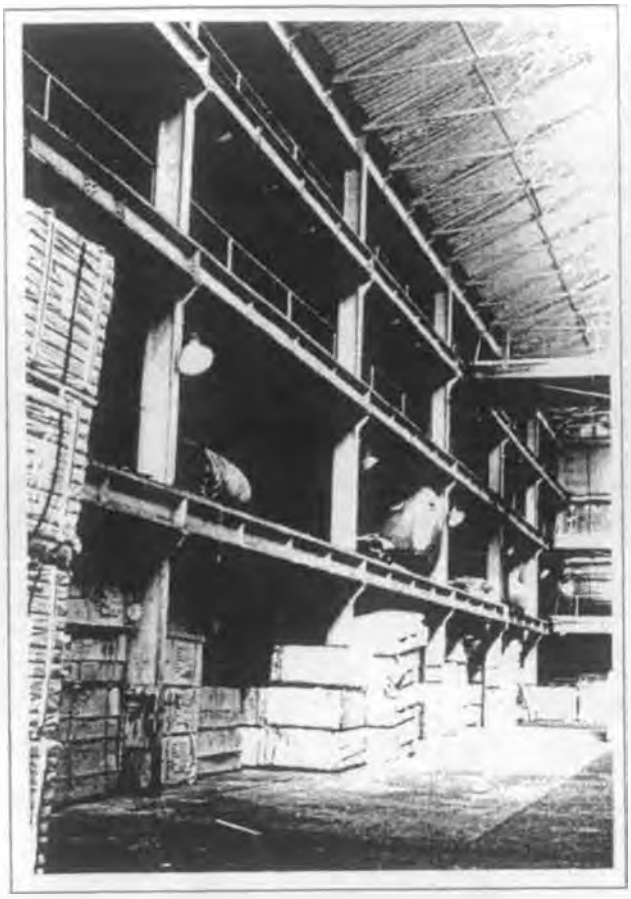


Figure 18 Sheerness Boat Store interior

The designers had thus reduced the floors to a series of iron-supported panels 30 feet by 15 feet. To subdivide these further they reverted to timber technology. The Navy had in store at this time a stock of seasoned oak, purchased for repairs to warship hulls, but no longer required since ships were now being built of wrought-iron (which, before long, would be replaced in turn by mild steel). The oak was used to provide joists 12 inches deep, which were laid from girder to girder at 7½ foot centres, parallel to the cast-iron beams running from pillar to pillar. The decking was finally formed of oak planks 3" thick. (It may be of interest to note that more of the Admiralty's oak stock was used at about the same time to make the long dining tables which are still in daily use in the Painted Hall at the Royal Naval College, Greenwich).

The use of timber for joists and decking meant that the building was vulnerable to fire. It is notable that some Victorian mills and industrial buildings avoided the use of timber entirely by spanning the spaces between iron girders with shallow brick arches, springing from the lower flanges of the girders. The surface of the floor above was levelled by using concrete above the bricks. The SUIAG party was able to see a floor of this type at the ex-brewery building at Hadlow in Kent. The use of the arched style in the Sheerness building might have been possible, but it would have added weight and cost to the building. When there was all that oak available, what choice would anyone knowing the Admiralty expect them to make?

The Boat Store roof itself is of interest too. This is supported on a series of trusses, spidery triangulated frameworks made up of thin metal members. These have been familiar in industrial buildings for years, but were novel in the 1850s. Close inspection shows that the tension members were formed from thin wrought iron rods, while the members carrying compression were made from cast-iron in cruciform section, thicker at the middle than at the ends.

The walls of the building were of corrugated iron; they served simply to keep the weather out, and did not contribute to the strength of the building. Corrugated iron is usually thought of as a modern (and somewhat unglamorous) material, and it is interesting to note that galvanised corrugated wrought iron sheet was available in mid-Victorian days. Thermal insulation was entirely absent, and a colleague of the writer who had occasion to spend some time in this building in Dockyard days recalls it as being bitterly cold in the winter. The Admiralty's main concern in designing the Boat Store had been the protection of their hardware rather than the comfort of their workpeople. . . . .

James Paffett

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The Steam Hammer

The iron industry before 1750 was a small scale industry. Small furnaces produced castings and pig iron, and bloomeries converted some of the pig iron into a ductile and purer form, wrought iron. The mechanisation and development of the iron industry required an improved source of power and the ability to fuel the processes with coal rather than wood (charcoal). The Newcomen engine, and later the Watt engine, provided the power sources and were fuelled with coal. The work of the Abraham Darbys, father and son, led the way in the use of coal for the production of pig iron. By the end of the eighteenth century castings of several tons could be produced (e.g. large cylinders for steam engines and the cast ribs of the iron bridge at Ironbridge).

The breakthrough in the production of decarburised iron, the conversion of pig iron into wrought iron, came with Henry Cort's patent of 1784 for the *"puddling"* process. Cort worked a small forge at Funtley (near Fareham). His puddling process defined wrought iron for the next century, for *"puddled iron"* equals *"wrought iron"*. An essential tool of the wrought iron forge was the hammer. The puddled ball of iron contains slag

inclusions which had to be squeezed out using a hammer and rolling mill, to give a strong fibrous and ductile material. For boiler plates and other applications where strength and uniformity are paramount, the rolled iron was cut up, re-heated, knocked into shape again with the hammer and re-rolled, sometimes several times. The ball of iron from the puddling furnace was manoeuvered to the hammer and through the rolling mill by hand so that the largest piece of wrought iron available was about 1 cwt (50 kg). However, pieces of wrought iron can be fire-welded together by heating them to white heat and hammering them together.

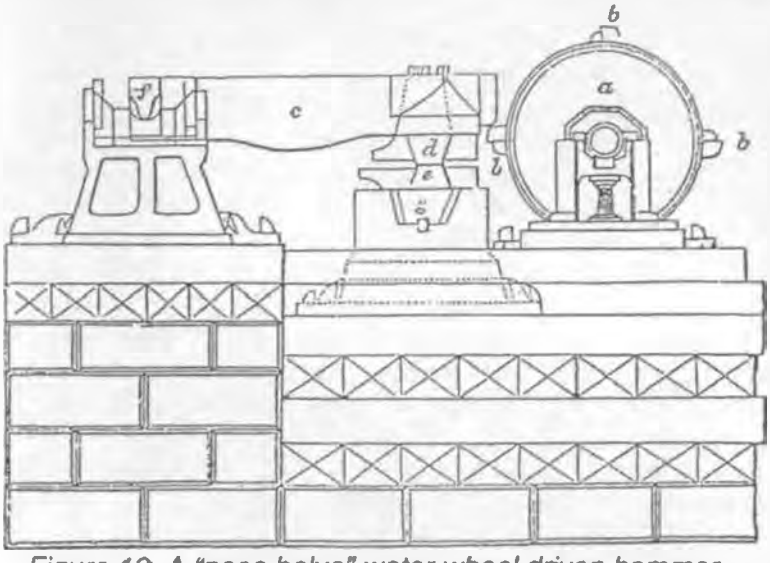


Figure 19 A "nose helve" water wheel driven hammer

In 1800 the typical forge hammer or helve was a 'belly helve' or 'nose helve' *(Figure 19)*. It was driven by a water wheel through gearing. Water power raised the hammer block which dropped under gravity to give a uniform and non-variable blow. The rate of striking blows was governed by the rotation of the water wheel and the number of cams on the drum. Getting rid of the slag from puddled iron was called *'shingling'* and water driven shingling hammers remained very popular with small forges well after the introduction of the steam hammer because some producers claimed that the regularity of blow of the water driven helve resulted in a superior product.

The first patent on the use of direct steam power to operate a forge hammer was incorporated in James Watt's patents of April 1784, the same year as Cort's puddling patent. Watt claims for his design:

> *"My Fifth New Improvement consists in applying the power of steam or fire engines to the moving of heavy hammers or stampers, for forging or stamping iron, copper, and other metals or matters, without the intervention of rotative motion or wheels, by fixing the hammer or stamper, to be so worked, either directly to the piston or piston rod of the engine, or upon or to the working beam of the engine or by fixing the hammer or stamper upon a secondary lever or helve, and connecting the said lever or helve by means of a strap, or of a strong rod, to or with the working beam of the engine, or to or with its piston or piston rod."*

Watt's design is shown in *Figure 20*. We do not know much of its work though it was known as *'the devil'*. Watt reported to Boulton that *"It has demolished all the fixtures many times already, and I suppose must be made wholly of cast iron"*. There is correspondence with John Wilkinson about steam helves but nothing more is heard of these 'devils' and Watt supplied Wilkinson with rotative engines to drive the cam drum of a standard helve. This layout became the norm.

In 1806, William Deverell obtained a patent for "improvements in the mode of giving motion to hammers." He claimed:

> *".....I have a steam cylinder with a piston and rod in it; at the end of the rod which comes out of the steam cylinder is a hammer, either made fast to the rod by welding, or in any other proper way. The steam from the boiler or steam vessel is let in underneath the piston by means of opening a cock or valve, or cocks or valves; the air at the top of the piston will be then compressed by the superior pressure of the steam underneath the piston. After the piston has been raised to a given height, there will be an opening made from the underside of the piston to a vacuum formed as in the common way.....The compressed air on the top of the piston will then drive down the hammer....."*

There is no evidence of Mr. Deverell making a practical hammer following his patent. A workable steam hammer was still 35 years away.

The metal parts of early steam engines for which castings were unsuitable were forged by the smith from wrought iron. Thus the parallel motion links, valve gear and governor were wrought and nearly everything else was cast. Cast iron was even used for crankshafts where its brittle nature made it most unsuitable. Forged crankshafts were beyond the capacity of the smith of the day. Whilst massive cast crankshafts survived on stationary engines operating under constant load the marine steam engine with its varying load, required a

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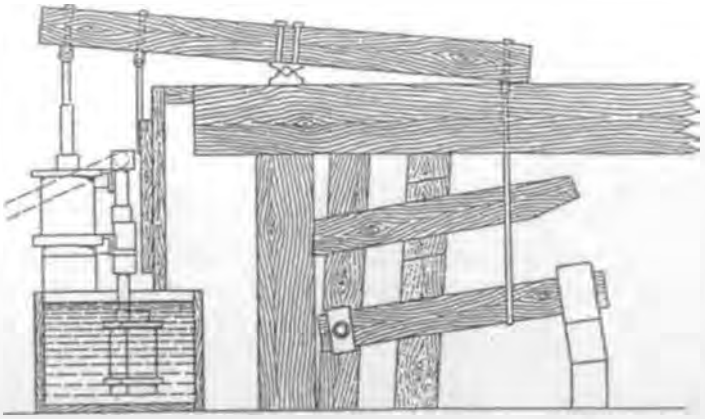


Figure 20 James Watt's "devil", from his 1784 patent

wrought iron crankshaft and other large forgings. When Brunel started the design of the *Great Britain* it was to be a paddle steamer. Nobody could be found to forge the paddle shaft. It was to solve this problem that James Nasmyth invented his steam hammer.

Francis Humphries, the engineer responsible for the machinery in the *Great Britain*, wrote to Nasmyth in November 1839. *"I find"*, he wrote, *"that there is not a forge hammer in England or Scotland powerful enough to forge the intermediate paddle-shaft of the engines for the* Great Britain*! What am I to do? Do you think I might dare use cast iron?"* The shaft was to have been 30 inches (750 mm) diameter. Such a large shaft placed on the anvil of a helve (Figure 19) would have "gagged" the hammer: that is, with the hammer raised to the top of the cam, the distance for the hammer to fall would be so small that next to no blow would be struck. Nasmyth realised that he wanted a machine which could raise the hammer block mechanically much higher than the pivoted helve and guide it onto the anvil as it fell. His first drawing of his steam hammer in his 'scheme book' *(Figure 21)* was dated 24 November 1839. Before the hammer was completed the *Great Britain* was changed from paddle to screw propulsion and so the first job for the steam hammer was not to be!

Nasmyth's sketches were shown by his partner to M Eugene Schneider, the ironmaster of Creuzot in France, and his manager M Bourdon. Thus it was that the first operational steam hammer was constructed by Bourdon at Creuzot. On a visit to Creuzot in 1842 Nasmyth saw this hammer in use forging a marine engine crankshaft. Bourdon referred to it as Nasmyth's hammer and Nasmyth patented it (9 June, 1842) when he got back to England. Years later, in 1871, Schneider, giving evidence to a French Select Committee on the Patent laws, claimed that Nasmyth was not the inventor of the steam hammer. Subsequent research established Nasmyth's claim.

Nasmyth's first hammer had a hammer block of 30 cwt (1.5 tonne) with a maximum fall of 4 ft (1.25 m). He delighted in demonstrating it to prospective purchasers. The hammer could give a gentle blow such as to break an egg in a wineglass (but not the wineglass) placed on the anvil, while the next blow would rattle the teacups on the dresser in a house a quarter of a mile from the hammer. A later hammer at Woolwich arsenal could disturb instruments at Greenwich observatory over 2 miles away, and still crack an egg!

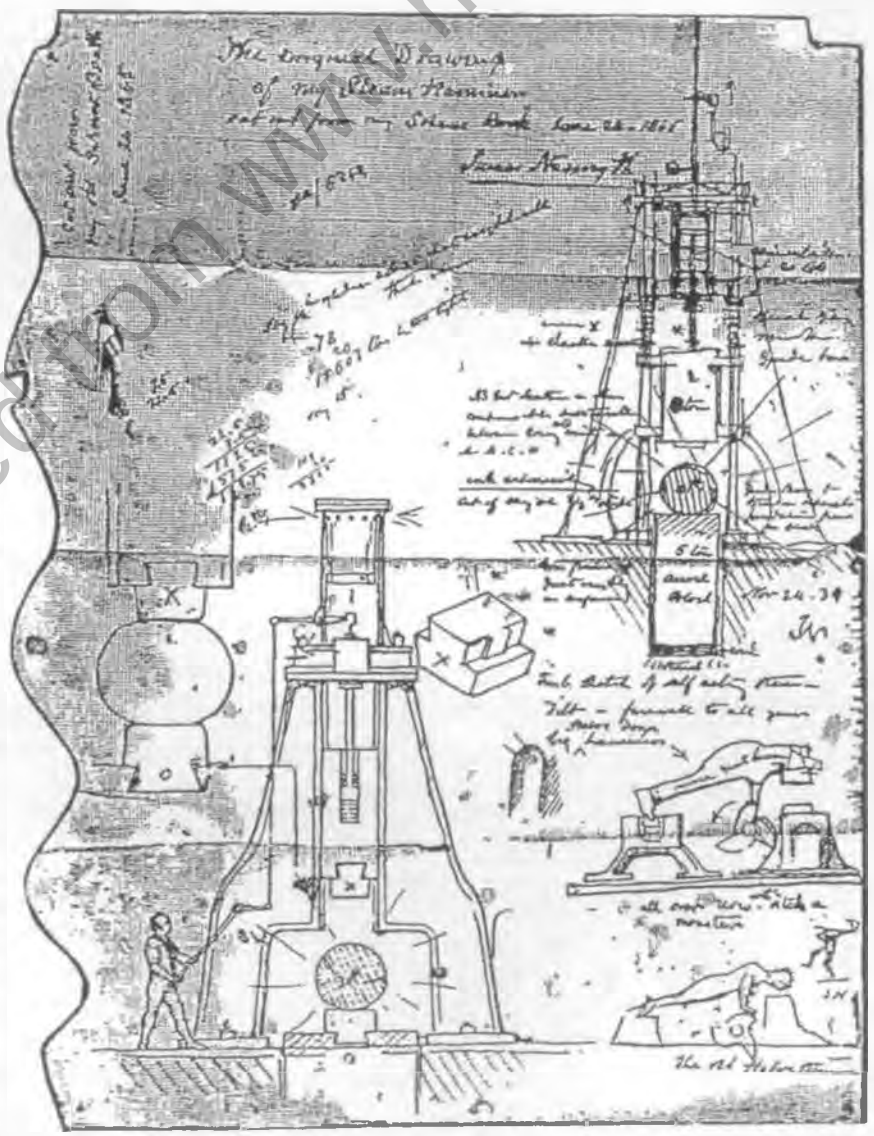


Figure 21 A page from James Nasmyth's scheme book, 1839

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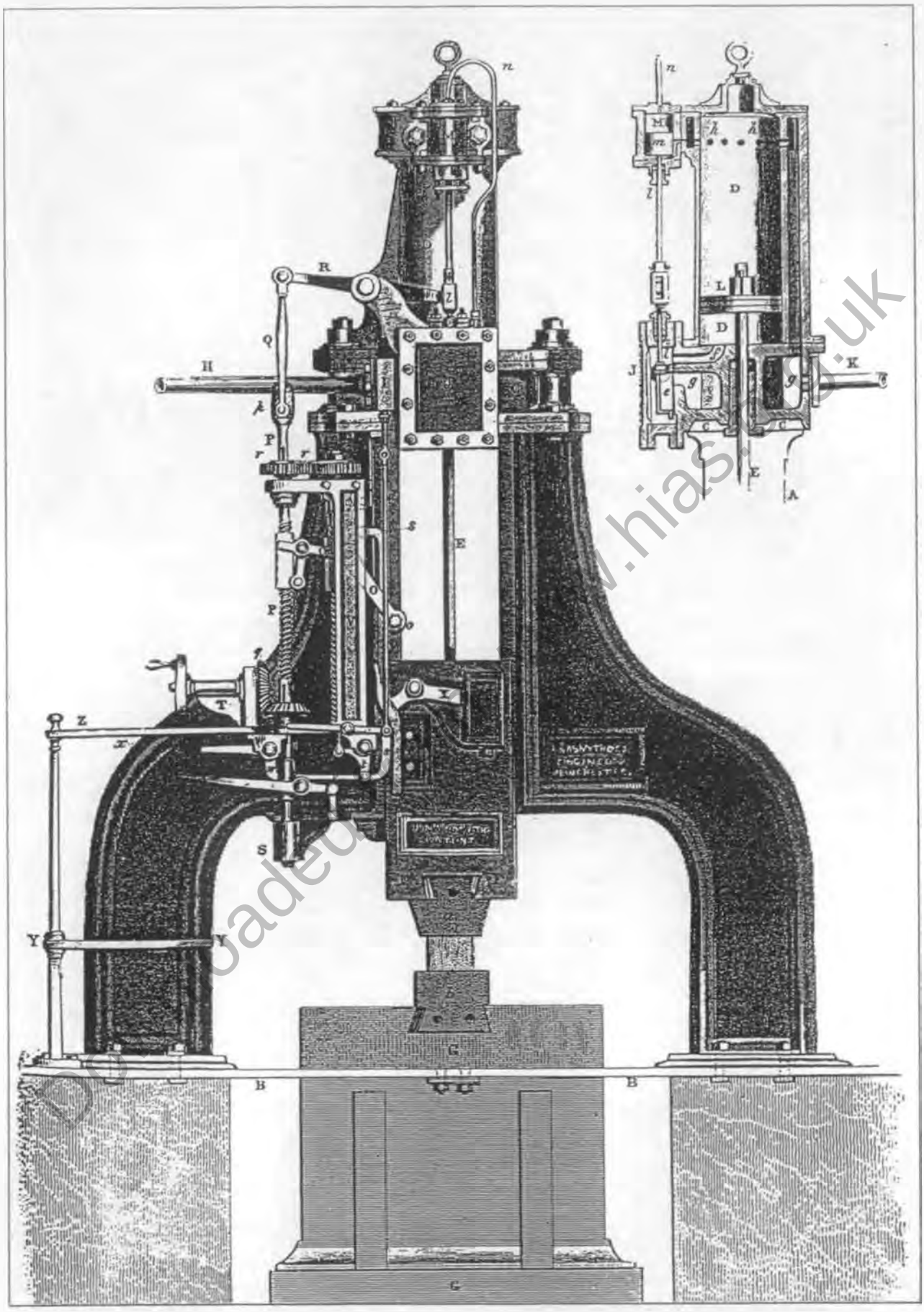


Figure 22 Nasmyth's hammer for the 1851 Exhibition

Ironmasters were not slow to see the advantages of a hammer whose striking rate and force of blow could be controlled so precisely. The original hammer was hand-worked to give single blows but, in 1843, Mr. Wilson, an engineer in Nasmyth's Bridgewater Foundry and subsequently Nasmyth's partner, designed a self acting gear so that the hammer could deliver repetitive blows. Also in 1843 steam was admitted above the piston so that the steam not only raised the hammer block, but also assisted gravity in accelerating it downwards. A Nasmyth steam hammer was exhibited at the 1851 Exhibition of the Industry of all Nations at the 'Crystal Palace' *(Figure 22)*.

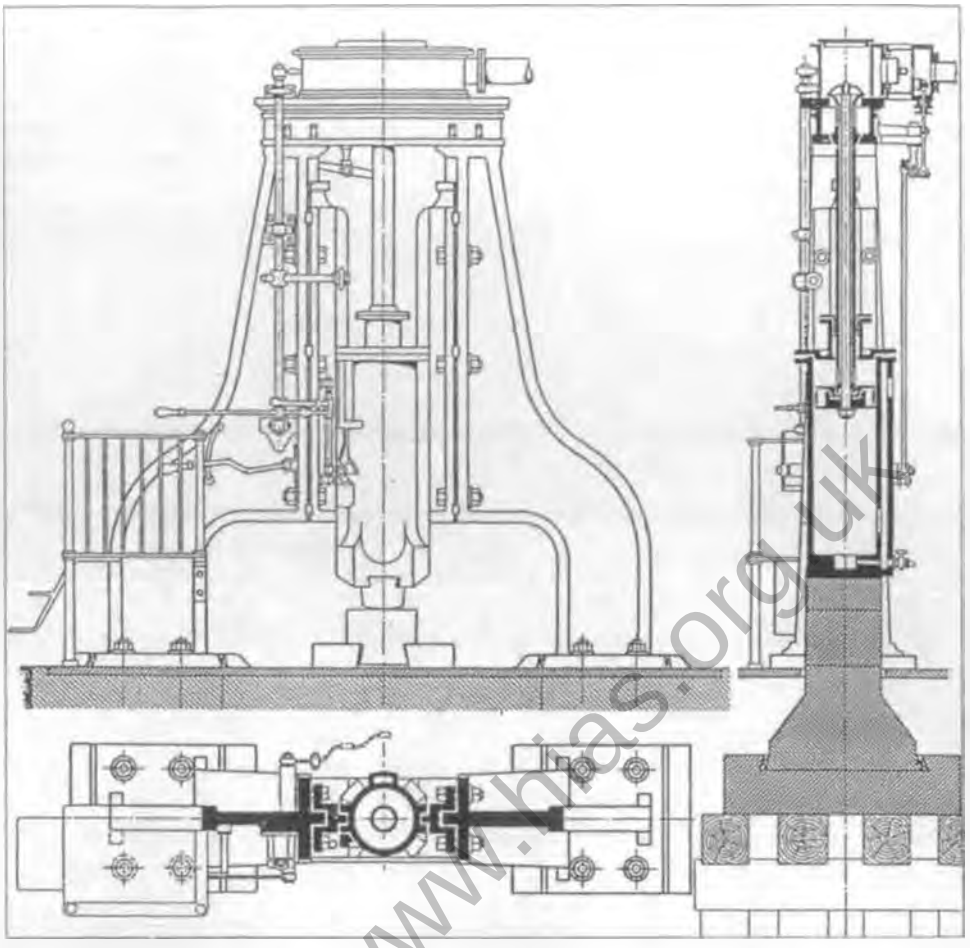


Figure 23 John Condie's first design of steam hammer, 1850

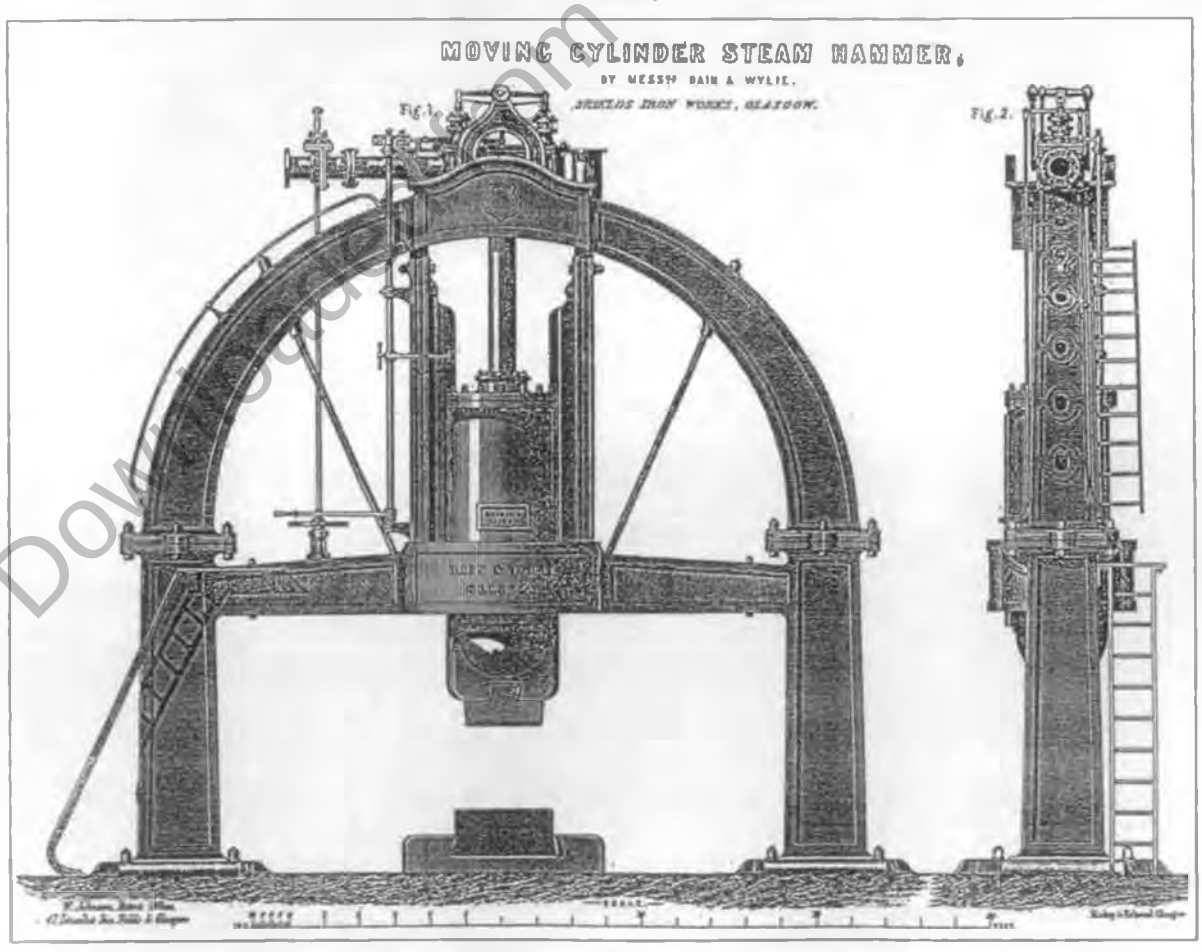


Figure 24 Condie hammer built by Bain and Wylie of Glasgow, 1861

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Figure 22 shows a single acting hammer of the traditional Nasmyth form. The anvil is a massive iron casting with separate foundations to the hammer which is mounted on, and guided by, a rigid cast iron frame. The steam cylinder and its valve gear contain several interesting ideas. To raise the hammer block, steam is admitted below the piston through valve *e*. When the piston passes the ports *h* in the cylinder wall the steam escapes and the air trapped in the cylinder above *h* acts as a spring cushion to stop the piston and hammer block. The stroke of the hammer can be varied by moving the trip levers up or down the threaded rods *P* which are geared to handle *T*. When used to deliver single blows the hand lever is connected to the trip levers. In repetitive mode, the inertia lever *x*, whose weighted end is in the box attached to the hammer block, operates the trip levers when the descending hammer meets resistance. When self-acting the hammer block automatically adjusts its stroke as the metal on the anvil deforms. The only difference in the double acting hammer is to rearrange the slide valve to make the steam cylinder double acting with steam above the piston to assist gravity, so giving a larger impulse for a given hammer block raised through a given distance.

As with all good ideas, other engineers sought to develop better forms of hammer or to circumvent Nasmyth's patent. Prominent amongst the alternative forms were those patented by John Condie (October 1846), Robert Morrison (August 1853), William Rigby (September 1854) and M Arbel (1855 in France).

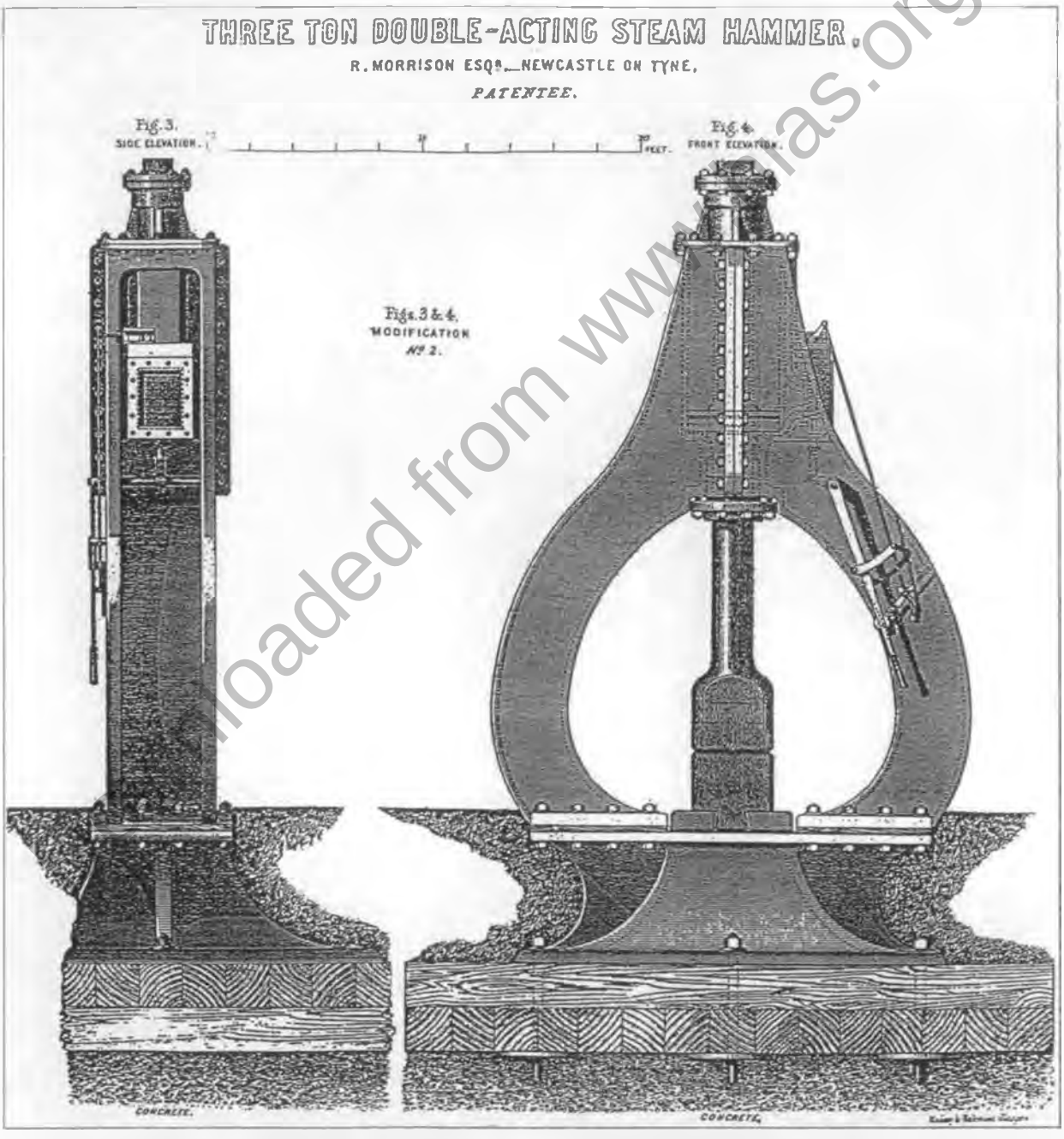


Figure 25 Morrison's 3 ton hammer, 1867

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Condie's design of hammer was an interesting one. He argued that, after the hammer block, the largest casting above ground was the steam cylinder. Thus he made the cylinder move as the hammer block, fitting it with a stationary piston and feeding steam in and out via passages in the enlarged piston rod (*Figure 23* shows an early one). Some very large Condie hammers were made, one of which was used to forge the paddle shaft for Brunel's *Great Eastern*. Large forgings required the fire welding together of many pieces of wrought iron. Fabrications like the sternframes of iron ships were large and complex and difficult to handle. They had to be moved around using small cranes to bring different parts of the forging under the steam hammer. Hammers with large portal frames to span these large fabrications were made for shipyards. *Figure 24* shows a Condie hammer of 1861 with a span of 16 feet (5 m) and a combined cylinder and hammer block mass of 5 tons (5 tonne).

One weak point of the Nasmyth hammer was the tendency to bend the rod connecting the hammer block to the piston. This rod carried both tensile and compressive forces and was unsupported except by the stuffing box at the base of the cylinder. Morrison sought to overcome this by using a massive hammer bar comprising the hammer head, piston and thick rod all forged as one piece. It was guided by stuffing boxes at top and bottom of the cylinder and had the same sort of self acting gear as the Nasmyth hammer. It proved a very popular design and *Figure 25* shows a small 3 ton (3 tonne) shingling hammer. Unusually, the hammer in Figure 25 has the framing supporting the cylinder bolted to the anvil. Although this might seem to give a stronger frame, the vibration led to cracks in the cast iron framing and all his subsequent designs had separate foundations for the anvil.

Rigby's modification was similar to Morrison's hammer but without the hammer bar extended through the top cylinder cover. He also introduced the polygonal or oval hammer bar to prevent the piston and hammer head rotating. The lack of a guide for the hammer at the top of the cylinder meant that it was easier to bend the hammer bar but Rigby hammers were very popular in small sizes for country smith's workshops.

The industries requiring the largest hammers were shipbuilding and the heavy armaments makers. As guns became larger, heavier and needed to be stronger to give shells a longer range, they presented ever bigger challenges to the ironmaster. Woolwich arsenal had one of the largest Nasmyth hammers to forge 80 ton guns for the Admiralty. It cost £70 000 and the mass of the hammer block was 40 tons. As a double acting hammer the blow was equivalent to the 40 ton hammer falling 80 ft (24 m)! The hammer frame and cylinder weighed in at over 500 tons. The foundations and anvil block came to 655 tons with another 60 tons for the facing block capping the anvil: iron was cheap in those days. Not to be outdone, the Krupp works in Essen, Germany built a hammer with a 100 ton hammer block. The change from iron to steel in the late nineteenth century put out of work many shingling hammers but work was still there for large hammers.

The steam hammer was not only required for the most massive forgings. Quality control and output

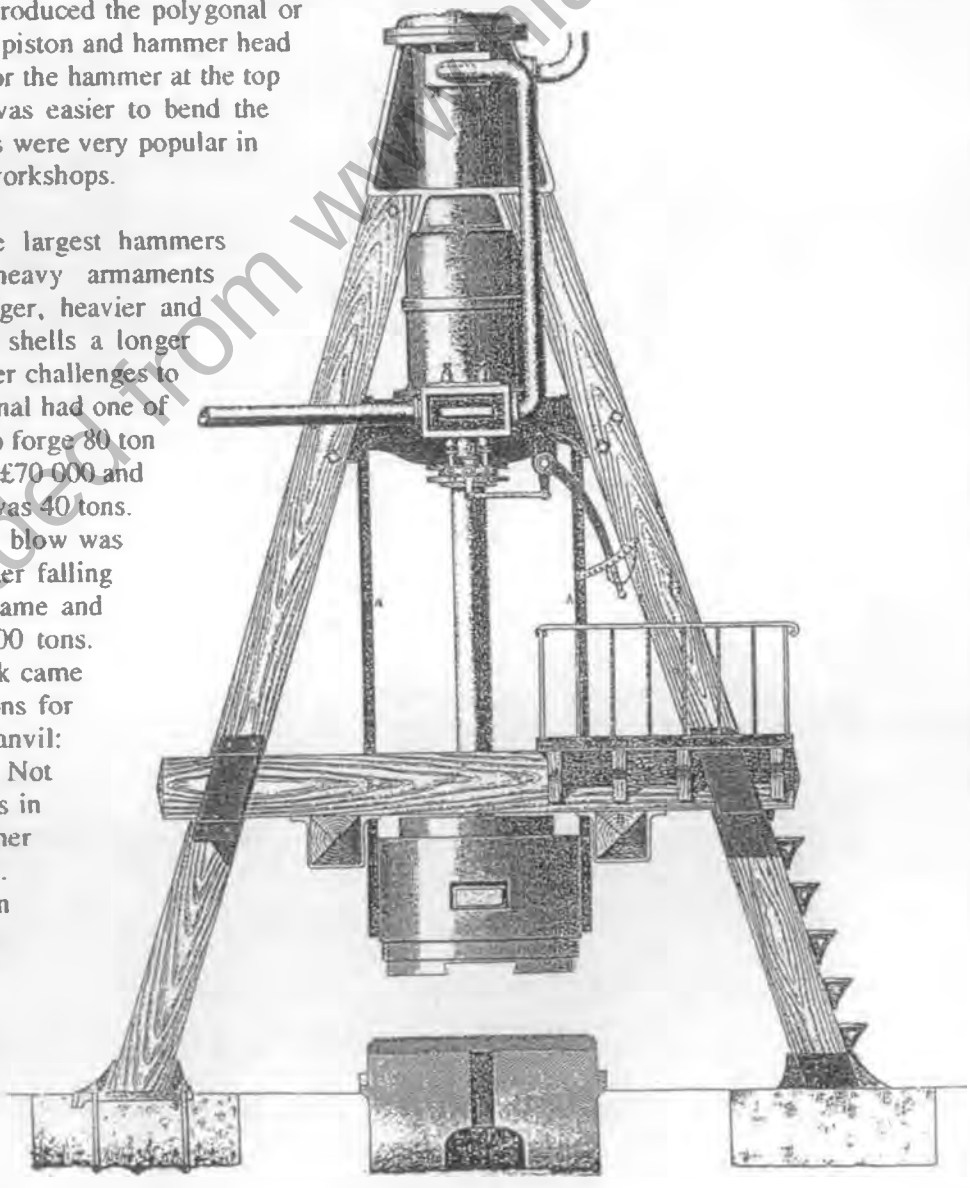


Figure 26 Arbel's steam drop hammer, 1860s

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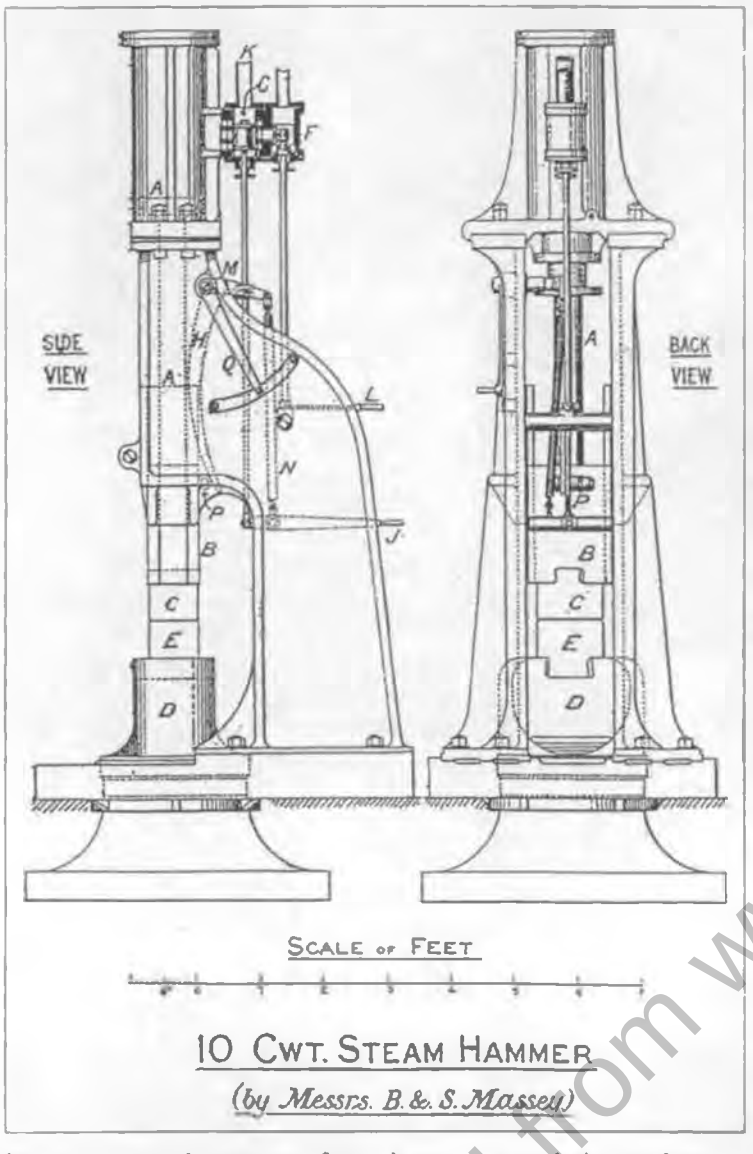


Figure 27 Small single sided hammer by B & S Massey, c1900

of smaller forgings could be improved by the change to steam power. Early railway wagon wheels were made of cast iron which developed cracks on the poor track of the day. M Arbel, in France, patented a wrought iron railway wheel in which the rim, spokes and hub were cut and bent from separate pieces of wrought iron. The pieces were arranged in a suitable former or mould, the whole assembly heated to welding heat and forged into a solid wheel under the steam drop hammer *(Figure 26)*. As the hammer is single acting the simple wooden frame to support the cylinder was adequate. Arbel's patent wheels were manufactured in very large numbers and a few can still be found supporting wagons on museum railways. Every railway workshop had its steam hammer for wheels, tyres and axles well into the steel era. The American Railways Master Mechanics Association yearbook for 1912 has three pages of data on steam hammers.

The technology of the steam hammer could be applied to other tasks. As early as 1843 Nasmyth himself adapted the steam hammer to form the steam pile driver and later steam shears for cutting iron plate and steam riveters were developed. The power hammer operated by compressed air was also a derivative and, after the end of steam, some small steam hammers were kept to run from the compressed air supply.

A steam hammer remained an important tool in the iron and steel makers workshop until about 50 years ago. Now few remain in museums and even fewer at work. Blists Hill ironworks at Ironbridge have a working hammer in their museum which is used for demonstrations. Patricroft museum, near Nasmyth's old foundry, has a small early Nasmyth hammer though not in operable condition. Kew Bridge museum has a small Massey hammer in the maintenance workshop. *Figure 27* shows the Massey single sided design. Though not as rigid as the Nasmyth two legged pattern it was popular with small workshops as it gave the smith more space to manoeuvre the work on the anvil. Beamish open air museum has the dismantled remains of a large Rigby pattern hammer from the Darlington Forge and I know of a few other derelict hammers which survive in store.

Martin Gregory

Engineering in Rural Hampshire

Victorian engineering is usually associated with the great workshops of the Midlands and the North but, like all generalisations, this is not entirely true. If engineering is considered as the manufacture of engines, then works were established in villages and market towns in the South and West of England. Even a cursory examination of trade directories brings to light at least 14 in Hampshire. In their early days they were prepared to make almost anything, particularly for the local farms. For labour they assembled carpenters, blacksmiths and iron founders; for material they used a great deal of wood, but this was gradually replaced by iron. Their products ranged from the simple, such as pig troughs and iron railings, through ploughs and pumps to threshing drums.

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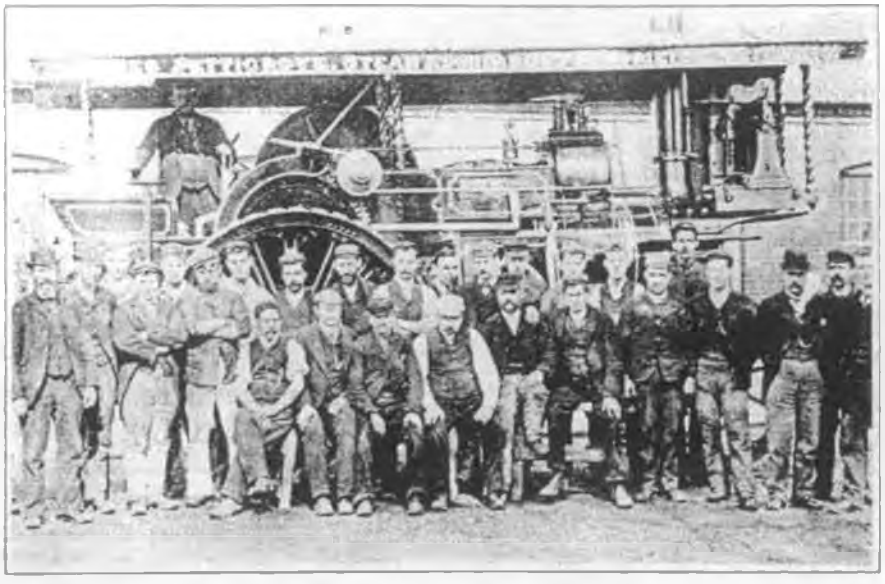


Figure 28 Wallis & Steevens of Basingstoke Workpeople with Showman's Engine

By the late 1860s, Taskers of Anna Valley and Wallis and Steevens of Basingstoke had begun to make steam engines. With the relative decline of their traditional market in the Hampshire countryside, the larger firms sought markets further afield, in Europe and beyond, to South America and the British Empire. Taskers arranged sales visits, particularly for their steam equipment, to Rumania and South America in 1893. Vachers, of Kings Worthy, produced hydraulic rams and water turbines for places where water power was available and fossil fuels were scarce. Their letter book of 1889 includes enquiries about freight rates for sending one of their hydraulic rams to Scotland (road to Winchester, rail to Southampton, coastal vessel to Glasgow and rail to Carluke) [1]. In 1893 they wrote for a quotation for sending their products to Bluff Harbour, New Zealand, by "*sailer*" [2] (shipment by sailing vessel being cheaper than by steamer). By the late 19th century, some Hampshire villages and market towns were sending their engineering products all over the world.

With four exceptions, the various works were established in the 19th century, many of them during the "Golden Age" of farming, between 1840 and, say, 1875. Apart from those that were transformed into manufacturers of special products, such as Taskers, few survived the Second World War. They either went out of business or gave up manufacturing to concentrate on repair work or selling other firms' products.

With regard to products, the works would respond to almost any orders, most of which came from the farming community. Ploughs, farm carts and threshing drums, all for use with horses, were typical. Special demands were met. For instance, Hetheringtons of Alton, being in the Hampshire hop growing district, supplied rolling floors for hop drying. Woodbournes (later Moores) of Kingsley made special presses for filling hop pockets. While Taskers did not specialise in millwrighting, they would undertake it if an order was to be had. For instance, they would supply new iron teeth for worn mill gearing; if wooden teeth were required, they would be made in the Pattern Shop. In the event, the Pattern Shop became responsible for millwrighting, including the dressing of stones [3]. When steam power was applied on farms, Taskers and Wallis & Steevens began to produce steam engines. Other works did not venture into this new field, but sold and repaired other people's engines. However, as examination of the collection of the Hampshire County Museum Service will show, the most characteristic products of the Hampshire engineering works were agricultural implements.

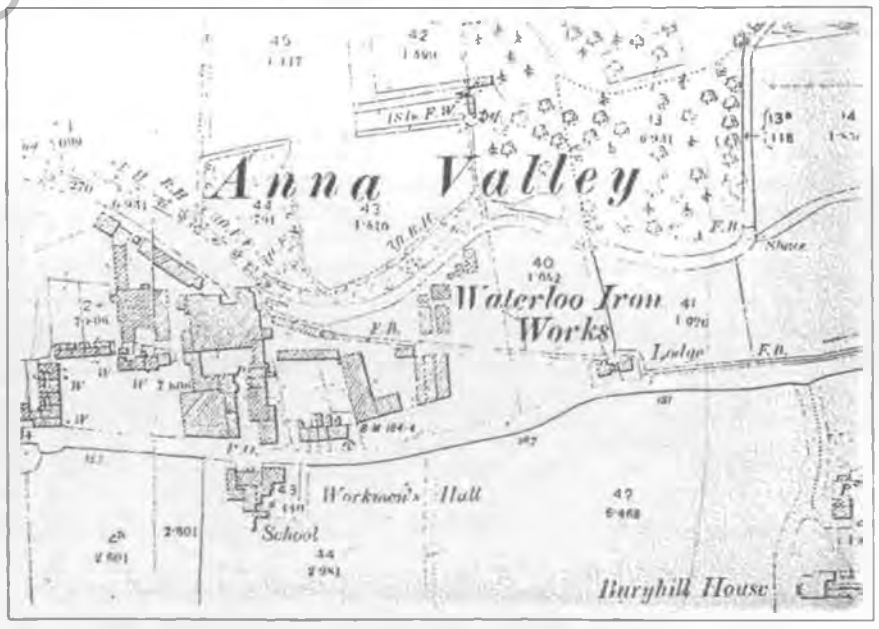


Figure 29 Taskers Waterloo Iron Works in Anna Valley. (Reproduced from the 1896 1:2500 Ordnance Survey Map, Sheet 23.11, 2nd Edition.)

These were the products, but how were they made? Most of the works had a smithy and a foundry, with workshops for the carpenters and the pattern makers. The

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products were completed in the machine shop and the erecting shop. Even the smaller works, such as Wheatleys of Wickham, had their own foundry, although it did not operate every day. Water power was used in a number of the works and, needless to say, they made their own water wheels. Taskers used their original water wheel of 1813 until 1880, when they built a water turbine to replace it [4]. In addition to providing power for the machine shop, this drove a fan which served the forges and foundry cupolas. Not many of the smaller works installed steam engines as, lacking railway access, coal was relatively expensive. (Wood was used for construction rather than fuel). They often advanced direct from manual, horse or water power to the internal combustion engine which was, in any case, more appropriate for small scale production.

Their workers were the greatest asset of a rural engineering works. Despite the current population movement from country to town, they attracted skilled, key men away from the towns. In some cases housing was provided. However, in most cases the workpeople were from a Hampshire market town or, in the case of village works, one or more villages. For instance, at Taskers, although a number lived in Anna Valley, they also walked in daily from Abbotts Ann, Wherwell, Amport and Weyhill. The two or three mile walk would come before or after a nine hour working day (oddly enough, men did not come from the nearby market town of Andover). Skill was, of course, required. However, machines tended to be slower, larger and simpler. With agricultural machinery, more importance was attached to reliability and durability than to efficiency. Tolerances were not as fine as today, but nevertheless there was no doubt about the skill of the workpeople, especially the moulders and the pattern workers who were responsible for the iron castings. Design tended to be pragmatic. The owners attended exhibitions and stocked other people's products - they hardly ever took out patents. In fact, essential information was carried in the minds of the owner and his workpeople. Only with their development into steam engine manufacture did firms like Wallis & Steevens and Taskers establish drawing offices. Normally the customer would decide what he wanted, usually like something else he had seen, and the owner and his foreman would make a few notes. Owners must have had some idea of costings, but lack of expertise in this field would account for some of their difficulties.

Once established, the supply of keyworkers was maintained by taking on apprentices, usually boys related to, or at least well known, to other workers. This tradition continued for many years. For instance, Hartley George Wort was a premium apprentice with Armfields of Ringwood between 1927 and 1933, gaining experience in all the shops and also in the drawing office. The labour was cheaper, more reliable and more flexible than in the great manufacturing towns. The only alternative was to work on the land. In their heyday, before the First World War, Taskers were paying their skilled men £1 10s a week, which was about three times as much as the wage of a farm labourer. As for conditions, there was no heating except for the occasional improvised coke brazier; lighting was by candles, except in the fitting shops where oil flares, later replaced by oil lamps, were provided. By the 1890s all the larger works and some of the smaller had their own gas making plants or small electric generators. Although primitive by modern standards, it was still better than working on the land. Housing was simple enough, but compared to the cities there was less chance of a cholera epidemic – and sometimes opportunities to grow your own vegetables. Perhaps not too important, but the production of so many 'one-offs', although economically inefficient, did give some freedom from the boring tyranny of mass production.

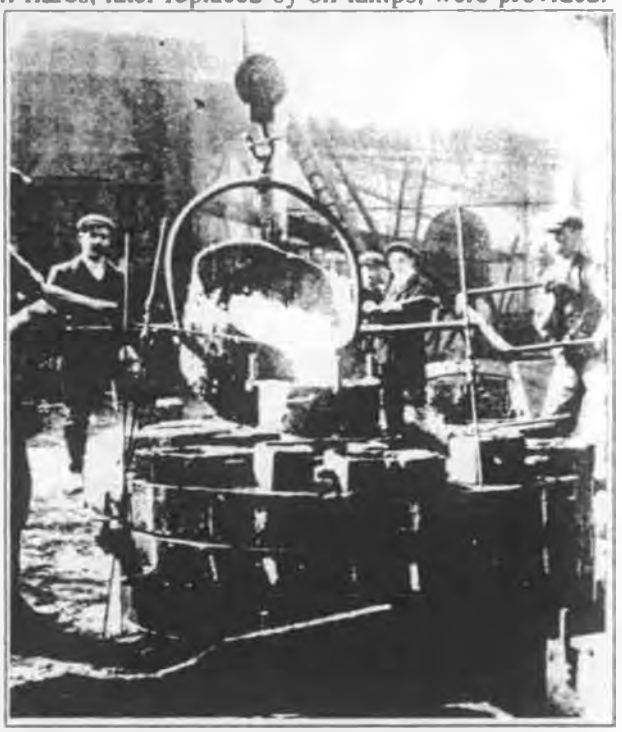


Figure 30
Taskers Waterloo Iron Works in Anna Valley. In the foundry - casting a wheel

Raw materials were more expensive than in the industrial centres of the Midlands and the North. Wood and, in some cases, moulding sand were available locally, but iron and coal had to be brought from a distance. For the Anna Valley site of Taskers, pig iron was produced in South Wales and brought by sea to the wharf at Redbridge, near Southampton. Until 1859 it was transhipped to a barge for conveyance up the Andover Canal to Taskers' wharf at Clatford. Coal came from the Somerset coalfield, by the Somerset Coal and the Kennet & Avon Canals to Burbage Wharf. It was then moved by road over the 19 miles to the works.

In 1865 the railway which replaced the Andover Canal was opened, facilitating the flow of raw materials and

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assisting in Taskers' great development period, when they moved into steam engines and the international market. However, the advent of railways was not an unmixed blessing for Hampshire's rural engineering, as previously it had been relatively easier to carry unbreakable raw materials like coal and iron, than machinery. The coming of the railways exposed the small engineering firms to competition from the industrial areas. By the turn of the century the rôle of the rural works as something approaching a universal provider of agricultural machinery had ended, although they obviously remained for repair work.

Today the siting of a production unit is the subject of careful, scientific judgement. In Hampshire in the Victorian period, the siting of most of the engineering works includes a high degree of chance. They were often established by a farmer or a blacksmith, who could raise the money to build a small works, usually including a foundry. To some extent the market towns were an obvious location, being visited regularly by farmers. But why select particular villages, such as Finchdean, Kingsley or Kings Worthy? For example, the works at Finchdean was established by John Canning, a farmer, in 1818. The Cannings continued to run the Finchdean foundry, along with two farms, until the last of them died in 1934. Subsequently the works was run by Mathers until the Second World War. At Kingsley, James Woodhouse extended the blacksmith's forge in 1841, to found the Park Iron Works. In 1878 he was described as "*an iron and brass founder, agricultural machinist, manufacturer of fixed and portable steam engines, tile and brick-making machines, patentee of hop bagging machines and various agricultural implements*". Many villages had smithies, so why did Woodhouse select Kingsley for his works? There was no water power on the site and, although a suitable moulding sand was available nearby, this was not a principal raw material. It was close to the Hampshire hop growing district, but other villages were nearer to it than Kingsley. It would seem that Kingsley was selected for personal reasons and, by happy chance, proved to be an adequate location. In some cases, after initial establishment, a short move was made to a site with water power. Taskers did this in 1813. Wheatleys opened their new machine shop on a water power site, but retained their foundry on its original site until its closure. Location clearly had some influence on the fortunes of the various works, but a more crucial factor was the skill of management. It is perhaps more than a coincidence that of the three firms which moved into the national market, Armfield and the Wallis family were Quakers and the Taskers were Non-Conformists.



Figure 31 Wheatleys of Wickham. Plan shows original works and foundry in High Street with extension near Methodist Chapel. (Reproduced from the 1897 1:2500 Ordnance Survey map, Sheet 67.09, 2nd Edition.)

While there appears to be no particular feature which attracted an engineering works to a village, did their presence have a major effect on the places? In most cases, in village or market town, engineering provided work for only a small proportion of the total population. Taskers was the only substantial village works, and was certainly responsible for the growth of Anna Valley. But even here, the 1901 census does not indicate dramatic growth. For instance, Abbotts Ann, which included Anna Valley, had reached a population of 510 and, of other villages that provided labour for Taskers, Wherwell had 480, Amport 665 and Penton Grafton (which included Weyhill) had 357. It cannot be claimed that the Victorian engineering industry had a great impact on the villages and market towns of Hampshire.

Having taken an overall view of the engineering works, in conclusion summary notes on selected cases may be of interest. A provisional list, based on Trade Directories, has been produced, but this list has its shortcomings. On the one hand, firms are included which had no foundry and concentrated on heavy repairs and agency work. With changes in owning partnerships, the same works may appear under different names. For instance, the Wey Iron Works in Alton is shown, at various times, as Hetherington Bros, Hetherington and Parker, Parker & Co, Hetherington & Co, Hetherington and Smith, and Hetherington and Moore. Notes follow on works in the market towns – Alton, Andover, Basingstoke, Ringwood, Romsey and Winchester – and in

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some of the villages – Anna Valley near Abbotts Ann, Finchdean near Idsworth, Hook near Winchfield, Kings Worthy, Kingsley, Stuckton near Fordingbridge and Wickham.

There have been two establishments in Alton, both described in an unpublished work [5]. The Wey Iron Works was founded in 1865 and, as mentioned above, were owned by various members of the Hetherington family, allied with a variety of partners. The main products were agricultural implements and machinery, including special items for the hop industry. They also undertook millwrighting. (The water wheel at Abbotstone Mill was marked "**Hetherington and Parker. Alton. 1876**"). Since they went out of business after the First World War, their buildings have been adapted and re-used for various purposes, and now form part of a community centre. The Victoria Foundry was established by W.F. Blake in 1846. A 1907 Directory gives a predictable list of products including ploughs, cultivators, drain hole covers and iron and brass foundry work. Between the wars, Blakes gave place to Enticknap. In the late 1950s the works were left for a disused paper mill and as V.F. Engineering, the firm found new markets in cement machinery and oil pipe lines.

In Andover, the Acre Iron Works was operated by Watson and Haig. It was established in 1855 when Alfred Watson purchased a small iron foundry in Junction Road. In 1923, they were undertaking steam cultivation and threshing. Hop gear of their manufacture is preserved at Chilcomb [6]. After the Second World War they moved away from the Junction Road site and the link with Victorian engineering was broken.

Basingstoke was the location of one of the concerns that grew into a large scale enterprise; its history has been well recorded [7]. Wallis and Steevens differed from the typical works managed by "incomers", as the Wallis family had been resident in the town for many years. By 1847 they were already operating as "*ironmongers, ironfounders and agricultural implement workers*". However, in 1856, Arthur Wallis opened the North Hants Ironworks on Station Hill, where the firm remained until after the Second World War. The development of Basingstoke New Town necessitated a move to an industrial estate. They had "taken off" from their position as a local engineering firm in the 1860s. In 1867 they built their first portable steam engine and, in 1872, marked their transition from the typical small firm by appointing an agent in Denmark. Over the years they specialised in steam traction engines and rollers and, later, diesel rollers.

Engineering was established in Ringwood in 1859, when William Munden, a blacksmith, started work in a part of Tunk's Brewery. In 1875 Joseph Armfield became a partner and a period of expansion began. To increase production, in 1882 a foundry at Stuckton, nearly six miles away, was purchased and in 1890, the Vale of Avon Ironworks was established on the opposite side of the road in Ringwood. Like Wallis and Steevens, Armfields "took off" from the small works division, but not into steam. Armfields specialised in mill machinery and, after 1910, water turbines. They continued to make and maintain mill machinery but after they were purchased by Wellworthys in 1943, this was concentrated at Stuckton.

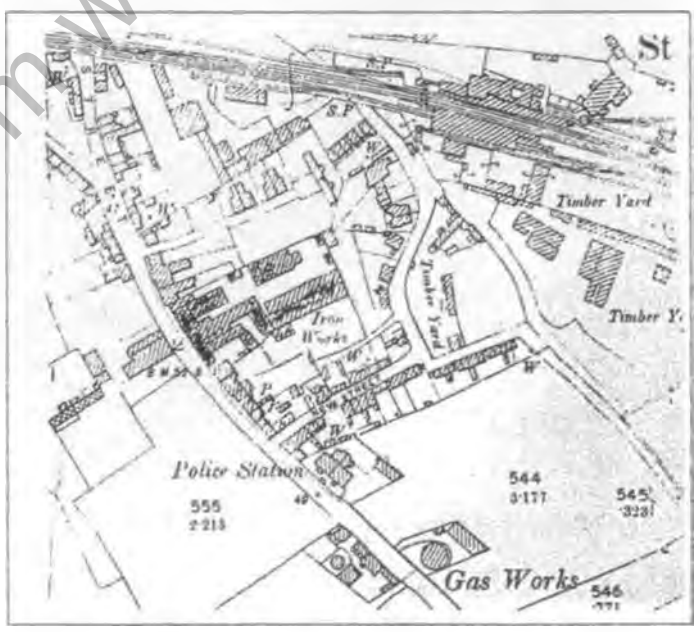


Figure 32 Armfields Vale of Avon Iron Works in Ringwood. (Reproduced from the 1897 1:2500 Ordnance Survey map, Sheet 70.11, 2nd Edition.)

Whereas the firms at Basingstoke and Ringwood developed to serve an international market, those at Alton, Andover, Romsey and Winchester did not venture much beyond Hampshire. The Test Valley Ironworks at Romsey was established by Walter Gascoigne from Northampton, who purchased a small ironworks in The Hundred [8]. An 1884 Directory describes the Test Valley works as "*Agents for Reaping and Mowing Machines, Engineers, Millwrights, Iron and Brass Founders*"; typical products of the foundry were plough shares, plates on roadside markers, drain hole covers and grave markers. At the peak, in the Edwardian period, 40 men were employed in the works and the firm also undertook repair work on farms and water mills within about 20 miles radius. After the Second World War, only repair work remained and, following its closure in 1962, virtually nothing of the works remained.

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There are records of at least three engineering works in Winchester. Perhaps the best known was Jewells, located in Lower Brook Street. In an 1889 Directory they were described as "mechanical engineers" and a surviving photograph shows a well equipped machine shop. However, the only products known to survive are products of a foundry, such as tie plates, lamp posts and drain hole covers. Deans (later Dean and Smith) had extensive works stretching from Upper Brook to Lower Brook Street. When the business was sold in 1924 it was trading as "**Winchester Motor and Deans Engineering**", and seems to have become involved in the motor trade. The Sales Particulars include a steam engine and vertical boiler, a 6hp Crossley gas engine, three cupolas, lay shafting and numerous machines. Although the premises included an engine room, foundry and wheelwright's shop, the motor garage and workshops with a vulcanising room for work on tyres may have received more use [9]. Walker & Co of Danemark Works, North Walls, advertised "Steam engines and boilers, waterwheels and turbines" and undertook well boring and pump work and provided machinery for flour mills and breweries. They offered to fit "*Warehouses, mills and private mansions with electric light either as a permanent installation by means of motive power or for temporary purposes by means of storage batteries; recommended for Balls, Parties, Evening Entertainments, etc*" [10].

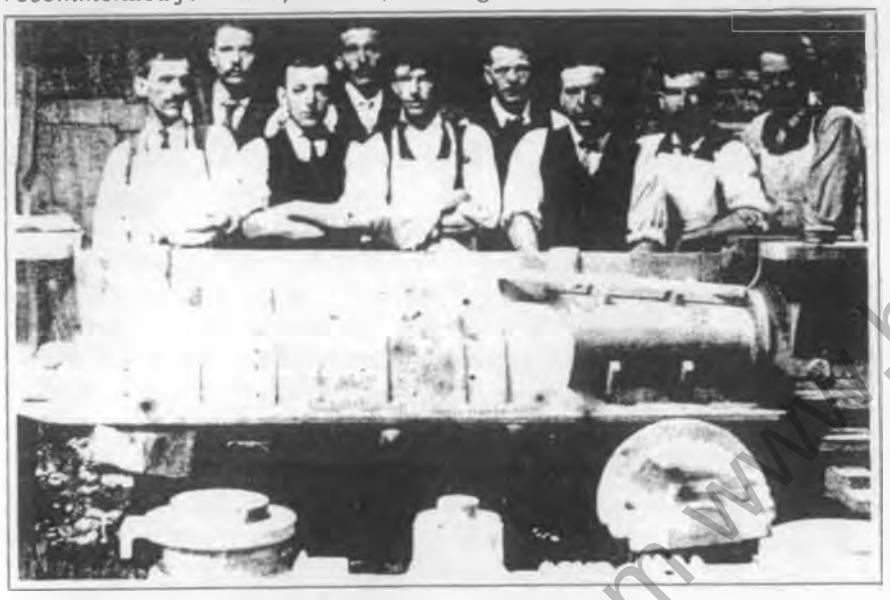


Figure 33 Taskers Waterloo Iron Works in Anna Valley Pattern Makers

Of the village works at Anna Valley, Finchdean, Hook near Winchfield, Kings Worthy, Kingsley, Stuckton and Wickham, only one developed into a large works. Reference has already been made to Taskers, Waterloo Iron Works, in business from 1809 until 1968. These dates cover two quite distinct phases. In the first, Taskers developed from a rural engineering works into a major plant for the production of steam engines and agricultural machinery. This phase ended in 1926, to be followed by a period during which Taskers enjoyed an international reputation for the production of semi-trailers. Because of the efforts of Mr A.B. Fuller, far more of the products of Taskers are preserved than of any other works [11]. Kings Worthy Foundry, named the Vulcan Iron Works, remained small compared to Taskers, but did achieve an international reputation for its hydraulic machinery. It developed during the period of H P Vacher and continued to operate as Green and Carter. In its latter days, the foundry was producing castings for domestic use (mainly fire grates) and aluminium castings. By the time of its closure in 1982, it was no longer linked to a local market.

The establishments at Finchdean near Idsworth, Hook near Winchfield and at Kingsley are all out of business – a small industrial estate occupies the site at Kingsley. Stuckton continued to operate after the others had ceased, although the level of activity fell after the retirement of Hartley George Wort in 1981. As mentioned above, Armfields purchased the Stuckton Iron Foundry in 1882, and George Wort became its manager in 1915. In 1953 the foundry was sold to the Wort family who continued millwrighting and farm work as the 'Armfield Agricultural Engineering Co'. In 1994, the buildings remain but activity is much reduced. Probably the Stuckton Foundry has the longest history of any of the Hampshire village engineering works, having been established by Thomas Shepherd in 1790.

Only one of the Victorian firms has survived under the same management. Musson's Foundry in Wickham was purchased by William Wheatley in 1890. The iron foundry produced the usual products for the farming community such as plough shares, feeding troughs and 36" presses (for cultivation). They also produced bridges for the Meon Valley Railway (opened in 1903), railings for Fareham Council and a large store of drain hole covers for Hayling Island. They provided the water driven machinery for Brownwich Farm at Titchfield. Apart from manufacture, they undertook contract work and hired out equipment - their stock included 36 steam rollers. As mentioned above, the machine shop was transferred to a former mill site where water power was available. The foundry closed in 1956 after which work was concentrated on repairs and the agency for other firms' products for agriculture. The site by the river continues in use and members of the Wheatley family are still directing the firm.

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The particular type of rural industry with which this article has been concerned lasted for little more than a hundred years, with a peak in the Victorian period. It did not employ a large proportion of the labour force but, by serving Hampshire farms, it contributed to food supplies for a burgeoning population and, to a modest degree, to the economy of Britain in its heyday.

Dr Edwin Course

Notes

[1] Hampshire County Record Office (HCRO) 137 M 87/1
[2] HCRO 137 M 87/2
[3] L.T.C. Rolt: *Waterloo Iron Works*. David & Charles 1969.
[4] Ibid
[5] P. Armitage: *An Outline of Alton's Industrial History*. Unpublished.
[6] Hampshire County Museums Service.
[7] R A Whitehead: *Wallis & Steevens, A History*. Road Locomotive Society 1983.
[8] LTVAS: *Old Romsey at Work*. LTVAS.
[9] HCRO 48 M 84 W/356.
[10] Copy of Advertisement: Author's collection.
[11] Hampshire County Museums Service Store: Tasker Collection.

Acknowledgements

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Southampton, and a first industrial revolution

The Middle Saxon town of Southampton was founded on a tongue of land upon the west bank, at the mouth of the River Itchen which was further restricted by a tidal lagoon and salt marsh to the south. The higher ground to the west and facing the mouth of the River Test or Anton was not developed until late Saxon and Norman times. The Middle Saxon town site, from much modern excavation, is predominantly on a low gravel bar and may account for the rather odd street alignment and peripheral form.

It is believed that little or no change has taken place in sea levels from these times, given a tidal range of about four metres. Land changes have been only very marginal with silting and reclamation of the lagoon and marshes. A slow extension of the river bank or shore line into the River Itchen is most marked by referring to modern maps. Up river flood water coinciding with spring tides may have resulted in many raised timber dwellings within the town.

A regular street layout has been discovered by archaeological excavation at many sites, but two streets are on the modern alignments, generally of St Mary's Street and Chapel Road. The parish church of St Mary's remains at its foundation site although the churchyard has extended southwards. Short sections of the town ditch have been revealed mainly to the north west flank and to the north of the Six Dials site. No main streets have been recorded, so far, east of the Derby Road alignment, although substantial occupation of this area down to the river bank may have existed. Much of this eastern area is recorded in later years as St Mary's Glebe and was tilled as farmland.

The harbour (if such existed) or main landing place for sea-going vessels would have been close to the later site of the Trinity Chapel and the east end of Chapel Road. Small local boats for navigating the Itchen and Southampton Water probably pulled in on to the most convenient river shore available. From early medieval sources and by more recent investigation, there is reason to believe that an early water channel, or natural drainage ditch carrying some spring water, existed parallel to the south of Chapel Road. If this was so, it would have provided a secure landing or loading point for coastal trading vessels and perhaps direct access to storage buildings. It should be remembered that Saxon sea-going vessels were built without keels, prior to about 880.

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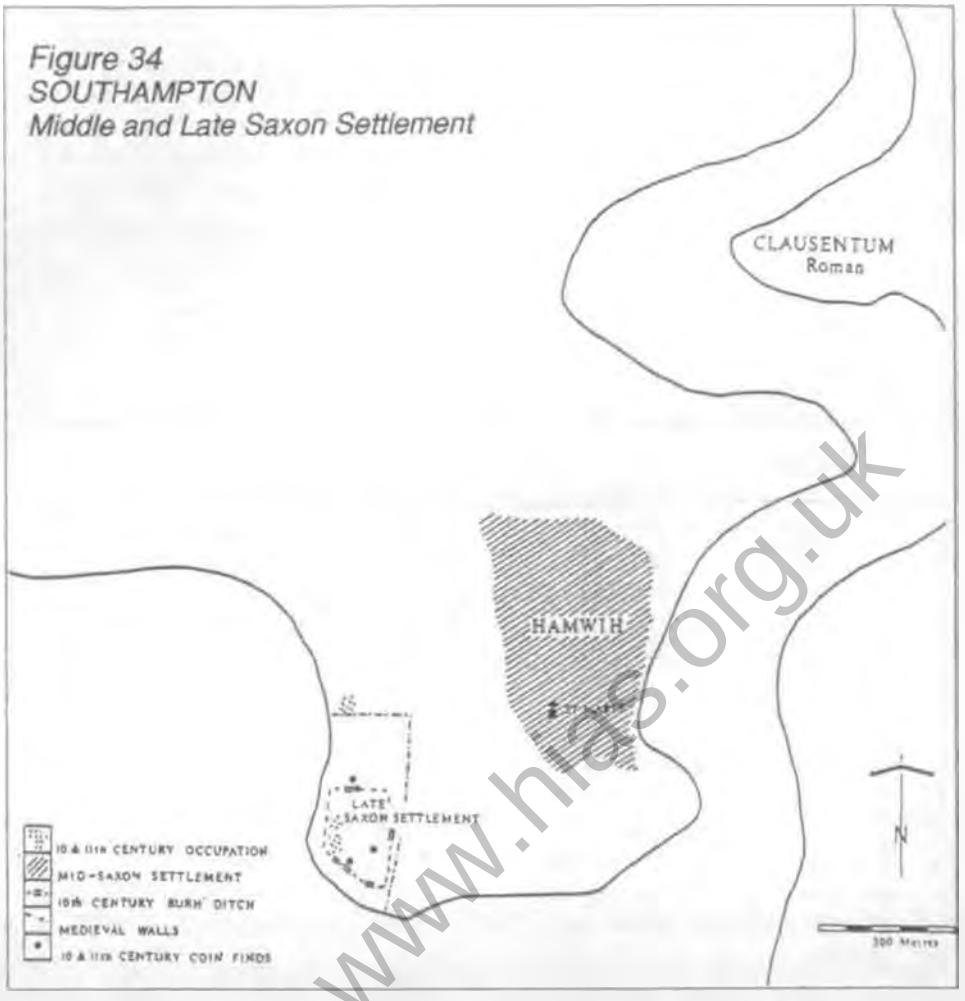


Figure 34
SOUTHAMPTON
Middle and Late Saxon Settlement

The foundation of Hamwic (or Hamwih or Hamtun) appears to have occurred in the reign of King Ine of the West Saxons (688 to 726). It was certainly Ine who made Hamwic his principal trading and production centre. This assisted him to expand his kingdom from centres such as Winchester and Wilton to include most of modern Hampshire, Dorset and Wiltshire becoming, in fact, Wessex. A *mercimonium* (a market) was established prior to 721, resulting in increased trading of goods with the western Celtic tribes and across the Channel down to the Iberian peninsula.

In the early years of the 8th century, Hamwic craftsmen potters were leaders in their field – exercising greater control of raw materials, oven temperature and timing – producing fine sand tempered ware (class 3) which has been recorded on both sides of the Channel. This fine pottery had degenerated by the early 9th century to various chalk and flint tempered coarse wares (class 2 and 4). These were produced in much greater numbers, reducing unit costs but fired in improved ovens to higher temperatures. The use of moulds to make clay vessels was also gaining increased use. The potter's wheel was not recorded in Wessex until about 900.

In the later years of the 8th century the Carolingians, ruled by Charlemagne, King of the Franks and Lombards, developed a refined wrought iron which slowly replaced the damascene forged swords. Invention and the advancement of technology was largely disseminated from the Carolingian Empire by traders and by high ranking men of learning to Charlemagne's Court at Aachen. At least one Wessex man of note is known to have travelled through Europe as far as the Middle East - being Adelard of Bath. Likewise Egbert, later King of Wessex (802 to 839), is known to have spent some years of schooling amongst the Carolingians.

The use of precious metals, mainly gold, was much favoured in the 7th to early 8th centuries, but it is silver which is mainly recorded being produced as caskets, chalices and jewellery at Hamwic. This had largely replaced the earlier use of iron alloys and pewter. The minting of silver coinage in this period is not well recorded, but Hamwic-struck coins begin somewhere between 680 and 710. Large volumes of silver were made into strap ends and tags, much of which may have originated by trading with the Celtic lands to the west. Trading networks grew and stretched well up into the Baltic, to Russia and as far as the Abbasid Caliphate in the east. Local liturgical and Christian objects were largely traded within the Carolingian Empire. As to whether this had any influence from Boniface's missionary work abroad is hard to say. Works of art with a status symbol would have had a greater value.

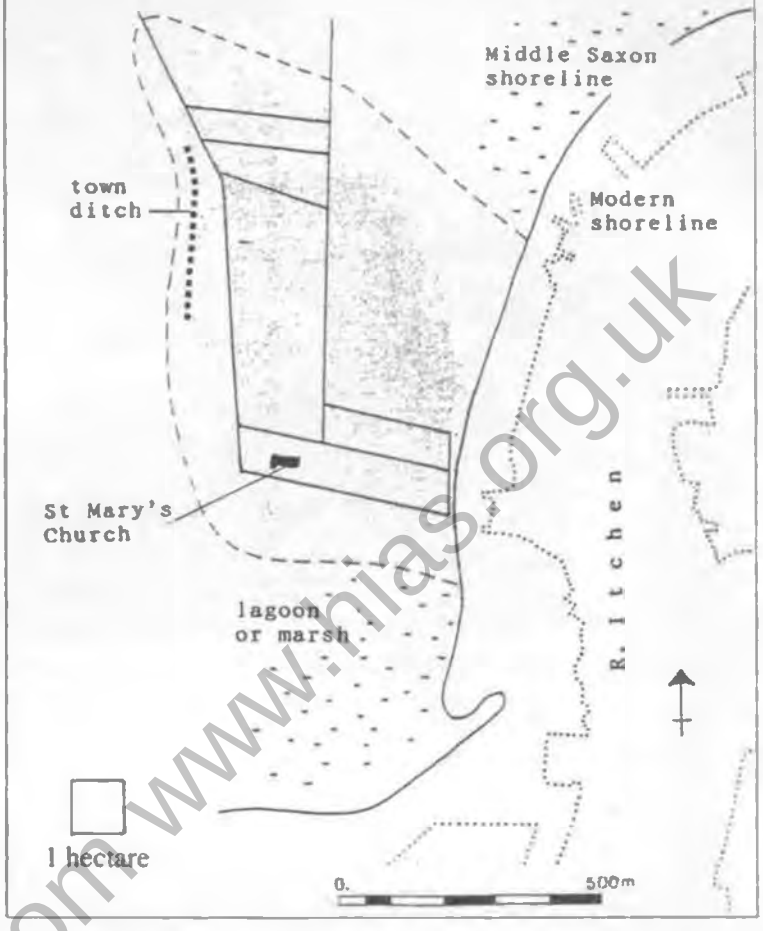
Other flourishing trades are not well recorded with any certainty but must have included agriculture, boat building, fishing and the processing of animal hides, wool, timber, stone, Roman bricks perhaps and certainly salt production. Fresh water was not plentiful for the town but many wells are a feature borne out of archaeology, as is the presence of hand quern stone fragments over a wide area. This leads one to believe that the town possessed no water mill, but is this necessarily the case? No current evidence is not reason to dismiss this entirely. I hope to be able to write more specifically on this aspect in 1995.

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There was a will at this period to challenge tradition by use of new technology. Experimentation may have resulted in the vast amounts of waste and spoil products which accumulated over the years. Hamwic can be recognised as taking a lead in many forms of industrial improvement and can rightly say to have led the First Industrial Revolution in England.

After Egbert became King in 802, the West Saxons had a supremacy of trade in southern England, which continued for a few decades more. But the sea-raiding Danes were not far away. Further west and across the Irish Sea, the Norsemen from Scandinavia were harrassing and settling in the Celtic lands. This must have reduced the amount of trading to these areas and a contraction which affected Wessex prosperity. Hamwic's superiority could not last, though it grew to be possibly the largest town in England before about 840, with a maximum population of between four and five thousand people covering perhaps close to 50 hectares. Ipswich, the centre of the East Saxons, followed the Hamwic developments and town form in many respects, including lack of good defence from the sea. It was, perhaps, not a good thing for a Saxon king to put all his trading "eggs" in one big trading post, so that when the raiding Danes attacked the town in 840, it was a shock which had later repercussions in much of Wessex. Although the folk of Hamwic fought them off, this was perhaps simply by greater number. They were not in a good defensive site and in time dispersion was inevitable. Other problems of out-growing the site may also be factors, such as fresh water supply, sanitation and provisioning.

Figure 35 HAMWIC (or HAMWIH)
Extent of town with street pattern



David Plunkett

Acknowledgements
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Corrections and amendments to I.A. Guide **50p**

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