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ROPE MAKING AT CHATHAM DURING THE EARLY NINETEENTH CENTURY

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Although an increasing amount of material is gradually being published on the naval dockyard at Chatham, relatively little has been directed to the ropery. Further, that which has been written concentrates almost exclusively upon the eighteenth century.[1] This is a most unusual oversight given that the Chatham ropery was of equal or even of greater importance during the nineteenth century, undergoing a massive series of changes in terms of management style, technology and the nature of the workforce. This paper will concentrate upon the early nineteenth-century ropery and attempt to correct this shortcoming in the history of such a large-scale industrial enterprise. Attention, in particular, will be given to the introduction of steam power, and new workplace practices.

Central to the manufacture of rope at Chatham during the early years of the nineteenth century were a number of core buildings, most of which still exist. Largest of these was the double rope house, which had been constructed between 1787 and 1791. Being 346m in length and three storeys high, it replaced two buildings constructed during the early seventeenth century – the spinning and laying houses. Other buildings making up the ropery were two hemp houses for the storage of hemp together with various additional stores and a tarring house. Of the two hemp houses, the larger stood immediately to the east of the rope house. It was originally constructed between 1728-9 and subsequently enlarged in 1743-47 and given a second storey in 1812-13. A second hemp house, attached to the north wall of the double rope house, had probably also been constructed during the early part of the eighteenth century. The two hemp houses provided storage for newly purchased bales of hemp, the basic raw material for the manufacture of rope. In addition, there were two yarn houses, one for the storage of white yarn and the other for black yarn. Both had been constructed during the general rebuilding of the ropery that had taken place between 1787 and 1792. Similarly, the tarring house, in which yarn was dipped in tar to prevent decay, was built during this

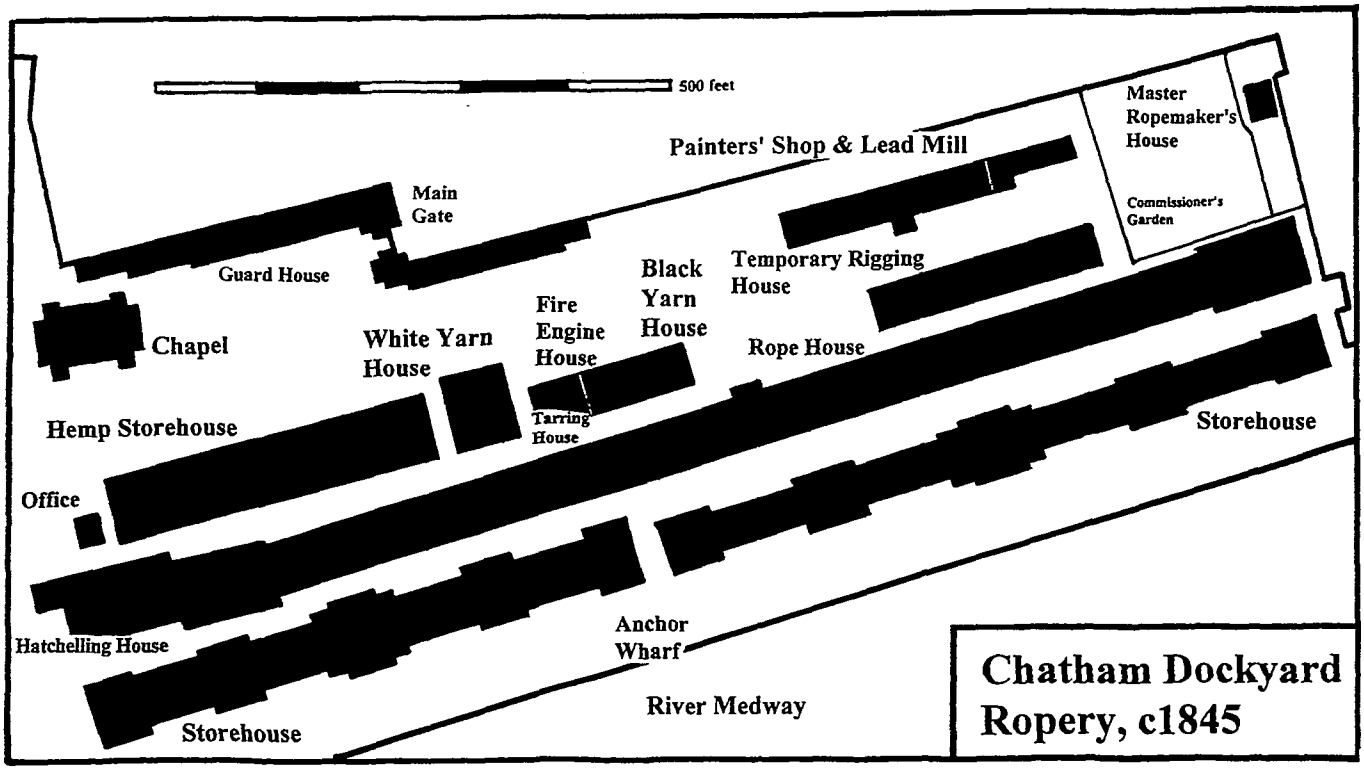


Fig. 1 Chatham Dockyard ropery re-drawn from an original map held at the National Maritime Museum Caird Library, NMM ADM/Y/C series.

same period. Through each of these buildings the raw hemp progressed, subjected to the various stages of manufacture before eventually reaching the laying floor of the rope house, for conversion into rope.[2]

Before proceeding further, a more detailed consideration needs to be given to the method by which rope was manufactured in the royal dockyards during the early nineteenth century. Of particular value is a Navy Board document dating to November 1823, which provides a complete description of the processes involved. It resulted from a general inspection of the roperies at Chatham and Portsmouth, the object being to consider how improvements might be brought about in terms of quality and economy. Initially, the visiting committee gave consideration to the quality of the raw material. At that time, hemp employed in rope making mostly emanated from Russia, usually described as Riga or St Petersburg hemp, with some use also made of Italian hemp,

> A comparison of the quality and strength of the Italian Hemp, with that of Russia occupied much of our attention; and the decided superiority of the former was proved by a variety of experiments, but particulars of which will be found in our minutes, and without dwelling upon our report in a more minute detail on the strength of the two sorts of Hemp, it will be sufficient to state that a piece of Italian Rope of 3 inches in size sustained a strength of 3 hundredweight more than a piece of Riga Rope of the same size, and the experiment was made several times with nearly the same result; and in the other sizes of Rope the same relative superiority was proved.[3]

The quest for an alternative source for the supply of hemp was to be an important objective throughout this period. Underpinning this was an Admiralty desire to break free of its hitherto heavy reliance on Russia, given that this country was a potential enemy. It was one reason why Italian hemp was under consideration, as also was chain cable.[4] A few years later, in 1832, and for the same reason, Chilean hemp was brought to Chatham for testing.[5]

The raw hemp, normally in bales of approximately a ton in weight, arrived at Chatham during the autumn, brought to the yard by specially commissioned merchant ships. Unloading was carried out at the anchor wharf, a large force of additional labourers employed for this purpose. Immediately prior to off-loading, each bale was inspected; the visiting committee of 1823 noted of the inspection procedure:

> We have every reason to believe that the Officers of the Yard discharge their duty in the receipt of Hemp with due fidelity to the

> Public, and fairness to the Contractors, so that according to the agreement none but good merchantable Hemp is received; and governing themselves by this principle. We regret to find that the Hemp of this year is not generally fit for the service, and that much of it has been rejected, so that the Board will be disappointed in their desire to make up by the present importations, for the deficiency of last year.[6]

Once approved and off-loaded, the bales were transferred to the hemp house for storage. It was here that the committee noted shortcomings in the methods used for storage:

> The mode of preserving the hemp in the Storehouses by guarding it from damp or currents of air has been pointed out by former Committees of the Board but as we doubt whether the Directions which have been given are acted upon in the same manner in all the Yards we recommend that an Order should be sent to each Yard to see that the bundles are all thoroughly free from damp before they are lodged in the storehouse, and that when there the whole be surrounded with Canvas, but the top left uncovered to let the heated air escape, and to be stowed so that the Hemp is not in contact with the walls.[7]

These instructions were duly despatched to the yards on 24 November, with the officers at Chatham ropeyard subsequently taking exception to the suggestion that hemp was not stored at the yard in the most appropriate conditions. The resident commissioner of the yard, Charles Cunningham, on behalf of the senior officer of the ropery, the Master Ropemaker, clarified the situation as it existed at Chatham:

> I beg to acquaint you that every attention is paid thereto, some of it is stowed against the sides of Houses which are lined with Board of a sufficient thickness to keep them dry, and where the sun comes upon it. As the bundles are open for inspection, it is stowed away loose, and is frequently opened for examination, and has always been found in good condition. I therefore suggest whether it would not be unnecessary to follow the process of placing canvas behind the hemp so circumstance, as described in the aforementioned letter, a measure, which in my opinion, and in the officers opinion, will not add to the security of the hemp, or afford any further protection against damp, than the measures before described have been found to do.[8]

The Navy Board, therefore, chose to pursue the matter no further, although they did reiterate, in a subsequent letter, that the regulation 'for the receipt of hemp in future should be carefully attended to'.[9]

Reverting back to the committee report of November 1823, attention was also drawn to the danger of hemp becoming over-hot; it indicated that the windows of the hemp house 'should be opened in dry weather, and occasionally the upper bundles thrown aside, and

those below brought to the top to guard against its heating'.[10] Overheating of hemp was a serious problem, leading to rapid deterioration in the quality of the product. Some three years earlier, for instance, the officers of the ropeyard at Chatham had reported 96 hauls of white yarn (effectively hemp in an early stage of production), which had been coiled three months earlier, becoming 'so hot in the centre that the thermometer stood at nearly one hundred degrees'. On this occasion, it was thought possible that the overheating had occurred through the application of too much train oil, this a necessary application during the hatchelling of hemp as it eased the combining process.[11]

Hatchelling was the next stage in the process and carried out in the hatchelling house, this adjoining the north wall of the ropery. The bales, having been broken up, batches of hemp were taken to this building where it was to be combed into fine hairs by labourers of the ropeyard.[12] To achieve this, a hatchel was used, a board upon which was set forty sharp-pointed iron pins and through which the tangled fibres of hemp would be pulled. It was at this stage that train oil was applied, especially useful if the hemp was dry. Normally applied through the use of a birch broom that was first dipped into a jug of oil and then struck over the top of the hatchel board. At Chatham however, it appears that a different procedure was in use, workmen applying the oil by hand. It was this incorrect procedure that could result in an over-application of oil, leading to the overheating of the previously mentioned hauls of yarn.[13] The visiting committee of 1823 provided the following description of how hatchelling was performed:

> The commencement of Ropemaking is first to issue a quantity of Hemp to each hatchellor, who having passed it several times over the hatchel, or cone, retraces in his hands the clean long fibres called topped hemp which is set aside for the manufacture of Rope above 3 inches; the part which is coned off by the hatchellor is collected together and sent to the Dresser under the name of Toppings the dresser in the process of his business collects from the Toppings a certain portion of Hemp, which in some of the yards amounts to one-half, at others to only one-third . . .[14]

The next step was to give the topped and dressed hemp to the spinners to be spun into yarn. This was undertaken on the spinning floors, these situated on the two upper floors and the loft of the double ropehouse. Each spinner would twist a portion of hemp fibres over a hook on a manually turned spinning frame. As the frame turned, he would slowly walk backwards, allowing yarn to be formed under the guidance of his left hand. At the same time, from a bundle of hemp

thrown over his shoulder,[15] and using his right hand, further hemp would be added as the yarn lengthened:

> The next step is to give the topped and dressed hemp to the spinners to be spun into yarn. The quantity issued is 64lbs to every four spinners, which is then divided into eight parts, each part intended to spin two threads and one quarter, but from not always being equally divided, it often happens that the yarn is spun into different sizes, but to make this more intelligible, suppose that in the division of the 64lbs one bundle is 9lbs, another only 7, it follows that as the yarn must be of the same length, one must be thicker than the other, and as the yarn so different in size might not, and probably would not be made up in the same Rope so as to let the one compensate for the other, it must frequently occur that the Ropes are greater or less than they were designed to be.[16]

The committee considered this an unsatisfactory arrangement and felt that each spinner should work from a bundle of the proper weight:

> It is therefore necessary to give general orders upon this head, directing that each spinner shall have a bundle of hemp to himself of the proper established weight, and that when delivered to him he is to take care to sort the quantity so as to have the yarn of equal size and strength.[17]

At this stage the yarn was transferred to the white yarn house in preparation for tarring. Here it usually remained a number of days – even longer on occasions – the tarring process at Chatham at this time only undertaken one day in every week. Of course, in busier periods, particularly if the nation was at war, the tarring process might be carried out three or even four days per week. The white yarn house stood adjacent to the tarring house, the yarn to be tarred passing through hatchways, via rollers, to the tar kettle. This was a large heated vat that kept the tar constantly boiling. However, care had to be taken not to let the tar either boil too lightly or too fiercely. In the case of the former, it was considered, incorrectly, that the tar would not have sufficient power to penetrate the yarn and, if the latter, it would not remain.[18] The yarn was drawn through the tar by means of a horse-powered capstan. Once pulled free of the kettle, any excess tar was subsequently squeezed from the yarn when it passed between a pair of steel plates, one convex in shape and the other concave, known as a nipper.[19] A manually operated capstan, set in the roof, pulled the tarred yarn through a further hatchway. This led across to the black yarn house where the wet tarred yarn remained to dry for at least two days.[20] Given, that at this stage heavy reliance was placed on both horse and manual power to operate the capstans, the attention

of the committee in 1823 was given to the possibility of introducing steam power, the cost of using horses being noted: 'The expense of tarring the yarn by horse is 2s per haul, each haul consisting of 400 yarns, and as it is usual to tar 20 hauls in a day, the expense amounts to £2 per diem'.[21]

Once dried, the tarred yarn was wound on to bobbins and returned to the rope house where the individual yarns were combined into strands on the ground level laying floor. This was achieved through the mounting of the bobbins at one end of the floor and attaching the yarn ends to a rotating hook mounted on a wheel frame. The wheel frame, manually powered and mounted on wheels, travelled the length of the laying floor, drawing out yarn from the bobbins and twisting the strands together. Each strand, to prevent theft, having the government mark inserted in coloured worsted through the whole length of the strand, the mark at Chatham being yellow. The final stage in the process, that of closing or 'laying' the great ropes, was also carried out on the laying floor. Here, it was the strands that were now being combined to form ropes of varying thickness. Laid out along the length of the laying floor, one end of the strands to be combined were connected to hooks that could be rotated on a fixed point, the back frame, while the remaining ends were attached either to a wheel frame, in the case of small ropes, or one of the larger jack wheels. To both separate the strands, and keep them at a constant height, trussels (or trestles) were placed at intervals between the jack wheel and back frame, removed in turn as the jack wheel moved forward. The hooks, both at the fixed point and on the jack wheel were then turned by manual labour, this twisting the strands to form rope with the jack wheel drawn along the laying floor. A further recommendation, and resulting from discussions with William Fenwick, the Master Ropemaker at Chatham, was that only jack wheels should be employed on the laying floor, with all of the frame wheels moved to the spinning floor.

> It would also be proper to direct the wheel frames in the several Yards to be moved up to the spinning floors by which there will be an opportunity of applying the wheel frames to two different sizes of strands at the same time and thereby afford the opportunity of making a greater quantity of cordage.[22]

The following describes how the combining of yarns and strands took place, which also applies to the combining of strands into rope:

> The end of a rope yarn being thrown loose, it will immediately untwist, and this with considerable force and speed; it would, therefore, be a fruitless attempt to twist two such yarns together; yet the inge-

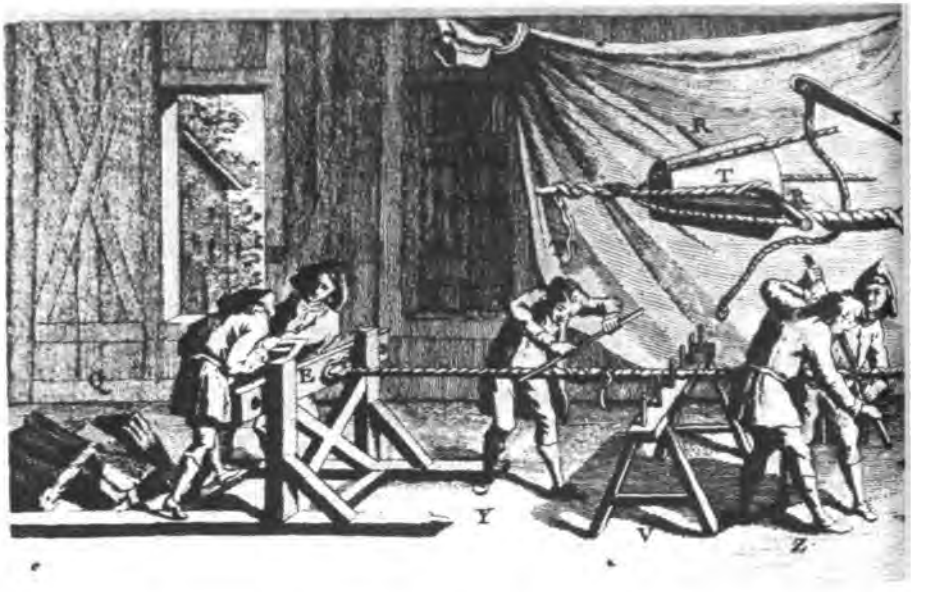
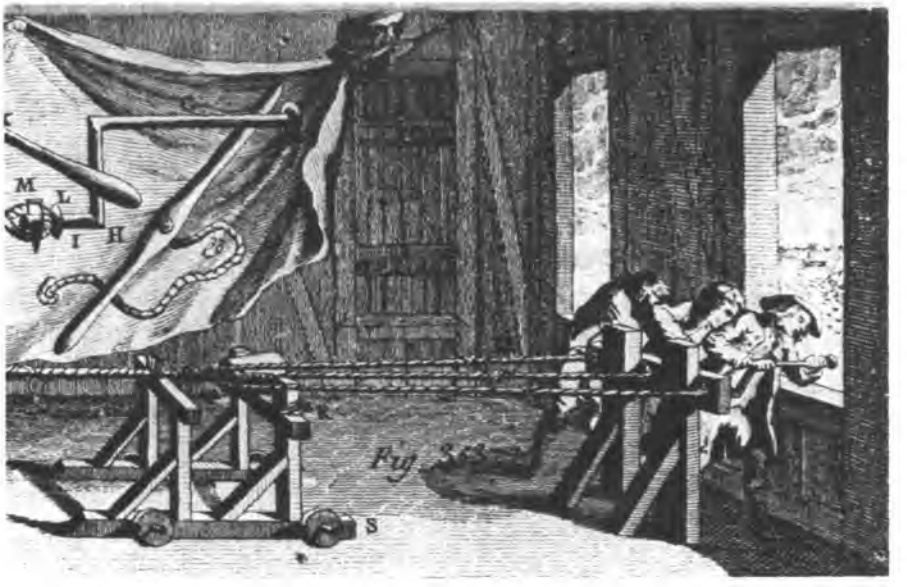


Fig. 2 A simplified version of the closing of hawser laid rope depicted in an 18th century engraving. A 'top' (marked T) has been inserted just before the point of closure and held in place by a top cart (S).

> nuity of man has contrived to make use of this very tendency to untwist not only to counteract itself, but even to produce another and a permanent twist, which requires force to undo it, and which will recover itself when the force is removed. Every person must recollect, that when he has twisted a pack thread very hard with his fingers between his two hands nearer together, the packthread will immediately curl up, running into loops or kinks, and will even twist itself into a neat and firm cord.[23]

In reality, to form ropes of great thickness, all that varied was the nature and size of the machinery together with the number of men required to fulfil the task. As for the great ropes, these were either cable or hawser laid, the former having three large strands, each of them containing three smaller strands, or nine strands in all, everyone of them of 37 original yarns, altogether 333 yarns; a hawser laid rope containing only three strands. To undertake the final process of laying hawser and cables, the stretching and laying placed such a high demand on labour that between 70 to 200 men were required.

Central to the spinning and laying processes were the frame and jack wheels. Frame wheels at Chatham were used both for the com-



A trussel (V) is supporting the strands upon combining while woolders (Z) are employed in helping twist the rope in the same direction as the cable is being laid.

bining of yarn into strand and for the closing of ropes under 2in. in circumference. The frame wheels in use at Chatham during the period of inspection were of timber construction with the wheel of the frame turned by hand. This sharply contrasted with the jack wheels, operated by manually turned winches driving endless ropes that ran the length of the laying floor. Employed only in the closing of ropes, the jack wheels in use at Chatham had been manufactured by the Henry Maudslay company twelve years earlier, possibly designed by Marc Brunel.[24] There were five jack wheels in total, these of varying sizes and all of iron construction. A fact that should be noted was that these had originally been designed for the purpose of being powered by steam, the Navy Board, at the time of their introduction, determining instead that they should be manually powered.[25] In their simplest form, the jack wheel machinery need consist of nothing more than a series of rotating hooks and a set of wheels that allowed the machine movement. However, owing to an invention by Joseph Huddart in 1793, the jack wheels in use at Chatham were much more sophisticated. Huddart, while captain in the service of the East India Company had observed the frequent breakage of ships' cables and

PLATE I

Two of the original Chatham ropery jack wheels that were delivered to the yard in 1811 having been constructed by the Henry Maudslay Company

found this to be a result of the outer yarns in the strands taking most of the pull while the inner took hardly any strain. Following retirement from the service he developed the idea of the yarns passing through a register plate and a forcing tube, these between them ensuring the yarns were equally taut and shared an equal amount of stress. The register plate divided the yarn by circular concave shells with holes for each yarn while the forcing tube compressed the strands and preserved the cylindrical contour of the surface. Huddart's register plate and forcing tubes were both incorporated into Henry Maudslay's machinery. However, the visiting committee of 1823 were not convinced that the register plates were correctly used at Chatham:

> With a view to greater expedition in making Rope it is the practice in the King's yards to run the yarns in four instead of single. The meaning of this is that four yarns are put upon the reel together, and when brought in to use for making Rope the four are run through one hole in the minor or register plate instead of placing the yarn upon the reel single and when making it into Rope giving each yarn a separate hole.[26]

Indeed, to reinforce the point, the committee went so far as to compare the strength of 3in. rope cordage made both singly and in fours:

> The Rope made of yarn runs single, sustained 15 hundredweight more than the other and as the fact of its 'greater strength appears to have been very well known by the Ropemakers' it is extraordinary that the frequent letters of reprobation written by the Board upon the subject of feeble cordage issued to the ships, this circumstance was never pointed out as the cause.[27]

As a result, a further order was issued, stating that yarn should only be spun singly. In doing so, it was admitted that this would be a very tedious process, but suggested that this tediousness would be overcome by the introduction of a steam engine for the forming of strands. The particular steam engine the committee had in mind, was similar to one already employed at the Limehouse commercial ropemaking yard, a further invention of Joseph Huddart. To emphasize the point, the committee also enumerated several other advantages that would result from the introduction of such a machine:

> The forming the strands by the Huddart steam engine will affect a saving of nearly one-third of the expense of making rope: or in other words, it will enable five men, who now make two ropes to make thirteen and the same charge for wages, namely 5/3d each man. [Furthermore] Huddart's steam machinery has the advantage of preserving a steady and uniform stretch upon all the yarns, on strands: while in manual labour the exertion or relaxation of the men must necessarily occasion an inequality in the bearing upon the yarn, or strands.[28]

However, the machinery was not to be immediately forthcoming and for this reason, so it would appear, the order for the more effective use of the register plates was ignored, the matter again having to be raised in October 1833 when methods of manufacturing cordage at the French naval yard of Cherbourg were under consideration.[29]

A further device that should also be considered at this point is the 'top' (see Fig. 2). Much older than the register plate and forcing tube, possibly dating to the manufacture of rope by the ancient Egyptians, it was basically a short cone of hardwood. Of considerable importance, it ensured uniformity in the process of twisting the component parts together. Each strand passed through one of three lengthwise semi-circular grooves that were cut into the top and, as the rope closed, it squeezed the top forward, at a point just before the point of closure, so ensuring production of complete three-stranded rope.

Some idea of the labour involved in manufacturing the large ropes can be gleaned from an account produced by Simon Goodrich in 1808. As with the inspectorial visit to Chatham in 1823, he was concerned to bring about improvements to the workings of the ropery, his survey resulting in the introduction of the Henry Maudslay machinery first brought to Chatham in 1811 and which should have incorporated the use of a steam engine. His description of the preparation and work required in the forming of strands for a 24in. cable makes interesting reading. Goodrich notes that 74 men were required to undertake this work, but for the subsequent closing of the cable, a total of 220 would be required:

> Seventy-four men are employed in forming the three first strands of a 24 inch cable; supposing the yarns to be reeled into the Tubes, the Machine brought down. One spinner attends the reels. The Layer attends at the Tubes to the forming of the Strands – twelve men assist in turning the Machine in going up. One puts in the Trussels. Fifty-nine men are employed at the fixed power at the upper end in drawing the machine up, seventy-four men close three of these into a cable strand. The three are cut off at the tubes to their proper length of 150 fathoms at lower end and placed on the hooks of one of the large Closing Machines, the fifth or sixth size, and all the men go down from the upper end excepting 30 and the strand is hardened up by the men at both ends all employed in twisting and woolding [men employed in turning the cable in the same direction as being laid] till the strand is hard, excepting the Layer. It is hardened up 8 fathoms before the Top is put in. Then the three strands are put on the middle hook and the top goes in for closing. The 30 men at the upper end begin to twist, the top advances and the other men at the lower end twist as many as can at the winches, and the woolders assist. The layer alone manages the top which advances upon a sledge and one man takes the trussels down as the top advances. When the strand is made it is 118 fathoms long. The operation may be repeated till 18 strands are formed, enough for six cables.[30]

While most of the committee recommendations could be implemented, those relating to the use of steam power to aid both the process of tarring and the forming of strands was something that required not only further planning but a considerable outlay of expenditure. As a result, the steam machinery failed to be introduced for a number of years. Instead, attention was given to a series of minor technological improvements, some of them not of overall benefit. Two of these improvements, both of which came to be questioned, were the introduction of cylindrical rollers in the formation of yarns and the use of flat nippers in the tarring house. Both were considered in September 1827 when William Fenwick was

brought before a further visiting committee. He indicated that cylindrical rollers, an invention of Joseph Parsons, the Portsmouth Master Ropemaker, tended to injure the yarn by drawing it through an increased number of hooks and rings than formerly. As for nippers, the tar was not so equally pressed out as with concave and convex nippers previously used.[31]

Generally, throughout the early part of the nineteenth century there was a great willingness to consider new ideas, the letter books of the resident-commissioner at Chatham regularly including details of experiments undertaken on lengths of rope manufactured by other methods or using alternative materials. In June 1817, the rope yard officers at Chatham were asked to consider samples of rope supplied by Thomas Grant of St Helens, a manufacturer of rope who had substituted tarring for a composition of black mineral paint:

> which rope he [Thomas Grant] states will be found equally pliant with the same sort of rope not painted (a piece of which accompanies the specimen) & much stronger than it would be if tarred.[32]

In being sent samples, the officers of the ropery were ordered 'to cause an experiment to be made of the paint' reporting on its 'strength and durability and its ability to crack and admit water'.[33]

Later that same year, experiments were undertaken on rope manufactured by Mr Bounsall. He had been invited by the Navy Board to demonstrate a model of the machinery he used for the manufacture of cordage. The Navy Board subsequently informing the officers at Chatham that they had ordered Mr Bounsell to Chatham ' . . in order that Experiments may be made upon the plan proposed by him, which we understand can be done at small expense'.[34]

In a subsequent report on the experiment, the rope produced using Bounsall's method was compared with rope previously manufactured at the Portsmouth naval ropery. Instead of proving the quality of the commercially produced rope, it simply threw up questions about the navy's own quality of rope. When put into a breaking machine to test its strength, the Portsmouth rope broke far too early, suggesting that it was a product of faulty manufacture. Subsequently informed of this, the Commissioner of Portsmouth dockyard, William Shield, was 'perfectly at a loss to account for the great super- iority Mr Bounsall's cordage had over the rope made in his yard' and requested that portions of the failed rope should be returned to Portsmouth for further tests.[35]

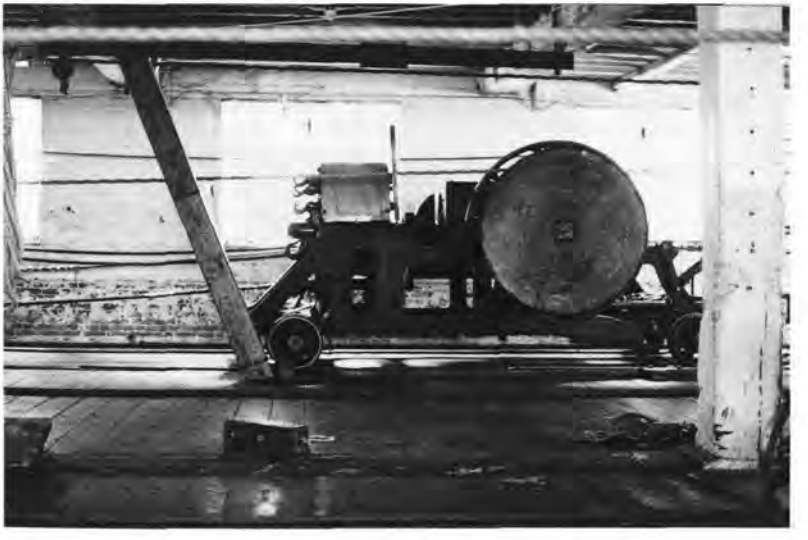
In the quest to bring about improvements in the manufacture of rope, considerable attention was also given to the workings of large

scale manufactories other than those controlled by the Navy Board. The war time period (1793-1815), in particular, had placed great demand upon the supply of rope, with numerous improvements developed. Among these, of course, were Huddart's various innovations at Limehouse. Two particular large-scale manufacturers of rope were William Heppenstall's works at Doncaster and Grimshaw & Co of Sunderland, both of whom had introduced new apparatus for the spinning of yarn. In 1804, Samuel Bentham, Inspector General of Naval Works, directed his mechanist, Samuel Reke, to visits the two factories and report on the value of the improvements, with a recommendation for Grimshaw's machinery to be installed at Woolwich.[36]

The post-war period opened further possibilities for the examination of alternative procedures of rope manufacture as a result of a more general period of friendship with France. In June 1816, William Pennel, the British consul at Bordeaux had been in contact with Bernard Dufourg, a former captain in the French marine, who was the inventor of ropemaking machinery installed at Rochefort. This machinery, so it was claimed, had brought about great savings, with the inventor prepared to offer both his machinery and technical help to the Admiralty for the sum of £25,000. In essence, Dufourg had developed a machine that wove a larger number of yarns into rope at an early stage, so foregoing the final process of closing with three large cable strands. This, according to Dufourg, not only allowed for a reduction in the total number of yarns required but also produced rope that was approximately 15 per cent stronger. For its part, the Admiralty was sufficiently interested in having a copy of the report sent to Chatham where it was examined by William Fenwick. However, Fenwick, having made a comparison of the strength of rope made by Dufourg's machinery, compared with rope made at Chatham, found the French rope to be considerably weaker.

Some years later, in 1833, a report on the workings of the naval ropery at Cherbourg, was sent to Moxon, Fenwick's successor at Chatham. This had been drawn up by Joseph Parsons, who had, together with Admiral F.L. Maitland, the Superintendent of Portsmouth yard, visited the dockyard at Cherbourg. A number of procedures considered superior to those in British naval roperies had been highlighted with a view to adoption. For this reason Moxon had been sent a copy, with an instruction that these new procedures should be introduced at Chatham. In particular, it was noted that in spinning yarn at Cherbourg, spinners were instructed to spin four threads per hour, while at Chatham the number was five threads per hour. This had led Parsons to declare that 'it is natural to suppose a better yarn is made'. Indeed, so important was it to the authorities at

PLATE II



One of the heavier jack wheels brought into the yard during the mid-1850s. Unlike its lighter predecessor, it was designed to run on rails

Cherbourg that this number should not be exceeded 'that the young spinners have a rope fastened to one leg which obliges them to go over a certain distance within a given time'. It is possible that James A. Gordon, the superintendent at Chatham from 1832 until 1837, was already aware of this report. Leastways, some six weeks earlier, and with Admiralty approval, he had reduced the number of threads to be spun to four per hour. Another innovation adopted as a result of Parson's report was the use of a redesigned register plate that drew out one strand at a time rather than in multiples of four, so allowing the strands to 'lay smoother' and with more regularity.[37] It was a point to which the committee of 1823 had also drawn attention, noting the misuse of register plates that should have been used to draw out single strands.

Attention to workplace practice was another aspect of improving the quality of rope produced at Chatham. During the Summer of 1833, two major changes were introduced, both affecting the system by which the ropemakers were employed. One of these concerned hours of employment, spinners often being allowed to leave the yard once a

PLATE III

A trustle used to support and separate the yarn and strands during the processes of combining and closing

specified amount of work was completed. As a result, many were leaving their place of employment considerably earlier than the rest of the work force.[38] This had long been identified as a cause of rushed spinning, detrimental to the final product. In September 1833, the Admiralty brought an end to this practice by declaring that no ropeyard worker could leave early.[39] Superintendent Gordon, in a letter to the Admiralty, indicated that the practice had long been in existence, but had become markedly worse from December 1822:

> the workmen have for many years past been allowed to quit the yard as soon as their stint were finished: and it therefore followed that their particular attention was directed to get it done as soon as possible without paying that due regard to good workmanship which they ought. In place of this it appears that on 3 December 1822 twenty pounds per cent was ordered to be abated from the rope makers task scheme, but to prevent their wages being reduced thereby they did twenty per cent more work in nearly the same number of hours as before and thus kept their wages precisely as before.[40]

The need for rigorous enforcement of the dockyard day became of even greater importance upon the adoption of the system whereby

spinners were required to spin four yarns per day instead of five. Introduced for the purpose of improving quality, it would have had the opposite effect had spinners continued to leave upon completion of a set amount of work. As well as introducing the four yarn per hour rule, Gordon was responsible for setting out activities that might constitute a fair day's work for additional rope yard duties. Hatchellors, under his instructions, were to complete seven bundles per man while those responsible for splitting and preparing the hemp for hatchelling had to split thirty bundles per day.[41]

A second major change for the ropeyard workforce was the introduction of classification. This moved the emphasis away from payment by results, known as task work in the dockyard and ropery, to that of a standard daily wage. However, to ensure both a reasonable output and a high level of quality, each worker was placed in one of three classes, with those in the first class paid at a higher rate than those of the second or third. However, entry into the first class was restricted, given only to those artisans with a proven level of efficiency and enthusiasm. Most therefore, were entered into the second class. The third class, with an even lower rate of pay, was reserved for those deemed inefficient or lethargic. Promotion and demotion between classes was a further aspect of the scheme and one deemed to encourage greater enthusiasm. At the outset, it was expected that one-third of the workforce would enter the first class, with the largest number placed in the second class. As to which worker joined which particular class, this was left to the dockyard superintendent, with Gordon at Chatham determining that of the 138 spinners employed, only 16 were to be initially placed in the first class. Of the remainder, they would be moved between the second and third class on 'a day-to-day basis according to the work in hand'.[42] However, unlike many other areas of the dockyard, task work was not completely abandoned in the ropery, allowing spinners to still benefit from the higher rates of pay that resulted from its use. In particular, piece rate payment was still seen as the most practical means of remuneration for those employed in the closing of the three cable strands on the laying floor where time was of the essence. Here, failure to complete the work by the end of the day would prove costly as it could not simply be abandoned overnight, the task having to be finished as a single process.

The system of classification was introduced on 1 August 1833 and from the start was not well received. In particular, it was seen as distinctly unfair, men in the second and third classes carrying out identical work during the same period of time for approximately 12 per cent less. Rather than show their opposition in the form of strikes, a method rejected by yard workers since the beginning of the century,

the spinners and labourers of the ropery joined with other artisans of the dockyard in a petitioning campaign, placing their grievances before the Admiralty.[43] Initially, the Admiralty ignored their demands for the ending of classification but were forced to be more responsive when local Members of Parliament and other dignitaries were drawn into the campaign of opposition. Eventually the Admiralty conceded, first bringing an end to the hated third class in April 1840 before finally abolishing the first class in September of that same year. In part, only, was the Admiralty decision a result of the workforce campaign. A more cogent factor was the increasing difficulty of recruiting and retaining skilled workers, the system of classification, together with generally low rates of pay, encouraging the young and able to seek employment elsewhere.

Two further grievances during this period concerned superannuation and the status of hired labourers in the ropery. Superannuation had long been a major advantage of employment in the dockyards, a man completing twenty years service automatically entitled to payment of a regular sum upon retirement. Shortly before the introduction of classification however, a scheme had been introduced that would phase out superannuation by making it unavailable to all new workers entering the dockyard and ropery. This had added to the discontent expressed throughout the 1830s, the Admiralty, in May 1839, trying to assauge work force anger towards classification, reintroduced the right of superannuation to all permanent members of the work force. In doing so, they failed to increase the level of payments that had been set in September 1809 and which, through inflation, had become hopelessly inadequate. The matter was again brought to the attention of the Admiralty and levels of payment increased by an order-in-council of August 1842, which increased the amount to be paid from £15 to £20, depending on length of service, to £20 to £24.[44]

The hired labourers of the ropery had a particular grievance, their conditions of employment entirely different from those permanently employed. At one time, the vast majority had been given a high degree of permanence, all entitled to superannuation and regular daily incomes that included days set aside for holidays. Admittedly none of this extended to those employed on a temporary basis, this at one time hardly mattered. Those so employed were either brought in to cover only limited periods of hectic activity or soon found themselves entered as permanent employees. In the post-1815 period all this had dramatically changed, a strong desire for economy seeing hired-labour status a permanent feature of rope yard employment. Individuals so employed, although accrediting to themselves many years of service, were at a distinct disadvantage when compared with

those achieving permanency. Moreover, under classification they were initially paid at the second class rate of 2*s*. 6*d*. per day with this subsequently reduced to the third class rate of 2*s*. In common with other members of the work force, they brought their grievance to the Admiralty through the use of petitions:

> The Petition of the Hired Labourers employed in Her Majesty's Dock yard at Chatham. Most humbly sheweth, That in consequence of the very high price of every necessity of life, your petitioners find their present wages (two shillings per day) very inadequate to the support of their families, and to furnish for themselves that portion of food requisite to keep up their strength sufficient to endure the labour to which they are subjected.
>
> That the price of Labour in the neighbourhood being at the present time from two shillings and ninepence per day – Your Lordships Petitioners beg to make known their distressed condition humbly entreating your Lordships will be pleased to take it into your humane consideration, and grant them such increase in pay as your wisdom may seem meet – for which act of humanity your Lordships humble Petitioners will as in duty bound ever Pray.[45]

On the matter of not being allowed holiday entitlement pay, a further petition was produced in 1838:

> The Petition of the hired Ropemakers employed in Her Majesty's Rope yard at Chatham most humbly Sheweth, That, although your Lordships have been pleased to establish certain Holidays for the workmen of the Dock yards, your Petitioners have hitherto been deprived of their pay on those occasions, and as most of them have families dependent on them for support, the loss of the pay is severely felt by your Petitioners, as their wages are barely sufficient to procure the necessaries of life for themselves and families.
>
> Your Petitioners therefore most humbly beg leave to approach your Lordships, entreating you will be pleased to take their case into your humane consideration and grant them the Privileges allowed to the rest of the Workmen of the Dock yards viz. to be paid their full wages for all the Established Holidays for which your Lordships Petitioners will as in duty bound ever Pray.[46]

Amidst all the upheaval surrounding workforce conditions, the 1830s also saw the first introduction of steam power into the ropery at Chatham. It had been a long time in arriving. The visiting committee of 1823 had recommended its introduction as had Simon Goodrich in 1808. Furthermore, the steam machinery brought to the ropery in 1837 was specifically to power the Henry Maudslay jack wheels designed for steam a quarter of a century earlier. A sum of £2,500 was raised in the government naval estimates of 1836, this to cover the

cost of a 14hp steam engine built by Boulton & Watt. To provide the necessary accommodation for the new machinery, the hemp house adjoining the north wall of the ropery was partially demolished and replaced by an engine house.[47]

The arrival of this machinery was to completely revolutionize the process of ropemaking at Chatham. On the laying floor it immediately reduced the necessity of employing such a large proportion of the work force during the final closing of the heavy ropes. Furthermore, it paved the way for construction of much larger and heavier jack wheels, these more able to handle the heavier ropes. Constructed within the dockyard and first used in the 1850s, these particular jack wheels were constructed to run on newly installed sets of rails that ran the length of the laying floor. At the same time, thought was given to making greater use of steam power, with a second engine providing power for the processes of hatchelling and spinning, a series of spinning jennies now installed on the top floor of the remaining hemp house. This machinery, which required of the operators only limited skills, now saw both the hatchelling and spinning processes undertaken by semi-skilled labour together with part-trained spinner apprentices. However, they in turn were to be superseded, the work of spinning eventually given to women.

The employment of women in the spinning process first occurred in 1864 when approximately 90 women began work. This was not the first employment of female labour in the dockyard, as women had been employed in the colour loft, manufacturing flags, since the end of the eighteenth century. However, there was a distinct difference between the two groups, with employment in the colour loft restricted to the wives or daughters of those either incapacitated or killed in dockyard or naval service. As a result, those employed in the colour loft were treated with a good deal of respect, with Joan Ryan, who has researched the early employment of females in the dockyard, noting that this particular group were always referred to as the 'ladies of the colour loft'.[48] The newly employed females entering the ropery were not accorded this same level of respect, referred to as 'the women of the ropery'. This reduced level of status resulted, in part, from their social background, not being widows or daughters of those previously in Admiralty service. In addition, less value was placed on the work they were performing, especially when compared with the skill of producing an intricately patterned flag, the ropeyard workers seen only as machine minders. In keeping with nineteenth-century views of morality, the women were strictly segregated from men, with female employees having separate entrances, staircase and mess room. They also worked different hours, so as to enter and leave the yard at different times to their male counterparts. Their only contact

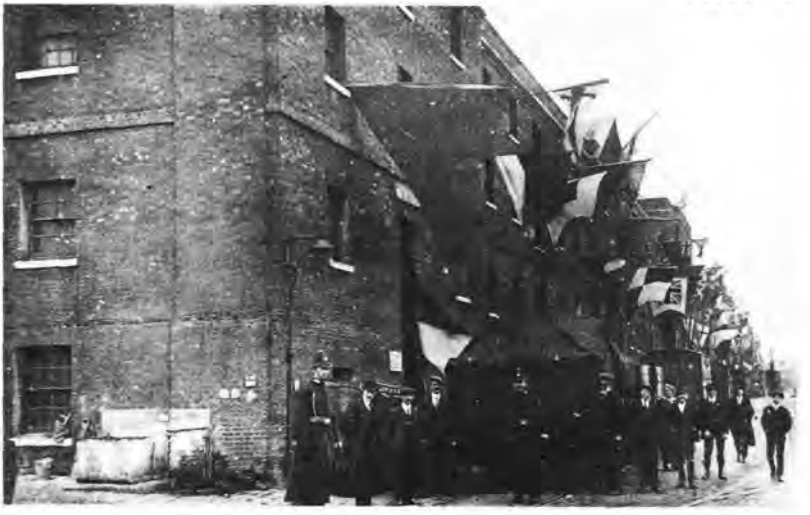
PLATE IV

Women were first employed in the ropery at Chatham in 1864 and, from the outset, were provided with separate entrances, a tradition that continued into the 20th century

with a man was that of their overseer. As for the reason for the introduction of women into the ropery, this was strictly an economy, it being possible to pay them less than men.

A visit to the present-day laying floor of the ropery at Chatham provides an interesting stepping stone to mid nineteenth-century Britain. Although most of the machinery is now electrified and the steam engines long dismantled, much else is little changed. The jack wheels, a mixture of those built in both 1811 and the 1850s, can still be seen, with the later ones still at work and undertaking exactly the

PLATE V



For the celebration of peace in 1918, the men of the ropery, together with one woman, appear in this rare photograph of the celebrations that took place on the Anchor Wharf. Here were located the main storehouses of the ropery

same work that they first began over 150 years ago. The spinning process, which is still carried out on the upper floor of the hemp house has undergone more serious modification, the machinery here mainly installed during the 1970s. However, to one side of this area may be found machines dating to the early twentieth century.

ENDNOTES

[1] J.G. Coad has given particular attention to the 18th-century ropery at Chatham: see 'Chatham Ropeyard' in *Post-Medieval Archaeology*, Vol. 3, pp. 143ff (1969); 'Manufacture of Cordage in the Royal Dockyards, 1760-1815', in *Gueres et Paix* 1660-1815 (Service Historique de la Marine, Rochefort, 1987), 211-19. In addition, the Chatham Historic Dockyard's own 16-page handbook to the ropery dwells almost entirely on the 18th century adding only a few, and not always accurate, references to the 19th century: see R. Holdsworth and B. Lavery, *The Ropery. Visitor Handbook* (Norwich, 1991). A brief consideration of the 17th century ropery at Chatham can be found in: Philip MacDougall, '"Refusing 'to do the Stint"': an early industrial conflict at Chatham Dockyard', in *Bygone Kent*, 16:1, 45-53.

[2] Coad (1969) *op. cit.* (see note 1), 152-5. In this paper, Coad provides a detailed description of the ropery as constructed at the end of the 18th century, the buildings of the ropeyard undergoing little further change until the introduction of steam power.

[3] PRO ADM106/3237, 4 November 1823.

[4] BL Add Ms 41, 399, 19 January 1831.

[5] NMM CHA/H/4, 12 Nov 1832.

[6] PRO ADM106/3237, 4 November 1823.

[7] *Ibid.*

[8] PRO ADM106/1827, 30 December 1823.

[9] *Ibid.*

[10] PRO ADM106/3237, 4 November 1823.

[11] NMM CHA/F/33, 5 January 1819.

[12] In the 18th century this task had been undertaken by a semi-skilled group of workers classified as hatchellors. According to muster returns, the number so employed varied between twenty and thirty. See NMM ADM/B series, 1715-1801.

[13] NMM CHA/F/33, 5 January 1819.

[14] PRO ADM106/3237, 4 November 1823.

[15] NMM CHA/H/8, 8 October 1833.

[16] PRO ADM106/3237, 4 November 1823.

[17] *Ibid.*

[18] A subsequent inspection of French methods of tarring rope revealed that temperature of 145°, lower than that used at Chatham, was adequate. See NMM CHA/H/8, 8 October 1833.

[19] W.A. Falconer, *A New Universal Dictionary of the Marine* (London, 1815), 320, describes a nipper in ropemaking as follows: a machine formed of two steel plates, eight inches square, and half an inch thick, with a semi-oval hole in each four inches wide, which, by the upper plating moving, enlarges or contracts as the tarring of the yarn requires.

[20] Nowadays these three buildings, the white yarn, black yarn and tarring houses are connected. As originally built, they were not.

[21] PRO ADM106/3237, 4 November 1823.

[22] *Ibid.*

[23] Falconer, *op. cit.* (see note 19), 414.

[24] The possibility of the jack wheels being designed by Marc Brunel, the man responsible for the saw mills at Chatham, is postulated by J. Coad (1989), 220.

[25] Coad (1987), *op. cit.* (see note 1), 219. In his earlier essay on the 18th century ropery (Coad 1969), the assumption is made that steam had been introduced into the ropery in 1811. This is subsequently corrected (Coad, 1987). In this later account, Coad suggests the failure to introduce steam in 1811 was through a possible fear of fire, the ropeyards highly susceptible to such a catastrophe. Alternatively, Coad suggests, it might have resulted from the difficulty of finding a powerful enough engine.

[26] PRO ADM106/3237, 4 November 1823.

[27] *Ibid.*

[28] *Ibid.*

[29] NMM CHA/H/8, 8 October 1833.

[30] Science Museum, Goodrich Diary.

[31] PRO ADM106/3239, 25 September 1827.

[32] NMM CHA/F/30, 26 June 1817.

[33] *Ibid.*

[34] NMM CHA/F/30, 17 October 1817

[35] *Ibid*, 25 October 1817.

[36] PRO ADM1/3577, 27 October 1804.

[37] NMM CHA/H/8, 22 August 1833; PRO ADM1/3395, 22 August 1833

[38] Times were seasonal, the Winter day being much shorter, the ropemakers then leaving with the rest of the yard.

[39] PRO ADM1/3482, 6 September 1833.

[40] PRO ADM1/3396, 4 October 1833.

[41] PRO ADM1/3396, 4 October 1833.

[42] PRO ADM1/3394, 30 July 1833.

[43] For a more detailed discussion of classification see: Philip MacDougall, 'A Demand Fulfilled: Analysis of an industrial dispute between the Admiralty and the civilian workforce employed in the naval dockyards of southern England, 1833-41', in *Southern History*, 19 (1997), 112-134.

[44] ADM1/5511, 11 August 1842.

[45] PRO ADM1/5137, 7 June 1838.

[46] ADM1/5137, 22 June, 1838.

[47] BL Estimates and Accounts 1836, xxxviii, 180-1; PRO ADM1/3404, 20 Feb 1837.

[48] Paper presented by Joan Ryan to University of Kent conference on 'Maritime Medway' held at the Chatham Historic Dockyard, 25 May 2002.