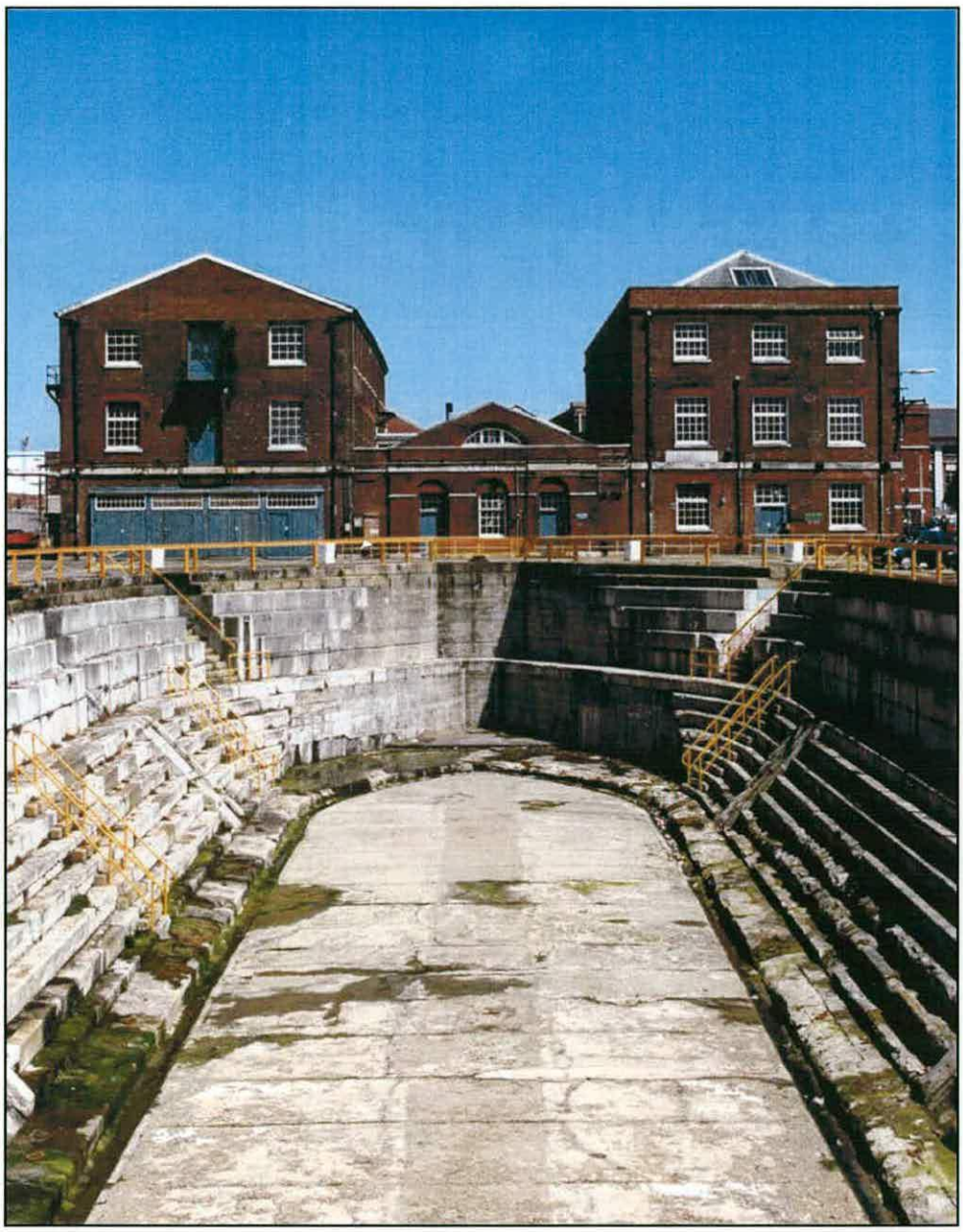
THE PORTSMOUTH BLOCK MILLS

THE START OF A REVOLUTION



REPORT BY JONATHAN COAD WITH PETER GUILLERY

ENGLISH HERITAGE

PORTSMOUTH BLOCK MILLS

MEETING WITH ROYAL NAVY

PORTSMOUTH, 31ST JULY

Dear Martin

THE PORTSMOUTH BLOCK MILLS: the Start of a Revolution

Please find enclosed a copy of Jonathan Coad and Peter Guillery's report to inform the above meeting. The report is being circulated initially to the survey team members and all EH staff attending the meeting and copies will be presented to the Navy and Historic Trust delegates on the day.

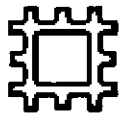
Any comments and corrections can be incorporated in the next version for wider distribution.

I should like to thank the team for their sterling efforts in producing the report so speedily and to Ursula Dugard-Craig for collating and scanning the material, designing and producing the report all in the matter of a few days.

Regards

Keith

Keith Falconer
Head of Industrial Archaeology



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THE PORTSMOUTH BLOCK MILLS

THE START OF A REVOLUTION

REPORT BY JONATHAN COAD WITH PETER GUILLERY

JULY 2003

PHOTOGRAPHY BY MIKE HESKETH-ROBERTS
DRAWINGS BY ANDREW DONALD AND MARK FENTON
ADDITIONAL RESEARCH ON ENGINEERING HISTORY BY TONY WOOLRICH

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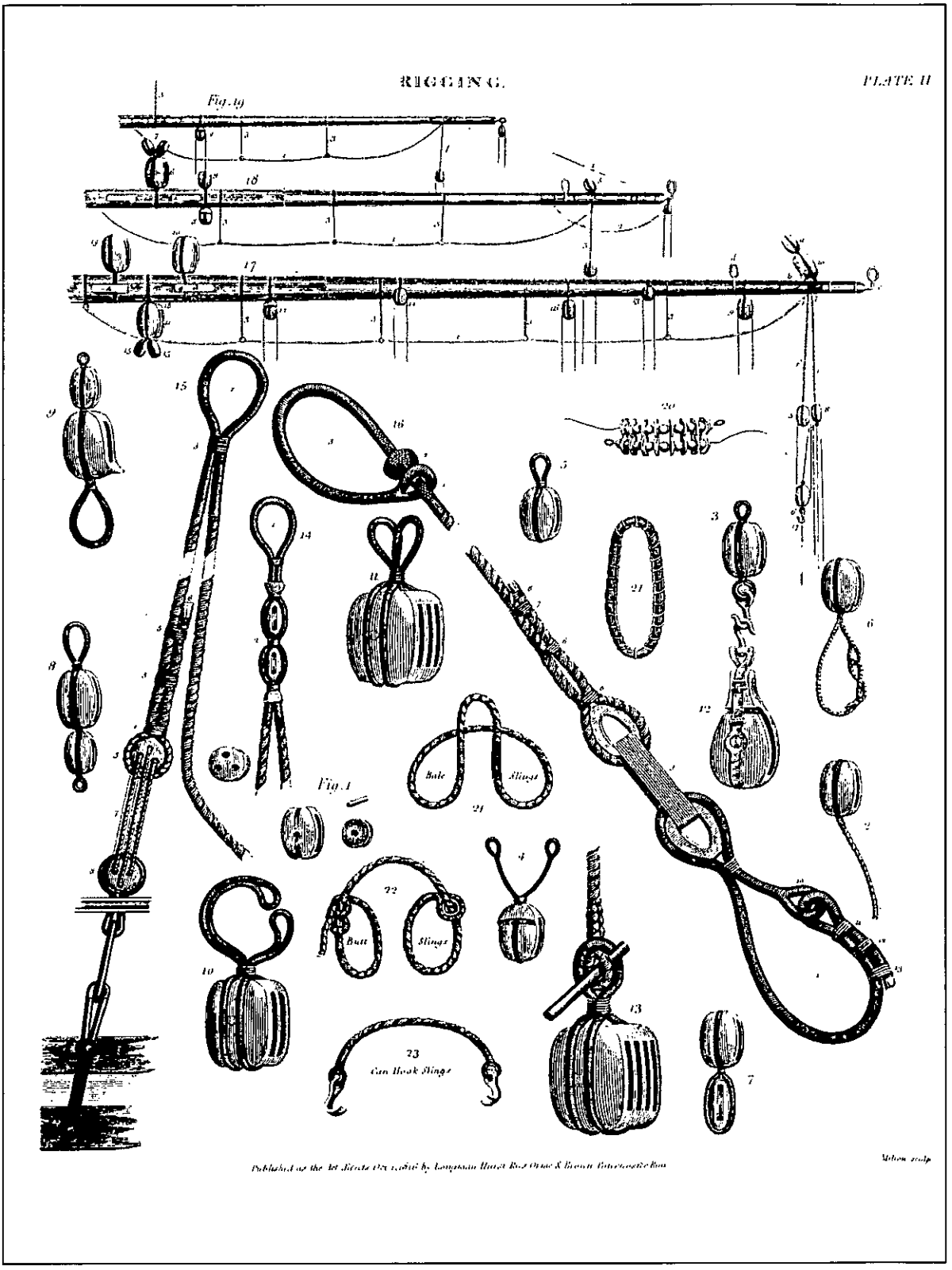

Ships Blocks, from Rees's Cyclopaedia (1812)

CONTENTS

FOREWORD

'the block machinery at Portsmouth is justly considered one of the wonders of the world'

(*British Encyclopaedia of the Arts & Sciences, 1835*)

The Portsmouth Block Mills have long been recognised as one of the seminal sites of the Industrial Revolution. This recognition of their significance was immediate – from the very start of their operation in 1805 they attracted huge interest and were visited by a procession of people who came to learn and wonder. This interest was in every sense justified. The modest complex of Georgian buildings had witnessed the first use of a steam engine in the Royal Dockyards, the introduction of Samuel Bentham's innovative powered sawmills, the triumphant realisation of Marc Brunel's revolutionary block making machines and a new order of working practices in the dockyards.

The Block Mills heralded the age of mass production using machine tools and, accordingly, have received huge attention both in the contemporary technical publications and in modern histories of technology and labour studies. In 1812, Rees's *Cyclopaedia* arguably the most influential technical record of its day devoted no less than 28,000 words and seven plates to the Mills and their machinery and derivative entries appeared in most encyclopaedias for the rest of the century. When the Mills finally closed in the 1960s, the Science Museum published a short book extolling the formative influence that their machinery had exerted on the development of the machine tool industry while recent studies have examined their place in the history of mass production and industrialisation of labour.

The emphasis on the technological interest of the machinery has in a sense overshadowed the considerable interest of the buildings themselves. That is something this report seeks to redress. Today's rather mundane surroundings to the north and east of the buildings masks the hugely historic nature of their site. The buildings, in fact, stand in part on the late eighteenth century platform built to pump between the adjacent dry docks and the 1696 Upper Wet Dock and partly on the vaults built in 1800-02 to cover over this dock. The survival of these two tiers of vaults, of the platform with its great well and drainage channels and sluices and of the steam engine houses within the South Building is remarkable in itself. When matched to the survival in situ of so much of the early transmission system for the block making machinery, the Block Mills achieve a significance of the highest order and this before even taking into account the fact that the building still contains a few of its original block making machines. It is no surprise therefore that when block making ended here in the 1960s consideration was given to the preservation of the buildings as a museum or historic site – a move thwarted by their continued low-key operational use.

The future of the Block Mills is once again under consideration and a preliminary recording exercise is being undertaken by English Heritage. This has examined many of the primary archival sources and brought together the major contemporary published accounts, patents, and modern commentaries. The buildings have been photographed throughout and are being surveyed graphically. All this material has been combined with an examination of the physical evidence to produce a new analytical record of the development of the building. A substantial report presenting the whole survey is in preparation, and will be available to the public by English Heritage through the National Monuments Record. The present report, produced for the occasion of the meeting between the Royal Navy and English Heritage to discuss the future of the Block Mills, incorporates summaries of the latest findings. The report emphasises the supreme interest of the Block Mills and underpins the case for their preservation in a fashion commensurate with their importance.

Sir Neil Cossons

Chairman, English Heritage

July 2003

ACKNOWLEDGEMENTS

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Mr David Bromwich, Librarian, Somerset Studies Library, Taunton.

The Search Room Staff, Portsmouth City Record Office.

Mr Mathew Sheldon, Archivist, The Admiralty Library, Portsmouth

Ms Holly Comben, Assistant Librarian, The Admiralty Library, Portsmouth.

Mr Tim Proctor, Senior Project Archivist, The Archives of Soho, Birmingham Reference Library

Mr Peter Tajasque, Reader Services Dept, the Science Museum Library, London

Mr Michael Wright, Curator of Mechanical Engineering at the Science Museum, London.

English Heritage also gratefully acknowledges the co-operation and financial support which the Royal Navy has provided towards the survey and the production of this report.

All photographs, except those separately credited, are English Heritage with appropriate photograph numbers.

SUMMARY OF IMPORTANCE

The Portsmouth Block Mills and its surviving machinery are one of the key monuments of Great Britain's Industrial Revolution. Its operations marked a highly-significant step towards global mass-production, as well as being a landmark in the history of the Royal Navy.

Figure 1. The Block Mills from the south west, 2003. [AA042456]

In 1799 the Royal Navy's first steam engine was installed here primarily to empty the dry-dock system. Between 1802 and 1805, this was joined by machinery designed by Marc Brunel and made by Henry Maudslay for manufacturing ships' blocks; in 1808 the Block Mills produced 130,000 blocks and it was claimed that ten unskilled men using these machines could replace 110 skilled blockmakers. This machinery and its method of operation represent the first instance in the world of the use of all-metal machine tools for mass-production.

The Block Mills today remain little altered internally or externally. The contemporary Brunel-designed and Maudslay-made models of the machinery are in the National Maritime Museum, while representative examples of the original machines are in the Science Museum. Further examples are held by Portsmouth City Museum and are on display in the dockyard and in the buildings themselves. The latter still contain substantial traces of the Royal Navy's earliest steam engines as well as early power-transmission systems and other historic woodworking machinery.

Figure 2. The interior of the Block Mills in 2003 showing the early overhead power transmission system and the turned wooden columns. [AA042405]

Beneath the Block Mills the old North Basin of 1690 continues the role it has fulfilled since the 1770s as a sump into which the surrounding Georgian dry-docks drain. These latter dry-docks and the former Great Basin together constitute the finest and earliest set of such engineering works to remain in Europe.

THE MODERNISATION OF THE ROYAL DOCKYARDS IN THE LATE EIGHTEENTH CENTURY.

By the middle of the eighteenth century, the Royal Navy had evolved into what was effectively the greatest industrial power in the western world. To build and maintain the growing fleet, the Admiralty and Navy Boards in the 1750s instituted a sustained programme, ultimately spread over 40 years, to modernise and expand the principal fleet bases of Portsmouth and Plymouth Dock [Devonport]. By the time of the outbreak of war with Revolutionary France the Royal Navy probably possessed the largest, best-equipped and most modern fleet facilities in Europe.

In 1795, the Admiralty appointed Brigadier-General Sir Samuel Bentham as the first, and only Inspector-General of Naval Works. His task and that of his small staff was to oversee this continuing modernisation and expansion, but more especially his team was charged with looking at the possibilities of introducing steam power and at mechanising production processes within the royal dockyards. For steam engines to justify their costs and to be effective, they had to be harnessed to simple repetitive tasks that were required on a regular basis. At the time of his appointment, the only non-human sources of power in the dockyards were a few horse-gins used for dock-pumping and in the tarring houses of the roperys. Bentham himself was a prolific inventor, notably of woodworking machines, and was keenly interested in seeing if the design of warships could be modified to allow a degree of mechanisation in their construction.

THE PORTSMOUTH DRY-DOCKS AND THE INTRODUCTION OF STEAM POWER IN 1799

The present dock system at Portsmouth owes its origins to the pioneer work of Edward Dummer in the 1690s. He constructed the wet-dock or Great Basin, later extended south and now known as No 1 Basin. Opening off the northern end of its east side was one of the two earliest stepped dry-docks in Great Britain. This, the Great Stone Dock, was extensively reconstructed in 1769 and is now No 5 Dock. North of the Great Basin, and approached originally from the harbour by a stone-lined channel, Dummer constructed a second rectangular wet-dock known as the Upper Wet Dock or North Basin. In 1699, by placing gates at both ends of the channel, Dummer was able to create a second dry-dock, although one that lacked the innovative stepped sides of the Great Stone Dock. This was rebuilt in 1737 with stepped sides and a stone eastern head and was renamed the North Stone Dock; now No 6 Dock. This reconstruction left the North Basin without a purpose.

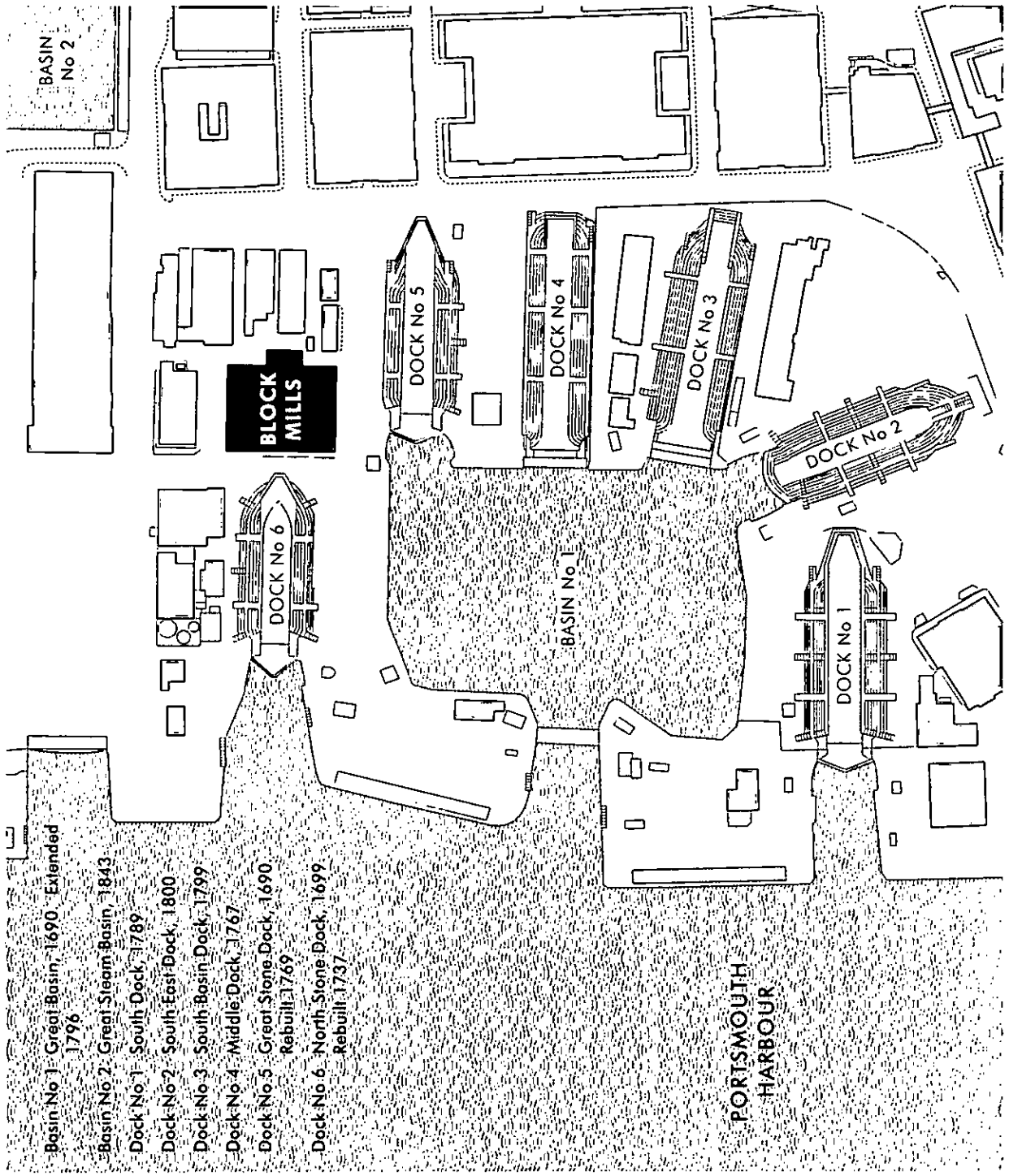

Figure 3. Portsmouth Dockyard. Plan of the centre of the Georgian dockyard.

The 1750s modernisation and expansion scheme for Portsmouth envisaged, among other major projects, the enlargement of the Great Basin and the construction of additional dry-docks. The works were to be spread over more than 40 years and involved at least nine changes of plan. As it finally evolved in the later 1790s, No 1 Basin was deepened and extended to its present extent. Two more dry-docks were added opening into the basin [No 4 - 1764; No 3 - 1799] and one was constructed at its southern end [No 2 - 1799] To the south of this complex, and entered direct from the harbour like No 5 Dock, was sited No 1 Dock, begun in 1789.

In 1770 an imaginative scheme was proposed to link all the drainage culverts from the existing dry-docks to the redundant North Basin and to use the latter as a huge sump into which the dry-docks could drain by gravity. The collected water could then be pumped by horse-gins into the harbour. This proposal was adopted and with the ultimate exception of the distant No 1 Dry-dock which was given its own set of horse-pumps, all new dry-docks were linked to the system.

The new horse-pumps for the North Basin, or reservoir as it was now called, were constructed at the western end of its south side on a rectangular masonry platform built out into the reservoir. The two horse gins were linked to a battery of 16 chain pumps set in a hexagonal stone-lined well-shaft set a little to the south between the gins. This arrangement appears to have worked well for the next quarter of a century. However, as Bentham noted in December 1797, the additional dry-docks then under construction [Nos 2 and 3], and the deepening of the Great Basin would be beyond the capacity of the system. Bentham was also well aware that late eighteenth-century steam engines were economical only when used regularly for simple repetitive processes such as pumping. Not only were the dry-docks at Portsmouth the most extensive of their kind, their sophisticated common drainage system would allow the most efficient use of steam power. He also noted that horse pumps installed for the recently-completed South Dock [now No 1 Dock] had cost £2,758, whereas he estimated that a steam engine 'of Mr Sadler's construction' would cost £800, pumping apparatus £500 and sawing machinery £600. He envisaged that the steam engine would pump out the reservoir at night and would power wood-working machinery by day. Bentham also planned that the engine should lift fresh water from a well to a water main to be laid round the dockyard. This could also be used for fire-fighting purposes. An early drawing shows a steam pump and a sawmill occupying the space of the horse-pumps.

THE ROYAL NAVY'S FIRST STEAM ENGINES.

In April 1798 the Admiralty authorised the installation of a 12hp steam engine designed by James Sadler, the Chemist on Bentham's staff. It began pumping work in March 1799. Drawings of Sadler's engine show it to have been a very early type of table engine, an invention later credited to Henry Maudslay. The Sadler engine was housed in a rectangular single storey brick engine house, replacing the eastern of the two horse gins.

By October 1799, Bentham was strongly advocating the addition of a second steam engine of 30hp. This was to guard against mechanical failure, allow the complete removal of the horse-pumps, and to provide extra capacity to allow the water level of the Great Basin to be raised to allow larger warships to clear the cills of the older dry-docks. In February 1800, the Admiralty ordered the Navy Board to follow Bentham's advice and purchase a beam engine from Boulton and Watt. Planning began for a narrow three-storey engine house located in line and to the west of the Sadler engine house, with a small two-storey boiler house on its southern side. After much revision of the plans it is probable that this new installation was completed by the end of 1801. Drive shafts linked this engine to the pumps and to the Sadler engine; the two engines could work in tandem or, if less power was needed or an engine was being serviced, a single engine could work the pumps.

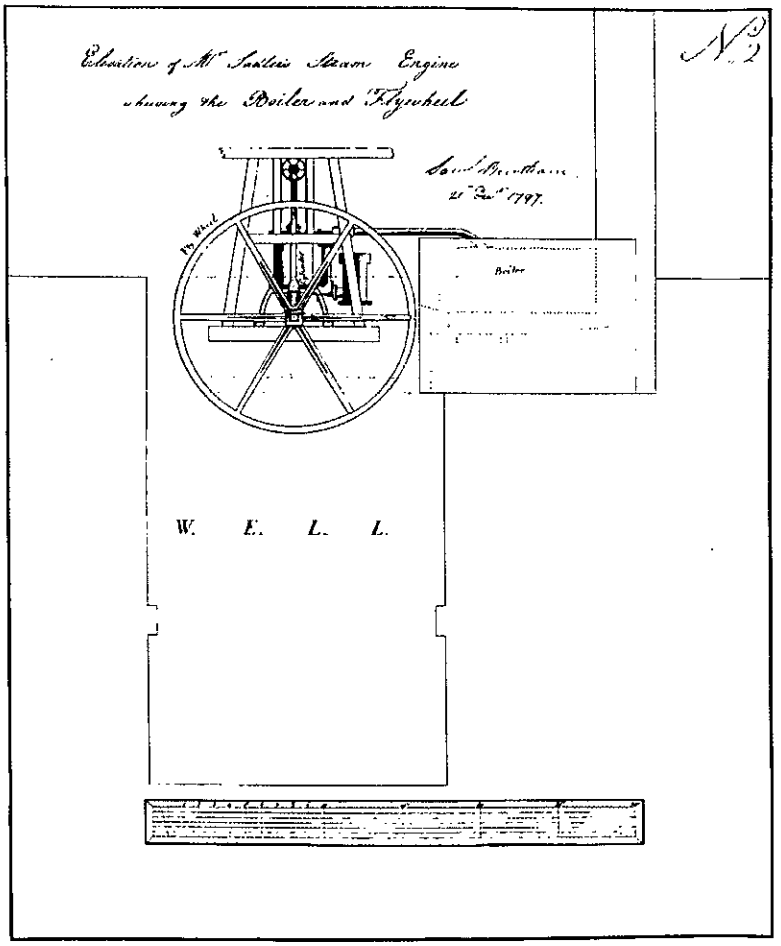

Figure 4. **The Royal Navy's first steam engine. A drawing of Sadler's table engine, signed by Samuel Bentham 21 December 1797. [National Archives: PRO ADM/140/49b]**

Figure 5. Inside the former engine house built for the Sadler engine in 1798 and subsequently modified. A photograph taken in 2003. [AA042399]

In 1807, the Sadler engine was replaced with a more powerful double-acting 30hp Murray and Wood table engine and a boiler house and chimney were added. The extra power was needed, but equally importantly, Simon Goodrich, Bentham's assistant, was finding that the single-acting Sadler engine, where power was applied only on the down stroke, was not delivering a sufficiently steady rotary motion for the woodworking machinery. In its turn, this 1807 engine was replaced in 1830 by a beam engine in the same location.

In 1837, the original Boulton and Watt engine was replaced by a new one from the same manufacturer. Parts of this engine frame remain in position in the west engine house.

Figure 6. **The base of the surviving chimney of the western boiler house in the south range of the wood mills. A photograph taken in 2003. [AA042389]**

COVERING THE RESERVOIR 1800-1802

Although Bentham's December 1797 plan showed a sawmill as an integral part of the first scheme, it is apparent this was not built as then envisaged. Both the Sadler and the Boulton and Watt engines were erected in engine houses constructed on the platform built onto the south side of the reservoir, leaving virtually no room for anything else apart from the existing pumps.

A few years earlier, Samuel Wyatt had proposed that the reservoir be roofed over level with the surrounding land to allow unrestricted northward expansion of the dockyard buildings. A more elaborate version of this scheme was proposed by Bentham in September 1799, when he advocated filling the reservoir with two tiers of vaults, the lower tier to form the reservoir itself, the upper tier optimistically to be used for storage. This scheme was approved in 1800 and by April 1802 the vaults were apparently complete. (See Figure 8)

Figure 7.

Part of the upper vaults photographed in 2003. [AA042386]

In mid-1801, soon after he had obtained permission for the purchase of the Boulton and Watt engine, Bentham had revived his 1797 scheme for a dockyard water main, but now extended to the wharves to allow warships to be supplied. The dockyard main was to be formed of a grid of 6inch and 4inch pipes. Bentham suggested that pressure for the main could be provided by placing a cistern capable of containing 200 tons of water 'over the top of [the] building containing the two steam engines and other machinery'. The cistern was to be supplied by an 8inch pipe from the pump from the fresh-water well shown immediately south of the main pump well in a 1797 drawing. The reference to a single building containing both engines and other equipment indicates that in 1801 Bentham had begun work on a much more ambitious wood mill, its southern range incorporating both the steam engines and their boilers and the pumps.

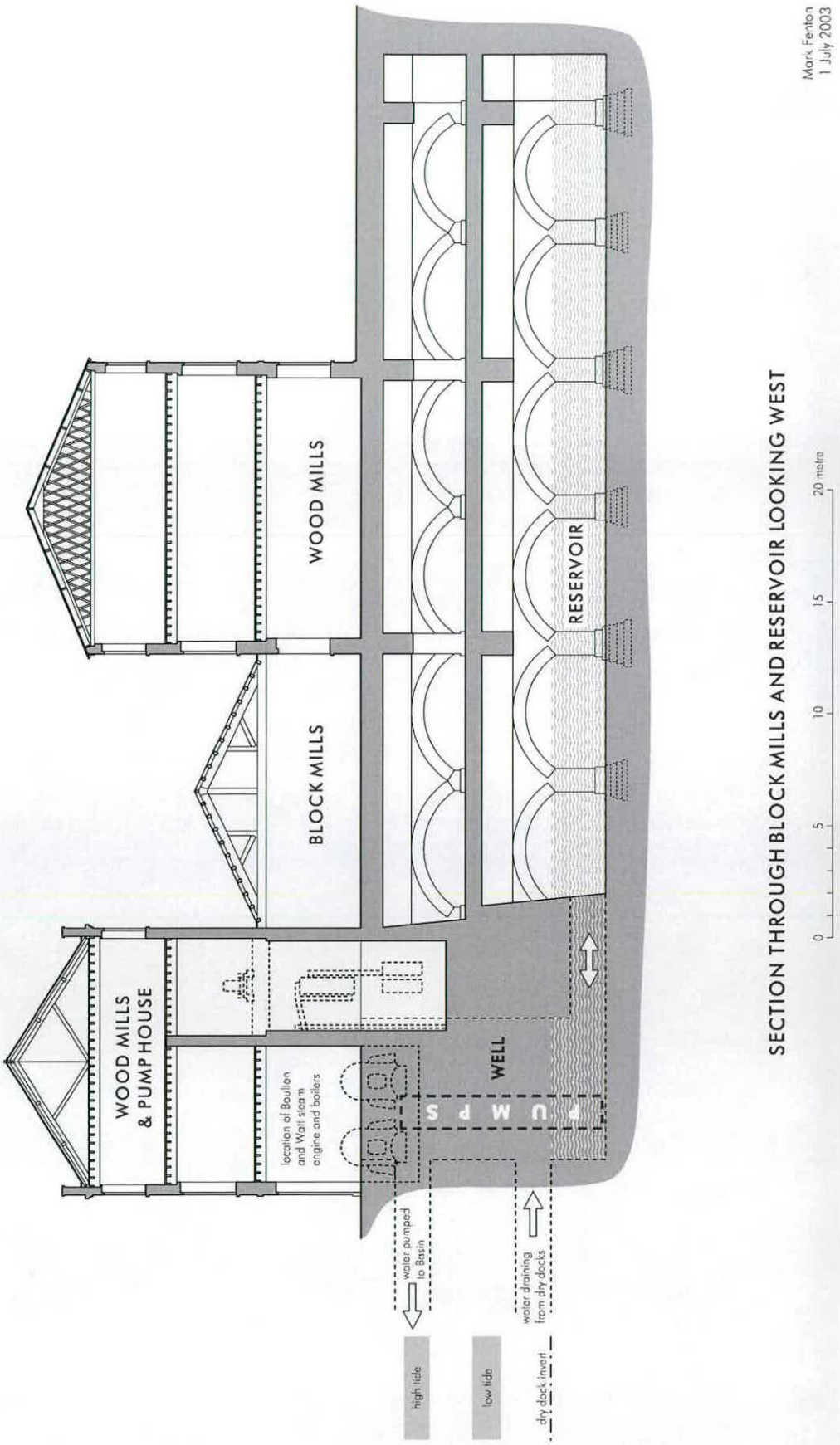

Figure 8. Section through the Block Mills and Reservoir Looking West

CONSTRUCTION OF THE WOOD AND BLOCK MILLS.

While the reservoir vaults were under construction, Bentham had been ordering a number of woodworking machines of his own design. By the Spring of 1802 these were arriving in the dockyard. No precise details of these machines have survived, but they almost certainly included mechanical saws and planing machines, possibly also self-acting morticing machines for which the general had obtained a patent in 1793. It is clear that Bentham was anticipating the completion of the vaults over the reservoir that would provide him with the space to construct a wood mill that would incorporate and make use of the two existing steam engines and their boiler houses. (See Figure 9)

On 14 April 1802, the Admiralty ordered the Navy Board to proceed with the construction of the wood mills at an estimated cost of £8827. The design envisaged two parallel east-west ranges with the space between them closed off probably with timber fences to form an enclosed yard for secure storage. The south range was to incorporate the existing steam plant and the reservoir pumps. Power was apparently transmitted to the north range by a drive shaft through the upper vaults of the reservoir. Each range was of three storeys with eleven-by-three-bay elevations, built using English-bond brickwork, with flat-headed windows and stone string courses over the lower storey. The architect was Samuel Bunce, a member of Bentham's staff and the first salaried architect to be employed by the navy. (See Figure 10)

By coincidence, the same day that the Admiralty authorised construction of the wood mills, Bentham was replying to Evan Nepean, First Secretary to the Admiralty Board, who had asked him to look at a model submitted by Marc Brunel for a system of making ships' blocks by machinery. In his reply, Bentham wrote:

> 'I am convinced that his invention is well suited to the purpose of manufacturing Blocks of all sizes with a degree of accuracy, uniformity and cheapness beyond what can be expected from the modes hitherto in use.'

This was a generous tribute, for earlier in the same letter Bentham had written:

> 'the making of blocks was one of the purposes for which it was intended to employ a part of the force of the steam engine erected in Portsmouth Dockyard'

- presumably using machinery designed by Bentham himself.

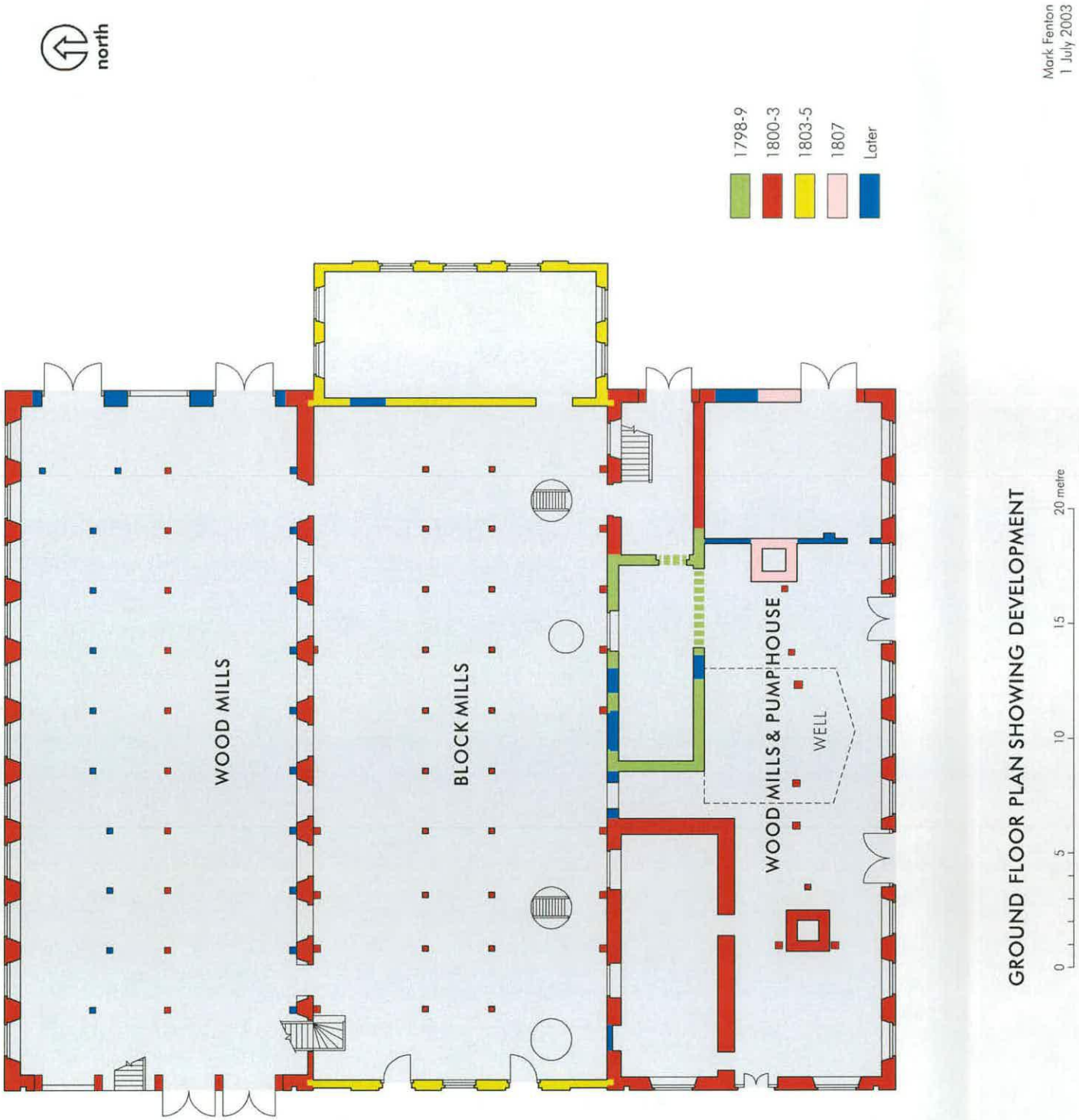

Figure 9. The Block Mills Ground Floor Plan indicating construction phases

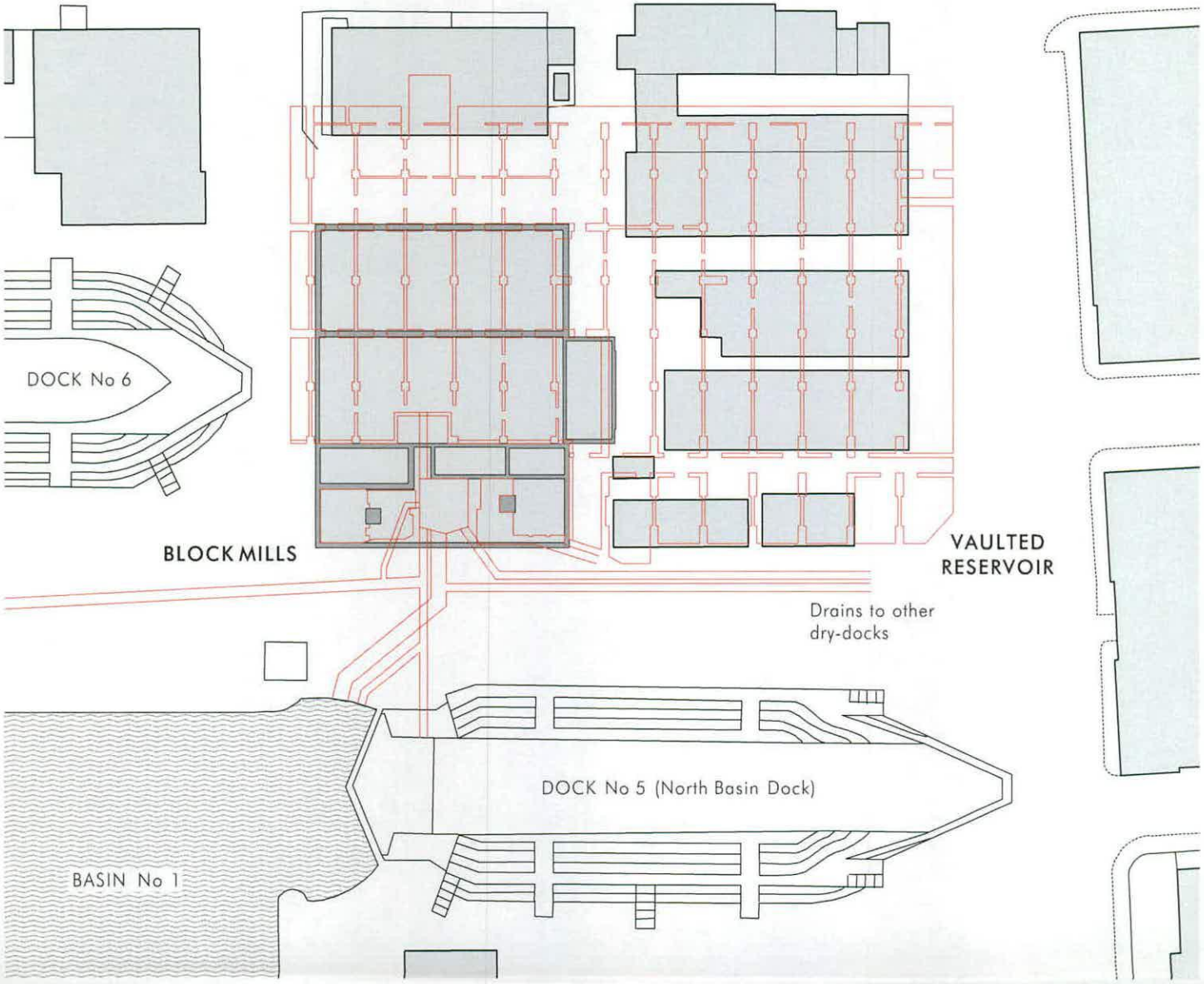

Figure 10. Portsmouth Dockyard. Plan of the Block Mills showing its relationship to the reservoir. Culvert details simplified.

On 2 August 1802 the Admiralty ordered the Navy Board to proceed with the necessary works to allow Brunel's blockmaking machinery to be put into production 'with as little delay as possible.' This bold decision was to transform the significance of the entire project. To accommodate most of the new block-making machinery, a single-storey building was added, infilling the yard. Internally, this is notable for the turned wooden Tuscan columns that support the roof trusses. These have no parallel in any other dockyard building and it is tempting to speculate that not only may they have been produced on some of Bentham's new wood-working machinery, but that they may also be manifestations of Bentham's awareness that what he was creating here would be a showpiece.

Conscious that all this machinery would need servicing and repair, Bentham suggested in June 1803 that a small workshop for the proposed resident engineer was necessary 'which should be on the same floor where the machines are fixed'. This workshop was added to the eastern end of the central range and was completed by 1805 along with the pedimented refronting of the west end of the central range.

Figure 11. The workshop added to the eastern end of the Block Mills. Its original equipment was to include a small forge and bellows, an anvil, vice and a 'good foot lathe with drills and chucks and a variety of hand tools'. [AA042457]

All these original buildings still stand, still incorporating the earlier engine houses, remains of the boiler houses and the great well shaft. There was to be a later addition of a single storey range of the 1830s along the north side of the north range to house vertical saw frames, but this was subsequently demolished. At the beginning of the twentieth century, steam power was replaced by electricity and the two boiler chimneys were reduced to below roof-level and capped. Possibly as a result of war damage, the northern range had its parapets removed and was re-roofed using a lattice-truss system. Internally, there have been alterations to the fabric over the years as machinery and drive systems were added, modified, replaced and repositioned. Fixing marks on floors, walls and roof timbers should enable a fairly comprehensive history to be constructed of the evolution of manufacturing here.

Figure 12. Portsmouth Dockyard at the end of the19th century. The Block Mills, still with their chimneys, lie just to the right of the top of the large chimney to the left of the picture. The small scale of this pioneering Georgian technology is dwarfed by the later 19th century workshops and foundries. [Photo Jonathan Coad Collection]

THE BEGINNING OF THE AGE OF MASS PRODUCTION USING MACHINERY 1803-1807

To produce all the various sizes of blocks needed by the Royal Navy, Brunel designed sets of machines of three different sizes. The first set for medium sized blocks was delivered in January 1803 and was operational by that summer. In May 1803 the Admiralty approved the ordering of a set of machines for smaller blocks which was in use within a year. By March 1805 the last set of machines for the 10-18inch blocks was in production. By September 1807, Brunel and Bentham felt sufficiently confident and experienced to state that the machinery could supply all the needs of the Royal Navy. The following year, the 45 machines produced 130,000 blocks.

Figure 13. A Brunel Corner Saw, photographed in 1968. [MPBW J371-2-68]

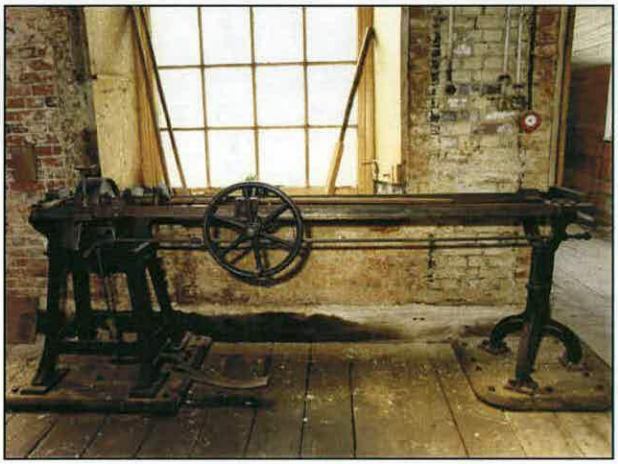

Figure 14. The surviving treenail machine on the first floor of the north range, photographed in 2003. [AA042412]

Although Brunel is rightly credited with the invention of this machinery, it is apparent from contemporary records that Brunel worked closely with both Bentham and Maudslay and that modifications to the machinery, some apparently suggested by them, were incorporated during manufacture. Bentham's contribution needs emphasising for he was a prolific inventor of wood-working machinery in his own right.

Figure 15.

The great Lignum vitae saw still in use in 1965. Note the set of original Brunel-made blocks used for hoisting.
[MPBW J391-6-65]

Figure 16.

The Lignum vitae saw in 2003, its belt drive still in place. [AA042414]

Figure 17. The first floor of the north range of the wood mills in 2003 showing the overhead power transmission. The Lignum vitae saw is off the picture to the right. [AA042411]

THE FAME OF THE BLOCK MILLS.

Although blocks may be of limited interest in themselves, such was the fame of Brunel's machinery as a mass-production manufacturing system that the entire section on 'machinery', amounting to 18 pages and seven plates, was devoted to it in Rees's famous *Cyclopaedia*. Later in the nineteenth century it was described in detail in a number of other encyclopaedias, including *Britannica, Penny, Edinburgh* and *Chambers*. In the *Encyclopaedia Britannica* it appeared in every edition from the fourth to the ninth of 1875. The Block Mills feature in most reputable histories of machine tools.

Apart from clock and watch-makers tools, the block-making machines were the earliest machine tools of substantial size to be constructed entirely of metal. Hitherto, frames for machines such as lathes had been made of wood. The use of metal throughout, except for the framing of the largest saws, greatly improved rigidity and accuracy and became standard practice in subsequent machine tool development.

The block-making machinery, each machine devoted to one aspect of the manufacturing process, also ushered in the age of the production line. From what is known of the disposition of the machinery within the building, this process took some time fully to evolve.

Not surprisingly, although the actual block-making machinery occupied only a part of Bentham's Wood Mills, it gave its name to the whole. So reliant was the Admiralty on this machinery, and so frightened of the consequences of a fire in the Block Mills, that in 1815 Brunel had a duplicate set of machines manufactured. These were stored in a fire-proof room at the new Chatham sawmills. Their eventual fate is unknown.

MANUFACTURING WITHIN THE BUILDING

It is important to remember that Bentham himself was an inventor of woodworking machinery, including planes and saws, and that the Wood Mills were originally designed for his own machinery and located here to take advantage of the navy's only two steam engines. Drawings of some of his woodworking machinery have been found, and it is hoped that in due course these can be investigated fully.

THE BLOCK-MAKING PRODUCTION PROCESS.

A block consists of three main parts: the shell, the sheave and the pin for holding the latter in the shell. Manufacturing each of these parts involved a series of distinct processes and machines before the final hand-assembly. The metal pins and the bell-metal coaks that were inserted as bearings for the pins in the sheaves were manufactured elsewhere, but the pins were finished and polished on site. The various machines used in the manufacturing process are named in *italics* below:

The elm shells passed through the following machines, starting as rectangular blocks of wood and finally being completed by hand: *Converting Saw* > *Boring Machine* > *Mortising Machine* > *Corner Saw* > *Shaping Engine* > *Scoring Engine* > *Spokeshave* and finishing.

The iron pin [timber pins were used for blocks intended for use in powder magazines] was forged cylindrical except for a short length at one end left square to bite into the shell and prevent rotation. At the Block Mills the pins went through two processes*: Pin-Turning Lathe* [to smooth the metal] > *Pin Polishing Machine* [final burnish].

The lignum-vitae sheaves passed through the following machines: *Converting Saw* > *Rounding or Crown Saw* > *Coaking Engine* > insertion of coak at this point > *Drilling Machine* > *insertion of rivets/ Riveting Hammer* > *Broaching Engine* > *Face Turning Lathe.*

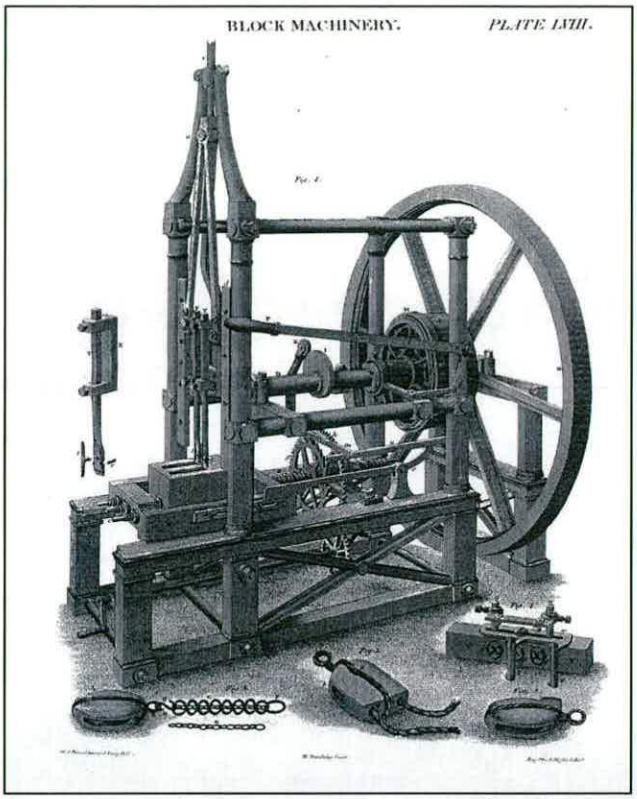

Figure 18.

Brunel's Morticing Machine, from Brewster's Edinburgh Encyclopaedia (1811) [Plate LVIII]

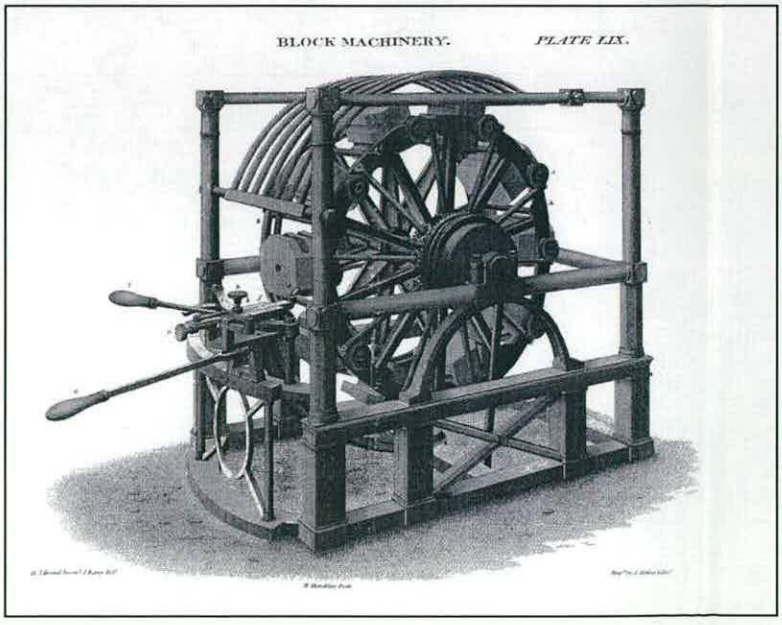

Figure 19.

Brunel's Shaping Engine, from Brewster's Edinburgh Encyclopaedia (1811) [Plate LIX]

The component parts were then hand-assembled. Other machines were available for specialised blocks and dead-eyes.

ORIGINAL LOCATION OF BRUNEL MACHINERY IN THE BLOCK MILLS

Rees' Cyclopaedia for 1812 indicates the following location of the 45 or so Brunel machines and shows how these occupied most of the space in the central and north ranges of the Wood Mills.

SOUTH RANGE:		
	Ground Floor:	Two steam engines, boiler rooms and chain pumps
	First Floor:	Partly occupied by Beam Engine; remainder used as store-rooms and workshop for small wooden articles.
	Second Floor:	Water cistern, store-rooms and workshops.
CENTRAL RANGE:		14 shell-making machines; one large boring machine; two dead eye machines
NORTH RANGE:		
	Ground Floor:	Five circular and two reciprocating saws to convert elm for shells
	First Floor:	Three lignum vitae saws, 13 sheave-making machines, 5 machines to turn and polish pins.
	Second Floor:	Store-rooms and workshops for small wooden articles.

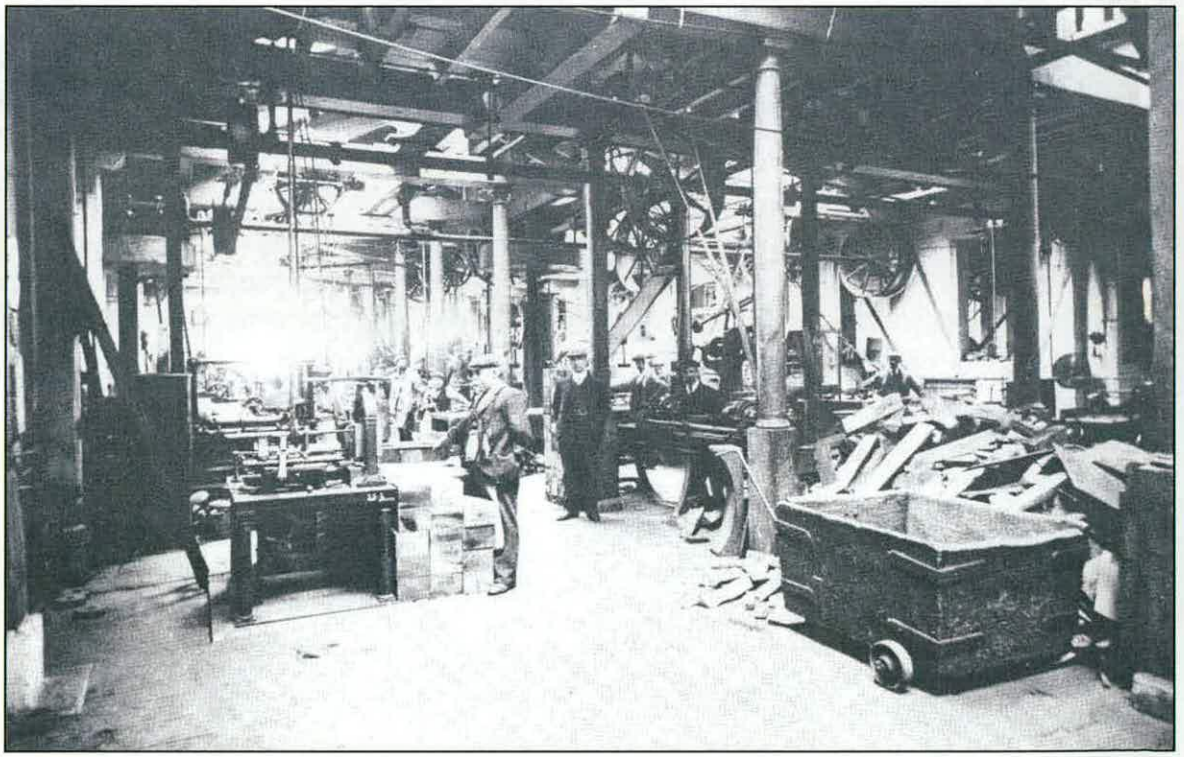

Figure 20. The Central Range of the Block Mills c.1900
[Portsmouth City Record Office]

CURRENT LOCATION OF SURVIVING BRUNEL BLOCK-MAKING MACHINERY

The Science Museum has the following eight machines: a converting saw of pendulum type, machines for boring and mortising medium sized blocks, machines for shaping and scoring small blocks. A converting saw for lignum vitae logs, and machines for rounding and coaking small sheaves.

Portsmouth City Museum has the following three machines: a boring machine, a mortising machine and a shaping machine. All are currently on display with the Portsmouth Dockyard Historical Society.

The Block Mills retains the following machinery in situ: A lignum vitae saw on the first floor of the north range; overhead line shafting, pulley wheels, oil bottles etc in central range. Small corner saw, large corner saw and a large scoring engine. These last three have been on display in No 6 Boathouse as part of a display by the Portsmouth Dockyard Historical Society. Throughout the Block Mills are the remains of overhead line shafting, cast-iron wall brackets and traces of fixings for machines on the floors.

There remain in the Block Mills a number of other machines unconnected with the block making process. In the former workshop is a 15ft bed lathe of 1830 by Collier of Salford. On the ground floor of the north range is a large overhead planing machine by Worsum of Chelsea, installed c1890. On the first floor is a trenail-making machine of early date. It could possibly be to a design by Bentham who is known to have proposed such a machine in 1797. This is a Maudslay-made machine, and drawings exist of a larger version.

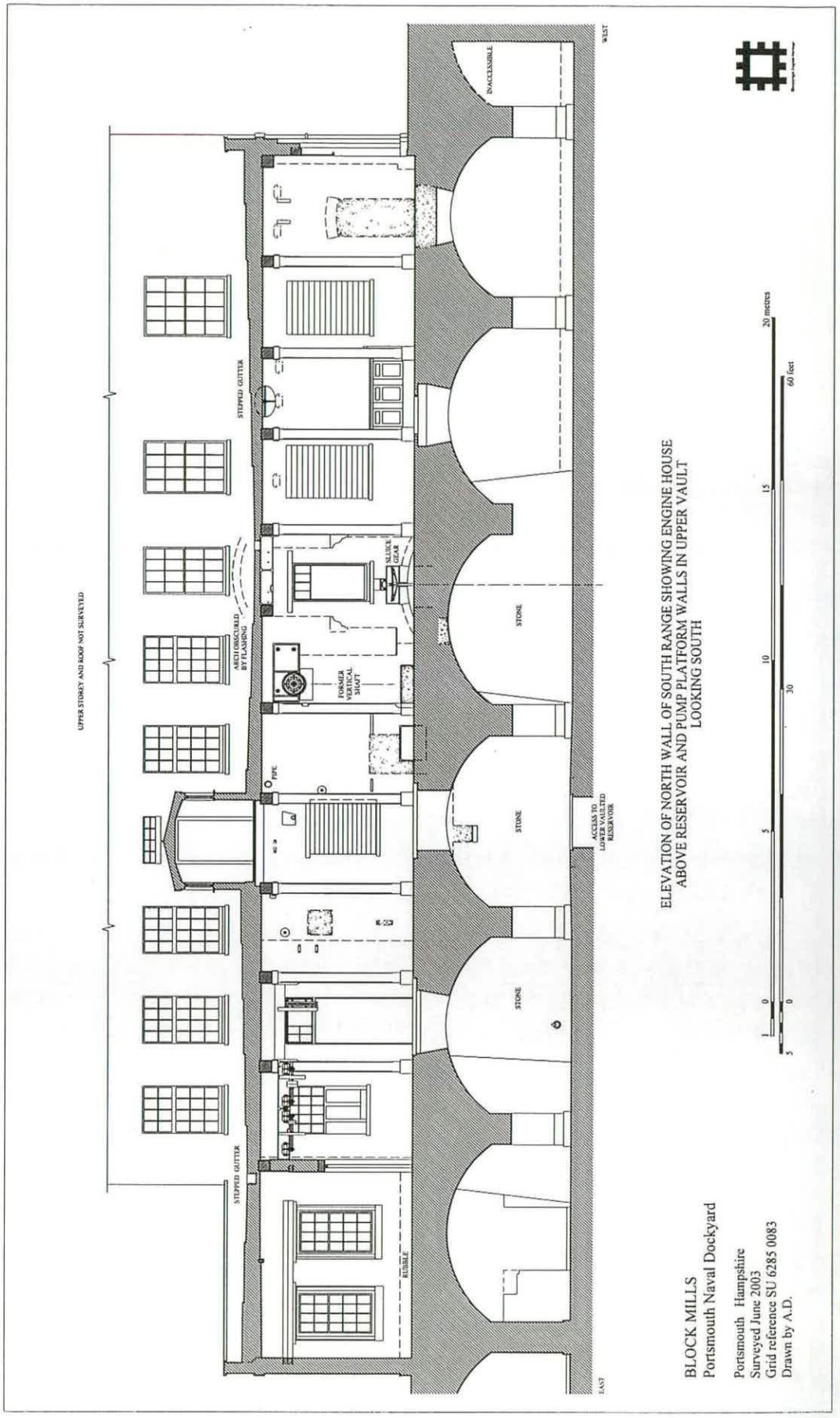

Figure 21. Elevation of the North Wall of the South Range of the Block Mills

A FUTURE FOR THE BLOCK MILLS.

The Block Mills retained a steadily-diminishing block-making and repair capacity into the 1960s, but long before then, most of the buildings had been given over to other uses. Other wood-working machinery came and went, while parts of the buildings were left vacant or used for storage. Hosemakers occupied some of the south range into the mid-1980s.

A growing awareness of the importance of the machinery had led the Admiralty to donate eight machines to the Science Museum between 1933 and 1951; Portsmouth City Museum was later given a further three. Others remain in the building and on display elsewhere in the dockyard.

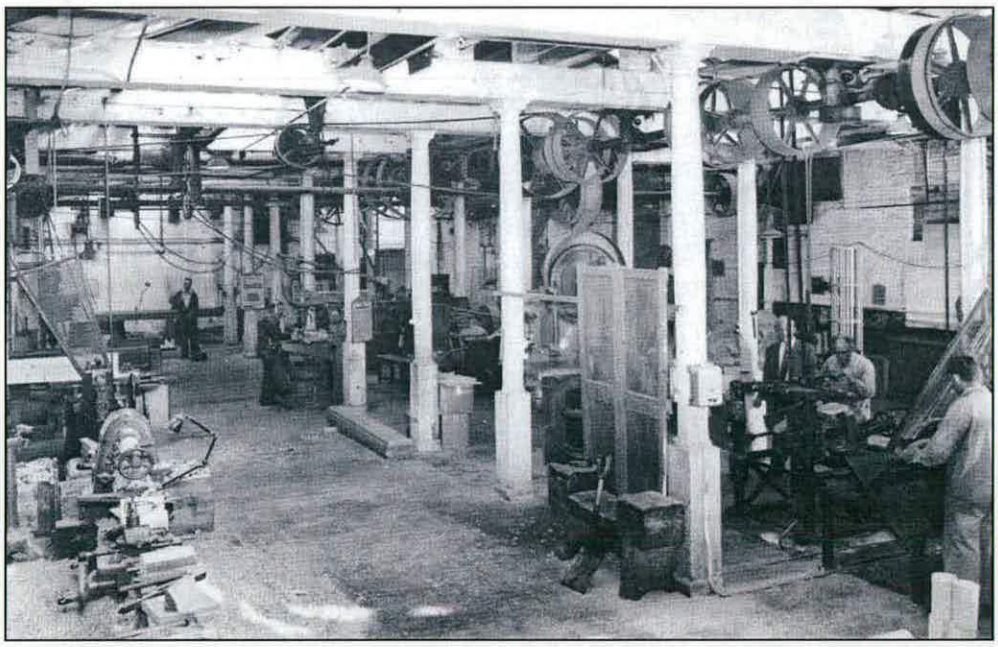

Figure 22 The interior of the Block Mills in 1965 shortly before production ended here. [Plate 183 from The Royal Dockyards]

In 1966 the Block Mills were scheduled as an Ancient Monument. A few years later the Ancient Monuments Board endorsed the Chief Inspector of Ancient Monuments' recommendation that the Block Mills and its contents were of such outstanding national importance that they should be taken into State care for conservation and display as a guardianship monument. The intention was to conserve the structure, replace the surviving machinery and make the building a centre for the history and display of dockyard engineering and technology used in support of the fleet. This transfer to the then Ministry of Public Building and Works was to take effect as soon as the Ministry of Defence could vacate the building. In the event, the Ministry of Defence retained a residual use for part of the building until 1986, by which time responsibility for the care of state monuments had passed to English Heritage.

The Block Mills have been little used for over 30 years and have stood empty for nearly twenty. Although there has been some maintenance of the main fabric of the building, there is concern about the deteriorating condition.

October 2005 will see the bicentenary of the Battle of Trafalgar. The numerous celebrations planned for that year will rightly focus on Lord Nelson's famous flagship and the circumstances and events surrounding the battle. But March 2005 also marks the bicentenary of the installation of the final set of block-making machines, signalling the completion of the Block Mills and the real start of mass-production. On 19 August 1805, HMS Victory had returned to Portsmouth Dockyard after two years continuously at sea, mainly leading the watch on the French naval base of Toulon. Her thorough refit at Chatham in 1803, and subsequent maintenance by her crew, meant that only minor repairs and overhaul of her masts, spars and rigging were now needed. For three weeks she was in dockyard hands before sailing with Nelson to rejoin the Mediterranean squadron off Cadiz on 28 September 1805. It is entirely possible, if unprovable, that the short Portsmouth refit saw some of the new machine-made blocks being fitted to her rigging.

Figure 23. The Block Mills across the Great Basin seen from the starboard side of HMS Victory. [AA042376]

Today, HMS Victory lies in sight of the Block Mills on the far side of the Great Basin. If the former is perhaps the most famous warship in the world, the latter was a key element in the modernisation of the royal dockyards that built and sustained the Royal Navy and is one of the most historically significant industrial buildings in the world. It would be entirely fitting if an appropriate future for the Block Mills could be devised and implemented in time for its own bicentenary in 2005, to emphasise the absolute interdependence of the Royal Dockyards and the Royal Navy.

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