

Gunpowder Mills Study Group

NEWSLETTER 15, AUGUST 1994

MEETING AT THE INSTITUTE OF HISTORICAL RESEARCH,
SENATE HOUSE, UNIVERSITY OF LONDON
SATURDAY 15 OCTOBER 1994
(PLEASE NOTE THAT THIS IS A REVISED DATE)

PROVISIONAL PROGRAMME

10.00-10.30 Assemble and Coffee in Common Room on Ground Floor

10.30-13.00 Talks and Discussion including:

Dr Peter Edwards, Department of History, Roehampton Institute:

"Gunpowder Supply in the English Civil War". This will be a preliminary account of a study of relevant Public Record Office documents.

Wayne Cocroft, Royal Commission on the Historic Monuments of England, Keele:

(1) "The Production of Gunpowder at Waltham Abbey".

(2) "A RCHME National Survey of Selected Chemical Explosives Factories".

13.00-14.00 Lunch. It is recommended that members bring a packed lunch which may be eaten in the Common Room where hot drinks can be purchased.

14.00-16.00 Further talks and discussion including:

Dr Brenda Buchanan, Centre for the History of Science and Technology, University of Bath:

"Highlights of the Gunpowder Sessions at the 1994 Bath ICOHTEC Symposium".

15.45-16.30 Group Activities (including slides of the May meeting at Bisley) and Group Management.

There should be ample time for members' contributions and those relevant to the theme of "Problems in the Manufacture of Gunpowder" would be particularly welcome. Please let Brenda Buchanan know if you would like to contribute (13 Hensley Rd, Bath, BA2 2DR; tel 0225 311508).

We shall be meeting in The International Relations Room on the second floor of Senate House. Goodge Street, Warren Street and Russell Square underground stations are nearby. Parking might be available in the University of London car park - entrance at NW corner of Russell Square.

To cover administrative costs a fee of £2 will be made. It would be helpful to know approximately how many people will be attending. Please therefore let Glenys Crocker know if you are coming (6 Burwood Close, Guildford, Surrey GU1 2SB; tel 0483 65821).

THE BISLEY MEETING

Glenys Crocker

We had perfect weather for the meeting at Bisley on 30 April. Members gathered in the morning in the open air at the Short Siberia Range where Bill Curtis and De Witt Bailey had put up their tables and spread out some historic firearms for our instruction. They then proceeded to give us the benefit of their knowledge and enthusiasm for the subject in a detailed account of each one, how it worked and where, when and by whom it was used, enlivened by so many anecdotes and fascinating specialised details that it is impossible to summarise. It included stories about the divergence of opinion on the kind of equipment deemed appropriate for the cavalry in different places and times and by different people at the same time, how Joseph Whitworth solved the problems posed by the fixed bullet weight specified by the government, the breech loader that took an hour to clean every time it was used, the pocket pistols that everybody carried and the Mexican bandits. Then it was hands on! We are indebted to Tony Yoward who took slides of all the fun - they were much enjoyed at the ICOHTEC meeting in Bath and we plan to show them at the Group's forthcoming autumn meeting in London.

The practical session finished promptly at 1 o'clock and we went to look at the targets and the system for operating them before going to the main Club House for lunch. The Bisley site is an interesting place to visit in itself, with its spacious lay-out of colonial style buildings with verandahs. We continued the meeting indoors in the afternoon. First we had a short business meeting in which we discussed future plans and recent developments, in particular those at Waltham Abbey and plans to comment on the Monuments Protection Programme step 3 report which English Heritage had circulated.

Meanwhile De Witt and Bill had set out samples of powder and cartridges and a fine collection of gunpowder containers and De Witt then gave us a talk on the containers. Again there were all kinds of intriguing details, such as how horns were softened by heat and then moulded, how softwood plugs on strings (so they didn't get lost) were replaced by spring chargers and then by ones which also measured the amount. Fashions in dress came into the story - we learned for instance that tail coats had pockets in the tail so the powder containers had to be long and slim. Besides horns there were leather and decorative metal containers and a simple corked one mass-produced from sheet tin. Many of the containers were beautiful craftsman-made objects which had clearly been cherished possessions of their owners.

Many thanks indeed to Bill Curtis and De Witt Bailey for such an enjoyable and memorable day.

GUNPOWDER LABEL FROM FAVERSHAM

Wayne Cocroft



*The label is 66mm
in diameter*

During a recent RCHME photographic survey of the Marsh Works at Faversham, Kent, two identical labels were discovered in a disused building. The Works were leased to John Hall & Son from the Government in 1832 and sold to them in 1854. The Company operated on the site until 1898 when it was incorporated into Curtis's & Harvey Ltd. It would therefore be interesting to know whether or not this label pre-dates the takeover in 1898 or whether Curtis's & Harvey continued to trade under the old title. The labels have been returned to the owners with a suggestion that they donate them to the Fleur de Lis Heritage Centre at Faversham.

THE MANUFACTURE AND MARKETING OF GUNPOWDER: A REPORT ON SECTION II OF THE 1994 ICOHTEC SYMPOSIUM

The 23rd International Symposium organised by the International Committee for the History of Technology (ICOHTEC) was held at Bath from 30 July to 4 August. The programme was divided into five sections and one of these, arranged by Brenda Buchanan, was on the theme of the manufacture and marketing of gunpowder. The abstracts of the papers submitted for this part of the symposium are being edited by Brenda and it is intended that these will be circulated to Group members in due course. In the meantime a brief personal report of the meeting is given here.

It was appropriate that the first talk entitled "Meeting standards, Bristol powdermakers in the 18th century" was given by Brenda herself. She first stressed the international character of the gunpowder industry. Usually some of the raw materials had to be imported and much of the powder was either exported or used in foreign countries. She then discussed problems associated with mills in the Bristol region. The second talk by Robert Howard of the Hagley Museum, Wilmington, Delaware was on "The evolution of black powder making from an American perspective". This was illustrated by a wealth of excellent slides of the Hagley Museum and several active mills elsewhere in the States. Robert emphasised that American powdermakers had a tendency for bigger, better and cheaper methods of production. These two lectures were presented to all 100 or so people attending the symposium.

The remaining talks were given to those who opted to attend the gunpowder sessions rather than presentations on one of the other specialised topics covered by the symposium. The first was by Bert Hall of the University of Toronto on "The coming of gunpowder and the use of firearms in the Renaissance". He noted that early gunpowder makers used mainly calcium nitrate rather than potassium nitrate and he called early corned powder "crumb powder". The Armada ships had two sizes of corned gunpowder and the English ships still had serpentine powder. This was followed by Kelly de Vries of Loyola College in the States on "Gunpowder and early gunpowder weapons". He spoke about the puzzling lack of understanding of the properties of gunpowder in the Middle Ages at a time when there was a continual evolution in gunpowder weaponry. Then Gerhard Kramer of Freiburg in Germany presented his paper on "Das Feuerwerkbuch". There are 47 known manuscripts of this Firework Book and the oldest version, dated to 1432 and held in the archives of the University of Freiburg, is to be published by the Deutches Museum of Munich. It is this book which proves that calcium nitrate was used to make gunpowder in the Middle Ages. It was also claimed that the historical existence of Berthold Schwarz can no longer be denied. Sarah Barter Bailey of the Royal Armouries then showed fascinating slides from the copy of the Feuerwerkbuch held at the Tower of London.

The next talk on "Black powder - its early use in mining and spread over Europe" was by Heinz Walter Wild of the Technische Universität Claustal, Germany. The oldest report of shotfiring underground dates from 1573 in a Venetian mine. It was also used in France before the well-known case of Schemnitz, then in Hungary but now in Slovakia, in 1627. It then spread and for example reached Ecton in Staffordshire in 1665. The development of the techniques of blasting, leading to the invention of fuses, were also summarised. Björn Ivar Berg of the Kongsberg Bergverksmuseum, Norway, then talked about "The production and consumption of gunpowder at the Kongsberg silver mines, 1734-1865". He listed nine Norwegian gunpowder mills, the earliest, near Bergen, dating from 1626. He then concentrated on the mill at the Kongsberg silver mines, showing slides of detailed technical drawings of the 1840s, when stamp mills were still being used, and of the scant overgrown remains at the site today. The next paper on "Living dangerously: gunpowder and other

explosives in Victoria in the nineteenth century" was given by Peter Milner of the University of Melbourne. Gunpowder was imported into Australia in substantial quantities following the discovery of gold in Victoria in 1851 (20,000 barrels in 1860). There were two powder docks in Melbourne harbour and 22 magazines in Victoria.

In the next session Seymour Mauskopf, of Duke University in the USA, gave a talk on "From Rumford to Rodman: the scientific study of the physical characteristics of gunpowder in the first part of the 19th century". He discussed the work of Count Rumford (1753-1814) on the force of fired gunpowder, of Guillaume Piobert (1793-1871) on the physical parameters of powder and of Thomas J Rodman (1815-1871) on prismatic powder. He noted that prismatic powder was introduced at St Petersburg in 1862. Ian Rae of Monash University, then spoke about "John Cyrus Martin and Australian gunpowder in the 1860s". Martin claimed, in 1865, that he had previously spent 25 years working at the Kennall Vale mills in Cornwall and applied to the colonial government in Victoria for a reward for having founded a new industry. This was the manufacture of a non-explosive substitute for gunpowder but unfortunately nothing is known of the invention or the company. This was followed by a talk by Bengt Åhslund of the University of Gothenburg on "Black powder manufacture in Sweden to the end of the 19th century". He concentrated on the supply of saltpetre in the period c1650-1800. Peasants were obliged to provide raw materials and manpower and there was a semi-military corp known as the Crown's Saltpetre Boilers. The workers migrated annually and operated in teams of two or three for each kettle. The Aker Black Powder Works near Stockholm was established in 1641 and is still in operation.

There should have been five papers in the next session but none of the authors (from Spain, Germany, Hungary, India and Russia) was present. This provided time for an excellent talk by Patrice Bret of the Comité Lavoisier on "The organisation of gunpowder manufacture in France 1775-1830". In 1775 Lavoisier and three colleagues were put in charge of a new State Gunpowder Administration and introduced scientific processes in the production and testing of saltpetre. They provided a modern training for the gunpowder officials and managed to double production in 12 years. The French Revolution gave an impetus to the industry. Seven times as much saltpetre was produced and four new gunpowder mills opened near Paris. Edge runners were widely introduced and then in 1819 sodium nitrate from Chile started to replace potassium nitrate. There followed a paper on gunpowder production in Spain and Latin America which was read in English, at very high speed, by Amaya Saenz, a Spanish research student who ran out of time before reaching Latin America. Fortunately she showed a large number of magnificent slides, including one of the painting of the mill on the ceiling of a room at the Uffizi Gallery, Florence, discussed elsewhere in this Newsletter. I look forward very much to seeing the printed version of this paper. Finally Owen Ward read a paper, at very slow speed, on "The use of windpower in gunpowder making: a windmill in Galicia", which should have been presented by Begoña Bas of Coruña, who was unable to attend. It was about a windmill used occasionally, until the owner's death in 1953, for preparing the ingredients for making fireworks for local festivals.

The final session was devoted in part to aspects of gunpowder manufacture and use in the British Isles. First Brendan Kelleher of Cork County Council gave an account of the Royal Gunpowder Mills at Ballincollig and of the establishment there of a Visitor Centre. Then Paul Everson described the recording work done by the RCHME at the Royal Gunpowder Mills at Waltham Abbey. Wayne Cocroft of the RCHME then commented on a paper on "The history of explosives in Russia" by Ivan Ivanovitch Vernidub, who was unable to be present. This was followed by Bill Curtis who showed slides taken by Tony Yoward at the Group's spring meeting at Bisley before talking about "The deterioration of gunpowder". He mentioned for example that gunpowder packed in old barrels retains its properties better than

that in new barrels. De Witt Bailey then discussed "A selection of gunpowder containers" referring to examples which he had on display and which some members had seen at Bisley. Finally Bill and De Witt were able to provide a considerable amount of information about a collection of fifty or so firearms brought along by the Curator of the Royal Bath Institute.

A feature of the meeting was the excellent social functions arranged each evening. We missed the first which was at the Camden Works Museum, visited by the Group during its spring meeting last year and also the last, which included a dinner on the "Great Britain" at Bristol. However we enjoyed the reception at the Roman Baths followed by dinner in the Pump Room, the reception and dinner at Green Park Station, where some of us ate last year, and the reception and dinner at the University of Bath, followed by a gunpowder salute at which Brenda Buchanan was persuaded to fire a canon.

In conclusion it was a very rewarding and enjoyable meeting which has enabled us to make contact with several overseas gunpowder historians and to get to know some of the "home" participants rather better. It was a pity that some of the key speakers were unable to attend and we missed particularly the talk on "The gunpowder mills at Spandau", which are near Berlin. We look forward to seeing these papers in print. Finally Angus Buchanan, who masterminded the symposium in general, and Brenda Buchanan, who organised the gunpowder sessions in particular, deserve our thanks for a very worthwhile meeting.

Alan Crocker

GOVERNMENT POWDER 1740-83; INDIAN TRADE BEFORE 1775

De Witt Bailey, who helped to organise the Group's Spring Meeting at Bisley, has written to us about his interests in gunpowder and we think that other members would like to hear about them:

"My chief interest in gunpowder lies in two faintly related areas, the first and major one being in the precise quality and granulation of Government powder in the period 1740-83. According to Congreve the bad quality and performance of British powder in America during the 1770s was a byword in the forces. We know from Jenny West that it was of a single granulation, and the records show that up to c1740 the Government was being supplied with fine powder for muskets and cannon powder. Thereafter this distinction disappears and all powder (except for rifle powder in 1776-7) is described simply as "corned powder". Charles Trollope believes that the British went over to the French powder composition c1740, which gave poorer performance but was apparently cheaper. We also know that the powder manufacturers were ripping-off the Ordnance during the period of the American War, and that the Ordnance's chief reason for acquiring the Faversham mills in 1759 was to act as a check and monitor on the powder supplied by the contractors, a plan which appears not to have been very successful. My own feeling is that the grain size may have been critical in the decline of the performance in small arms, but if the composition, and failure to compress and/or glaze is also involved, then the performance would have been even worse. The scattered negative evidence suggests that Ordnance powder, apart again from the rifle powder, was not glazed but that glazed powder might be supplied on an approved individual request basis. It is not clear, in the Ordnance context, whether glazing at this period meant merely polishing or polishing and coating. The second area which is of particular interest to me is the export of powder to North America prior to 1775, particularly that related to the Indian trade."

**WALTHAM ABBEY SEMINAR, 6 AUG 94.
"THE ROYAL GUNPOWDER MILLS: PAST & PRESENT"**

This seminar was organised by English Heritage in order to provide a forum at which the historical importance of the Waltham Abbey site in the development of the explosives industry could be emphasised and at which proposals for the future development of a museum and interpretative centre could be discussed. It was a well attended meeting, with representatives from the Ministry of Defence who own the property, the local MP, Steve Norris, the Mayor of Waltham Abbey and other local elected representatives, as well as members of English Heritage, the Royal Commission on the Historical Monuments of England (RCHME) and other groups, including our own, with a particular interest in the historical development of the site.

After introductory remarks from Trevor Knapp, Assistant Under-Secretary of State at the Ministry of Defence, Ron Dane, the Director of CIVIX, planning consultant for this site to the Ministry of Defence, spoke about their work over the preceding years and gave credit to Angus Buchanan for the speed with which the RCHME began their study. The rest of the morning session was given over to detailing the historical development of the site and emphasising the importance of these developments in the national context. Jenny West concentrated on the history of gunpowder production at Waltham Abbey from the mid-seventeenth century onwards, at first in private hands under the auspices of the Hudsons and the Waltons and then, following the purchase of the business by the Crown in 1787, the important developments that took place under the auspices of William Congreve, the Comptroller of the Royal Laboratory. The importance of the site to the national industry was emphasised. Geoff Hooper, Vice President of the Ordnance Board and a former Director of the research establishment at Waltham Abbey, paid particular attention to the later development of the site as a state factory, still producing gunpowder but more significantly playing an important role in the development and production of explosives such as guncotton, nitroglycerine, cordite and tetryl. It was emphasised that Congreve vaunted Waltham Abbey as a laboratory to send out best technology and practice to private industry, and that this practice had been maintained thereafter. Paul Everson, editor of the RCHME report on Waltham Abbey, then gave an account of the remains to be found at the site and the results of the comprehensive site survey carried out by his organisation last year. This report was on sale at the seminar and copies will be brought to the Group's Autumn Meeting for members to consult.

The afternoon session, introduced by Jennifer Page, Chief Executive of English Heritage, was given over to the discussion of proposals for the future development of the site. Neil Cossons, Director of the Science Museum, spoke about the various options available for a site at which only the buildings remained and at which there was little of the original machinery. A favoured option was the provision of a dowry from the present owners to provide capital for the setting up of a museum and interpretive centre that would thereafter be self supporting. Martin Cherry, the Head of Listing Branch at English Heritage and the convenor of the seminar, then explained the details of the site, that two-thirds had been scheduled as an ancient monument, that there were 21 listed buildings, and that much of the northern part of the site was designated as an SSSI. Such factors defined the importance of the site but did place some restrictions on any future development. The final speaker was David Prince, Director of PRC Ltd, who produced a report he had been commissioned to make by the WARGM Trust Steering Committee. This report discussed the viability of a museum with a national status concentrating on the history of explosives and the development of an ecological interpretive centre. It was proposed that a Foundation could be established

to hold the land and a capital fund as a permanent endowment, and that this Foundation would grant an operating lease to a separate charitable company to operate the site as a museum and interpretive centre, whilst a separate trading company could concentrate on merchandising and catering activities. Plans for a gradual development of the facilities were outlined, with specified objectives for the first three years designated as a preparatory stage and further specified objectives for an ensuing four stages of development over at least ten years. The report was warmly received and there followed an animated public discussion, which revealed amongst other matters the sensitivity of local feeling on the issues, and including contributions from members of our Group which emphasised the importance of the site. This report will now be forwarded to the Ministry of Defence for their consideration. A copy will be available for consultation at the Group's Autumn Meeting.

For the final part of the seminar the meeting split into three groups which were then given a guided tour of the site, each group being led by someone closely involved in the surveying and excavation work that has gone on during the last few years. Much of the decontamination work has now been completed, and new developments since members of the Gunpowder Mills Study Group last visited the site include the excavation of parts of the internal navigation system, the unearthing of several craft that were used on this system, and the uncovering of the underdriven machinery in the steam incorporating mills. Another feature of the presentation was a series of 15 watercolours of the site painted by Freda Titford earlier this year. It is hoped to display these along with others yet to be painted at a special exhibition at Epping Forest Museum at some future date.

Keith Fairclough

THE HOUNSLOW POWDER FACTORY IN 1896

Our member **Bill Curtis** has discovered a series of articles entitled "The Sporting Powder Industry of Great Britain", which was published in *The Sporting Goods Review* in the mid-1890s. In particular he has given us a copy of the third article in the series on the mills of Curtis's & Harvey at Hounslow, which appeared on pages 61-63 of the issue dated 16 March 1896. The article is headed by an excellent photograph showing part of the works including a boiler house chimney, the so-called "shot-tower", with an eight-sided pyramidal roof, several other low buildings including two on either side of a waterwheel and a large pond in the foreground being crossed by a punt. The author describes a visit to the site and makes several interesting points. Some of the charcoal cylinders were horizontal but others were vertical. Double refined saltpetre was being powdered and sifted but crude saltpetre was no longer being refined, although the equipment was still to be seen. Sulphur was ground under heavy stone runners powered by water. Mixing was carried out in drums with balls of *lignum vitae*. The incorporating mills were in groups of six, three on either side of an engine house, all driven by overhead shafting. Plates of ebonite were used in the hydraulic press house. Corning was carried out using toothed and smooth rollers. Glazing of black, brown and compound powders was powered by a large waterwheel. Drying was carried out by steam at 100 to 150 deg F. Dusting was powered by a "teledynamic" rope from a distant waterwheel. There were two large storage magazines. Pebble, black and brown prismatic, blasting pellets, diamond grain and basket powders were being produced. Spurious labels included "Cubtis's & Marvey of Hounslom" and "Cortis's & Hadvey". There was a large steam cooperage and box and canister making departments. The visit also included the stables, the proof ground and workmen's dwellings.

A similar article on "The Faversham Factory" will be summarised in a future Newsletter.

Alan Crocker

In April 1705 the Ordnance signed their first contract with a new gunpowder supplier, Samuel Shephard, and he was to remain a regular but small supplier throughout the remainder of the War of Austrian Succession. After that however his name never appears in the Ordnance records again. In those records it is usually just his name that appears, but on one occasion he was further described as a merchant and on another as junior.(1) There were two Samuel Shepheards, father and son, both of whom became MPs in 1701. The father died in 1719 and the son in 1748. In 1668 the father became a member of the Dutch Reformed Church in Austin Friars and in 1681 he served as a deacon of that community.(2) In April 1692 a Samuel Shephard, merchant, was appointed an assistant of the newly incorporated Company of Salt Petre Makers,(3) whilst in 1702 John de Berdt of Battersea left Mr Samuel Shephard of London, merchant, £50 in his will. De Berdt was also a member of the Dutch Reformed Church, and was the father of the gunpowder maker of the same name who worked at Wandsworth mill during the War of the Spanish Succession.(4) These last two references could apply to either the father or the son. In 1710 the father was described as being "for shipping and foreign trade by far the first in England", and in 1719 his will, in which he described himself as being a merchant of London, was proved. This will provides no clue as to his business activities, it merely makes provision for his wife, Mary, and splits the rest of his estate between his two sons, Francis and Samuel, provided they make provision to pay annuities totalling £110 included in the will.(5) It does seem likely that it was the son who supplied gunpowder to the Ordnance, and a comment in 1715 that he "Resolved to be a Cambridgeshire country gentleman" would explain why his name never appeared again as a supplier of gunpowder after 1714. He certainly succeeded, for his will notes monetary bequests of over £52,000 plus several annuities. From 1708 until his death in 1748 he had served as the MP for either Cambridge or Cambridgeshire, and between 1717 and 1721 he was a director of the East India Company.(6) His will gives no indication of any link with the gunpowder industry he had once worked in. What remains to be discovered is just where he produced gunpowder, for no link has been found with any production site. Is it perhaps possible that he did not produce gunpowder, that he imported it from Holland in order to meet war demands? It would be interesting if anyone can shed further light on his short career as a supplier of gunpowder.

Notes

1. PRO, WO 48/45, 21 April 1705, WO 48/46, WO 51/70 fo.48, WO 51/71 fo.58, WO 51/73 fo.49, WO 51/77 fos.46,120, WO 51/78 fo. 73, WO 51/79 fos.65-66, WO 51/83 fos.38-39, WO 51/85 fos.40,109, WO 51/86 fo.41, WO 51/87 fo.135, WO 51/88 fo.57, WO 51/89 fos.113,125,135.
2. Guildhall Library, Ms 7404 fo.131; W J C Moens, editor, *The marriage, baptismal and burial registers 1571 to 1874 and monumental inscriptions of the Dutch Reformed Church, Austin Friars.* (Lymington, 1884), 212.
3. PRO, PROB 11/465 sig 11; Moens, *op cit*, 210,212.
4. *Calendar of State Papers Domestic 1691-92*, 249.
5. PROB 11/567(16); J R Woodhead, editor, *The rulers of London 1660-1689* (London, 1965), 147.
6. PRO, 11/762 sig 162; R Sedgewick, editor, *The history of parliament: the House of Commons 1715-1754* (2 vols, London, 1970), ii, 420-21.

THE LIVERPOOL GUNPOWDER MAGAZINES: FURTHER INFORMATION

Jane Longmore, who is Head of Historical, Social and Cultural Studies at St Mary's University College, Strawberry Hill, Twickenham, has provided the following additional information on the gunpowder magazines at and near Liverpool which were the subject of an article in Newsletter 13, pp 6-10.

"Within the Liverpool town books I discovered the following references:

9 October 1751 - reference to new powder magazine in Cheshire (Liverpool Record Office, 352 MIN/COU/1/1/10, f503)

6 November 1751 - reference to powder magazines moved to Cheshire (LRO, 352 MIN/COU/1/1/10, f509)

7 December 1768 - reference to permission granted to John Bridge to enclose a piece of ground to the south and east of his house on Sion Walk according to the plan produced and to take down the present magazines and watch house, rebuilding them in some place to be determined by the Mayor and Committee of Views with the consent of his Majesty's Board of Ordnance. This land was to be converted into a bowling green at his own expense (LRO, 352 MIN/COU/1/1/11, f477). This appears to be a different powder magazine - the area of Sion Walk is occupied by the present Anglican cathedral. It appears that there was some further difficulty with this proposed arrangement: on 5 July 1769 Bridge's lease was revoked "*it being found inconvenient to lease out such land at present*" and the corporation offered to pay for rebuilding the powder magazine and Bridge's expenses in pulling it down (LRO, 352 MIN/COU/1/1/11, f491). On the 5 April 1775 John Bridge was allowed to enclose this land on condition that he did not build any dwelling house or other building along the south-west frontage. A bowling green is marked in the relevant position on the map of Liverpool in W Moss, the Liverpool guide (first edition, Liverpool 1796).

Other relevant references to the powder magazines occur in R Brooke, *Liverpool during the Last Quarter of the Eighteenth-century* (Liverpool 1853). Brooke refers to the Liverpool gunpowder magazine standing at the north end of Clarence Street after a lease of 1737 from the Corporation of Liverpool had granted the land for three lives and twenty one years (page 134). Brooke continues that the magazines were pulled down and later (c1768) transferred to Liscard, Cheshire where the corporation had purchased an acre of land for £30 from Robert Richardson. He adds that the Brownlow Hill building was used for French prisoners of war until the borough jail was built in Great Howard Street in the early nineteenth-century. J Touzeau, *The Rise and Progress of Liverpool, 1551-1835* (2 vols. Liverpool 1910) refers to the grand jury at the quarter sessions presenting the old magazines as existing contrary to the law and a danger to life, whereupon they were moved from the north side of Brownlow Hill to Liscard, Cheshire in October 1751. He adds that the expense of purchase was paid by the corporation (£30) who then leased the land in thirty one lots (vol 2, page 507). Finally in J Stonehouse, *The Streets of Liverpool* (Liverpool 1870) there is a reference on page 157(?) to the line of a street from Rodney Street cut through the powder house fields adjoining fields belonging to Mr Gildart. The powder house stood exactly on the site of the opening of Russell Street and was, according to Stonehouse, "*dangerous and inconvenient*". He adds that the magazines were moved to Liscard prior to 1768."

Jane Longmore adds that at the site of the Liscard Magazines, the pub of the same name is very atmospheric.

MANUAL PRODUCTION OF GUNPOWDER IN SPAIN

Keith Fairclough

Amongst the treats for any visitor to the recent Goya exhibition at the Royal Academy is one painting which shows the manual preparation of gunpowder. The painting entitled "The Making of Powder in the Sierra de Tardienta" is on loan from the Palace of La Zarzuela, Patrimonio Nacional, Madrid. It was painted by Goya at some date between 1810 and 1814, as part of a sequence of prints about the "Fatal consequences of the bloody war in Spain against Buonapart". After the lifting of the siege of Saragossa in 1808 the Spanish military authorities involved in the efforts to drive the French from Spain invited Goya to visit them and record what he saw. On his subsequent journey it seems possible that Goya saw an illicit munitions manufactory in a wild area of Aragon, and that the painting of the preparation of the powder, and another of the making of shot, was Goya's response. Both paintings are reproduced in the exhibition catalogue, and the gunpowder painting is also reproduced on a very small scale in the free guide that is given to all visitors to the exhibition.

The painting shows no buildings or any other evidence of any permanent production. Rather it is a picture of makeshift preparation of powder that must have gone on near the battle front. Ten men are shown, crowded on top of each other, each of whom has a long handled spade-like implement with which he makes the mix in the wooden bowl at his feet. Both the implement and the bowl seem to be made of wood. Nearby are the wooden boxes in which the powder is packed and a pitcher of water which may have been used to wet the powder while it was being worked with the spade-like implements. If this is an accurate portrayal of such a scene, are the men incorporating gunpowder from the three raw materials, or are they merely reworking already made gunpowder for use soon afterwards? If they are making gunpowder, were such manual methods common, or did the Spanish have to adopt these methods solely because they had no permanent production facilities to use, these being controlled by the French government in Spain? The Ordnance did sometimes deliver saltpetre to army posts. Was this so that such manual production of gunpowder could be undertaken? Finally, does anyone know of similar paintings by other artists?

MANUFACTURING GUNPOWDER IN FRANCE, 1795-1830

David Hansell has sent us a copy of a substantial paper by Patrice Bret entitled "Le Dernier des Procédés Révolutionnaires: La Fabrication et L'expertise de la Poudre Ronde (1795-1830)", which was published in *Annals of Science* (1993) 50, pp 325-47. It is preceded by the following summary in English.

"During the French Revolution, political and military circumstances, combined with lack of success with chlorate powder, led the government to favour rationalization of manufacturing processes in an attempt to increase the range of guns. In 1796 "poudre ronde", invented by J P Champy (1744-1816), Lavoisier's successor as head of the administration of powders and saltpetres, seemed to be nearly the ideal gunpowder. For a reduced price, it produced sufficient powder, with maximum security in manufacture and use. Despite the approval of the scientific and military experts, however, production was stopped through politico-bureaucratic obstruction. At the end of the Empire, J S Champy (1778-1845) perfected his father's process to create the first mechanized production system, the introduction of which brought about the modification of the work processes and the design of gunpowder factories created during the Restoration. Paradoxically, the success of this system led to its failure after a decade of production that always remained experimental. "Poudre ronde" called in question metallurgical techniques by blowing up the canons. The

hitherto unpublished first expert report on this process, of 1813, provides the opportunity to follow through the development of a manufacturing process that foreshadows the mechanization of the gunpowder industry in the nineteenth century, while remaining quite clearly the product of year II of the Revolution. The opportunity is also provided to enquire into the criteria and quality of expert opinion at the time when chemical analysis of gunpowder was beginning under Proust, Gay-Lussac and Brianchon."

David Hansell has examined the French text and notes that he is not clear why the process description is claimed to be an improvement. In particular he asks: "Was there no process to remove dust previously or did the old style product disintegrate in store?" He also suspects that there is a bit of special pleading in parts and, as ever, a whole series of questions are raised. We still have to look at the paper in detail but superficially it looks very good.

CONFEDERATE GUNPOWDER IN THE AMERICAN CIVIL WAR Alan Crocker

The May 1994 issue of the journal *America's Civil War* contains an article, on pages 20, 22 and 24, by Louis S Schafer entitled "Colonel George Washington Rains worked wonders with the Confederacy's nascent Nitre Bureau". It concerns mainly the very large steam-powered gunpowder mill at Augusta, Georgia, which was opened on 27 April 1862. Before the Civil War (12 April 1861 to 9 April 1865), gunpowder was not stored in the Southern States so that the Confederacy had a great need for powder. Two mills were therefore set up in New Orleans and produced just over 2 tons of gunpowder per day but they had outstanding orders for another 200 tons. Then on 28 December 1861 an explosion brought operations to a standstill. Gunpowder amounting to 1.3 tons per day was also being produced in July 1861 at a previously abandoned mill in Nashville Tennessee. The saltpetre was being obtained from deposits in limestone caverns in Kentucky but most of these were captured by Union forces early in 1862. Teams were therefore sent out to dig earth from beneath privies and latrines. Other caverns were also explored in Arkansas, Alabama, Tennessee and Georgia and good quality nitrates discovered, excavated and converted to pure saltpetre. In practice however the best source turned out to be Texas and by October 1862 there was a stockpile of 2000 tons.

At the same time gunpowder was being smuggled from Europe and it is estimated that during the 4 year conflict about 1650 blockade-running vessels arrived safely in port with approximately 1200 tons of powder. However much more was needed and Col George Washington Rains, a former professor of chemistry, geology and mineralogy at West Point Military Academy, who was in charge of the Confederate Nitre Bureau, decided to build a full-scale mill along a 2 mile stretch of canal near Augusta, Georgia. Rains obtained 24 edge runners (known as rollers in America) each weighing 5 tons and 12 circular iron plates, presumably for use as bed-plates, from the Tredegar Iron Works in Richmond, Virginia, 4 further edge runners from Chattanooga, Tennessee, and from south of Macon, Georgia, a 300 ft long and 12 ins diameter line shaft from England [perhaps from Tredegar Iron Works in Glamorgan, Wales?], an aging 130 hp steam engine from an abandoned cotton mill, evaporating pans from a Tennessee iron works and copper boilers converted from confiscated turpentine and whisky stills.

Impure sulphur was obtained from Louisiana sugar growers, who had imported it to refine their harvest and Rains developed an ingenious and rapid purification and distillation procedures. The resulting pure sulphur was pulverised using 5 ft thick iron rollers and sifted through silk but as the Confederacy supply of silk became exhausted a method of separating out the very fine powder using pulsating blasts of hot air was introduced. Willow for making

charcoal was also scarce but Rains discovered that cottonwood was a suitable substitute. Retorts were used and fired for about 2 hours. They were then cooled in the adjacent canal and the charcoal pulverised in rotating barrels containing bronze balls. The mixed ingredients were then saturated with water and steamed. This reduced the mixture to a slush and allowed the saltpetre to crystallise partially within the charcoal. The result was that incorporation time was reduced from 4 hours to less than 1 hour. Rains also carried out microscopic examinations of the gunpowder and found that the charcoal particles were pitted with minute holes. He was able to devise a process in which these were filled with saltpetre, hence enhancing the powder.

Rains added a further 12 edge runner mills at Augusta giving, presumably, 26 in all. There was a serious explosion in the early days killing seven men and destroying 3 tons of gunpowder. Timber walls 10 ft thick were constructed between buildings and doors were fitted with 2 ins thick glass. The mills were powered from below and had 30 gallon dowsing tanks. The magazines were below ground level and had light-weight zinc roofs.

Some of the information provided in the article and reproduced above is puzzling. For example the 2 tons of powder per day produced at New Orleans and 1.2 tons per day at Nashville seems very large compared with the 1200 tons in 3 years estimated for the very big mill at Augusta. Also from where was the European gunpowder being smuggled? The innovative technology is also interesting. Rains knew little about gunpowder manufacture when he was appointed so from where did he get his ideas? The dowsing arrangements in the incorporating mills sounds English and the saturating and steaming of the gunpowder mixture is reminiscent of Henry Drayson of Maresfield in Sussex and Fritham in Hampshire. Finally it is fascinating to discover that saltpetre earth was being dug in the 1860s, as it was in England in the late 16th and early 17th centuries.

[We are indebted to Scott McCracken, an archaeologist friend now working in Sweden, for sending us a copy of Louis S Schefer's article].

After preparing the above account I discovered further information on the Augusta mill on pages 39-40 of the RCHME Waltham Abbey report, which is reviewed elsewhere in this Newsletter. The source of much of Schefer's article is a book by G W Rains entitled *History of the Confederate Powder Works* and published at Augusta in 1882. It seems that Rains acquired a copy of a pamphlet on the manufacture of gunpowder as carried out at Waltham Abbey written by F Baddeley and published privately in 1857. As a result the layout of the Augusta mills is similar to the 1858 mills at Waltham Abbey. In particular there were six chambers on either side of a 130 hp steam engine, the chambers faced alternately in opposite directions, the mills were powered by means of an underground drive shaft and there were drenching tubs above the incorporating mills. Rains experimented with improving the Waltham Abbey processes. For example he dispensed with pressing because he decided that the pressure of the incorporating mills was adequate. Also he combined glazing, drying and dusting into one operation by using heated barrels.

CHANGE OF ADDRESS

Shane Gould, our member who was responsible for preparing the Monuments Protection Programme report on The Gunpowder Industry for English Heritage, has left the Cranstone Consultancy and is now working for the Archaeological Advisory Group, Planning Department, Essex County Council, County Hall, Chelmsford, Essex CM1 1LF.

CORRESPONDENCE ABOUT KYNOCHTOWN AND POWDER BARGES

We recently heard from **Harold Mann** of Faversham, Kent, asking about the manufacture of gunpowder at Kynochtown in Essex, which is now known as Coryton and is an oil terminal. When the *Gazetteer* was published we knew about the production of modern propellants and explosives at Kynochtown but had no information about gunpowder being made there. Later we discovered from Ted Patterson's booklet *Gunpowder Terminology & Incorporation* (Faversham Society, 1986) that Kynochtown was licenced to make black powder from 1897 to 1920 and that an incorporating mill explosion had occurred there in 1910. Also we discovered an article on Kynochtown by A Clifton Kelway in *Essex Review* 16, 1907, pp 112-121 (see Newsletter 8, p 8), which explains that there were sections at Kynochtown for the manufacture of guncotton, black gunpowder, smokeless powder, cordite, nitro-glycerine and .303 cartridges. So, we sent a copy of this article to Harold Mann and he has sent the following response:

"My first interest was in the railway shown on a 1938 map. It is of interest that the "Kynoch steamers" were mostly Thames sailing barges. Having no engine they were much employed in the powder trade, even until the 1950s, to work from Gravesend to the explosives anchorages, where the cargo would be transferred to foreign going ships. This anchorage is about 5 miles downstream from Kynochtown, and may have been a factor in choosing the site. One of the last wooden barges built, *Lady of the Lea* (1931), was for the Admiralty, to carry explosives from Waltham to Woolwich. She is smaller than usual, still sails, and is based at Faversham. The site would seem to have been vulnerable in the last war, but I know nothing of its later years." Harold Mann has also noted a small "Explosives Factory" marked on the 1 inch OS map of 1921 at Stanford-le-Hope Marsh, about 2 miles SW of Kynochtown.

Members interested in learning more about the use of Thames sailing barges to transport powder should contact our members David and Elizabeth Wood, 11 The Embankment, Twickenham, London TW1 3DU. David has written a 64 page booklet *Powderbarge WD* (ISBN 0 905270 03 7), published in 1977 by the Society for Sprintsail Barge Research. It is dedicated to *Lady of the Lea*.

INCORPORATING MILL CHARGES

Fred Hamond, our member who rebuilt the incorporating mill which was re-opened last year for demonstration purposes at Ballincollig, County Cork, has written about the quantity of gunpowder that was incorporated at any one time. This was limited to 40lbs per mill by a 1772 Act of Parliament but increased to 50lbs for sporting and Government powder and 60lbs for blasting powder by an Act of 1860. Later, further increases up to 250lbs were allowed for particular mills but these did not apply to Ballincollig. Fred assumes that the density of gunpowder is roughly 125lbs/cuft so that a 60lb charge would have a volume of about 0.5cuft or one half of a bucket-full. Now the surface area of the base of the Ballincollig incorporating pan is 47sqft so that a 60lb charge would spread out to a depth of about one-eighth of an inch. Fred thinks that this is impractically small and wonders whether the limitation on the charge was disregarded. Fred is confident about the area of the Ballincollig pan, although this is rather larger than what we have deduced from other mills. Perhaps the solution is that efficient ploughs would scrape the whole half bucket-full into the path of each runner so that there would be a substantial thickness of powder to run over. Do members have any further comments?

GUNPOWDER MILL AT THE UFFIZI

Alan Crocker

In May, our member Charles Trollope phoned to say that he had just returned from Florence where he had visited the Uffizi Gallery. Much to his surprise he found that one of the rooms has a painted ceiling featuring a gunpowder mill. Unfortunately he had been unable to purchase a photograph of this ceiling and wondered whether the Group might be interested in finding out about its history. So, I wrote to the Director of the Uffizi (in English) explaining that we would be interested in obtaining a photograph and any available information. I mentioned that, if the painting were 16th or 17th century, it would be interesting to compare the gunpowder technology it shows with that in contemporary illustrations in German documents. In particular I suggested that this would be a good topic for an article in our Newsletter and I enclosed a copy of the last issue.

I received a response (in Italian) consisting of a letter and a photocopy of an article entitled "Soffitti nei Corridoi nelle Sale" by Caterina Caneva with 22 small and rather poor reproductions of paintings on the ceilings of "Sale 19-23". With the help of Sarah Barter Bailey, I have deduced that the painting is one of five on the ceiling of Room 23. It was painted by Ludovico Buti in 1558 and was restored in 1945 and 1979. It is in an oval surround and shows a stamp mill at the left, a worker using a sieve at the right centre and, in the background through an arch, what appears to be a hand-operated mortar and pestle with an overhead sprung beam. By chance a slide of the painting was shown by a Spanish speaker at the Bath ICOHTEC meeting and revealed its beautiful colouring. The technology seems to be somewhat out-of-date for 1558.

GUNPOWDER MILL AT ST PETERSBURG IN 1729

Alan and Glenys Crocker

During August we visited the Peter-Paul Fortress at St Petersburg, which was founded by Peter the Great in 1703. Within the Fortress, the Commandant's House is now occupied by the St Petersburg History Museum. One of the display panels on the upper floor of this museum shows two engravings of 1784, by an unknown artist, which are copied from the book *Wonders of Nature and Art*. The first, labelled "Gunpowder mills", shows a waterwheel, a stamp mill and a man using a sieve. The second, "Preparation of Gunpowder", shows a large pan in the foreground, another over a fire in the background, a sieve, weights and two men. Above these engravings is a copy of a 1729 "Plan of location of gunpowder factories on the city island", by an unknown surveyor. The plan shows a small island in the estuary of the River Neva, upon which St Petersburg stands. Twenty buildings are marked and numbered but unfortunately we were unable to transcribe the labels. We assume that the mills were animal powered as the area is flat and there is no tide so that water power is not possible. The first 1784 engraving is therefore somewhat misleading. We hope to obtain more information by writing to the Director of the Museum but if we have a Russian-literate member who is visiting St Petersburg, please look out for this display. It is in the room with the big anchor! [Thanks to Jim Riordan, Professor of Russian at the University of Surrey, for translating the Cyrillic words we copied painstakingly but inadequately from the display].

NEW OVERSEAS MEMBER

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REVIEW

[Wayne Cocroft & Paul Everson] *The Royal Gunpowder Factory, Waltham Abbey, Essex. An RCHME Survey, 1993*, RCHME, 1994, ISBN 873592 25 6. Part 1, A4, 193 + vi pages + 7 tables. Part 2, A3, 14 plans and 1 illustration. £10 plus £2 p&p.

At a meeting of the Group held at Waltham Abbey in May 1992, Angus Buchanan, then a RCHME commissioner, was encouraged to recommend to RCHME that the site of the Royal Gunpowder Factory be surveyed and recorded. His recommendation was accepted and three months of fieldwork commenced in January 1993. This report is the result of that fieldwork and the associated documentary research and analysis. Together with a vast amount of supporting information, it forms a deposited archive account for the National Monuments Record (NMR). It is therefore structured as an NMR report and, although being made available to interested parties, is not a formal RCHME publication.

The report is divided into five sections. Four of these are bound together in an A4 flexible binding and the fifth, consisting of 14 plans and a 1735 view of the site, in a separate A3 binding. Section 1 (26 pages) is basically introductory material, explaining the status and organisation of the report, the circumstances and methods of the survey, a 5 page summary, acknowledgements and a very useful bibliography. This is divided into cartographic sources (43 items), official publications (9), internal reports (2), explosives legislation (7), unpublished sources (31) and published sources (89).

Section 2 is the Descriptive Report, including site history (23 pages) from c1650 to 1992 and site description (54 pages) divided into 11 areas. It concentrates on the North Site and the Lower Island and not the South Site, which was developed from the 1880s. The site history is concise but thorough and covers several unfamiliar aspects including a link with the Confederate Powder Mills at Augusta, Georgia. The meat of the section is however the very detailed site description, which is based on an inventory of "component sheets" (which are available for consultation). One of these sheets has been prepared for each standing building, principal buried remains and earthworks and other monuments. It is not easy to deduce how many of these sheets were prepared as at least three different reference systems are used, a current Ministry of Defence number, a 1923 map number and a RCHME number. I found this very confusing. Part of the problem is that buildings were re-used, demolished, and replaced, so that many different structures and activities may be associated with a given location, and each had to be recorded and explained. In order to try to master the system I decided to make use of the report to find out about the building which has been suggested as a museum of the gunpowder industry (see Newsletter 11, pages 4-6).

I located this building on the site plans (A3, fig 3) and deduced that it is in Area L, which is covered by the RCHME 1993 survey plans (scale 1:1250) of figs 9 and 10. In practice our building is on fig 9 and is numbered L149. The Contents page (iii) then told me that the site description of Area L starts on page 71, where the subheading gives a cross-reference to figs 3, 9-10. On page 72, I discovered that L149 was known as the Group E Steam Incorporating Mills. However it was originally a pellet house and was converted to become incorporating mills in 1878. It was T-shaped in plan and at the rear there was an enclosed coal yard and tall chimney. The rear wing was a boiler house containing two Lancashire boilers raising steam for a centrally-placed beam engine formerly housed in a tall axially placed tower. The engines were secured to bed stones surrounded by a floor supported on cast-iron beams. To either side of the engine and below the floor level of the building was a segmental cast-iron flywheel. The engine powered a central horizontal drive shaft housed in a tunnel, termed a drive shaft alley, beneath the floor of the mill bays. There were three bays either side of the engine house. The tunnel was constructed of cast-iron plates. Beneath each of the mill bays,

the drive shaft alley widened out to form a circular chamber in which was housed a horizontal gear wheel driven by a pinion wheel attached to the drive shaft. This wheel was engaged by means of a friction clutch controlled from the outside of the mill. The drive shaft clutches and pinion wheels remain *in situ*. The engine bases and gearing may survive as the fly wheels were visible at the ends of the drive shaft alley backed by loose brick rubble. The incorporating mill machinery sat on the floor above the chamber with a drenching tub over the machinery to douse the mill in water in the event of an explosion. At the end of the 19th century the building was converted into cordite incorporating mills. The gunpowder mills were removed by cutting the vertical shafts and allowing the horizontal gear wheels to drop into the sub-floor chamber where the majority of them remain. The below floor shaft was replaced by an overhead drive shaft powering belt-driven cordite incorporating machines. Thus in practice I was able to discover a large amount of interesting information about this particular building and no doubt could also do for several hundred other features on the site.

Section 3 is the Analytical Report which is based on the physical remains of the factory but strengthened by reference to the wealth of available historic sources. It divides the development of the factory into ten chronological or functional phases (31 pages) and also has a substantial section on power, transport and safety (21 pages). Finally there is one appendix on the technology of explosives manufacture (26 pages) and another providing manufacturing flow diagrams for black powder, nitrocellulose for cordite MD or guncotton, cordites MD and W, nitroglycerine and tetryl (6 pages). This section is easier to read than Section 2 but inevitably repeats some of the information. In order to assess it, I again looked for building L149. The contents list states that the subsection on "The final phase of gunpowder: development and demise 1850-1898", starts on page 116 and on pages 117-18 I found interesting additional information.

The building was first constructed as a pellet powder house in response to the introduction of pellet powders for use in large charges in 1867. It consisted of a boiler house, an engine house and a hydraulic accumulator tower. However there was no space for a press so it is assumed that this was sited elsewhere in an unlocated building. The construction of the building appears to have been premature as in 1869 it was reported that pebble powders gave superior results to pellet powders. Hence in 1877 work began to convert the building into a standard T-shaped gunpowder incorporating mill. The engine house and hydraulic accumulator tower were retained, a new boiler house added to the existing one and three incorporating mill bays added to either side of the engine house. Again, in principle, I could have carried out the same exercise for several hundred other site features.

Section 4 lists 14 volumes of components sheets: Acid and Tetryl Factories, Aqueducts, Bridges, Canals and Leats; Area A; Area H; Area L; Barges; Buildings 1-40; Guncotton Drying Stoves 74-98; Lower Island Works; Millhead; New Hill Nitroglycerine Factory; Nitroglycerine Factory E1-E16; Quintin Hill - South Site; S27-S90. There is also an example of a component sheet. This is for building S31 which by chance is a press house which may have been associated with L149. Between 1879 and 1945 it had six different uses and these are listed with start and finish dates. There are also 21 cartographic references, 7 documentary references, a list of historic and RCHME photographs, a summary of relationships with other monuments and a description including constructional materials, roof materials and structure, power source, dimensions and two paragraphs of text.

In conclusion, all I can say is that this is an incredibly impressive report and will prove invaluable to all interested in the Waltham Abbey site. The fact that it has been prepared by RCHME staff who until a couple of years ago had no knowledge of the explosives industry and little of industrial archaeology is amazing. We owe our thanks and congratulations to all concerned.

REVIEW

Anthony Pasmore, ed. *New Forest Explosives, An Account of The Schultze Gunpowder Company of Eyeworth and The Armaments Research Department, Millersford.* New Forest Section, Hampshire Field Club & Archaeological Society, 1993. ISBN 0 907473 08 3. A5, card covers, 36 pp. £2.50.

This booklet makes available the full contents of a trade pamphlet on the Schultze Gunpowder Company published in c1896 and a *Picture Post* article of 1945 on the work of an unnamed explosives range "somewhere in England in the depths of the countryside", ie ARD Millersford. There are also short editorial introductions to the two articles. The Schultze pamphlet, which contains 18 photographs of the works at Eyeworth Lodge near Fritham (NGR SU 226146), is the one upon which our member Tony Yoward based a talk to the Group in 1989 (Newsletter 7, page 1). The Company made a very successful smokeless sporting powder manufactured from woodpulp, nitric and sulphuric acids, barium nitrate, vaseline, acetone and alcohol. Following a general introduction the pamphlet contains sections entitled The Factory, The Foreman's House, Eyeworth Lodge, Stables, Carhouses etc, Entrance Gate, Nitrating Tanks, Purifying House, Grinding House (with edge runners), Hardening House, Drying Houses and finally commendations including "I always use Schultze Powder, and greatly prefer it to all others. Its perfect regularity imparts great confidence".

Schultze gunpowder was of course a modern propellant but the editorial introduction explains that the previous occupant, Mr Drayson, was also a gunpowder manufacturer. This introduction is based entirely on a series of "Office of Woods" files held at the Public Record Office. It records that Drayson applied to the Crown for a lease of Eyeworth Lodge to establish a gunpowder manufactory in October 1859. He undertook to spend £1500 on the works over three years and started in 1860. The following year he proposed to sub-let part of the site to Capt Brown of Romsey who had taken out a patent for compressing gunpowder into solid charges but there is no evidence that this happened. By this time the firm is referred to as Drayson & Campbell. In 1866 Drayson assigned the lease to a Mr Broderick, apparently to raise funds for further investment. Drayson was due to retire in 1866 but in May 1869 Broderick complained that he had absconded resulting in losses of £300 to £400. However in the following month Broderick sold the lease to Clement Dale and William Bailey for the Schultze Gunpowder Company. Tony Yoward and other members of the Group have much additional information about Drayson and his gunpowder mills at Maresfield in Sussex and at Eyeworth (Fritham) in the New Forest and we shall provide the editor of the pamphlet with appropriate details.

The second article in the booklet is on a World War II Armaments Research Department establishment which occupied a 650 acres site at Millersford. It was located on the south-west side of the B3080, the entrance being approximately at NGR SU 213176. It was used for static trials of explosive devices. The editorial introduction is based on discussions with former workers at the site and a sketch plan based on aerial photographs is provided. The *Picture Post* article emphasises the use of high speed photography in recording explosions and armour-piercing bombs penetrating steel plates.

Alan Crocker

During April each year the Association for Industrial Archaeology organises a week-end conference and Glenys and I usually attend as representatives of the Surrey Industrial History Group. This year the theme was "Typologies" concentrating, as examples, on limekilns and maltings. The meeting was based at The Ironbridge Institute, which is housed in the Long Warehouse, adjacent to Abraham Darby's furnace of 1709 and The Museum of Iron, at Coalbrookdale. The Institute provides postgraduate courses in industrial archaeology leading to awards of the University of Birmingham. We arrived early and took the opportunity to look for books on gunpowder in the Institute Library. We found several which we knew well but also the following two with which we were unfamiliar.

S I Levy, *Modern Explosives*, in the "Common Commodities and Industries" series. Pitman [1920]; ix + 109 pages.

This is based on personal experience gained by the author in World War I. It has chapters on modern explosives and their raw materials, chemistry of explosives manufacture, the acids section of an explosives factory, the manufacture of propellant explosives, preparation of high explosives, explosives in war and peace, and chemistry and national welfare. It contains ten photographs of H M Factory, Queens Ferry (QF) [North Wales], Gretna (G) and H M Distillery, Portishead (P), near Bristol. In particular they show: (1) H M Factory QF with many buildings and a railway, (2) the Tetryl Sifting House at QF with condensed nitric acid collected in earthenware, (3) the Nitric Acid Retort House at G with nitrating pans in batteries of four, water connections above and acid connections below, (4) the Cotton Nitrating Room at G with wooden washing and boiling vats, washing taking several days, (5) the Nitroglycerine Hill at G with five women wearing rubber caps and boots pouring nitroglycerine into rubber bags, (6) transporting cordite at G, showing an electric locomotive and large distances between buildings, (7) the TNT Nitration House at QF with four nitration pans, (8) the TNT granulating and packing house at QF, showing linen bags being used to collect TNT, which has passed through granulating rolls on the floor above, (9) the Tetryl Nitration House at QF, (10) H M Distillery at P showing concentrated Borneo spirit containing toluene. I did not have much time to study the text but it seemed very sound.

Norman B Wilkinson, *Explosives in History*, Hagley Museum, Wilmington, Delaware, 1966; 2nd printing 1975. 63 pages.

This popular booklet, suitable for children, is mainly concerned with Du Ponts. However it does summarise the early history of gunpowder manufacture in North America. The first mill was on the Neponset River near Milton and Dorchester, not far from Boston. It was established by Walter Everenden from Kent and operated from 1675 to the 1750s. In about 1753 a second mill was started by Benjamin Everenden at Canton, Mass, and this continued until 1766. At the beginning of the Revolution they had about 80,000 lbs of gunpowder, mainly stolen from the British. Henry Wisner, powdermaker of southern Ulster County, NY, then wrote a pamphlet on how to make gunpowder. Everenden's mill was revived and a Philadelphia mill operated by Oswald Eve was started in 1775, selling powder for 8 cents per lb, and this operated until the early 1800s. Georgia and Delaware each had one or more mills but the leading producer in 1776 was Pennsylvania with 5 mills. Continental Powder Mill on French Creek in Chester County, about 5 miles from Phoenixville worked till 1777. France and the Netherlands supplied the North Americans with saltpetre. In 1791-5 there were 5 mills near Philadelphia, 1 in Montgomery County, 2 in Lancaster County, 2 in York County and 7 in Berks County. Maryland had a Gunpowder River near Baltimore, the first mill at Gwynn's Falls surviving until 1812. There were also mills at Bellona Plant on Jones Falls, near Washington and at Hazardville, Connecticut.

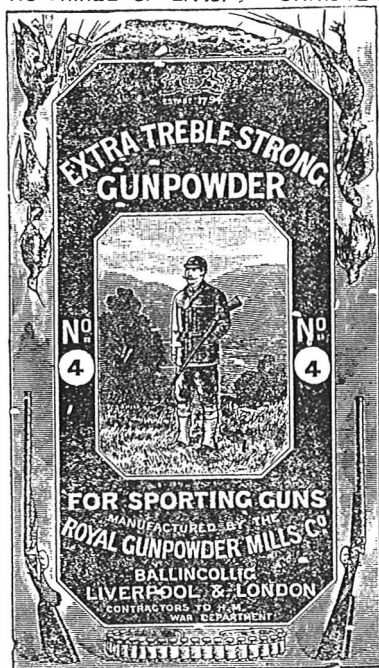
A SELECTION OF BOOKS ON THE TECHNICALITIES OF GUNPOWDER

This is the title of an article by **Bill Curtis** which appears in "The Book Collectors' Column" of the June 1994 issue of *Classic Arms and Militaria*, pages 40-45. Bill starts by recommending the bibliography and list of sources in Jenny West's book on *Gunpowder, Government and War in the Mid-Eighteenth Century*, Royal Historical Society, 1991. He then comments on: John Gray's *A Treatise of Gunnery*, London, 1731; Benjamin Robins's *New Principles of Gunnery*, 1742 (reprinted by Richmond Publishing Company 1972); Alessandro Vittorio's *A Treatise on Gunpowder*, translated into English by Captain Thomson in 1789; George Montagu's *The Sportsman's Directory: or, Tractate on Gunpowder, Founded on a Series of Experiments: together with Some Remarks and Suggestions on Fire-arms*, 1792; *The Act to Regulate the Making, Keeping, and Carriage of Gunpowder, within Great Britain*, 1772; Pierre Van Cortlandt's *Essays upon the Making of Salt-Petre and Gunpowder*, 1776; Francis Grose's (reputed) *Advice to the Officers and Soldiers of the British Army*, (satirical) c1782; William Muller's *The Elements of the Science of War*, 3 vols 1811; O H Goodenough's *Notes on Gunpowder Prepared for the Use of the Gentleman Cadets of the Royal Military Academy*, 1868 (with 5 large fold-out plates of the Waltham Abbey machinery); J Braddock's *Memoir on Gun-Powder*, Madras, 1829; J Braddock's *Treatise on Gunpowder*, London 1832; William Jacob's *Practical Hints on the Proof of Gunpowder*, Bombay, 1844; James Walker's *Remarks &c &c &c on the Safe Conveyance and Preservation of Gunpowder*, 1814; William Anderson's *Sketch of the Mode of Manufacturing Gunpowder at the Ishopore Mills in Bengal with a Record of the Experiments Carried on to Ascertain the Value of the Charge, Windage, Vent and Weight, etc in Mortars and Muskets, also Reports of the Various Proofs of Powder*, London, 1862; Andrew Ure's *Dictionary of Arts, Manufactories and Mines*, 1830s, 5th ed edited by Robert Hunt 1860; HMSO's *Regulations for Magazines and the Preservation of Artillery Material*, London 1899; *Dean's Manual of the History and Science of Fire-arms*, 1858 (reprinted by Standard Publications Inc 1946); J Scoffern's *Projectile Weapons of War and Explosive Compounds*, 3rd ed 1858 (reprinted by Richmond Publishing Co 1971; John Read's *Explosives*, Pelican 1942; Arthur Marshall's *Explosives their History, Manufacture, Properties and Tests*, 3 vols 1917-32.

GUNPOWDER MILL NEAR GLYN CEIRIOG, NORTH WALES

Tony Stevens, Vice Chairman of the Surrey Industrial History Group, has brought our attention to a gunpowder factory at Hendre, near Glyn Ceiriog, which is 4 km south of Llangollen, Clwyd, North Wales. This was previously unknown to us and is not included in the *Gazetteer*. The mill is referred to in *The Glyn Valley Tramway* by W J Milner, which we have not seen but was published in 1984 by Oxford Publishing Co. On page 31 there is a photograph of what is described as "The works of the Wood Gunpowder Co at Hendre, built around 1880". Appendix 2 lists the Blasting Powder Works at Hendre, 1870-79 and Appendix 3 lists a watermill for the Wood Blasting Co at Hendre - manufacturing gunpowder from 1870 to 1879. As far as we are aware it was not licensed following the Explosives Act of 1875. We note that on the OS 1:50,000 map (Sheet 125) "Hendre Farm" is located at SJ 189343, which is 4 km SW of Glyn Ceiriog on the opposite side of the Ceiriog valley from the the B4500. We hope to provide more details about this mill in the next Newsletter and would welcome any information about it which members might have.

FAC-SIMILE OF E.T.S. 31b. CANISTER.



THE BALLINCOLLIG
Royal Gunpowder Mills Company

LIMITED,

2, EAST INDIA AVENUE, LEADENHALL STREET, LONDON, E.C.

Telegraphic Address:—"FIRELOCK, LONDON." LIVERPOOL OFFICES—2, INDIA BUILDINGS.
WORKS—BALLINCOLLIG, IRELAND. ESTABLISHED 1794.

CONTRACTORS TO H.M. WAR DEPARTMENT.

MANUFACTURERS OF

HIGH-CLASS SPORTING & MILITARY POWDERS.

SOLE MAKERS OF THE

R.P. (Royal Premier),

AND

E.T.S. (Extra Treble Strong),

SPORTING POWDERS,

For which the makers claim the following advantages:—Reduced Recoil.
Reduced Smoke, Reduced Fouling.

BLASTING POWDER of every description at Market Price.

Prices and Testimonials to Shippers and the Trade only.

The advertisement reproduced above was discovered by Bill Curtis in *The Sporting Goods Review* for 1895/6. This is the only known illustrated advertisement for The Royal Gunpowder Mills at Ballincollig.

CIVIL WAR GUNPOWDER MILLS AT GLOUCESTER

Wayne Cocroft has brought our attention to an article by Malcolm Atkin and Russell Howes in *Post-Medieval Archaeology*, 27 (1993), pp 15-41, entitled "The use of archaeology and documentary sources in identifying the Civil War defences of Gloucester". From 10 August to 5 September 1643 a garrison of about 1500 parliamentary forces at Gloucester held off an estimated 30,000 royalists before being relieved. At the beginning of the siege there was a stock of only 40 barrels of gunpowder but two powder mills, probably one on the Quay and one in the Cathedral Precinct, were able to replenish supplies. A payment of £9.6s.0d was made to Thomas Davis, the powder maker and Thomas Barnes was paid £3.11.0d for a fortnight's work in making saltpetre. Also Augustine Loggins was paid for hauling saltpetre liquor from Mr Boyle's "pidgin house".

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