

**Gunpowder & Explosives History Group**

**Newsletter 9, Autumn 2004**

**GEHG AUTUMN MEETING**

Members' Day and Annual General Meeting

Saturday 30<sup>th</sup> October 2004

**INSITUTE OF HISTORICAL RESEARCH, SENATE HOUSE,  
MALET STREET, LONDON, WC1E 7HU**

10.00 Meet in Common Room for coffee

10.30 Meeting in International Relations Room

Lunch The Common Room - please bring a packed lunch

13.0 Annual General Meeting

16.30 Meeting disperses

We would like to invite as many members as possible to prepare a small contribution to the day: recent research, ongoing enquiries, puzzling questions, solutions found, obscure features, future opportunities.

**SALTPETRE MELTING HOUSE, WALTHAM ABBEY**

Wayne Cocroft



Royal Gunpowder Mills, Waltham Abbey, Essex, Saltpetre Melting House 1787

The theme of the spring meeting of the GEHG was saltpetre and it was appropriately held in the former Saltpetre Melting House at the Royal Gunpowder Mills Waltham Abbey. A report on the meeting will appear in the next Newsletter.

**SALTPETRE THEFT FROM WALTHAM ABBEY**

Les Tucker

In 1795 the Mills were enlivened by an incident which had an element of slapstick about it, although the consequences were serious. Unbelievably George Hicks a labourer at the Mills made off with an entire cartload of saltpetre. They caught up with him at Chelmsford and in January 1796 he was sentenced to transportation for 7 years. Bearing in mind it was government military material it could have been worse. One does wonder whether this was an early example of the 'stealing to order' which plagues the owners of luxury vehicles nowadays. It is difficult to imagine that the cart was taken on the offchance, it seems possible that Hicks had been assured of purchase by a private maker who was prepared to take the material no questions asked.

**THE DARWINS, GUNPOWDER AND SALTPETRE**

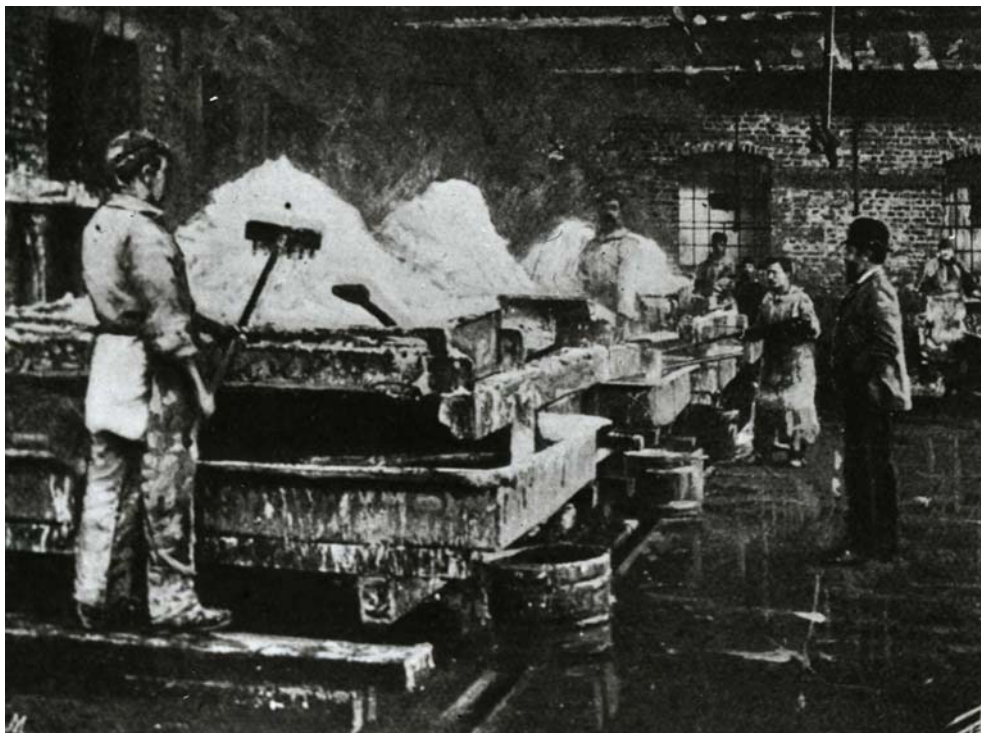
Les Tucker

Erasmus Darwin, grandfather of Charles, of natural selection *The Origin of Species* fame, in his youth was sent to boarding school where he almost killed himself and his friend Lord George Cavendish with a gunpowder experiment. The world therefore almost missed *The Origin of Species* and all its ongoing effects. Erasmus had a favourite sister Susanah. They regularly corresponded and perhaps he had the gunpowder experiment in mind when he wrote the following poem:

My dearest Sue  
 Of lovely hue  
 No sugar can be sweeter  
 You do as far  
 Excel Su-gar  
 As sugar does saltpetre

## THE KNOWLER FAMILY AND SALTPETRE REFINING

Les Tucker



*The Waltham Abbey saltpetre refinery, The Strand Magazine 1895*

This photograph was one of a series taken to illustrate a *Strand Magazine* article on the Waltham Abbey Mills published in 1895, when the era of gunpowder was coming to an end. It shows the saltpetre refinery and the bowler-hatted figure was John Thomas Knowler who at that time had forty three years of service behind him and was termed the ‘father of the factory’

Waltham Abbey was a self contained town with the Mills its main employer. There was a tradition of succeeding generations of families entering employment there, often in the same occupation as their predecessor. One such family was the Knowlers.

The Knowler connection started in 1789 when Samuel Knowler came from the mills at Faversham to work at Waltham Abbey, initially in the Corning House. By the time he retired in 1821 he was an Assistant Master Refiner of Saltpetre. He was followed by his son Samuel John Jones Knowler, who became a Master Refiner of Saltpetre, retiring in 1857. He was the father of the John Thomas Knowler in the photograph

who also in due course became a Master Refiner of Saltpetre. He did not marry and the family connection with saltpetre refining ended with him, although other Knowlers, e.g. Edward, a Danger Building Visitor, worked at the Mills into the early 20<sup>th</sup> century.

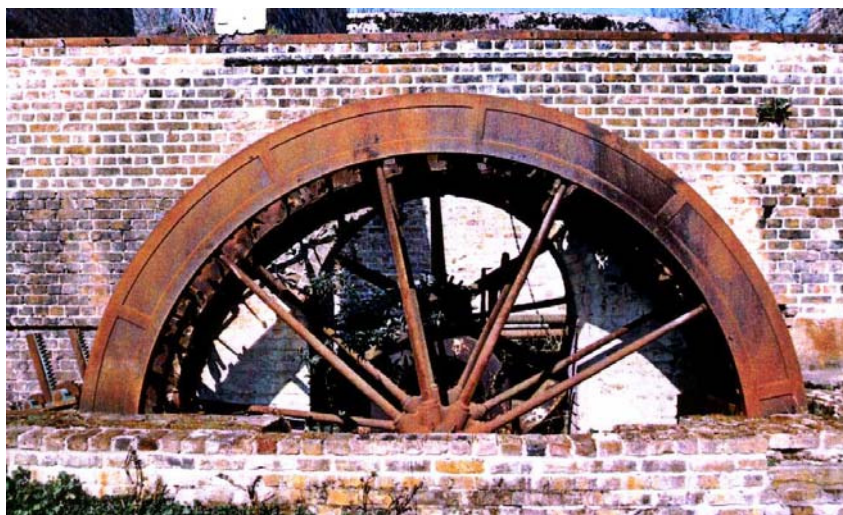
### **A WATERWHEEL BY WILLIAM FAIRBAIRN AT THE ROYAL GUNPOWDER MILLS WALTHAM ABBEY**

Kenneth J Major



*The Presshouse - to the right is the waterwheel and pumphouse, in the centre is the traverse and the left is the gunpowder press.*

Sir William Fairbairn in his book *Mills and Millwork* describes his work in powder mills and in this he states that he worked at Waltham Abbey gunpowder mills. The large waterwheel and grinding pans are described on page 530 of the 4<sup>th</sup> edition of 1878. The waterwheel which concerns us is not illustrated.



*The waterwheel with the flywheel beyond*

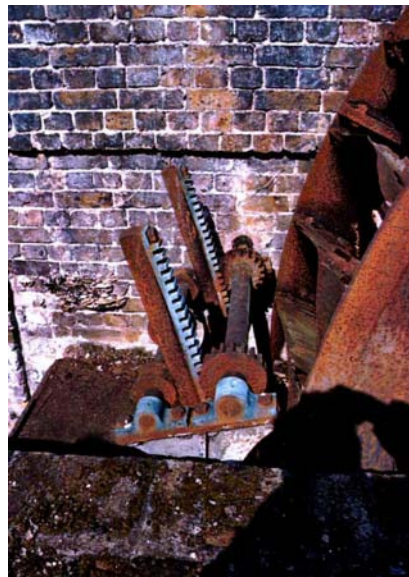
Sir William Fairbairn was responsible for the waterwheel and machinery in the press house in 1856. At this time he was part of the establishment. He had worked with Prince Albert in the Great Exhibition of 1851, on the Britannia Bridge across the Menai Straits and was commissioned to work at the Royal Gunpowder Mills at Waltham Abbey. Though the castings made by his firm were never signed we must accept that he created the waterwheel, pumps and powder press at Waltham Abbey.

What characterises the Fairbairn water wheel at Waltham Abbey? The waterwheel is small being only 14ft (4.26m) diameter and 3ft 2in (965mm) overall. The shrouds are a surprise being 14in (355mm) deep. The 40 buckets of this wheel are supported by U-shaped castings in the middle of their spans. This is a variant on the detail in Mills and Millwork. The arms are very heavy and there are 10 in each face of the waterwheel. They are wedged to the hub where each arm is socketed and when in place held by a wedge in a vertical plane. The arms are 1<sup>3</sup>/<sub>4</sub>in (45mm) diameter at the shroud and 2<sup>3</sup>/<sub>4</sub>in (70mm) at the hub. The cylinder in the hub to receive the arms is 5<sup>1</sup>/<sub>2</sub>in (130mm) diameter, and that is a single casting.

Sir William Fairbairn adopted the use of standard screw threads. He used a 2<sup>1</sup>/<sub>2</sub>in (63mm) hexagonal nut throughout the work, to connect the arms to the shrouds, the plummer block to its base plate and the base plate to the brick supports.

Because there was powder in production Fairbairn used an excess of bronze bearings, in plummer blocks, in the rack and pinion of the hatch and in other positions. This was over the top as there was a traverse between the pump area and the press house.

An important example of the design skills of the Fairbairn millwrights' office and draughtsmen was the design of the hatch controls. Here the plummer blocks are not supported horizontally but at an angle. The plummer blocks have oiling holes which are vertical!



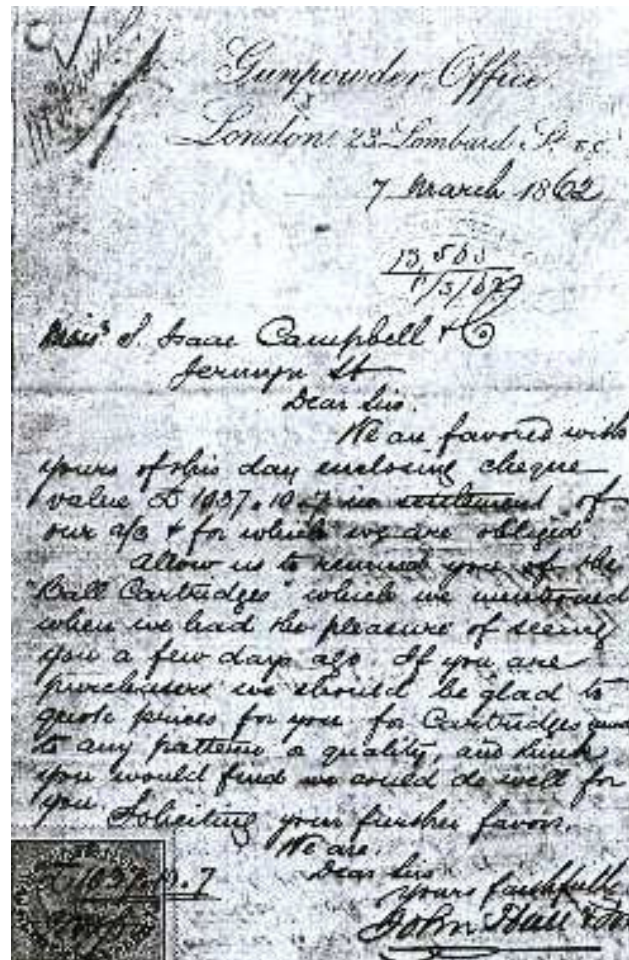
*The hatch controls. Note the plummer blocks with the oiling holes set vertically.*

We can conclude that we have an important and rare example of the Fairbairn waterwheel. Only five Fairbairn waterwheels are known to survive (*Touchpaper* September 2004, 9) and this water wheel of 1856 is a variant on the designs published in *Mills and Millwork* before that date. I hold that it is a Fairbairn waterwheel because of the description in *Mills and Millwork* particularly the Powder Mills Chapter.

Transcript of paper delivered at the GEHG meeting at Waltham Abbey, 7<sup>th</sup> May 2004.

## CONNECTING JOHN HALL AND THE CONFEDERATE STATES OF AMERICA

Will Adye-White



Recently a document came into my possession which confirms the sale of gunpowder by John Hall & Son to the Confederate States of America (CSA) during the American Civil War, 1861-65.

The document is a letter from John Hall & Son dated 7<sup>th</sup> March 1862, acknowledging receipt of payment for an earlier order of powder. The amount was for £1037 10s 7d. This was a very significant powder order.

The letter is addressed to S Issac Campbell & Co. They were the English agents for the CSA. Caleb Hulse also signed the note; he was sent to England in May 1861 by

CSA Ordnance Chief Josiah Gorgas to purchase various Ordnance supplies, which obviously included gunpowder. He was able to do this through the offices of Campbell & Co.

In the letter, the writer mentions that John Hall & Son were able to quote prices on cartridges made to any pattern or quantity. Since Hall & Son did not have the facility to make ammunition, they would have undoubtedly contracted out at the time. Similar receipts have been seen from Eley Bros Limited, who were major ammunition manufacturers of the day.

When the war erupted, the Federal Union forces in the north blockaded the southern states of the CSA. This dried up the supply of cotton to the British Isles and very soon led to the idling of many of the mills in England that relied on cheap American cotton to make their products. This very quickly resulted in an economic slowdown or economic panic as they were known at the time. This slowdown would have also affected the gunpowder mills and ammunition makers of the day. Needless to say, Hall & Son would have been quick to capitalize on any order for powder or any potential order.

There are a number of other letters from the same source that this one came from. The other letters include at least one from other John Hall & Son and several (between 4 and 6) from Curtis's & Harvey for orders of powder. However, the writer has not had an opportunity to view or acquire these as of yet.

This is conclusive proof that at least John Hall & Son sold powder to the Confederacy (CSA) during the war between the States. The unanswered question is: did the powder make it through the blockade? Unfortunately, we may never know the answer to this.

## **HARRISON AINSLIE AND THE MELFORT POWDER WORKS, ADDENDA**

Peter Sandbach

Subsequent to the publication of the article on 'Harrison Ainslie and the Melfort Powder Works' *GEHG* 7, 5-11, Peter Sandbach has supplied some further information on Cumbrian powder sites and the Melfort Powder Works.

### **Headen Haw Magazine**

An incomplete magazine stock book, 1871-6, (5 of its 8 pages are lost) is preserved in Barrow Record Office (BDB2/5/3) provides evidence for Harrison Ainslie's activities as a powder merchant. The magazine lay just outside Barrow Docks at Headen Haw, an island at high tide. Powder was brought to the magazine by the ships the *Melfort* and the *Whitriggs*, it was then taken by cart to the company's magazine at Poalka (near their mines) or by William Gradwell's carts to Hodbarrow. The book also reveals the ships and their trading patterns with the *Lorn* taking powder to Newport, the *Newland* sailing to Wigan, and the *Melfort* bound for Queensferry. The last delivery arrived on the *Mary Atkinson* on 12 July 1875 and the last powder was sent to Poalka magazine in February 1876.

## Low Wood Gunpowder Company

The following extracts are taken from three volumes of letter books of the Low Wood Gunpowder Company, volumes 957, 958 and 959 covering the outgoing letters November 1865 to February 1867 and August 1865 to September 1867. Most of the correspondence is to W S Briggs their manager in Liverpool; the first two volumes contain correspondence from John Dodgson and the third from J Collinson. The letters cover the period after the Low Wood Works was purchased in 1863 by the Low Wood Gunpowder Company from Daye Barker and Company. The punctuation in the extracts follows the style of the originals.

### *The Melfort explosion*

4<sup>th</sup> December 1866 LW/958/550

Dear Mr Briggs,

The 100 Halves and 100 Quarters Bright B named in yours of the 3<sup>rd</sup> instant shall be prepared for you as soon as we can turn to 67½% quality.

I have not seen any published account of the explosion at Melfort. Two different reports have reached us – one that a Mill had exploded – the other that the Granulating House containing the new Rollers recently supplied by Hastie and Co had been destroyed. Both reports however agree in the sad fact that 1 Man and 2 Boys were killed and this will doubtless be only too true as it comes from one of our Coopers whose Father is employed at Melfort.

Herewith you will Order from Messrs Kennedy Brothers which as attention, also Note from Messrs Daniell & Jones.

The very wet and stormy weather is again impeding our Shipping Operations. A fine day is now a matter of very rare occurrence with us.

Yours very truly

John Dodgson

14 March 1867 LW/958/673

Dear Mr Briggs

We have yours of the 13<sup>th</sup> with Order for Fremmington which shall have our best attention.

You will find herewith particulars of powder which will leave Cark tonight of which you were advised by Wire from Ulverstone “Five Tons of Bonney will leave cark for you to-night”

You would see from the extract which we sent you on the 11<sup>th</sup> instant that the explosion at Melfort occurred at 5am.

We may explain to you that the Corning House and Press House would not be free from powder. Such buildings invariably contain a certain amount of powder in the regular course of work and we thought we had gone into such matters fully from time to time with you when passing through our several Buildings. It is of too long nature to describe by letter and we will therefore explain all minutely when you are next here.



I enclose the cheque received this morning from the Furness Railway Co value £56.0.0 which amount please place to the Agency Account, and oblige.

Yours very truly  
John Dodgson

*Transport from the Low Wood Gunpowder Company*

The shipping agent used by the company was W Sandbach, with an office at the Savings Bank Buildings, Ulverston. He preferred to ship by E Winder's schooners, but he also used vessels owned by a Greenodd coal merchant Thomas Iddon, and also the *Ulverston*, which was owned by her captain John Clark and others.

A shipment could be anything up to 800 barrels, usually bound for Liverpool, otherwise for Newport, Cardiff, or Wigan. They preferred to use the Roundsea magazine, but would use Cark Beck or Ulverston during neap tides.

In 1876, Winsham Sb Company of Northwich, Cheshire, built an iron screw steamer the *Leven* for the Low Wood Gunpowder Company. There are only passing references to the *Leven* in the letterbooks, although between 1876 and 1882, she made over 100 passages to Ulverston, usually arriving from Liverpool with a cargo of saltpetre and departing with powder.

The company owned four railway vans, and complaints that they were still in the livery of Daye Barker indicates that they were in use before 1863. Rail shipments were between 30 and 100 barrels, the legal limit being 5 tons. Destinations mentioned in the letter books include, South Wales, Essex, Ashby de la Zouch, Gateshead, Shropshire, and locally to the Kennedy Brothers at Askham and the Hodbarrow Mining Company.

By road gunpowder was moved by a carrier named Elwood. On 23<sup>rd</sup> November 1866, he set off with a consignment of 60 quarter barrels weighing 15cwt to Dufton. On 26<sup>th</sup> November, he was expected to take the first of two carts of 120 quarter barrels to the Nenthead Powder house for the Governor and Company of the Alston Moor mines. The second shipment was to be on 17<sup>th</sup> December 1866.

The owners of the Low Wood transcripts may be contacted at Ulverston Heritage Centre, Hanover House, Victoria Road, Ulverston, LA12 0BY or on the web site <http://www.rootsweb.com/~ukuhc/index.html>

**EXPLOSIVES MAGAZINES, CHISELHURST CAVES, KENT**

In October 1914 the Royal Arsenal Woolwich began to rent, at a cost of £221 per annum, abandoned chalk caves at Chiselhurst, Kent for the storage of high explosives. To prepare the caverns for their new role a narrow brick entrance passage was constructed and covered with earth to match the contours of the overlying head. Internally the floors and walls were timber-lined and by November a non-commissioned officer and twelve men were stationed to guard the magazine. In operation explosives were transported from Woolwich by train and then transferred

onto road lorries, before being loaded onto the cavern's internal tramway system. The principal explosives stored in caves were Picric Acid (Trinitrophenol, Lyddite) and Trotyl (Trinitrotoluene, TNT), initially there was capacity to store 500 tons of explosives raised to 1000 tons in 1915.

Some of the problems of storing explosives in caverns were revealed in May 1916 when it suffered localised flooding after a thunderstorm, later in the November of the same year flooding was caused by a blocked sump. In the same month the cavern also suffered roof fall.

Rod Le Gear 'Brief notes on Chiselhurst Caves as an Explosives Magazine in WW1' *Kent Underground Research Group (Kent Archaeological Society) Newsletter 78*, September 2003, 1

### **THE HISTORY OF K B QUINAN AND THE QUINAN STOVE AT THE ROYAL GUNPOWDER MILLS, WALTHAM ABBEY, NORTH SITE**

*K B Quinan was one of the great figures of the explosives industry and the following gives a brief synopsis of his career and the Quinan guncotton drying system before discussing the Quinan stove at Waltham Abbey.*

The story begins in the rich gold fields of South Africa, indirectly of vital importance to the British economy. Blasting was a fundamental part of the mining operation and blasting explosives were a significant component in the mines cost structure. Following his development of the chemically based dynamite and blasting gelatine and their meteoric success in world mining Alfred Nobel had been assiduously creating the empire which was to bring him immense wealth, by building new factories, by licencing, by absorption of other companies and the forming of trusts for specific markets, to the point where Nobel enterprises were a dominant force in world explosives. Too dominant for some - in South Africa they came up against an equally forceful influence in the shape of Cecil Rhodes and the De Beers Mining Corporation.

For the South African market Nobel had manoeuvred to the position where one of his trusts the British South Africa Explosives Co effectively controlled the market. Rhodes considered that the trust's pricing policy represented abuse of a monopolistic position and after fruitless negotiation on price ordered that De Beers should create its own explosives works. The site chosen was the village of Somerset West near Capetown. The General Manager of De Beers was an American, G F Williams, and he was aware of the high reputation of an ex-US Army Colonel W R Quinan who had become in civilian life manager of the California Powder Co Quinan was approached to become manager of Somerset West and he accepted, bringing with him vital supervisory staff and technicians.

In 1901 on a trial basis he gave a post to his nephew K B Quinan. In 1903 the Cape Explosives Works commenced production. From the outset W R displayed high leadership and technical development qualities and the works became one of the prominent explosives works of the world. There must have been some genetic trait in the Quinans suited to explosives management. The nephew K B exhibited the same qualities and as his uncle gradually stepped back from the day to day activity of the

factory so the nephew moved in, becoming an 'extremely efficient' works manager in 1904 and on the death of his uncle in 1910 becoming general manager. Space does not permit discussion of all of K B Quinan's achievements and innovations, but two give an idea of the scope of his activity. The first is an example of the strategic thinking which characterised him. The factory had been obtaining its glycerine from Holland and K B had ordered that a glycerine distillery be built at Somerset West. Although this was done on commercial grounds originally by an incredible chance the plant was completed on the day war was declared in Europe, thus avoiding reliance on what had now become the highly vulnerable sea lanes from Europe to Africa. The other was the system he had designed for drying guncotton which he had patented. The system was a substantial improvement on existing methods and there was sufficient interest to justify manufacture and marketing under licence by Fraser and Chalmers, engineers of Erith, Kent.

The Quinan system for drying guncotton is discussed in the Appendix.

All this with Somerset West and his work highly respected must have caused Quinan some satisfaction. But war had come and fate decreed a wider destiny. By 1915 the British Army on the Western Front was in serious difficulty through lack of sufficient artillery ammunition and propellant. The Times called it 'The Shell Scandal'. Lloyd George was appointed Minister of Munitions with Lord Moulton heading the Committee on High Explosives to reorganise and significantly increase the output of the munitions industry. A telegram was sent to Quinan 'inviting' him (since he was not a British national and America was not at that time at war with Germany) to come to London to aid the war effort with his advice. The telegram must have been persuasive - it was received in the morning, by half past four on the same day he was on the mail steamer for London. On arrival he was appointed Head of the Explosives Supply Department, charged with designing and overseeing the building of a series of factories which were to transform the munitions industry in Britain.

One of these came to be called the greatest explosives factory on earth. The site chosen was in Dumfriesshire in southwest Scotland, with good rail and sea links and safe from attack. The logistics were mind boggling, involving a torrent of materials and most of the construction workers having to be brought in from outside, mainly Ireland. Reflecting the name of the settlement in the middle of the site the works was named H M Factory Gretna. Building Gretna was not for the faint hearted. Work continued round the clock and the workers toiled in a sea of mud and materials. Local accommodation was hopelessly inadequate. There were three shifts a day and workers shared a bed, one coming off shift occupying it as the other left to go on. Until they could find something newcomers had to sleep in the massive drain pipes they had built beside the roads. Very high wages could be earned, a substantial part of which immediately in time honoured fashion found its way into the coffers of the local breweries.

Construction began in August 1915 and a year later the factory was complete - stretching for 9 miles from the west at Dornock on the Solway Firth in Scotland across the border to Mossband near Longtown in England, connected to 3 main rail lines, 90 miles of internal rail lines, 100 miles of water mains, its own powerhouse with four turbo alternators serving 22 miles of electric mains, 8 hydraulic plants, 8 hydraulic accumulators, 54 steam boilers.

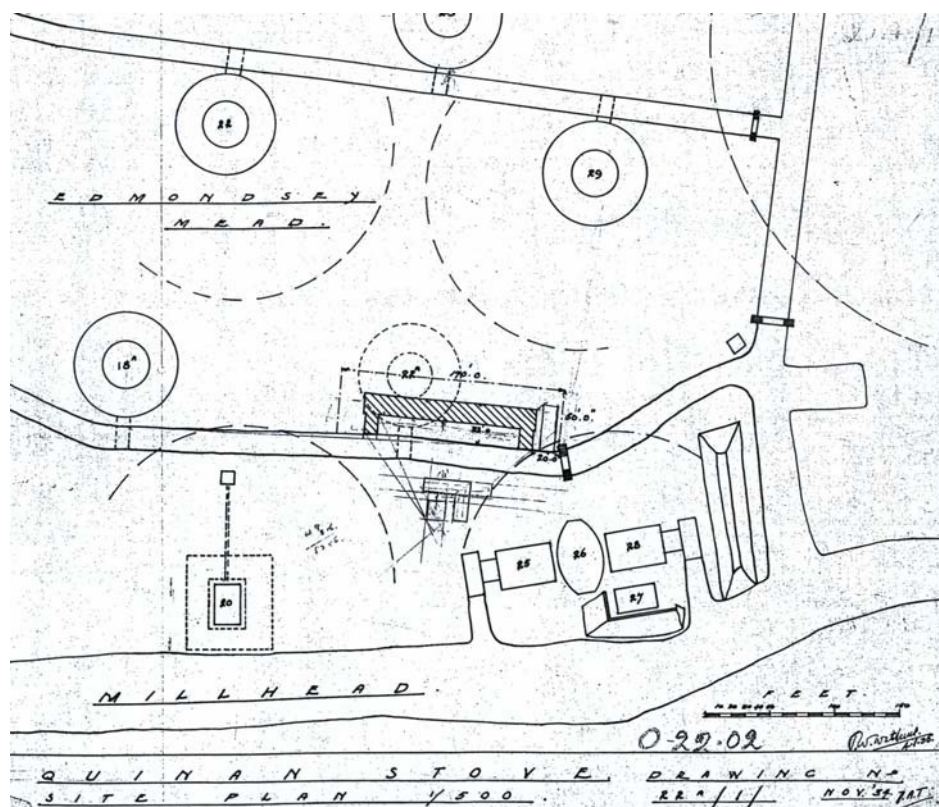
The first cordite left the works in August 1916. The pressure for output was intense. In the initial stages the works did not permit itself the luxury of any set breaks for meals. In the complex the guncotton drying stoves employed the system which Quinan had designed. Gretna was an outstanding success. Productivity was excellent and by the end of the war a total output of cordite of 57, 000 tons had been achieved. After the War Quinan returned to South Africa. His contribution to the success of the munitions effort had been immense and he was awarded the nation's highest civilian honour, Companion of Honour; as a foreign citizen he could not be knighted.

After much debate on whether Gretna or Waltham Abbey would survive as the main Government cordite factory, at the last minute having decided it would be Gretna the Government changed its mind and Waltham Abbey continued. Gretna was largely dismantled in the early 1920s.

### **Installation of the Quinan Stove at Waltham Abbey**

After the War the explosives industry turned again to civil use with the military side becoming again a largely unknown low-key activity. By the 1930s however the first warnings of a tangible outside threat were being received within the Governmental machine and whilst the public, soothed by the speeches of Mr. Baldwin, hoped for the best the military supply organisations behind the scenes quietly began to prepare for the worst. Revealingly the 1935 report for the Mills for the first time contained the phrase War Emergency Activities and mentioned uncertainty as to the 'removal of the factory', referring to proposals for new factory building in the safer west of the country.

In 1934 a decision was taken to install drying stoves on the Quinan pattern at Waltham Abbey. It is not entirely clear whether at that time, bearing in mind the early date, this was a basic plant update or part of a rearmament programme, possibly the former but overtaken by events as the 1930's moved on. Tom Gladwell speaks of the atmosphere influencing work in 1936 - 'They knew something was going to happen' (extract from Ron Treadgold's oral history archive) and Mrs June Cox, daughter of Mr. P G Knapman, Superintendent of the factory at that time, recalls in her recollections that the volume of her father's work noticeably increased as the 1930's progressed with extended hours being worked. His frequent comment was 'There is a lot we have to do in the next few years'.



*Location of the Quinan Stove, shown overlying the demolished Guncotton Stove No.17, this plan was originally drawn in November 1934.*

Possibly partly arising from this increased tempo of rearmament activity, the Quinan development at Waltham Abbey attracted considerable interest in the national explosives arena. At the initial planning stage no less than five outside bodies participated - the Home Office, Government Research Department, Royal Naval Cordite Factory, Ordnance Factories, and ICI.

It appears that considerable effort was directed to investigation of the structure and material of the building as a design exercise for future danger buildings, the basic advantages of the operating design being given. What emerged, in 1936 at Edmonsey on the North Site, was a building of decidedly modern appearance amongst old guncotton stoves that were rapidly becoming relics of the late 19<sup>th</sup> century. At that time in the wider world much experimentation was taking place in the use of concrete, both in the domestic and commercial fields, and this extended to the Quinan Stove. It was constructed of concrete with a barrel shaped roof, bitumen coated. The walls consisted of concrete frames on a steel frame anchored in the ground. Reflecting the need in a danger building to allow the passage of blast, the roof panels were relatively lightly secured and the walls were infilled with wire mesh concrete rendered. Natural light was provided through ten light sections in iron frames. Electric lighting consisted of the usual danger building system of wiring in small bore tube with lights hung on the outside walls. The standard shoeboards denoting clean and dirty areas were employed. There were 15 processing bays. The walls were covered in painted calico to facilitate cleaning.

A separate Engine/Fan House provided the warm drying air via pipes laid over the top of a protective traverse. Waterways - The Stove was served by a cut off the main waterway system in the usual way. In 1936 two new boats were supplied with the description 'Dry Guncotton Boats - Quinan Type'. Swim headed both ends, at 26ft. they were 7ft. shorter than the standard dry guncotton boat and 2ft. narrower. The Quinan cut was already entering the maintenance work schedules. The Rivers and Cuttings report for the year includes 'The dredging of shoals at Quinan Stove Cut'.

The Quinan Stove was built on the site of Guncotton Stove No.17, building No.22a, and rather confusingly the new building retained the same number. 22a/3 was allocated to the Engine/Fan House. External blast protection was in the form of 'Chilworth mounds'. These were based on a design originating at the explosives works at Chilworth in Surrey, with earth revetted by bitumen covered corrugated iron sides, reinforced by flat bottom iron rails. Traverse 22a/1 was between the Stove and the Engine/Fan House and 22a/2 protected the general area to the south of the Stove. It can be conjectured that by this time it had become clear that future expansion of production would take place in the new factories being planned for the west of the country and the Edmonsey Quinan Stove became the design template for these. It admirably succeeded in this function. In 1938 it produced 177 tons of dried guncotton and it was reported that 'the experience gained in operation has proved invaluable in the planning of the new cordite factory' (which would have been ROF Bishopton, Renfrewshire). Alf Nicholls recalls the smaller size pans, quicker drying and increased efficiency of the new installation and the design's successful transfer to Bishopton (extract from Ron Treadgold's oral history archive).

It is worth quoting the following comment on the Quinan design from a History of Chemical Engineering published by the American Chemical Society - 'The principle of preparing warm, dry, filtered air and forcing it through fluidized beds of guncotton restrained from escaping by covers of special fine cloth was a brilliant solution well ahead of its time. It probably increased the output of the cordite factory by 50% by reducing the throughput time'.

Some doubt has been raised as to the validity of perpetuating the Quinan system of drying when a system of cordite manufacture had been evolved which avoided the need for guncotton in a dry state by using a wet slurry of nitrocellulose pumped to the mixing house for blending with nitroglycerine. To examine this question is beyond the scope of this history of the Quinan Stove - did the designers decide to concentrate on the building, not wishing, under the pressures of war to change the whole manufacturing process?

A further Quinan Stove existed in what was to become P1 Section on the South Site of the factory. After the Second World War it was employed in drying nitrocellulose in two functions - single based compositions for aircraft ejector release units and where particular accuracy of composition was required in double based propellants being investigated. It is evident therefore that whilst by then the wet mix process was widely used a need for Quinan drying of guncotton still existed.

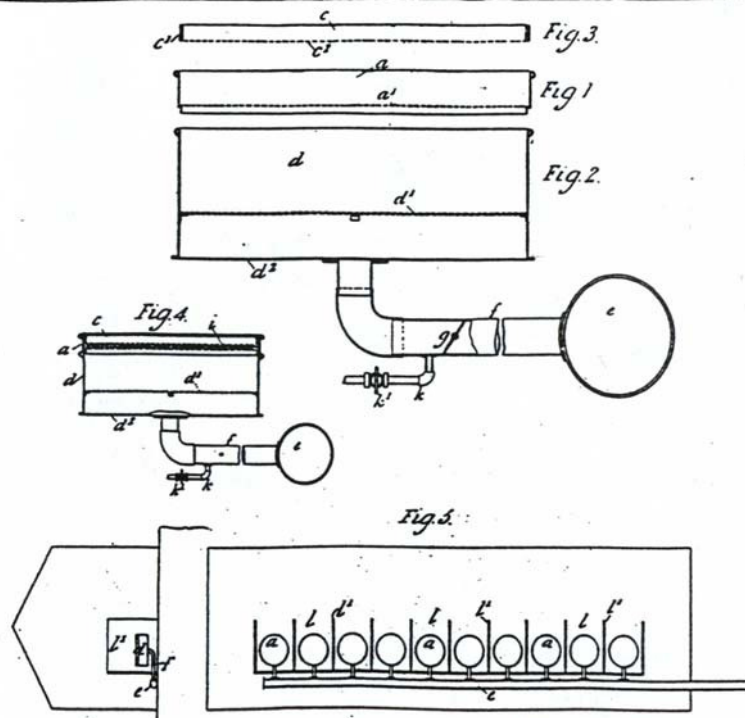
## Today and the Future

The Quinan Stove stands today in the deserted north of the site, threatened by encroaching vegetation, still looking modern compared with the surrounding relics. As more explosives facilities disappear it is possible it is the sole surviving building of its type in Britain. Until relatively recently it was in fair condition. However the fabric has now moved into a downward path. The roof bitumen has failed, the concrete on the walls is spalling, the window frames have rusted and most ominously the iron structural frame is rusting. Without attention to this the building will eventually collapse. The building has recently been placed on the English Heritage Buildings at Risk Register. It is to be hoped that this will prompt some preservation action.

The Quinan Stove represented an important stage in development of chemical explosive processing and served the nation well in two World Wars, notwithstanding the possibility that, in ideal conditions, a new system development replacing it might have been introduced earlier. It is:

- An outstanding example of enlightened process design involving a challenge to existing received wisdom leading to increased efficiency, safety and to reduced cost
- A surviving physical reminder of the great political events of the 1930's when once again preparations for the unthinkable had to be made
- A little known example of the application of 1930s concrete techniques to the very specialised industrial function of danger buildings
- A memorial to the man of whom the *Times* said - 'It would be hard to point at anyone who did more to win the 1914-1918 war than K.B.Quinan'

## Appendix: The Quinan System for drying Guncotton



*A Frasers and Chalmers schematic diagram of a Quinan guncotton drying installation with 10 drying bays*

- a – basket                      a1 – perforated sheet metal
- c – basket retaining screen    c1 – basket retaining ring    c2 – cover for basket
- d – galvanised iron air distributor/basket support    d1 – perforated false base
- d2 – closed bottom    e – hot air main              f – hot air pipe    g – hot air valve
- k – compressed air pipe              k1 – compressed air valve    l – alcoves
- l1 – fireproof walls

Pre-Quinan The use of dried guncotton blended with nitroglycerine to make cordite initiated the building of guncotton drying stoves at Waltham Abbey. These consisted of batteries of stoves served by Engine and Fan Houses. The Engine House powered a belt drive to the Fan House which blew air over heaters and into the stove. A later version comprised a central Fan House with blowers which blew hot air from a heat exchanger consisting of pipes served by steam from boiler houses.

Drying was a time consuming and expensive process and efforts were directed to increasing the amount dried at one time. By the late 1930s stoves were drying 5000lb of guncotton for 60 hours at a temperature of 35C.

Quinan Quinan appraised this system, identified disadvantages, and produced a design which eliminated perceived disadvantages and improved performance.



The characteristics of the existing system were :

The drying of a large quantity at one time for a prolonged period led to super drying - continued drying of material after part is dry. This could lead to electrification of the batch

Handling of material in large unwieldy batches led to the risk of friction which in conjunction with electrification could lead to fire and explosion

‘The GREATEST POSSIBLE CARE is to be taken when handling Dry Guncotton to carry out all operations as quietly as possible . FRICTION OF EVERY KIND IS TO BE AVOIDED’

*Extract from Factory Rules for handling Dry Guncotton*

Prolonged heating could lead to loss of product stability

Excessive drying times restricted throughput and increased utility costs

Quinan’s design turned the existing system on its head, eliminating the disadvantages and conferring further advantages.

Electrification avoided by eliminating super drying. This was achieved by rapid, 60 minutes, drying of smaller quantities in smaller containers, 16lbs, at a much higher temperature, 61°C, with the warm air being passed directly through the guncotton, which was spaced out in thin layers

Danger of friction in handling at the unloading point substantially reduced by laying the material on a sheet in the drying basket with sheet only being lifted out complete with contents at the end of drying

Provision was made for the guncotton to be cooled before handling by circulating through the material compressed air which cooled as it expanded

Avoiding prolonged heating eliminated loss of product stability

Safety increased by separate drying bays with fireproof walls

Substantial reduction in cost of utilities

The much shorter drying time more than compensated for the smaller individual loads, thus materially increasing throughput and ultimately factory output of finished product.

## **OARE GUNPOWDER WORKS**

*Arthur Percival*

In January 2004 work began on the £1 million restoration project of the Oare Gunpowder Works. The restoration will include the conversion of the former cooperage into a visitor centre, repairs and conservation of the canals, bridges and other features and the construction of new viewing platforms. Clearance work has revealed a powder punt sunk in the base of silted up leat. In June, one of the suspended edge-runner mills from ICI Ardeer was moved down to Faversham and installed in a reconstructed bay of the 1920s incorporating mills. The project has been funded by the Heritage Lottery Fund, Brett Environmental Trust Ltd, the Forestry Commission, South East England Development Agency, the Department of the Environment – Food and Rural Affairs, English Heritage, Swale Borough Council, and Faversham Town Council. The restoration work is scheduled for completion in November 2004 and subsequently Swale Borough Council and volunteer groups will manage the site.

*Oare Gunpowder Works Newsletter Autumn 2004*

**WALTHAM ABBEY GUNPOWDER PEOPLE – A review** Wayne Cocroft

This useful publication is the result of the increasing collaboration between the Royal Gunpowder Mills and the Waltham Abbey Historical Society, who now have use of a couple of rooms on the site.

This typescript volume is divided into four sections - the Waltham Abbey mills, the Sewardstone mills, selected gunpowder people and nominal roles of Royal Gunpowder Mills people. The first section documents the Hudson and Walton families who ran the Waltham Abbey mills prior to their acquisition by the government in 1787. It is concluded that gunpowder production began at Waltham Abbey in 1665, when Ralph Hudson agreed to supply the Ordnance with 100 barrels of gunpowder per month. It remained in the Hudson family until the early 18<sup>th</sup> century, when it was recorded on 3 June 1702 that William Walter signed a contract to supply the Ordnance with powder. This section concludes with a compilation of map extracts of the Royal Gunpowder Mills dated between 1783 and 1884.

The second section documents the families associated with the Sewardstone mills, located to the south of Waltham Abbey, their site is now lost beneath the George V reservoir. Gunpowder production began at Sewardstone in 1640 and lasted until about 1716. An interesting postscript to explosives manufacture at Sewardstone was a proposal in 1872 by the Patent Cotton Gunpowder Company Limited to manufacture Schulze Powder, a nitrocellulose based propellant. The proposition was later withdrawn.

The third part of the book records the histories of some of most important families associated with the Royal Gunpowder Mills including, the Draysons, Newtons, and Knowlers. The book concludes with various nominal rolls of workers at the mills from the late 18th century to the end of the nineteenth.

It is recognised that there is still more work to be done on the family histories of the Hudson and Walton families and on the later nominal rolls, particularly using data from the Census Returns. The usefulness of any future editions of this reference work could be improved by the addition of a figure list, bibliography and index. The volume is, nevertheless, an important contribution to the history of the Royal Gunpowder Mills and the other mills of the Lea valley. Given the well-known personal interconnections within the gunpowder industry, this collection will also be of value to researchers working elsewhere in the country.

Peter Huggins, 2004, *Waltham Abbey Gunpowder People* Waltham Abbey Historical Society, typescript publication, 168 pages, 25 figures. Copies may be ordered from Royal Gunpowder Mills Co Ltd, Powdermill Lane, Waltham Abbey, Essex. Cost £8.25 incl. p&p cheques payable to *Royal Gunpowder Mills Co Ltd*.

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### NEWSLETTER 8 – AN APOLOGY

Wayne Cocroft

I would like to apologise for the erratic formatting of Newsletter 8. I think that a file I copied into the master document corrupted the font settings for parts of the Newsletter, despite the correct fonts appearing on my computer screen they printed out incorrectly. Due to the fast approaching deadline for confirming the details of the Waltham Abbey meeting I decided to send the Newsletter as there was insufficient time to re-type it.

