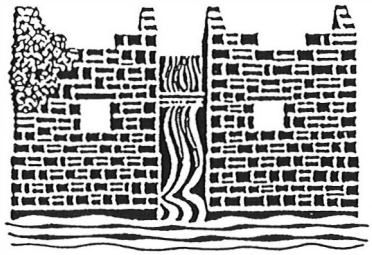


Gunpowder Mills Study Group

NEWSLETTER 21, AUGUST 1997

AUTUMN MEETING AT FAVERSHAM

24-26 OCTOBER 1997

It was originally intended that this would be a one-day meeting on 11 October. For various reasons this has been changed and we apologise to those who will be inconvenienced.

Provisional Programme

Friday 24 October

19.30 - 21.00 Dinner at a Faversham pub: "The Chimney Boy", Preston Street

21.00 - 22.00 Talk by Arthur Percival on "Faversham and its Gunpowder Industry"

Saturday 25 October

09.30 - 12.30 Meeting at the Fleur de Lis Heritage Centre, Faversham

09.30 - 10.15 Lecture by Keith Fairclough and Glenys Crocker on "17th and 18th Century Inventories of the Faversham Gunpowder Industry"

10.15 - 10.45 Lecture by Alan Crocker on "The 1796 Faversham Apprentices Illustrated Notebooks of 1796"

10.45 - 11-15 Coffee

11.15 - 12.30 Lecture by Wayne Cocroft on "The RCHME Surveys of the Faversham Gunpowder Mill and Explosive Factory Sites"

13.00 - 14.00 Lunch

14.00 - 17.00 Tour in shared private cars of some of the local sites (eg the restored Chart Mills, the substantial remains of the Oare Works, the surviving remains of the Marsh Works, the active Abbey Explosives Works (Long-Airdox) with 1920s equipment etc) led by Wayne Cocroft and Arthur Percival

19.30 - 21.00 Dinner at a Faversham pub: "The Chimney Boy", Preston Street

21.00 - 22.00 Talk by John Williams (Head of Heritage Conservation, Kent County Council) on "Challenges in Industrial Archaeology in Kent"

Sunday 26 October

09.30 - 12.30 Visits to sites not seen on Saturday afternoon

13.00 - 14.00 Lunch

14.00 - 16.00 Visit to the displays in the Fleur de Lis Heritage Centre (if not seen already) and general discussion of "The Faversham Gunpowder Industry" led by Arthur Percival and Wayne Cocroft and chaired by Alan Crocker

16.00 Depart

If you are interested in attending please, complete the enclosed form which gives further details about numbers, costs, accommodation etc.

THE SPRING MEETING IN LONDON, 1997

This meeting was held at the Institute for Historical Research on 24 May. The first paper was given jointly by Glenys Crocker and Keith Fairclough, who summarized their article "The introduction of edge runner incorporating mills in the British gunpowder industry". This has been accepted for publication in the *Industrial Archaeology Review*, and will probably be published in the 1998 volume due next May. Until recently the earliest reported date for the introduction of edge runner incorporating mills in Britain has been around 1720, at the Woolley mills in Somerset. Then in 1991, our member Vincent Conaghan prepared a feasibility study for restoration work at the Corkagh powder mill site near Dublin and found a reference to gunpowder mills 'with stones' being set up there in 1719 by Nicholas Grueber. Keith's discovery of inventories of the Sewardstone mills in 1708 and 1713 has now pushed back the date of the adoption of edge runners to the period of the French wars in the late 17th - early 18th centuries. Further details are given in an article later in this newsletter. An interesting technical point which was made in discussion was that the press poles mentioned in the inventories may indicate the use of lever presses, rather than screw presses. There was also discussion on the difficulty of quantifying the difference in capital cost between pestle mills and the more expensive edge-runner mills, and indeed on the general question, addressed by Keith in his part of the talk, of why it took so long for edge runners to be widely adopted.

The second paper on "Gunpowder and Other Mills at Regensburg" was given by David Jones, who is an authority on the history of millwrighting and very active in The International Molinological Society (TIMS). For several years he has been researching mill archives, mainly of the 16th and 17th centuries held at Regensburg City Museum. These are exceptionally well preserved as the mills belonged to the city and include many detailed plans and elevations, diaries and even models of mills. Regenburg is on the south bank of the Danube near two long islands and for many centuries its bridge was the only crossing point for several hundred miles in each direction. Because of river transport the danube could not be dammed to create a head of water for mills. Therefore undershot waterwheels had to be used. However the level of water in the river is very variable and therefore fixed waterwheels were impractical. One solution was to used waterwheels fixed to boats but by the 15th century waterwheels balanced on large pivoted timber frames, which could be raised and lowered had been developed. These were used for corn, polishing, oil, leather, fulling, spice, paper, saw, iron, copper, boring and gunpowder mills. Some of these were located on starlings or artificial islands supporting the piers of the bridge, taking advantage of the increased velocity of the water caused by the constrictions. Others were on the islands with water channelled to their wheels along extensive artificial channels or leats.

The first recorded gunpowder mill was built in 1534 opposite the city on the island below the bridge. However in 1541 it was rebuilt downstream, further from the city near the eastern tip of this island. This mill was damaged by floating ice, a recurring problem, in 1561. Then in 1612 a new mill was built on the south bank of the river just to the east of the city wall. It is not clear whether this was an alternative or an additional site. It was damaged by ice in 1616, burnt down in 1618 and rebuilt in 1619. Then in 1665 plans were deposited for a new gunpowder mill but it is not clear that it was built. All of these mills used stamps to incorporate the gunpowder. One of the plans dating from the 1550s shows a beam with seven mortars, three with single stamps and four with quadruple stamps. Another plan shows all single-stamps mortars and some of the mortars had small individual doors. It was pointed out that some of these stamps appeared similar to those used in oil mills and it was felt that a better understanding of the technicalities of the use of stamps for incorporating is needed.

It was a very stimulating talk and very impressive that a British molinologist had discovered

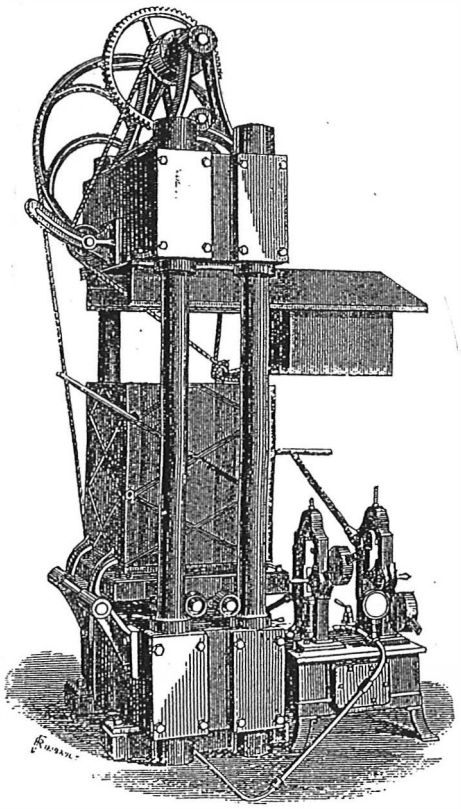
this wealth of information about historic mills in a German city. David's paper will be published in the proceedings of the TIMS conference which is being held in Budapest in August this year.

The final talk was given by Frederic S Lee, who is an American member working in the Department of Economics at De Montfort University, Leicester. His subject was "The Gunpowder Trade Association, 1872-1902", although he concentrated primarily on the first half of this period. In 1865, at the end of the Civil War there were about 31 gunpowder manufacturers in the States, mainly in New England and Pennsylvania. The lack of demand after the War caused prices to drop by 50%. A National Board of Powder Manufacturers was established in 1868 to try to stabilise the industry but it was not successful. Gradually Laflin & Rand and Du Pont emerged as the dominant companies, controlling the smaller manufacturers and dividing the market. The number of independent mills declined from 19 in 1870 to 10 in 1874 and to 1 in 1878. Then in 1878 a General Trading Agreement was set up. An article on the situation in 1874, as recorded by Lammot Du Pont, appears later in this Newsletter and it is planned to give a more detailed account of Frederic's talk in a future issue. It would be interesting to see a similar analysis carried out of the British industry, particularly the way in which Curtis's & Harvey were able to take over so many rival firms at the end of the 19th century.

At the end of the meeting Bill Curtis reported briefly on a visit he had made to the site of the Augusta gunpowder mills in Georgia and on the fact that he had acquired a very small sample of late 18th century powder. Brenda Buchanan then reported that she had become one of the four appointed Foundation Trustees for the Waltham Abbey project. Alan Crocker summarised provisional plans for holding a weekend meeting at Faversham in October and it was agreed that Bill Curtis should explore the possibility of holding another meeting at Bisley next Spring. Finally Glenys Crocker announced that the Group has about £500 in reserve.

THE MANUFACTURE OF GUNPOWDER IN *ENGINEERING* 1878 (continued)

In Newsletter **20** we printed six illustrations of machines for manufacturing gunpowder taken from vol 25 of Engineering (1878). A further four illustrations from the same series of articles are reproduced with captions in convenient spaces in the pesent Newsletter.



7. Hydraulic press consisting of a 2 ft square box containing broken-down gunpowder and gun-metal plates, a block if wood for pressing and a mechanism for rotataing the box from the horizontal loading to the vertical pressing position.. Constructed by Taylor & Challen of Birmingham: from *Engineering* of 1878.

THE CHANGE FROM PESTLES TO EDGE RUNNERS Glenys Crocker & Keith Fairclough

The present article is based on the talk given by the authors at the 1997 Spring Meeting reported above. It provides a brief outline of their forthcoming paper in the *Industrial Archaeology Review* (1) with a new table of sites on which the evidence has been summarised. Until recently, known evidence has placed the introduction of edge runner mills in the context of private trade, *c.*1720. However, inventories of the Sewardstone mills show that edge runners had been installed there by Sir Polycarpus Wharton by 1708.(2) It is deduced from the circumstances of Wharton's career and the financial problems which landed him in a debtor's prison by 1710,(3) together with evidence given by bargemen to the Court of Sewers regarding works on the River Lea, that the likely date of installation was about 1694. There is also a record from Wandsworth in 1715 of 'Millstones Vizt Eight Runners and four bed stones much worn and Severall of them Cracked, £20'.(4) Clearly therefore, the new technology had been adopted by manufacturers who were supplying the government during the wars with France which ended in 1713.

The Sewardstone evidence suggests that mills 'much differing from the common sort' which Wharton set up 'near Windsor' (probably at Wooburn, Bucks) in about 1681,(5) may well have been edge runner mills. It also resolves the problem of the relationship between the use of edge runner mills and the adoption of the press. Evidence of presses before the late 18th century has been elusive. Guttman stated that 'caking under presses was first done in England in 1784, but it cannot be ascertained whether the use of presses was invented in that year or earlier'(6) and Robert Howard favoured a late date for the acceptance of edge runners since they did not give a satisfactory product until the press was adopted for increasing the density of the mill cake.(7) The 1708 inventory of the corning house at Sewardstone records 'one press fixt with the pole and all other things thereunto belonging one trough for breaking the cake when presst'. The reason for the shortage of evidence for presses is probably that, before the introduction of hydraulic presses at the end of the 18th century, they were part of the equipment of the corning house and not of a separate press house.

The table shows gunpowder manufacturing sites with their known periods of operation up to 1772, the year in which pestle mills were in general made illegal by Act of Parliament. It also shows known dates for the use of edge runners at particular sites and for the use of iron edge runners, demonstrating that refinements were being made by the 1750s. The late use of pestle mills is also shown. The available evidence suggests that by the late 17th century edge-runner mills were perceived as the best type by some major British producers. They were installed by Sir Polycarpus Wharton at Sewardstone and probably Sir Peter Rich or his son Edward at Wandsworth during the French wars but fell out of use as their mills closed down. They were then reintroduced in the 18th century by manufacturers who had the necessary capital (Corkagh, from government support; Woolley, from the Bristol merchant trade). Long-established mills (Chilworth, Waltham Abbey) appear to have adopted edge runners from the mid-1730s onwards, perhaps as old equipment needed to be replaced.

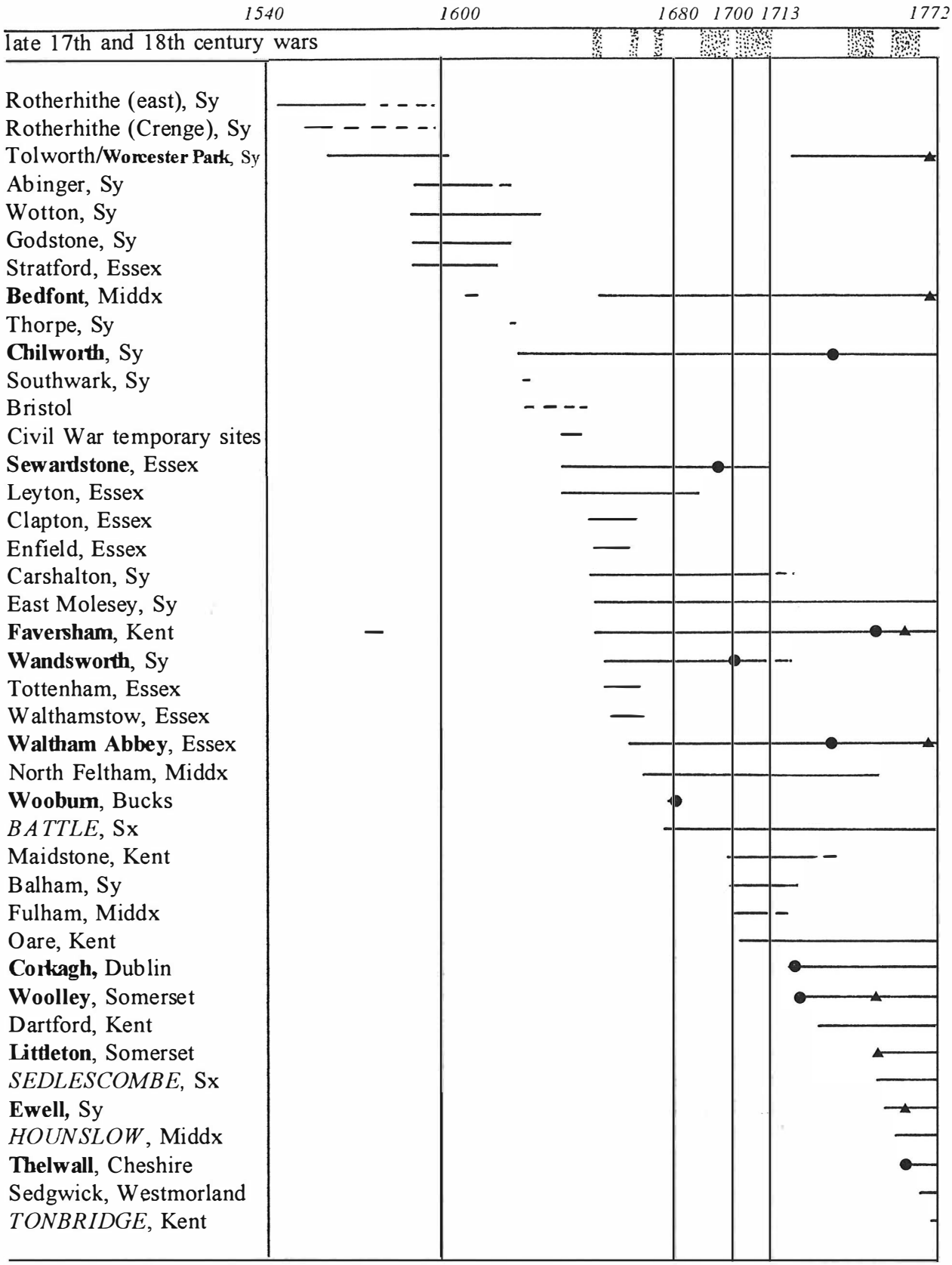
Discussion

Some suggestions may be made as to why it took so long for pestle mills to be replaced

1. Contemporary society was not ready for rapid technological innovation. There is little evidence that the Ordnance took an interest in stimulating improvement. Prince Rupert had done so, but this was perhaps a personal quirk that the administration was unable to sustain once he had died.

2. The association of the introduction of edge runner mills with Sir Polycarpus Wharton, if correct, was not the best advertisement for their use. Although there is no evidence that his

Recorded use of Edge-runner Incorporating Mills



Bold: edge runner mills recorded or inferred
- ● date of edge runners
- ▲ date of iron edge runners

ITALIC: mills using pestles in 1772
Sy: Surrey
Sx: Sussex

financial problems were were caused by the new technology, his economic failure cannot have encouraged others to investigate his methods, particularly since edge runners were more expensive. It is perhaps interesting to speculate as to why Sir Polycarpus used them only at Sewardstone and not at his larger manufactory at Chilworth, as present evidence suggests.

3. The risk of uninsurable accident would encourage conservatism in capital expenditure.

4. Later evidence from France and elsewhere shows that a different point of view existed which maintained that stamps gave a better quality product. It may be significant that there is no evidence of important Huguenot producers such as the Azires and the Gruebers introducing edge runners when they did innovate in other processes of manufacture (glazing). It may have been the safety factor which finally encouraged the use of edge runners rather than qualitative or economic considerations.

5. Congreve's concerns in the late 18th century show that little was known about obtaining the best results. Thus any advantages in using edge runners were not being fully exploited.

6. The higher demand for armaments in times of war can stimulate different responses. It can encourage technological innovation, or it can discourage this if it would delay production. The addition of extra stamp mills to existing capacity, or even the construction of temporary horse mills, might seem a more sensible option than installing the more expensive edge runner mills.

7. From the later 17th century onwards the Ordnance insisted on a competitive industry. After the 1670s they were no longer prepared to sign monopoly contracts with any one supplier, although there is some evidence that producers such as Walton and Grueber made overtures for such contracts during the first decade of the 18th century. In a competitive industry, with no guarantees of favourable consideration after the end of any war, there was less incentive to increase capital expenditure. After 1714 the long period of peace only encouraged such conservatism.

8. The producers at Woolley were aiming to supply a new growing market and may have had a confidence that new producers in the Home Counties would not have shared. As new producers they could easily choose new technology, whereas existing producers in a shrinking peace-time market would continue with existing plant until it became obsolescent. This may explain the piecemeal introduction in the Home Counties after 1714, and the more widespread introduction of edge runners as factories expanded and retooled for war once again after 1740.

9. Such a situation might suggest there was no great cost differential between gunpowder produced with stamps and that produced with edge runners, but evidence of this is needed.

Finally it must be emphasised that, as the table shows, much more evidence is required, particularly for the use of edge runners at established mills in the Home Counties.

References

1 Glenys Crocker & K R Fairclough, 'The introduction of edge-runner incorporating mills in the British gunpowder industry', *Industrial Archaeology Review*, forthcoming

2 London Metropolitan Archives Acc/1953 /C/1029/2

3 K R Fairclough, 'The hard case of Sir Polycarpus Wharton', *Surrey Archaeological Collections*, **83** (1996), 125-35

4 A G Crocker, G M Crocker, K R Fairclough & M J Wilks, *Gunpowder Mills: Documents of the Seventeenth and Eighteenth Centuries*, Surrey Record Society, forthcoming

5 A G Crocker, 'Wooburn (Bourne End) Gunpowder Mill, Bucks', *GMSG Newsletter*, **11** (Sept 1992), 15

6 O Guttman, The manufacture of explosives, 1895, vol 1, 204

7 R Howard, 'Black powder manufacture', *J Society for Industrial Archaeology*, **1** (USA, 1975), 13-28

THE GREENWICH GUNPOWDER DEPOT

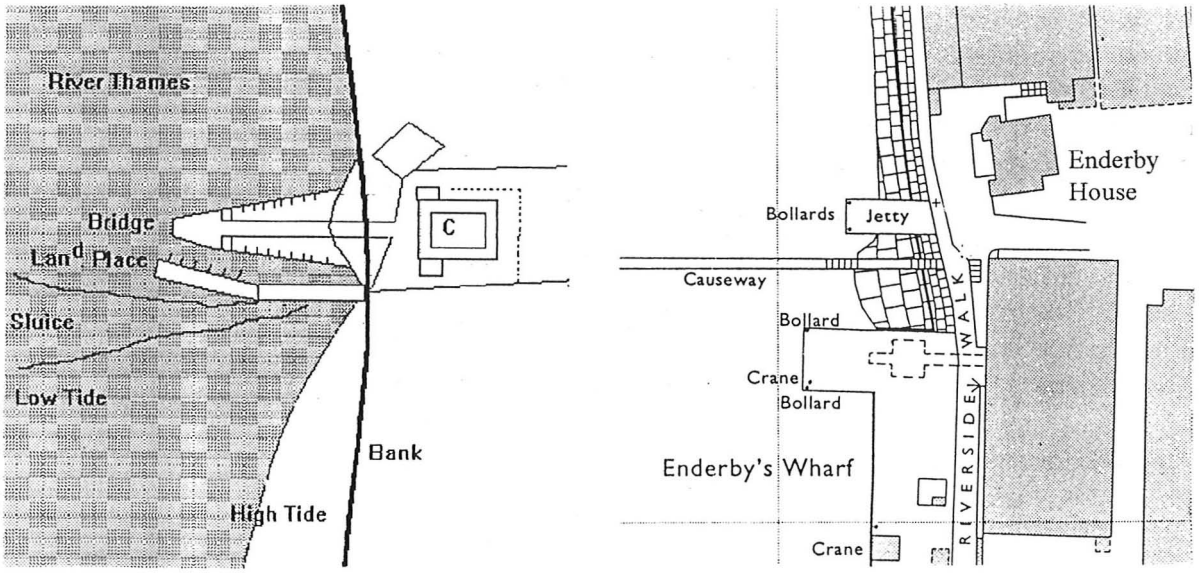
Mary Mills

Paul Guillery's recent excellent work on the Purfleet gunpowder depot contains some brief information about its predecessor at Greenwich. One point on which I was not happy was his statement that this was sited on what has since become Piper's Wharf. The reason for my disquiet was to do with land ownership. The major landowner for that area of Greenwich is a local charity, Morden College. While Piper's wharf was theirs, an ex-Government site would not have been in their ownership, unless there had been a reversionary clause. I do not entirely rule out that Morden College may not have reserved some rights over the site but, because the Government had been able to dispose of it in 1803, it is probable that any lease was a very long one. The main candidite was the very large site, taken over by the Enderby family in the early 1830s and which is today within the Alcatel/STC site.

This identification of the gunpowder depot site with Enderby's can be confirmed by a deed of 1839 in the Kent County Archive (Coles Child Collection) which refers to "land belonging to the Board of Ordnance, formerly the Old Magazine and now in the use of Messrs Enderby".

One of the most interesting features on the Greenwich riverside is Enderby House. This was built around 1840 and is said to have been a family home. It is now used as offices by Alcatel and remains as an interesting reminder of the whaling trade. In front of it and slightly up river, some cable winding machinery stands on a jetty and recalls the site's associations with cable making.

A closer identification of the exact site of the gunpowder depot can be attempted with the help of a plan, dated as 1717, in the Morden College archive. A rough sketch of this plan, together with a plan based on a 1950s map, is given below. Walking downstream with the 1950s map the bulk of "Enderby's Wharf" is passed with a large industrial building inland. The next landward building is Enderby House with another, more truncated jetty in the river. Between the two jetties a "causeway" is marked. This causeway in fact consists of a set of steps going down into the river and at low tide this extends to a (possibly concrete) ramp which continues into a deep channel. From underneath this ramp - clearly to be seen at low water - a sluice emerges. A sluice is marked here on the 1840s Tithe Map.



The proposed site of the former Greenwich gunpowder depot based on: left, a sketch of a 1717 plan, and right, a simplified 1950s map [x80,000].

If it is taken that the sluice has not moved, then it can be equated with the sluice on the 1717 plan. The "bridge" can then be identified with the truncated jetty - the date of which is not known but it is not shown until the 1890s OS map. It then seems that Enderby House is the site of the gunpowder depot. [The grid reference is TQ 3914 7876.]

I am aware that this identification is based on guesswork. I have not consulted either the Thames Conservators nor the Sewer records and they may well throw a different light on the problem. The deeds of the Enderby site have not been located and are most probably unavailable with Alcatel. It would make sense however to have put Enderby House on what was probably a good foundation in the middle of a marsh and it would have made even more sense to have used an existing jetty. The Alcatel site is "security" and it does not seem possible to get into Enderby House. It seems likely that an archaeological survey is likely to be undertaken on the foreshore here and it will be important to alert the archaeologists on this point.

SECOND NMRC BUCHANAN SEMINAR

This annual seminar was inaugurated last year to mark Angus Buchanan's 14 years of service as a RCHME Commissioner. It is arranged jointly by the Royal Commission on the Historical Monuments of England and the Centre for the History of Technology of the University of Bath and held at the National Monuments Record Centre, Swindon. This year the seminar was given on 13 June by Wayne Cocroft. His subject was "19th Century Developments in the Manufacture of Gunpowder" and several members of GMSG attended. Indeed we were invited to arrive early for a tour of NMRC, which is housed in buildings of the former GWR railway works, take part in a Reception and, after lunch, attend the lecture.

Our host was Keith Falconer, who is in charge of Industrial Archaeology at RCHME. He showed us around the building starting with the exterior, which superficially appears to be of one build but when examined with care reveals many different building phases in different types of stone from quarries on the GWR network. Behind, but attached to the building, two inter-linked, large, modern, air-conditioned archive stores have been constructed. If the stores are threatened by fire they are sealed and the air conditioning pumps reversed so that the air is evacuated. Inside, we saw the library and search rooms, housing NMRC's enormous collection of photographs, including for example those linked with the Simmons Collection of county volumes of notes on windmills and watermills, including gunpowder mills, which are held at the Science Museum Library in South Kensington. We then had the Reception which provided an ideal opportunity to interact with RCHME/NMRC staff, members of the Bath Centre and others, particularly those involved in establishing the Waltham Abbey Royal Gunpowder Mills Trust. Lunch was taken in the NMRC canteen, which became very overcrowded and hence encouraged us all to interact even more.

Wayne Cocroft's lecture was an ideal one to commemorate Angus Buchanan's contributions to the work of the RCHME as, following a GMSG meeting at Waltham Abbey, it was Angus, as a Commissioner, who encouraged them to undertake a massive survey of the site, which led to the scheduling of some 100 acres and the listing of 21 buildings by the Department of National Heritage. Wayne has of course talked to GMSG members on several occasions about the survey work he supervised at Waltham Abbey. This has resulted in him conducting a national survey of gunpowder and modern explosives sites which is to be published in book form in the coming year. He has also made interesting comparisons between developments in England and elsewhere, particularly in the 19th century. This was the theme of his stimulating lecture, which was followed by much discussion. We plan to give a more detailed account of the lecture in a future Newsletter.

FULHAM GUNPOWDER MILLS

Keith Fairclough

On 3 December 1721 administration of the estate of Tanneguy Azire of Fulham was awarded to his widow Hester. The following January a probate inventory of his estate was taken for presentation to the court.(1) This inventory gave little indication of any business interests except that at the very end there was a note 'decd at his death was possessed of a Lease of some powder Mills in the parish of Fulham which went at a much higher Rent than the same is worth and therefore of no value but a loss to this Exhibitant'. Such a statement meant that no further details were given of this particular mill.

Tanneguy Azire was a member of a Huguenot family with long connections with the gunpowder industry, working mills at Faversham and Maidstone in Kent, and Tanneguy had supplied gunpowder to the Ordnance between 1707 and 1715. At present he can only be associated definitely with Fulham. His father and brothers had worked the Oare works at Faversham, so it might seem sensible to assume that he took over these works in 1707, but if so, it was only for a short time for Arthur Percival has written to me with the information that Francis Grueber was paying poor rates on the Oare works in 1710.(2)

As early as 1701 there is a reference in the Fulham parish registers to 'Mr Aziers Nomans Land', whilst in April 1705 and April 1706 he was described in the same source as a gunpowder producer when his children John and Ann were baptised. In his history of Fulham, Feret notes these facts, and states that Nomans Land was a house at the north end of the hamlet of Fulham on either side of the present North End Road in West Kensington.(3) However it seems probable that his powder works lay elsewhere in Fulham. A survey made about 1715 of 'His Majestys private road from London to Fulham', the present day Kings Road, shows land on Chelsea Creek described as plot 25 where the tenant was Mr Azere and the landlord was Mr Mainard.(4) This survey does not indicate any gunpowder mills, but such detail was not necessary for the purposes of the survey.

The site was remote from habitation and had access to the Thames for transport, but there was no water power. Instead the mills were worked by horses as is made clear in a plea made on Tanneguy's behalf by a neighbour in 1713. This plea noted his 'Horse Mill for making of Gun powder' and claimed that he was a very honest man who held the 'good Will of all his Neighbours', but who 'will nowe be ruined, if you are not pleased to take him in a Share in renewing of decayed powder'.(5) Tanneguy was awarded a contract to repair powder at this date, but he was never a supplier to the Ordnance thereafter.(5)

No other information has been found about these gunpowder mills at Fulham, and there is no evidence of their existence either before or after any association with Tanneguy Azire. It seems sensible to assume that they were temporary facilities first erected at some date during the War of the Spanish Succession (1702-14), and that they had fallen out of use for some years before the inventory was taken in 1722.

References

1. Family Records Centre, PROB 6/97 fo.159; PRO, PROB 3/21/17.
2. Personal communication Dr Arthur Percival 26/3/1997. Citing Kenneth Melrose, Davington: parish and people, forthcoming. For details of the Azire family at Faversham see G Crocker and K R Fairclough, *Industrial Archaeology Review*, accepted for publication, and for details of Azire family at Maidstone see above.
3. C J Feret, *Fulham Old and New* (3 vols, London, 1900), ii, 257, 299.
4. British Library, MPE 482.
5. PRO, WO 55/1795, parcel 812, part.

GUNPOWDER MILLS AT MAIDSTONE

Keith Fairclough

In his researches into watermills along the river Loose in Kent, Spain noted that Bridge Mill at Maidstone, the lowest mill on the Loose before the river enters the Medway, was a gunpowder mill in the early eighteenth century.(1) Recent research into the history of the Huguenot family of Azire, who worked Oare Mills at Faversham,(2) has shown that it was this family who were associated with this mill at Maidstone. Unfortunately this investigation still leaves unanswered several questions which further research into local Maidstone records might be able to answer. However it does seem likely that the powdermills were first set up between 1698 and 1704 and that they continued to operate until either an explosion in 1731 or, if rebuilt after that, until *c*1741.

On 22 December 1727 Judith Azire of Maidstone, widow, made her will. Within two weeks she was dead. In her will she left her friends and executors, Ludovici alias Louis de Caufour of Tovil in Maidstone and Nicholas Rawlings of Maidstone, bricklayer, her half share in a lease to a dwelling house in Maidstone, and also 'the powder Mills and all other Mills workhouses and outhouses thereunto belonging ... together with all Coppers Furnaces and all other Utensils belonging to the said Mills ... empty barrells excepted'. She also left instructions that Louis was to work the remaining saltpetre stocks into gunpowder. If there was insufficient charcoal and brimstone in stock then he was authorised to purchase enough to work the remaining saltpetre, but if there was any surplus charcoal and brimstone after working the saltpetre then he was to sell this surplus. Any income from the sale of the gunpowder or surplus raw materials was to be used by her two executors to pay the legacies that Judith had left. The executors were also asked to fulfil all the conditions of the existing lease.(3) Details of this lease have not been found.

Judith was the widow of Paul Azire, who on the 21st October 1698, when 35 and living at Faversham, had been granted a marriage licence to wed Judith Ferrant of St Anne Westminister, aged 33, at one of the French churches or chapels in London or its suburbs.(4) The Azire family had been producing gunpowder at Faversham since 1684, when Peter Azire a Huguenot refugee had been granted a licence to erect powder mills. Peter Azire had three sons, Lewis, Paul and Tanneguy, all of whom were to be involved in the industry.

However, the Paul Azire who married Judith Ferrant was not the son of Peter Azire. His son named Paul had married Mary Lafond and had died in 1705.(5) The relationship between the Paul Azire who married Judith and the family of Peter Azire has not been established, but the fact that this Paul was living at Faversham in 1698 does suggest that he was a member of the same family and that he was also involved in the family business.

Spain noted that the Maidstone rate books described the Bridge Mill at Tovil as a fulling mill in 1698 but as 'The Powder Mills' in January 1704. Such a development is confirmed by an entry in the parish records for January 1705, when the burial of Daniell Remascawy, a powder maker, was noted.(6) Such evidence suggests two possibilities, that Paul Azire had opened up powder works at Maidstone soon after his marriage and that Remascawy was a workmen there, or that Remascawy had first erected these mills and that Paul Azire took them over after his death.

A further dilemma is that between 1705 and 1707 a Paul Azire & Co supplied gunpowder to the Ordnance, whilst between 1707 and 1715 Tanneguy Azire was a supplier. Was Paul Azire & Co the trading name of the firm at the Oare mills at Faversham that was run after Paul's death in 1705 by Mary his widow or Peter his son, or is it possible that Paul Azire & Co was the trading name of the Paul Azire who worked the gunpowder mills at Maidstone? It is not known when this last Paul Azire died. At present it is known that Tanneguy Azire was working powdermills at Fulham, but further information is needed to establish whether

he was also associated with the Oare and Maidstone works. It seems possible that he worked both of them, one of them or neither of them.

Another piece of missing evidence is who took over at the Bridge Mills after Judith Azire. Her will does not suggest that she intended her executors to run the works permanently, and no evidence has been found that either de Caufour or Rawlings ever did.(7) Yet the gunpowder mills did continue to operate beyond a term implied in Judith's will for in 1731 there was a major explosion at Maidstone:

23 July 1731. 'A Powder-Mill at Maidstone in Kent blew up by which two Men and a Child were kill'd; a Paper-Mill and a House adjoining were destroyed; the Tiling and Windows of several Houses, and the Windows of a Church at a great Distance very much shatter'd'.(8)

Of this explosion Spain further noted that in 1819 a history of Maidstone had recorded 'This, many years ago, was a gunpowder mill, and tradition has preserved the memory of a severe explosion occurring here, occasioning the loss of several lives; by which the farmhouse on the opposite bank of the river was so much shaken, the direction of the wind concurring with the force of the shock, as to require part of it to be supported with props for many years afterwards, and which indeed was done till lately, when it was pulled down.' The nearest mill upstream of the Bridge Mill site was the Lower Tovil Mill. This must have been the paper mill blown up in the explosion, for Spain and other paper historians have noted that it was an important paper mill at this time.

Spain records that as late as 1741 the rate books still referred to 'Powder Mills and Meadow' at the Bridge Mill site, but that thereafter corn milling and then oil milling was recorded. It is possible that the site lay derelict and it was only after investment in a new corn mill had been undertaken that the rate books changed, or had the powder mills been rebuilt after the explosion. If the latter, it is not known by whom.

References

1. R J Spain, 'The Loose watermills 1', *Archaeologia Cantiana*, **87** (1972), 43-79 and 'The Loose Watermills II', *Archaeologia Cantiania*, **88** (1973), 159-86.
2. For details of the Azire family at Faversham: G Crocker & K R Fairclough, *Industrial Archaeology Review*, accepted for publication. For details of Tanneguy Azire at Fulham, see below.
3. Family Records Centre, PROB 11/619, sig 1. The legacies were: £10 10/- to the treasurer of the charity school in Maidstone for teaching poor children; 50/- each to her friends Anthony Leber and Maudlin his wife; £5 each to Sarah Smith of Maidstone, spinster, and Judith Knowles of Harley in Kent, widow. The remainder of her personal estate was left to her brother-in-law, John Farrand (sic), his son John Francis, her nephew Daniel Simmonds and her niece Judith Symmonds.
4. Lambeth Palace Library, Vicar General Marriage Allegations. Details of the marriage have not been found.
5. J M Cowper, editor, *The register booke of the parish of St George the Martyr, Canterbury* (Canterbury, 1891), 128; Kent RO, PRC 17/80 fo.334.
6. Kent RO, Bishops Transcripts for parish of Maidstone. Research into the original registers has not been undertaken.
7. When de Caufour died, in 1746, he was living at Canterbury and his will made no reference to any property, to any trade or of any Azire or other person associated with the gunpowder industry: Family Records Centre, PROB 11/760 sig 74.
8. *Gentleman's Magazine*, i. 309. A report of this explosion in *The Kentish Post or Canterbury News Letter* has not been consulted.

FIVE ACTS OF PARLIAMENT RELATING TO GUNPOWDER

Bill Curtis

I have recently acquired original copies of the undermentioned Acts of Parliament which may interest members of the Group. If anyone would like to see the complete texts, I can arrange for them to be copied (tel/fax: 01745 584 981).

1. "An Act for making more Efficient an Act passed in the Fifth Year of His Majesty's Reign [1719], Intituled, *An Act for preventing the Mischiefs, which may happen by keeping too great Quantities of Gunpowder in or near the Cities of London and Westminster, or the Suburbs thereof.*"

Dated 9 October 1722 and finally enacted on 12 November 1724, this Act makes provision, after 1 June 1725, for prohibiting the keeping of more than 200 lbs of powder in any one place in London or Westminster for more than 24 hours. Magazines belonging to the Crown are exempt.

2. "An Act for granting an Allowance upon the Exportation of *British* made Gunpowder."

Dated 23 January 1727 and finally enacted on 21 January 1730, this Act recognised that the British powder makers were suffering from foreign competition because of the high levels of duty imposed upon imports of saltpetre and sulphur. It enacted that the Customs should pay 4s.6d. per barrel of 100 lbs for all powder exported as merchantise. Export had to be proved by production of a certificate from an appropriate official at the place of landing (eg British Consul) and the powder was not to be re-landed in the UK.

Special provision was made for the Africa Trade, to quote: "And whereas Gunpowder exported for Africa in sold and delivered in very small Parcels, and at Places along the Coast, where no Certificates can be had, therefore be it further enacted by the Authority aforesaid, That in every such Case upon Proof made upon Oath, or, being of the People called *Quakers*, upon solemn Affirmation of the Master, Mate, Purser, or other Person, having charge of the Ship during the Voyage, importing, that such Gunpowder was sold and delivered upon the Coast of Africa, ..." It goes on in the same vein about swearing the powder has not been re-landed and that these oaths may be taken in lieu of the Certificates. The possibility that the duties on sulphur and saltpetre might be abated is covered by a provision that the rebate will be reduced in the same proportion.

3. "An Act for preventing Mischiefs which may happen by keeping dangerous Quantities of Gunpowder in or near the Cities of London and Westminster."

Dated 1 December 1741, this Act is stated to be for the purpose of improving the Act outlined in 1 above. It details the ways in which dealers are flouting the existing regulations by placing large amounts in private houses and other places not recognised as stores. The Act limits the storage of powder in such premises to 50 lbs and restates that dealers shall not store more than 200 lbs for longer than 24 hours. Exemptions were granted for ships actually passing and re-passing on the Thames or delayed there by tides or bad weather. Powder in transit on carts etc was also exempt. The Act did not apply to Government or Public Magazines.

4. "An Act to prevent the Mischiefs which may happen by keeping too great Quantities of Gunpowder in any One Place, or carrying too great Quantities of Gunpowder together from One Place to another."

Dated 10 November 1747 and finally enacted on 29 November 1748, this Act came into effect on 24 June 1749 extending regulation to all cities with their suburbs and to any market town in England and to one hundred yards therefrom except in the case of royal palaces where the distance was extended to one mile. The Act did not limit the previous Acts referring to London and Westminster. Storage of powder was limited to 400 lbs and less than 24 hours. Larger quqntities of up to 3,000 lbs were not to be kept anywhere in England other

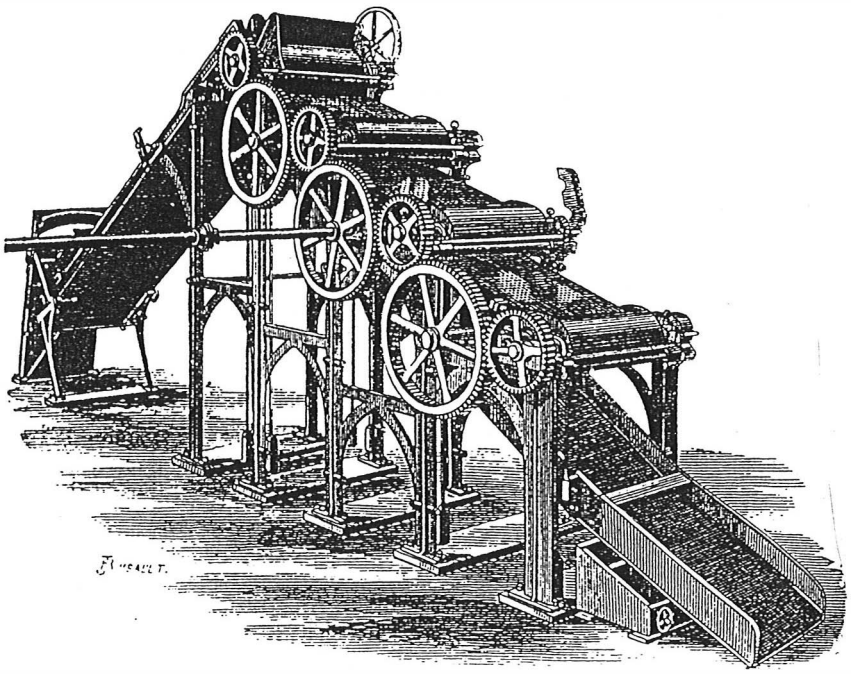
than in custom built magazines that had been approved. Existing structures built as magazines were exempted unless they were adjudged dangerous and unsafe by the Justices upon complaint by two or more inhabitants.

Gunpowder in transit by any vehicle was limited to 2,500 lbs and by any vessel to 5,000 lbs within one mile of any city or market town. Barrels were to be closely hooped and secured against leakage and the carts and vessels had to be covered. Penalties were also to be applied to any person acting in a careless manner when in control or working with powder.

Exemptions were made for the magazines at "Barkin Creek's Mouth" Essex, Erith Level in Kent and Liverpool in Lancaster, as well as Government magazines. The exemption also applied to the magazines forming part of powder mills.

5. "An Act to impower His Majesty to prohibit the Exportation of Salt Petre; and to enforce the Law for impowering his Majesty to prohibit the Exportation of Gunpowder, or any sort of Arms and Ammunition; and also to impower His Majesty to restrain the carrying Coastwise of Salt Petre, Gunpowder, or any Sort of Arms or Ammunition."

Dated 31 May 1754 and finally enacted on 13 November 1755, this Act reinforced that of the third year of King Charles II which referred to gunpowder, arms and ammunition. The Act added saltpetre to the controlled items and details at length the penalties for transgressors and the systems for rewarding informers reporting breaches of the law. The sanctions were entirely financial with the Crown receiving two-thirds and the informer one-third.



8. Corning or granulating machine with four rotating pairs of cutting rollers which are 7 ins in diameter. These have rectangular screens below them to carry the gunpowder from one pair to the next. Constructed by Taylor & Challen of Birmingham; from *Engineering* of 1878.

THE MANUFACTURE OF GUNPOWDER.

We are indebted to Paul Merricks who has sent us a copy of this report which was published in *Godey's Lady's Book* in Philadelphia in June 1861.

We should never advise any one, who is not called by duty, to visit a Powder Factory, for, firstly, you run a risk of being blown to nothing; and, secondly, you increase the danger in which the workmen are placed. So, to save you, reader, from these dangers, and to give you a clear account of the various processes that are gone through to produce this important element of war, we sit down to write.

As we enter the gates we observe nothing very particular, and our guide seems to be used to all matters connected with the business, so we go gently on until we reach several large stacks of wood, alder and willow, which are standing there to be dried by the atmosphere, previous to being converted into Charcoal. Each piece of wood is about three feet in length, and the manner of burning is as follows: A series of iron cylinders, each about two feet six inches in diameter and five feet in length, are ranged in a building known as the cylinder house. Each of the cylinders is set in brick-work, so arranged that the hot air from the furnace plays quite round it, causing the heat on the upper and under sides to be uniform. Made to fit these cylinders are others of thinner iron and lighter make, capable of being drawn in or out at pleasure. In this portable cylinder, technically called a slip, the wood is put, and then pushed into the fixed cylinder and shut in by air-tight iron doors, or doors made air-tight by means of sand. As soon as the action of carbonization commences, all the gaseous products of the wood are expelled through a hole at the back of the cylinder, and thence into the flues, where they are burnt. Here is a twofold benefit. The gases are almost sufficient to convert the wood into charcoal, and the great nuisance which would be caused by their escape into the atmosphere is avoided. After remaining in these cylinders at a low red heat for about six hours, the wood is perfectly carbonized. It is then allowed to cool; and when drawn out is charcoal of the purest quality and is ready for grinding. This process is none other than that of grinding coffee. The charcoal is put into a hopper, from which it falls into the mill, is cut or crushed to pieces, passed through a reel covered with a canvas of the finest mesh, and is then fit to perform its part in the manufacture of gunpowder.

Sulphur is prepared by heating a quantity of crude sulphur in an iron pot, conducting the vapors into cool chambers, where they fall as a very fine powder, called flowers of sulphur. When the chamber becomes warm these flowers of sulphur melt, and run into cylindrical moulds, in which form the sulphur is called roll sulphur, and is quite pure. It is then ground and passed through a very fine sieve, when it also stands ready.

The last and most important ingredient is Nitre or, as it is more commonly called, saltpetre. This is obtained chiefly from Bengal, and in its crude or "grough" state contains from one to twenty per cent of impurities; common salt being the chief. In this state then it arrives, and before being used has to be freed from every impurity. This used to be done by repeated boilings and crystallizations; but now it is boiled once and passed (in a fluid state) into large shallow copper pans, called coolers. Now if allowed to cool at rest it forms itself into large crystals, which contain much that is impure; but if you can get the crystals small, there is little impurity to be found. This is obtained by keeping the liquid constantly in motion during the cooling process; so that the nitre crystallizes in very small particles, so small indeed that the saltpetre thus crystallized is called saltpetre flour, and is, if carefully washed with distilled water, absolutely pure, and so fine that no grinding is necessary. Under the old system the saltpetre had to be thrice boiled, thrice set to cool in crystallizing pans, and then melted, run into moulds, cooled, and ground. We are indebted to the French for the new process.

After having then seen our ingredients carefully prepared, we now bring them together in a house, called the mixing house. They are here weighed in the following proportions: saltpetre 75 per cent, sulphur 10 per cent, charcoal 15 per cent. These ingredients are then placed in the mixing machine, which is simply a wooden box, through which a shaft passes armed with long copper or gun-metal teeth. The shaft is made to turn on its axis very rapidly, and by means of the teeth the mass is intimately mixed. A bag is placed under the machine, a slide is withdrawn from the bottom, and the powder (for such it is now, but very weak) falls into the bag. The quantity placed in one bag is called a charge, and weighs between forty and fifty pounds.

The charge (green charge called generally) is now ready for the incorporating mills, where the several ingredients, which before were only mixed, are now incorporated, or very intimately combined, by means of a heavy grinding pressure. Imagine a large round dish of iron. In the centre of the dish is an upright shaft, made to turn by means of gearwork underneath the floor; on this dish are placed two wheels, called runners, made of iron or stone, each weighing three or four tons. Through the centre of each runner a horizontal spindle passes, which spindle also passes through the upright shaft before mentioned, cutting it at right angles. When the upright shaft is put in motion of course it carries round these runners, which perform about ten revolutions per minute. The weight of the runners causes great pressure upon the powder, which is spread equally over the bottom of the dish, and the small circle in which the runners revolve causes the grinding, by which means, and the aid of water, the intimate mechanical combination of the ingredients, upon which the strength of the powder entirely depends, is obtained. The time necessary to bring the powder to its proper strength varies from one hour to ten, according to the quality required. One manufacturer has patented a process by which he causes the bottom of the dish to be heated, by which means he obtains the required strength in a much shorter time. When taken from these mills it is in broken cakes of a grayish color, and about half an inch in thickness. It is now called mill-cake, and has attained its greatest strength, all after-processes decreasing its explosive force, but increasing its durability.

From the incorporating mills it is taken to the press house, where the mill-cake is passed between cylindrical toothed rollers, which in motion turn towards each other, and crush the powder again to dust. On one side of this press house you see a large cubical box placed between four iron columns, which support a huge crossbar of iron, called a cap; underneath the cap is suspended a cube of wood to fit the box which stands below. The powder, when broken down, is carried to this box, on the bottom of which a layer of it is placed. This layer of powder is covered with a sheet of copper, and on the copper is placed another layer of powder, then another sheet of copper, and so on, alternately a layer of powder and a sheet of copper, until the box is full. A man then turns a small cock, the box begins to rise, and pushes itself against the piece of wood suspended beneath the cap. As this wood fits the box, the box keeps rising, but as it rises the powder is compressed to the requisite hardness. But how is the box made to rise ? By hydraulic pressure. The box stands upon the ram, as it is called; this ram fits into an iron cylinder; into the cylinder water is forced, which raises the ram and of course the box placed upon it. The pressure obtained is generally about four tons to the square inch upon the ram. When the pressure is taken off, and the box opened, the powder and copper are compressed into one solid mass; but a few hard blows with a wooden mallet soon cause the cakes to separate. The copper plates are put aside for future use; the cakes of powder, about two feet six inches square and one-eighth of an inch in thickness, are carried to the breaking-down machine, where they are again passed between the toothed rollers and broken into pieces hard and black, of irregular forms, varying from an inch and a half to half an inch in length. The powder is now fit for granulating or corning, as it is

called. Before we leave this house we may just get a glimpse at the men here, and yet the men you cannot see, only their intensely black faces and lively eyes. Strong men and true, no doubt, to their employers, but not always conscious that while careful for "the master," they are caring for their own lives.

We take leave of the press house, then, and follow the hard pieces of powder to the granulating house. Here we are in great danger, and not very well able to see it on account of the "dust" flying about. However, we can perceive the "house" is tolerably full of machinery; consisting principally of the toothed cylindrical rolls and "Jacob's Ladders". These "Jacobs" are endless straps passing over wooden wheels; each strap has a number of cups fixed upon it. The powder is "shot" into a hopper on the floor; at the bottom of this hopper one of the wooden wheels rotates, and over it the endless strap passes. In the downward journey the cup is inverted, but no sooner does it get its turn on the bottom wheel that it rights itself, and not only so, but fills itself with powder, which it carefully carries to the housetop, and as it turns on the upper wheel shoots its load headforemost into another hopper, from which it passes between the rollers, and is crushed into the required sized grain. So these "Jacobs" save the trouble and expense of having men to carry up the powder on their backs. The powder here is not only granulated, but a large portion of the dust is taken from it and returned to the incorporating mills.

We have now the powder in grains of various sizes and of a very dull grayish brown color, not much like the powder of commerce. But we shall get it so much like that, that you will recognize it wherever you may meet with it. From the granulating house it is carried to the rubbing house, where the powder is placed in cylindrical vessels of wood or canvas, and rapidly turned upon the vessels' axes. By this motion the grains of powder are hardened, and by the attrition they gain a glossy appearance and look bluish-black. This rubbing of the powder is a great deterioration to the explosive quality of the powder; it makes it less angular, but, as a counterbalance, it is much more durable, being less impervious to moisture than before. Well, having whirled it in the cylinders for ten or twelve hours, and having seen it brought out, and noted its different appearance, we follow it to the drying house. Not long since it used to be dried as follows: The powder was spread upon canvas cases and placed in racks round a room, called the stove; into the wall of this building a huge iron pot was built: not standing on its bottom, but so placed that the bottom of the pot should project into the room while the mouth was outside. In this a fire was kindled, and the bottom of the pot heated to a red heat. Pleasant, certainly, when one entered to see the round red pot glaring in amongst the powder and threatening death and destruction to all. Now the stove is heated by means of steam pipes passing through it, and the temperature usually obtained is about 130. For twenty hours it rests in this warm climate, during which time it parts with all its moisture except about nine per cent. At this stage the powder is somewhat dusty and of different-sized grains; two things then are required, to clean it from the dust, and to separate the grains into the various sizes, for large or small arms. To accomplish these ends, the powder is transported from the stove to the dusting house.

The dusting house, as its name implies, is the place where the powder is dusted, or finally cleansed from any remaining dust. This is an important affair, as the fouling or not fouling of the gun depends greatly upon this matter. It is generally performed by causing the powder to run through a series of reels covered with open canvas, which reels are rapidly whirled round, and while they are in motion all the very fine powder or dust falls through the canvas. When properly dusted, the different-sized grains have to be separated one from another; the "large grain" for artillery; the "fine grain" for rifles; the "double F" and "treble F" for sporting purposes; and so on. When separated it is carefully weighed, put into barrels, headed up, and carried away to magazines, quite finished and ready for use.

These various processes cannot be carried on without much risk to life and property, hence the necessity that exists for the greatest possible care throughout all departments. Every man has clothes to be used only in the houses, so that there can be no chance of the least particle of grit getting on to the clothes, neither is any man permitted to wear metal buttons. All shoes are exchanged for shoes made only of leather, no nails of any kind; and these are worn only in the houses. In the machinery brass and copper are largely employed, because from them it is almost impossible to strike fire and to prevent any friction under foot should grit get into the houses, the floors are carefully covered with leather. Still, with all these precautions, accidents are not entirely avoided, though greatly diminished.

FORMER GUNPOWDER FACTORY AT YOKOHAMA

Arthur Percival has provided us with five photographs of a former gunpowder factory on the outskirts of Yokohama, taken by a friend of his, Akira Ozawa, in 1995. The factory had just closed and the works moved to a new site, probably not far away. Unfortunately each of the photographs is simply labelled "former gunpowder factory", which is not very informative, but the following notes may be of interest.

1. A sylvan scene with no buildings.
2. Taken from a high vantage point. Low corrugated iron buildings in the foreground with other industrial buildings including a tall chimney shaft beyond. All surrounded by trees.
3. Entrance to a tunnel through an embankment with several signs in Japanese, and also an upright green cross. An English colleague who knows some Japanese has told me that the signs mean "danger", "safety first" etc.
4. A single story concrete building, see figure, with an almost flat, grey, sheet-metal, light-weight roof, small covered windows, surrounded by an embankment from which the photograph appears to have been taken.
5. Similar to 4 but with a concrete block building but a brown, gabled, light-weight, tiled roof.

THE GREAT STRUGGLE BETWEEN LAFLIN & RAND AND DU PONT

One of the documents used by Frederic Lee for his talk on the Gunpowder Trade Association at our Spring Meeting is a 17-page hand-written report entitled The Manufacture of Gunpowder in the United States in 1874 (Hagley Museum & Library, Lammot Du Pont papers: Series B, Accession no 384, Box 28-36). Lammot Du Pont is of course well-known to British gunpowder historians from his accounts of visits to Britain (see for example Wilkinson, N B, An American powder maker in Great Britain: Lammot du Pont's Journal, 1858, *Trans Newcomen Soc* **47**, 1975, pp 85-96). In the 1874 document he lists all the gunpowder mills working in each State and provides a statement or an estimate of the powder being manufactured at each one. In all 46 different companies are listed and, retaining the arrangement and spelling of the original, their production in kegs per annum was as follows:

Maine: J Brisby, 8,000 (corrected from 6,000); J P Marble, 7,000; Oriental Powder Mills Co, Gorham, Cumberland Co, 55,000. Total: 70,000.

Massachusetts: American Powder Co, Acton, Worchester Co, 32,000. Total: 32,000.

Connecticut: Hazard Powder Co, Hazardville, 164,400; Mrs Rand, near Middletown, 4,500. Total: 168,900.

New York: Rand & Co (formerly Wadham & Rand), Rochester, 15,000; Laflin & Rand

Powder Co, Schaghticoke, Ranselaer Co, 42,500; Saugerties, discontinued: Kiskatom, Catskill Mills, 17,000; Orange Mills, New Burgh, 39,000; Empire Mills, Kingston, Ulster Co, 150,920. Total: 264,420.

Pennsylvania: Moosic Powder Co, Carbondale, 6,250; Moosic Powder Co, Spring Brook, 143,415; Luzerne Powder Mills, 22,000; Laflin Manufacturing Co, 49,176; Quakake Powder Co, Carbon Co, 20,532; Wapwallopen Powder Mills, 94,088, Edgeworth Mills, 36,945; Locust Run Powder Mills, 24,339; Mahanoy Mills, Gerardville, 6,552; American Powder Co Smithville, 6,018; Philip Ginter, 6,511; Little Tunnel Mills, Bouchert, 4,970; Indian Run Mills, Pottsville, 960; Cressona Schuylkill Co, 56,500; Daniel Alspack, Orwigsburg, 4,000; Gorley, Pinegrove, 3,000; Trevorton Powder Co, Barry & Co, 8,140; Rothmel Maury & Co, 10,075; Bougham & Fredrick, 7,500; George Ravor, 7,500; Leibig, Brandonville, 3,000; Louis Koch, St Clair, 9,500; Brand & Spear, Chambersburg, 7,200; York Mills, Thos Bramard & Co, 4,500; George Miller & Bros, Sumneytown, 7,500. Total 550,171.

Delaware: Upper Eleutherian Mills, 32,942.8; Upper Hagley, 56,750.68: Lower Hagley, 160,084.8; Brandywine Mills, 34,029.96; Sycamore Manufacturing Co, Tenn 4,000; California Powder Co, 116,909. Total: 404,717.24.

Ohio: Austin Powder Co, Cleveland, 58,392; Miami Powder Co, Zenia, 50,000; Plattesville Mill, Wisconsin 21,000; Lake Superior Powder Co Wisconsin, 3,022.5; Marietta Mills, Penna Johnson formerly of York, 100. Total: 132,514.5.

Overall Total: approximately 1,620,000 kegs.

It is striking that all of the mills were associated with only seven states, although the figures for Delaware include California and Tennessee and those for Ohio include Wisconsin. It is also clear that the industry was dominated by Pennsylvania, although many of its 25 mills had a very small output. There were no mills, apart from the small Tennessee one, in the southern states. The list also provides much further fascinating detail. For example the four mills in Maine and Massachusetts had 17 water wheels and employed 46 men. Hazard in Connecticut was estimated to have made 124,400 kegs of soda powder, 24,000 of saltpetre blasting powder and 20,000 of sporting and Government powder. Mrs Rand in Connecticut made powder principally for fuses and fireworks. The Empire Mills at Kingston, New York had 4 heavy West Point rolls and 8 dusting barrels. In Pennsylvania, Trevarton, Rothmel Maury and Louis Koch each had two stamping mills, with 24, 36 or 42 stamps and the Marietta Mills had "one small stamping mill of 12 stamps or 2 pots". The mean value of Delaware powder (mostly soda) was $2.37 and of Maine powder (mostly saltpetre) was $2.91 per keg.

In practice the companies were all controlled by, or associated with, either Laflin & Rand (L&R) or E I Du Pont (DP) and, as much of the powder was manufactured from nitrate of soda, Lammot Du Pont gives a list of purchases of soda by the two groupings. L&R bought 40,714 bags, averaged over 1873 and 1874, and DP 22,566 bags in 1874, starting on 20 May. To the uninitiated this might suggest that L&R used nearly twice as much soda as DP. However a calculation specifically for 1874 is then carried out claiming that this is misleading. Allowing for some of the nitrate of soda being converted to saltpetre and including Friends (F) results in 26,466 for L&R & F and 25,548 for DP & F. Indeed if the Friends are excluded the result is L&R 17,418 and DP 21,589, so that Du Pont win handsomely! Remarkably, when the calculation is carried out for Soda "B" powder packed in kegs L&R & F had 445,439 and DP & F win with 486,014 and if the Friends are excluded L&R have 321,875 and DP 350,974. Finally considering Saltpetre "A" powder in kegs L&R & F had 66,000 (F contributing none) whereas DP & F had 190,634 (DP contributing 161,855).

[We are indebted to Frederic Lee for letting us see a copy of Lammot Du Pont's report.]

THE BABER FAMILY OF POWDERMAKERS

Nicholas Barber

My particular interest in gunpowder arises from a general interest in military history and a recently discovered family link with seventeenth century gunpowder manufacturing. I would like to get in touch with anybody who may have information about any aspect of the following.

My Grandmother was a Miss Baber. Her family can be traced back to 1527 in Chew Magna in Somerset. My family were variously Serjeants (a type of Barrister), JPs and Recorders (a part-time judge) in the town of Wells. They acquired land through links by marriage with a daughter of a Bishop of Wells. By 1627 a Dr John Baber, was Vicar of Chew Magna, he was closely linked to the administration of the estates of the Bishop of Bath and Wells, which included the Mendip mines, which lay between, Chew and Wells. He had several sons, the eldest, John, who was Recorder of Wells, Francis, who was a prominent Justice of the Peace, and I believe William, 'Pirate gunpowder maker' of Bristol.

The earliest reference to gunpowder I have comes in 1628, when John Baber (the Recorder) was also MP for Wells (Harleian MS. 2313, British Museum, quoted 'Commons Debates 1628', volume 2, by Johnson & Cole, published by The Yale Centre for Parliamentary History, 1977). On 9 April 1628 he was arraigned before the House of Commons for billeting soldiers illegally in Wells. In his defence he excuses himself 'that he did it for fear of being pursuivanted (as he had been before for resisting the commission of the saltpetremen), and for the disposing of the soldiers on the quiet'. We know that this was in 1627 but I have not been able to find further details of his trial. Does anybody have any leads?

My next references came from the Victoria County History of Surrey, which explains that the manufacture of gunpowder was a state monopoly, run by John Evelyn. My ancestor was breaking the monopoly, hence the description 'pirate'. The VCH states that, of the others with whom John Evelyn found himself in competition, 'the powder makers of Bristol are first mentioned on 24 February 1631-2, when we hear that their names were to be taken from Evelyn and they themselves sent for by warrant. On 8 March 1633-4 the names of four of them are given in a warrant for their appearance before the Council. But the warrant does not appear to have been actually issued, owing to Evelyn having given no charge in writing against them. The Bristol makers appear more frequently during the period of the monopoly of the Chilworth mills, and on 19 December 1637 the mayor was directed to search and suppress all the works in the city. One Baber seems to have been particularly refractory and persistent in continuing his manufacture. He is no doubt the William Baber, or a relative of the man of that name, who after the Restoration petitioned the king for payment for the large supplies of powder worth £1,500 with which he had furnished Charles I at Bristol. In 1640 the Commissioners, in order to increase the sale of the government's powder, advised the revocation of this licence and the suppression of the mills.'

James Russell, an author of a recently published excellent booklet *Civil War Defences of Bristol*, has sent me extracts from *Annals of Bristol in the Seventeenth Century* published in 1900 by J Latimer. Pages 119-120 state that in 1631 on information of the Justices at Chippenham, two men, Cossley and Baber, were dragged before the Privy Council charged with fraudulently buying the king's saltpetre and converting it into gunpowder. The charge was not proven, because two months later they were able to petition for release from prison. although it is thought that they may have paid a fine.

In 1637 Baber was still a 'conspicuous offender' manufacturing in defiance of the Kings Mandate and the Mayor was ordered to suppress the mills. In November 1638, John Dowell, a customs official, reported that Baber had a mill in the suburbs making 2cwt a week. Does anybody know of any evidence of where in Bristol they were working, or who they were

supplying? Was it the Mendip mines, the Irish War, or perhaps the new colonies in America, some of whose promoters, including the Popham family, came from Chew Magna. Surely 2cwt a week was a lot!

John Rocque's Map of 1742 has a 'Babers Tower' marked on it near the old Lawfords Gate, just inside the Civil War defence line, near the present Midland Road and Unity Street. Could this be the site of the works? All too soon the King would need Baber's powder.

My next source has been from *The Royalist Ordnance Papers*, published by the Oxford Records Society in the 1960s and 70s. The note to page 14 says that Baber was the King's chief powder supplier until replaced by Strode and Wandesford in 1644. Between 8 January 1643 and 30 May 1643, he supplied 148 barrels to the New College Oxford magazine. On page 29 we are told that William Baber with the aid of his son and his uncle, Randolph Thomms, who had also been outlawed in the 1630s, set up works in Oxford and had started production by January 1643. It suggests that Baber had agents or may have manufactured elsewhere in the West Midlands, possibly Worcestershire. He claimed to have spent £3000 in building the works at Oxford and received £500 when he petitioned for compensation in the 1660s. In February 1644 he was ousted from the Oxford works.

Recorder John Baber, back in Somerset, was an important royalist official, but by no means the most prominent royalist in Somerset. Yet he had to compound to the victorious roundheads for the largest single sum of any Somerset royalist. Was this because he was perhaps seen as a war profiteer?

At this point, I become less sure of the story. From the DNB, I know that my direct ancestor Dr and later Sir John Baber, son of the Recorder and MP above, and possibly nephew of William, became a student of Christ's College Oxford in 1642. On 3 December 1646, he was admitted by virtue of the letters of Colonel John Lambert, Governor of the Garrison of Oxford.

I believe that Lambert was the parliamentarian governor, so Baber must have become reconciled with the puritans. He was careful however to keep a foot in both camps. He went at some stage to Leyden, then on to Angers, where on 18 November 1648 he qualified as a physician. By 1650 he was practising medicine in Covent Garden. At the Restoration, he was appointed Physician to King Charles II, and knighted on 19 March 1660. He was used as a go-between with the Presbyterians in the complex political negotiations of the time. He appears in Pepys's diary of 12 January 1666, as having spoken with Lord Brounker, Lord Craven, and Sir G Carteret. All three were influential courtiers. Carteret was Navy Treasurer, (a good contact, if you had gunpowder contracts in mind perhaps!), Craven, a Privy Councillor, Protector of Charles's aunt, the Winter Queen of Bohemia, throughout her long exile, and Lord Brounker, a Navy Commissioner, who had spent the Commonwealth in private life in Oxford, and was Pepys's boss. From his *Diary* we know that Pepys travelled with Baber and Brounker in the same coach to Convent Garden on 14 March 1666. Later in the 1670s Pepys and Baber contested the Parliamentary seat of Kings Lynn.

What has this to do with gunpowder? Well, I think as a courtier and lawyer, with the King's ear, Sir John Baber was extremely well placed to help a kinsman, William Baber the younger, with his petition.

Recently I stumbled on hints that the family's involvement in gunpowder may have extended beyond the Restoration. Sir John Baber's son, also called John, bought a house on the outskirts of Sunninghill, and was living there with a post at one time as huntsman to Queen Anne. Family tradition has it that he was initially very rich, but squandered his money. He founded a spa, at Sunninghill, frequented by poets including Pope, and also Lady Montague Wortley. The direct route from Sunninghill back into London is the present A315, the Staines Road. In present day North Feltham the road crosses the River Crane, on the Baber Bridge.

For a long time this had puzzled me. I then had a luckly break. Whilst reading Glenys Crocker's Shire Album on *The Gunpowder Industry*, I discovered that the Bridge is at the entrance to the old East Bedfont Gunpowder Mill! I would love to hear from anybody who knows of any information on the Bedfont Mills. Are they old enough? The existing brick weir, and building are possibly old enough, but to my amateur eyes look more like eighteenth century work. The actual bridge has a stone footing, but has been rebuilt on several occasions.

Did the Babers receive an existing ex-Parliamentarian mill in compensation for their losses, or did they perhaps found a new mill on Hounslow Heath, with its good connections by water to the Thames and the Naval stores down river?

Gunpowder seems to run in my grandmother's family, her maternal grandfather, Brigade Major James Barton, was an East India Company Officer, in the Bombay Presidency Horse Artillery. After retiring in the 1825 as Commandant and Quartermaster to the Deccan Artillery, he was from 1 October 1827 to 19 May 1829, Agent for Gunpowder and Superintendent of Factory at the gunpowder factory at Matoonga in Bombay, on the site of the present day Bombay University.

[The above article is based on a letter written by Nicholas Barber, a new member of GMSG. We have partially answered a few of his questions and put him in touch with Brenda Buchanan, who has specialist knowledge of the Bristol powdermakers].

HERODSFOOT POWDER MILLS, ST PINNOCK, CORNWALL

This is the title of a 6 page A4 "Historic Building Report" prepared, following a brief visit to the Herodsfoot site on 3 February 1995, by Alan Stoyel, Allan Brodie and photographer Peter Williams of RCHME. The relevant section of the 1885 OS 1:2500 map and five full-page page photographs of buildings are appended. The "Summary" is as follows:

"Herodsfoot Powder Mills is a complex in a wooded valley on the border between the parishes of St Pinnock and Lanreath. It was started in 1845 by the Isaac family, and Quaker involvement ensured that the black powder produced here was restricted to civil use, for blasting in the mines and quarries. It was the second largest gunpowder mills in southwest England until it closed in 1898. In the 1914-18 War military explosives were manufactured, however, and production continued on the site until a serious explosion occurred in 1963. After this the works was run down, and it finally closed in 1965. The site has been redeveloped by the Forestry Commission with the building of holiday cabins, but incorporating many of the features of the powder mills. Various buildings, earthworks and watercourses survive on the site. The walls of two of the pairs of water-powered mills on the site remain, complete with their waterwheels. These wheels appear to date from the original establishment of the works in 1845 and constitute a very rare survival for this industry. The site is not scheduled, nor are the mills listed."

The text discusses three pairs of incorporating mills including the two with waterwheels. However, when GMSG visited the site in 1987, we were able to show the party a fourth ruined pair of mills with broken sections of a waterwheel, one of which had the foundry name, WILLIAMS & CO ROSELAND VALE, cast on it. We had unearthed this at Easter 1985 when on holiday in one of the Forestry cabins. We have reported this discovery to Alan Stoyel and provided him with a plan of this pair of mills. We can also recommend the cabins.

Alan Crocker

THE GUNPOWDER MILL AT RADCLIFFE NEAR NOTTINGHAM

On page 26 of Newsletter **20** we appealed for information about a powdermill at Radcliffe near Nottingham at which, according to a statement on pages 122-3 of Antonia Fraser's book *The Gunpowder Plot*, there was an enormous explosion on 27 April 1603. We have received several responses. First, Alan Gifford of the Midlands Mills Group has been unable to discover any evidence for a gunpowder mill at this site. Then, Wayne Cocroft pointed out an entry on page 215 of the Chronology chapter of *The Rise and Progress of the British Explosives Industry*, E A Brayley Hodgetts, ed, Whittaker, 1909. This reads:
'1580, 19th February. A letter to Barnard Randall, Thomas Gardner, and the Connestable in reference to the patent for glass granted to Jacomo Vertolini- "Complaint is made untotheir Lordships by the said Jacomo that one Sebastian Orlandini and one John Smithe have verie lately sett up a furnace at the *gonpouder mille* by Ratcliffe, intending to make glasses". They are, therefore, "to repaire unto the said gonpowder mylle" and destroy the furnace. (Acts of the Privy Council, xii, 337.)'

The glass industry has been selected by English Heritage for its Monuments Protection Programme, which seeks to document sites of national importance for which statutory protection should be considered. Members will remember that the gunpowder industry has been surveyed in the same way by Shane Gould (see Newsletter **14**, pp 7-8, Feb 1994). The glass report, which was prepared by David Crossley, does not list Radcliffe near Nottingham as one of the sites investigated.

The early English glass industry, which made window and vessel glass for domestic use, was concentrated in South East England. It has been described in detail by G H Kenyon in his *The Glass Industry of the Weald*, Leicester University Press, 1967. These Wealden sites date from about 1330 to 1618 but in the late sixteenth century forest glasshouses, as the sites are known, started to appear outside the Weald. In particular Kenyon mentions sites in Hampshire, Sussex, Kent, Gloucestershire, Herefordshire, Staffordshire and Cheshire, but not in Nottinghamshire. However, the names Sebastian Orlanden, Jacomo Verzelini and John Smith are associated on pages 210-11 with a site in Great Goteley Wood at Northiam in Sussex, NGR TQ 842250, which is thought to be the same site as one associated with the adjoining parish of Beckley. It seems that in March 1579 Orlanden, of Venice, was involved in a dispute with Smith, citizen and glazier of London. Also in 1581 there was a dispute, about a furnace which had been pulled down, between Orlanden, Smith and Verzelini, who controlled the luxury trade in the London crystal glass industry which developed in the 16th century. In particular it is said that John Smith operated at Beckley in Sussex and at Ratcliffe in London.

This information suggests that the Ratcliffe mentioned in *The Rise and Progress* was in London and is not Radcliffe near Nottingham. Ratcliff, as it is now written, is on the north bank of the Thames, opposite Rotherhithe, where the earliest known gunpowder mill in Britain was situated. Indeed David Crossley's MPP report lists Ide's Glass Works at Ratcliff (TQ 3565 8095) and allocates it top grading for protection.

Returning to Antonia Fraser's *The Gunpowder Plot*, Keith Fairclough has checked her sources and reports that there is no mention of Radcliffe Mill in John Hale's *The Civilization of Europe in the Renaissance* and that Stow's *Annales* refers to a gunpowder mill blowing up in about 1603 at Redriff, which is an alternative name for Rotherhithe, and not at Radcliffe which is not mentioned.

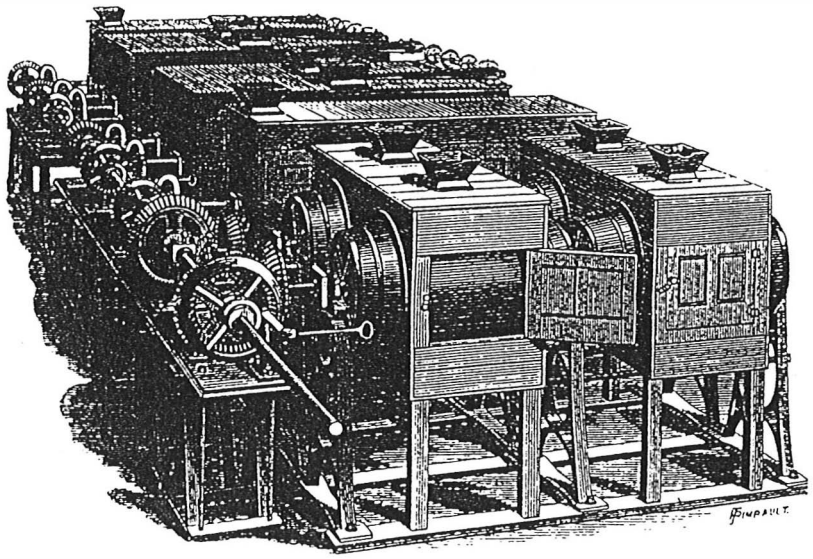
Incidentally, Ratcliff is also of interest to gunpowder historians because of the fire which on 23 July 1794 destroyed 455 houses and 36 warehouses (see H P Clunn, *The Face of London*, Spring, London, new ed. c1959, p 297). It was caused by the boiling over of a pitch-

kettle at a boat-builder's from where the flames spread to a barge loaded with saltpetre and then to the East India Company's saltpetre warehouses which were blown up, raining fire on adjacent buildings.

Alan Crocker

WALTHAM ABBEY ROYAL GUNPOWDER MILLS TRUST

Substantial progress has been made in recent months in ensuring the future of the Waltham Abbe Royal Gunpowder Mills site. Until recently all the work was being done by a Trust Steering Committee set up by the Ministry of Defence. They have agreed proposals for the site development, have been successful in obtaining a grant of £6.5M from the Heritage Lottery Fund and have negotiated an endowment of £8M from the Ministry of Defence. A Foundation to hold the freehold of the site and the endowment has been set up and Brenda Buchanan, International Secretary of GMSG, is one of the Foundation Trustees, representing the Science Museum. Also, an advertisement appeared in March inviting applications from those interested in becoming trustees of an Operating Company with responsibility for developing and maintaining the site as a museum and visitor attraction. It is understood that about 150 applied, about 24 were interviewed and 12 appointed, subject to formal approval by the National Heritage Memorial Fund. The Company will become operational in November but the trustees will be attending functions before then, including a weekend seminar in mid-September. Alan Crocker, Chairman of GMSG, is one of these trustees and other members might also have been selected.



9. Set of four glazing barrels, in the foreground, each of which holds 400 lbs of powder, glazing taking 5 to 6 hours. There are reels for removing dust from large grained opowder, in the background. Constructed by Taylor & Challen of Birmingham: from *Engineering* of 1878.

USE OF AMMONIUM NITRATE IN EXPLOSIVES MANUFACTURE

Gerry Moss has provided these responses to a query on the history of chemistry

From: Mark Kaszniak

I would like to add some information to support the opinion that ammonium nitrate was not used in place of potassium nitrate in gunpowder type explosives c1815. According to a US Bureau of Mines publication (Information Circular 8179), Ohlsson and Norribin patented Ammoniakkrut (Swedish patent 59-1867) on May 31 1867. This patent describes the use of ammonium nitrate as an explosive, either alone or in mixtures with charcoal, sawdust, napthalene, picric acid, nitroglycerin, or nitrobenzene. The industrial development of ammonia dynamites followed. These consist of ammonium nitrate admixed with various fuels which are sensitized by varying percentages of high explosives, such as nitroglycerin. In 1935, a new product called Nitramon was developed which is based on the explosive decomposition of ammonium nitrate. However, it was the development in 1955 of Akremite, a mixture of prilled Ammonium Nitrate and carbon black, which brought to the attention of the mining industry and others the basic principles and advantages of using fuel-sensitizied ammonium nitrate mixtures, prepared at or near the site of use, as low-cost blasting agents.

Also, Dr Zuck may be interested to learn that C E Monroe, in "The Explosibility of Ammonium Nitrate", Chem and Met Eng, **26**, 1922, pp 535-542, reported an explosion in Kensington on March 20 1896 which involved ammonium nitrate. This occurred in an enamalled iron retort in which 18 pounds of ammonium nitrate was being heated to produce laughing gas for dental use. The plant was demolished. This was apparently one of the first accidental explosions of ammonium nitrate to be reported. Of course, since then there have been some very famous ones, such as Oppau in Germany and Texas City in the United States. Monroe also quotes the following in regard to ammonium nitrate from Turner's *Chemistry* of 1835: "When this salt is exposed to fire, it liquefies, emits aqueous vapor, drys and detonates."

From: Peter Morris, Science Museum, London

I would like to support the point that nitrous oxide, although unknown as an anaesthetic, was widely used as a "recreational drug" c1815. Other possible uses of ammonium nitrate can be discarded. It is too early for ammonium nitrate to be used as a fertiliser and it would have been too expensive. Similarly it would have been too expensive and dangerous to be a flux. I doubt (but cannot refute) that it was used in place of potassium nitrate in gunpowder-type explosives, again mainly because of cost. I do wonder if it might have been used occasionally as a food preservative, but it does not appear to have been used in medicine (except to make nitrous oxide). Turning to freezing mixtures, they were commonly prepared by the 1780s, and Richard Walker, the famous freezing-mixture maker of Oxford, made a mixture of nitric acid, Glauber's salt (sodium sulphate) and sal ammoniac (ammonium chloride) to freeze mercury for the first time in England in January 1789 (notice the absence of ice or snow). This shows that ammonium nitrate could have been used in freezing mixtures at this time, but a mixture of the cheaper nitric acid (or possibly potassium nitrate) and sal ammoniac was commonly used.

First Golden Age of Rocketry: Congreve and Hale Rockets of the Nineteenth Century

Wayne Cocroft reports that this book looks excellent. It can be obtained from The Naval & Military Press Ltd, PO Box 61, Dallington, Heathfield, TN21 9ZS, tel 01435 830111 (fax 830623), for £14.95 plus £2.50 p&p. Full catalogue on http://www.naval-military-press.co.uk

Richard Winship Stewart, *The English Ordnance Office 1585-1625, a Case Study in Bureaucracy*, Royal Hist Soc - Boydell Press, 1996. ISBN 0 86193 233 1. Hardback. £29.50. 181 plus xii pp.

This book examines the procurement, maintenance and supply of weapons and munitions to the English armies from 1585 to 1625. The period commences with preparations for the war with Spain, continues through that war and the rebellion in Ireland, extends through the peace of James I and ends with the renewal of war in 1625. The aim is "to integrate political, financial, industrial, administrative and military concerns in order to highlight the workings of the arms supply network in war and peace". There are in all eight chapters and five appendices but this review will concentrate on Chapter 5, entitled *Gunpowder and Saltpetre*, which occupies pages 80 to 95.

Much of the material contained in this chapter was new to me. It commences with a section on "the petremen", which explains that it was not until the 1620s that saltpetre began to be imported by the East India Company and that even then it was several years before they could supply all the government's needs. Therefore saltpetremen toured the countryside looking for suitable caches of "earth", setting up central processing plants near handy sources of water and firewood, digging up the "earth" to a depth of eight feet, loading it into barrels or tubs, transporting it for processing in carts which had to be provided, very reluctantly, by local farmers, mixing it with water and boiling it several times. The resulting saltpetre was then loaded into barrels and taken to the gunpowder mills while the petremen moved on to create havoc in a different area. The activity was very unpopular with local people as the workmen dug up the floors of buildings, not just pigeon houses and stables but on one occasion a church "for the women piss in their seats, which causes excellent saltpetre". They also often neglected to fill in the holes they dug. Indeed they were so unpopular that in 1603 many county residents refused to allow them to dig at all because the queen had died which it was claimed invalidated the petremen's rights. However, as saltpetre was an essential commodity the abuses were allowed to continue. The amount of saltpetre which could be manufactured is interesting. For example in eight months in 1589 twelve petremen brought over 650 cwt into the Tower.

The second half of the chapter is on "gunpowder production" and explains that domestic manufacture was limited and large quantities had to be purchased overseas, especially from the low countries at relatively high prices (12d-15d per pound rather than 8d). This was particularly true in time of war and in 1588 the fleet fighting the Armada had a critical shortage of powder. Consequently, a monopoly for the production of gunpowder was granted to George and John Evelyn and Richard Hills. The Evelyns had mills in Surrey but the author has incorrect information about these and should have referred to the Group's *Gazetteer*. Although the Evelyns had a monopoly, the price remained low and it is noted that in 1640, after the monopoly had collapsed, the price became 18d per pound. A table is provided which shows that the government spent £158,000 on gunpowder between 1593 and 1625, this being the largest single expense of the ordnance office, the total being £428,000. In 1624 80% of the expenditure was on gunpowder. This was in anticipation of war with Spain. During the period 1620-28, £124,000 was paid to the financier and merchant Philip Burlamachi for saltpetre and gunpowder which he acquired from the Low Countries. Clearly domestic production was inadequate for the scale of warfare in the 1620s and it appears that the government had been guilty of short-sightedness during a time of peace. The author goes on to provide information on how much powder was used by different guns and the amount of powder issued to ships and land forces in battles. During peacetime powder was seldom used apart from saluting other ships and flags or fighting off the occasional pirate. Domestic

production was able to cope with this demand but the chapter concludes that self-sufficiency in gunpowder for England in the early seventeenth century was virtually impossible.

Much of the information upon which this chapter is based has been obtained from documents in the Public Record Office. There are however many references to books and articles with which I was unfamiliar. I certainly found it to be of great interest and recommend that GMSG members read it in detail themselves.

Alan Crocker

Andrew Pye, "An Example of a Non-Metalliferous Dartmoor Industry", pp 221-40 of Deborah Griffiths (ed), *The Archaeology of Dartmoor, Perspectives from the 1990s*, Devon Archaeological Soc & Dartmoor National Park Authority, 1996, ISBN: 0 9527899 0 6 (DAS), 1 85522 503 4 (DNPA)

This is a brief account of a detailed survey carried out in 1989 at the Cherrybrook gunpowder mills site near Postbridge on Dartmoor. Andrew Pye reported on this work at the GMSG Autumn Meeting in 1990 and with Rosemary Robinson co-authored a full report of the survey, together with an account of historical research which was produced by the Exeter Museums Archaeological Field Unit in June 1990 (see GMSG News **8**, Nov 1990, page 1). The present account is one of 16 papers in a volume, which is the report of a conference held in 1994 to celebrate the centenary of the Dartmoor Exploration Committee. It includes nine photographs and eight figures selected from the full report. Members of GMSG visited the site in May 1987 when we had a tour of mills in Cornwall and Devon. (GMSG News **4**, July 1988, pp 2-3).

The mills were established in 1844/5 and closed in about 1897. In its heyday it employed up to 100 people. Eighteen buildidngs, all of granite, survive in a derelict state. These include two striking chimneys and indeed the whole site, with its complex system of watercourses stretching for miles across Dartmoor, is very impressive. There is also a mortar which is featured on the cover of Glenys Crocker's Shire album on *The Gunpowder Industry*. The paper is divided into sections discussing each stage in the manufacture of gunpowder and suggesting which of the buildings were used for each process. Unfortunately no historic plan of the site labelling buildings has been discovered and, although the use of some of the buildings, particularly the incorporating mills, is clear, it is difficult to be precise about the function of others. Still it is encouraging that an account of the survey has been published in a readily available form and the paper is essential reading for those visiting the site, for which incidentally permission is required.

Alan Crocker

Maurice M Whitten, *The Gunpowder Mills of Maine*, 1990. $24.95 (plus $11.00 p&p air or $5.00 p&p sea) from author at 11 Lincoln St, Gorham, Maine 04037-1703, USA.

This book covers all the Maine mills from the beginning in 1817 to its end in 1920. The chapters are historical introduction, the manufacturing process for black gunpowder, Gorham-Windham powder mills, North Buckfield powder mills, Camdem powder mills, Warren powder mills, manufacture of smokeless powder in Gorham, and the end of the industry. There are also 18 appendices dealing with explosions and the establishment or liquidation of the powder manufacturers.

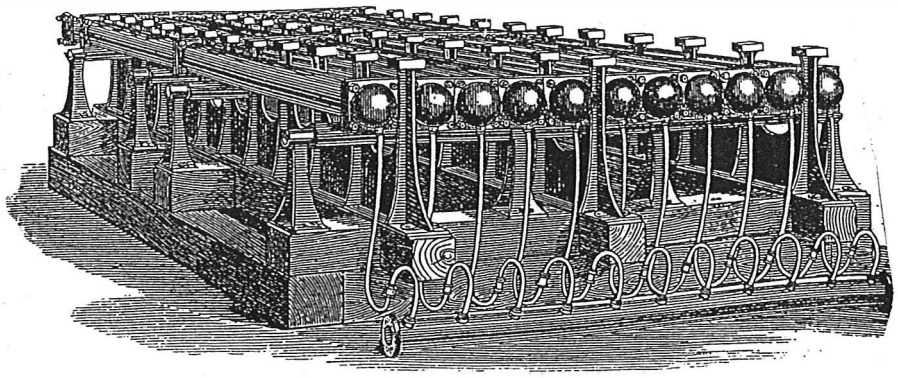
Frederic S Lee

Andrew Mead with photographs by Martin Jones, "Secret World on the Edge of London: The historic landscape of Waltham Abbey Royal Gunpowder Mills will soon be made available to the public", *The Architects' Journal*, 5 June 1997, pp 28-33

This is an article based on interviews with Wayne Cocroft, the RCHME archaeologist who led research into the site after it was decommissioned, Dan Bone, the Director of CIVIX the consultant development planners, and Stuart Pearson, landscape architect for the project. It is illustrated with a plan of the 71 hectare site and 13 rather romantic colour photographs. These show the grade I listed incorporating mills of 1861, vegetation invades a switchboard, the grand nitrator - hub of the nitroglycerine factory (2), the Quinan Stove of 1936 (2), E-shaped concrete traverse beyond the Long Walk bend, the dried up canal in the southern part of the site, a brick wall fractured by a sycamore, traverse with stopped clock, steel bridge over still-full canal, floor of demolished acid factory and red-brick cornice of no 4 press house of 1979 [misprint for 1879]. The text discusses general issues on the nature of the site (an extraordinary fusion of landscape, architecture and industrial archaeology), scheduling, decommissioning, decontaminating, planning, history, touring the site, designing the museum, and woodland, grassland. waterside and marshland habitats. It concludes that "up to now this has been a rare text-book example of the disposal of an MoD estate and that if the intricacies of public access are handled as adroitly, this unusual, evocative place should continue to cast its spell."

CITY ISLAND GUNPOWDER MILL, ST PETERSBURG

In Newsletter **18**, pages 6-7, we published a sketch of a 1729 plan of this mill together with a key to the buildings. Mark Ashworth, a librarian at the University of Surrey, has now examined the available photographs of this plan and suggests the following improvements to the translation of some items in the key. 2 "Timber barn for dry powder". 3 "Wooden drying house". 4 "Wooden shed for storage(?) of old gunpowder". 5 Wooden shed for storage of dry gunpowder. 9 "Building where dry powder is measured(?) and put into barrels. 13 "Shed with various stores/supplies(?)". 14 "Shed with gunpowder (in it). 15 "Quarters for the foremen and apprentices". 16 "Lords' (ie, nobles') courtyard in which the gunpowder master craftsmen/ foremen live". 19 "Lords' stables". 20 "Quarters for masters and senior appentices". Mark confirms that there is no mention of a sulphur house and has not been able to decipher the scale.



10. Series of 22 cast-iron pipes about 11 ft long for heating 256 trays which could dry 30 to 40 barrels of gunpowder. The small pipes in the foreground are for draining away condensed steam. Constructed by Taylor & Challen of Birmingham: from *Engineering* of 1878.

EXPLOSION AT THE GUNPOWDER HOUSE IN DELFT ON 12 OCTOBER 1654

From an oil painting by Egbert Lievensz van der Poel (1621-64), Stedelijk Museum Het Prinsenhof, Delft. It purports to show an explosion of some 80-90,000 lbs of gunpowder.

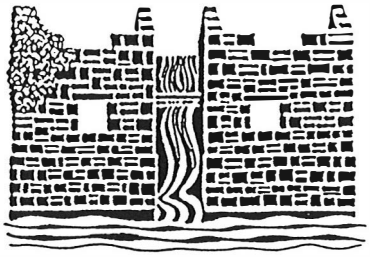
GUNPOWDER AT ICOHTEC 25

The 25th Symposium of the International Commitee for the History of Technology (ICOHTEC) will be held in Lisbon on 18-22 August 1998. The general theme will be "European Technology in a Global Context" and one of the seven main topics will be "The Technology and Application of Gunpowder in an International Context". Papers are invited; abstracts to be submitted by 31 Dec 1997; registration by 15 Mar 1998. Further particulars may be obtained from Brenda Buchanan, 13 Hensley Road, Bath BA2 2DR.

GUNPOWDER GHOST AT ELTERWATER

The *Westmorland Gazette* of 10 January 1997 reported that a teenager staying at the Langdale timeshare complex, which is on the Elterwater gunpowder mill site, had seen a man wearing a flat cap, waistcoat, baggy trousers, work shoes and an old scruffy coat, who appeared out of nowhere and glided past her staring straight ahead. The Newspaper states that "It is believed to be the spirit of 64-years old John Foxcroft who along with three other men died in an explosion in 1916". I happened to be staying at the timeshare at the New Year but could not have been responsible for previous sightings of this ghost in the 1970s.
[Thanks to Alice Palmer for supplying the Newspaper cutting]. *Alan Crocker*

Published by the Gunpowder Mills Study Group
Edited by Alan Crocker
6 Burwood Close, Guildford, Surrey GU1 2SB.
Tel 01483 565821, Fax 01483 259501, email A.Crocker@surrey.ac.uk



Gunpowder Mills Study Group

6 Burwood Close, Guildford, GU1 2SB

tel 01483 565821; fax 01483 259501
a.crocker@surrey.ac.uk

August 1997

This note is being sent, together with the August 1997 Newsletter of the Gunpowder Mills Study Group (GMSG), and related material, to those closely associated with the Waltham Abbey Royal Gunpowder Mills project.

GMSG was established in 1985 to bring together individuals researching the history of the gunpowder industry in different parts of Britain. As indicated on the enclosed membership list is has about 70 members including several from overseas. It has close links with other national bodies, including the Wind and Watermill Section of the Society for the Protection of Ancient Buildings (SPAB) and the Association for Industrial Archaeology, and also the International Committee for the History of Technology. Its International Secretary is Brenda Buchanan. GMSG anticipates that it will develop even closer links with WARGM.

One of the first tasks for the Group was to prepare a Gunpowder Mills Gazetteer. This was compiled by Glenys Crocker and published as a 56-page A5 booklet by SPAB in 1988. It contains information on about one hundred former gunpowder manufacturing sites in the British Isles. Copies are still available at £2.25 plus p&p from SPAB, tel 0171 377 1644

GMSG normally holds two meetings each year. One of these is a one-day conference, currently held at the Institute of Historical Research in London, and the other a longer meeting often visiting gunpowder mill sites in different parts of the country or overseas. These meetings have for example been held in South Wales, Cornwall, Somerset, Scotland, Cumbria, Surrey, Kent, Denmark and France. Several meetings have been held at Waltham Abbey and, it was at one of these meetings that our member, Angus Buchanan, who at the time was a RCHME Commissioner, was alerted to the importance and potential of the WARGM site and subsequently proposed that it should be surveyed in detail by the Commission. GMSG has also had close links with English Heritage particularly in providing much of the information for its National Monuments Protection Programme report on the Gunpowder Industry.

The Group's Newsletter is produced twice a year in February and August, convenient times for advertising the meetings which usually take place in May and October. In particular the front page of the present issue and the enclosed sheet has the programme for a meeting at Faversham in October. Please return this slip if you would like to attend.

Fortunately it has been possible to run GMSG in an informal manner so that the membership fee is only £5 a year. If you are interested in joining please send your subscription to Glenys Crocker, at the above address.

Professor A G Crocker DSc CEng FSA
Chairman, Gunpowder Mills Study Group