ROYAL GUNPOWDER MILLS

WALTHAM ABBEY

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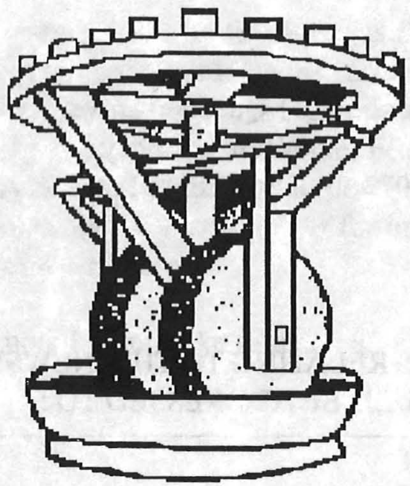
Touchpaper

The Newsletter of the
ROYAL GUNPOWDER MILLS WALTHAM ABBEY
FRIENDS ASSOCIATION



JUNE
2003

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PLEASE NOTE: Deadline date for submissions to the next issue is 15th August 2003

EDITORIAL

At this time of year we are usually asking for renewal of subscriptions but as we have changed the financial year from June to January we shan't be asking for renewals until the December issue so enjoy your extra free 6 months.

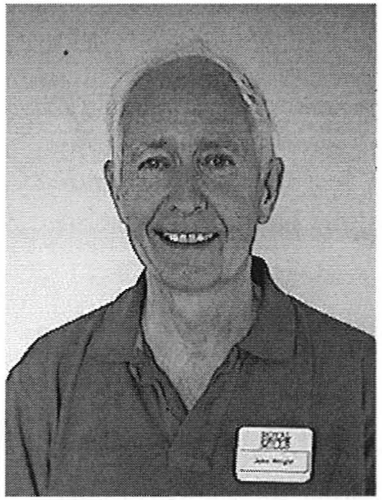
This issue sees Part II of Les Tucker's article on the development of Chemical Explosives.

It was a bit of struggle to fill this issue as the number of your contributions has dropped so please try harder for the next issue. In particular I look forward to receiving your recollections, letters and snippets of gossip for the next issue. Feedback is also very important to any editor so if you like, or don't like, what is printed please let me know and any suggestions for improvement will be given careful consideration.

On a personal note I would like to thank all of you who sent me messages of condolence.

Norman Paul
Editor

CHAIRMAN'S NOTES



To complete the story of 'Old Bluey' started in the last Touchpaper, he eventually managed to free his hoof from the blue rope and was seen limping but still wearing his blue 'hat'. Now that most of the deer have lost their antlers he is indistinguishable from the rest.

The opening weekend, 3rd - 4th May went very well with the aid of the US Civil War Society who did some very good and very noisy displays. Some 4-500 visitors attended over the two days.

With only a few paid staff we rely very much on volunteers and Board members to man the site for visitors and any additional volunteers will be most welcome.

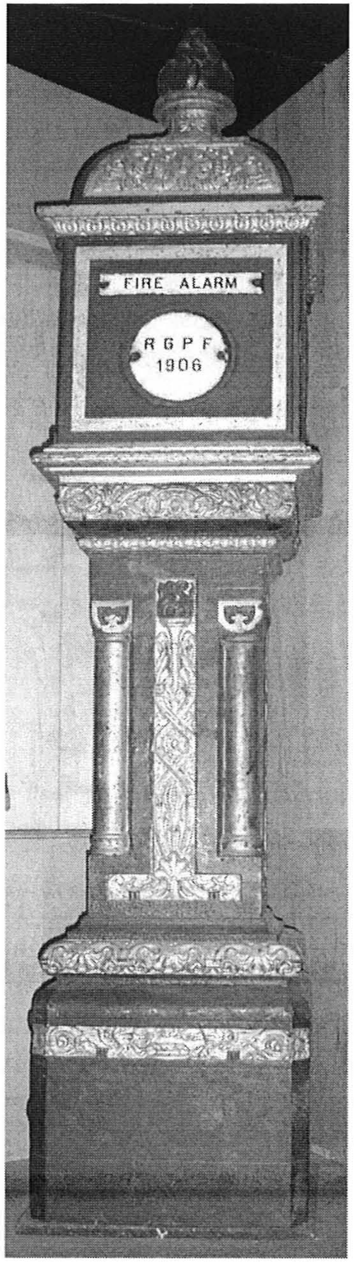
On Friday 2nd May, prior to the opening, there was the 'Friends Day' on site and some 30 plus members took advantage of this. A progress meeting was held during the day and members were given updates on site developments, to have a discussion session plus an opportunity to go round most of the site.

There are new exhibits to be seen and I hope as many of you as possible will come and visit - together with your friends, relatives and hangers on.

John Wright

THE SIEMENS FIRE ALARM SYSTEM

For those of us who worked at Waltham Abbey, or the Royal Small Arms Factory, we were made aware of our past history by the red fire alarm pillars bearing labels such as 'RGPF 1906' or 'RSAF 1908'. They were all part of the scenery and I for one never gave a thought to how they worked, or if they were ever used 'in anger'.



Then, just as South Site was about to be closed by Royal Ordnance in 1989. It was decided to preserve two of the fire pillars and their central control unit as part of the Royal Ordnance historic collection. Alan Short and Ron Hemming were given the task of revitalising the best two pillars and the control unit and providing an electrical power supply to replace the original Leclanche cells.

After a demonstration of a successfully refurbished system the units and a number of spare pillars were shipped to Westcott en route for Chorley. However, they never reached Chorley and remained at Westcott until 1999 when they were returned to Waltham Abbey.

The best pillar was selected as part of the main exhibition while the control unit and the remaining pillars were stored in a dry but unheated building in the Edmonsey area where they have remained until recently when it was decided to see if the system could be made to work again after some 13 years in storage,

An examination of the control unit gives cause for hope that it can be made to work if the electrical power pack has not deteriorated. However, the bases of the pillars will require some restoration since the majority were not removed from their original sites with any thought that they would be needed again. The state of the internal mechanism is another unknown quantity. Until I asked a few questions I believed that the system depended only upon electrical power for operation but that is only partly true. It seems that the pillars contain weights that are allowed to fall once the actuating handle has been pulled. The weights are connected to a wire wound round a shaft which, in turn, is fitted to a cam. The cam opens and closes electrical points to produce interruptions to the current that normally flows continuously through the mechanisms which are wired in series. Long or short interruptions are possible and each alarm has its characteristic sequence so that the control unit can identify which alarm has been activated.
On the control unit is a card showing 16 patterns, 8 for alarms on North Site and 8 for alarms on South Site:-

<u>North Site</u>

NG Hill No. 2	— —	Daisy Island	— — —
Edmonsey Stoves	▪ —	Edmonsey Engines	• • —
Long Walk	• • • —	Group E	• • • • —
Group A	• • • • •	Refinery Gate	— • • • •

<u>South Site</u>

Lower Island	— • • •	Swing Bridge	— • •
Proof Range	— ▪	G.C. Lab.	▪ — —
N.A. Can. Factory	▪ — ▪ —	Cordite Office Q.H.	▪ — —
Black Ditch West	▪ — ▪	Acetone Recovery	• • — —

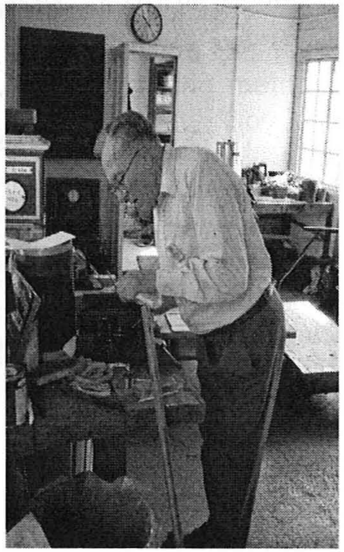
If a pillar contains its original mechanism then an examination of the cam interrupter will show where it was sited. Once an alarm has been used the weight may be raised with a special winding key (which is still attached to the control unit in a plastic bag). Unfortunately a second key is needed to unlock a door on the fire pillar to reach the inside of the alarm and this second key has not been found.
I am indebted to Chris Evans and Alan Short who have pointed me in the right direction and explained the workings of the alarms.
Bryan Howard

WORK ON THE FIRE ALARM:

Although there are many jobs to be done on Site and never enough people some members of the regular work parties have found time (especially when the wet weather precludes any outdoor work) to appraise a project to renovate and re- install the fire alarm system - if at all possible.

The work involves both the actual alarms

and the actuating mechanisms -



ANOTHER WORK PROJECT

THE CORDITE PRESS

This impressive piece of equipment stands on the roundabout at the top of Long Walk and was erected, on a mill stone by the contractors.

It had been standing outside for some years and was very rusty but thanks to the single handed efforts of Gerry Miller, who regularly comes up from Tonbridge in Kent, it has been restored in its original colours and is an even more impressive sight for visitors.

Our special thanks to Gerry for his dedication to this project.

NON-LISTED PRINCIPAL STRUCTURES OF THE ROYAL GUNPOWDER MILLS

Part III DEVELOPMENT OF CHEMICAL EXPLOSIVES

Section 2. 20th Century - The Edmonsey Acid and Nitroglycerine Factories

Nitroglycerine - The Story so far

The evident superiority of nitroglycerine to gunpowder in explosive power and economy, making it a patently very attractive, and profitable to the supplier, product for the ever expanding construction, mining, quarrying, tunnelling, railway building etc. activities of the 19th century led the Nobel family on a quest to make the material a practicable commercial proposition. By the end of the 1860's Alfred Nobel had produced a safe and effective medium for nitroglycerine in the form of dynamite,later in the mid 1870's combining nitroglycerine and nitrocellulose (guncotton) in blasting gelatine - these developments leading to a huge commercial success worldwide. Nitroglycerine development was therefore driven initially by the civil application. In the late 1880's Nobel produced a military propellant based on nitroglycerine and nitrocellulose, ballistite, and this was followed by the British cordite in 1889. This rapidly replaced gunpowder, creating the need for a governmental nitroglycerine production facility for military purposes and in 1890 a nitroglycerine factory was erected on newly purchased land at Quinton Hill to the south of Waltham centre, the existing powder factory lying to the north.

The Manufacturing Process:

Early

In the early days of nitroglycerine the manufacturing method was basic, consisting of pots of mixed nitric and sulphuric acid standing in containers of ice cold water or ice and salt, the sulphuric acid being necessary to absorb the water formed during nitration, with glycerine poured slowly into the containers and the contents of the pot stirred by hand. The nitroglycerine was settled out from the acid in a settling funnel and run into water for washing. The washing was imperfect and the product was therefore impure and not suitable for prolonged storage. The typical amount produced in one operation was very small - around 100 g. As demand increased the number and size of nitrating pots was increased and progressive improvements were made - more attention was paid to acid purity, washing, and glycerine inflow and mixing and stirring became mechanised.

Later

By the end of the end of the 1860's manufacturing had been refined into a system comprising;

Nitrating vessels - cylindrical lead tanks with outer wood casing, cold water circulating between tank and case and in lead pipes within tanks

Agitation - by compressed air

Glycerine inflow - regulated by means of earthenware stopcock

Fumes - carried off by glass pipe in cover of nitrating vessel, amount of fume production monitored for danger through glass observation panel

Production temperature - monitored for danger by thermometer in vessel cover

Emergency provision - In the event of fume or temperature reaching danger level whole charge could be dumped into a 'drowning tank'

After nitration the charge was run into a water tank and the mixture agitated with wooden paddles, the nitroglycerine sinking to the base and drawn off into separate tanks where it was washed several times with water and soda solution to neutralise any remaining acid elements.

The system had inherent flaws - no provision for saving, repurifying and concentrating spent acids, difficult to avoid excessive production of nitrous fumes, difficulty of control of glycerine inflow, leading to continuing possibility of overheating. To solve the loss of spent acid problem from the 1870's the separating tank was introduced. The charge was run in and after the nitroglycerine had separated the spent acids were run off into separate tanks for reprocessing.

Basically this was the pattern of plant employed in the works Nobel set up or licensed.

Safety - Apart from the above drawbacks, the nature of nitroglycerine with its extreme sensitivity to shock etc. meant that the manufacturing system involved two fundamental hazards - firstly it was a batch process which meant that relatively large volumes of the material were present at each stage presenting a serious risk to operating staff and secondly control of flow, e.g.at base of nitrating vessels and at seperating and washing tanks relied on earthenware stopcocks - a constant potential for accident, see below.

Nitroglycerine Manufacture at Waltham Abbey

Nitroglycerine plant following the Nobel pattern, but with some modification, was erected on the new Quinton Hill site in 1890. After a serious explosion in 1894 following the recommendation of the subsequent Committee of Enquiry a second plant was erected in 1897, this time back on the original north site on Edmonsey Mead to the north. In 1904 the Quinton Hill plant was put into reserve and Edmonsey became the Waltham Abbey nitroglycerine producer.

1. The Acid Factory 1902 - 1943

Quinton Hill had bought in its acids from the East London chemical industry. Edmonsey presented an opportunity to purpose build an acid factory on the site, ensuring higher concentration and purity and efficient recovery and reprocessing and in 1902 an acid factory was constructed between the Horsemill Sream on the west and the nitroglycerine factory to the east.

The plant reflected two main functions - production of nitric acid and concentrated sulphuric acid. Nitric acid acid production was a distillation process,based on the design of F.Valentiner whereby sodium nitrate, commonly termed nitre or Chile saltpetre reflecting its main origin and distinguishing it from the saltpetre employed in gunpowder manufacture, which was potassium nitrate, was distilled with sulphuric acid producing nitric acid and the by product 'nitre cake'- a mixture of two sulphates. Disposal of by products was and is a perennial problem in the chemical industry. On occasion as in the gas industry a profitable outlet is found. The destination of Waltham Abbey nitre cake is not known. However it is interesting to note that the Royal Naval Cordite Factory at Holton Heath, Dorset sent 50 tons per week of its nitre cake to Harpic Ltd., the makers of the well known domestic cleaner of the same name.

Acid recovery and reprocessing was an important part of the activity of the Edmonsey acid factory. Plant employed for this purpose included an after-separatinghouse, denitrating towers to remove nitric acid from sulphuric acid, sulphuric acid concentrators. These followed the Kessler design. In the late 1930's this was replaced by the 'Evans-Bowden' design. The Kessler plant was built of acid proof Volvic lava bricks from France (vide TV mineral water ads.) and the authorities became uneasy about cost and security of supply. Dr.R.C.Bowden, Superintendent at Waltham Abbey 1934-1939, devised a plant employing British made acid resistant bricks built in layers jointed with glass powder and pumice at a cost of £40 per fill compared wityh £600 for Volvic. This was very successful and the Evans-Bowden concentrator was built at Waltham Abbey and other governmental and private factories at home and overseas. Lt.Col.P.H.Evans was Dr.Bowden's predecessor as Superintendent, from 1917 to 1934, Dr. Bowden was the first civilian Superintendent.

The Acid Factory was a tough place to work. There was much physical handling of material in taxing conditions - constant possibility of leaking joints or burst pipes spurting acid, spills over the floor, working atmosphere heavily fume affected. In fact an eminent commentator on the chemical industry at the time evocatively termed the nitric acid process 'a laborious procedure of manslaughter'.

The Acid Factory was demolished after WWII. All that remains are floor slabs and one building - E10 Nitrate Soda Store.

2. The Edmonsey Nitroglycerine Factory 1897- 1960's

The Edmonsey Nitroglycerine Factory is now a place of mystery dominated by the nitrating 'hill' in the deserted north of the site, surrounded by the other long deserted processing buildings. The isolated nature of the surroundings and the knowledge of what was produced there evoke a strong sense of history if not foreboding in the observer.

Nitrating House Exit Tunnel for Guttering (1981)

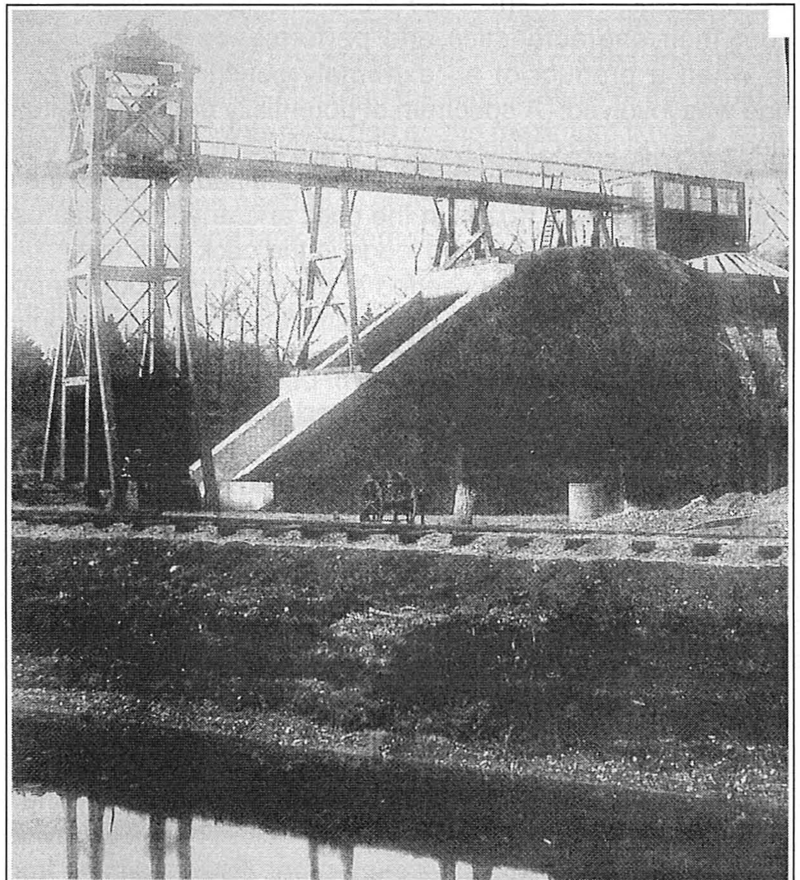
The factory consisted of an Acid House, Charge House, the Nitrating House, Washing Houses, Filtering within the Mixing Houses, Wash Water Settling House, Mud Washing Shed and waste washing water settling ponds

The sensitivity of nitroglycerine and the need to clean after each batch meant that it could not be transported between buildings by pipe. The flow of chemical was by gravity, in lead lined V shaped guttering supported on trestles,with canvas covers fixed on one edge and tied on the other, permitting untying for cleaning and inspection after each batch. As Edmonsey was a flat site the height necessary for gravity flow had to be created by raising the processing units on platforms within the buildings. The processing buildings were round timber structures with conical roofs set within circular brick revetments and over this earth blast traverses, giving the site the appearance of a series of grassy mounds - 'hills'. Each building had a curved brick arched entrance with red painted door indicating danger. Guttering for nitroglycerine and wash waters entered and left the buildings through brick arched tunnels. Floors were covered in lead with the interior of the roofs lined with Willesden paper.

Processing tanks were of lead for acid resistance and also as a soft metal spark resisting.

Acid mixing and delivery to the Charge House

Concentrated nitric and sulphuric acids were pre mixed and stored at the Acid Factory. The nitric acid was run into the mixing tank first then sulphuric acid was blown in by compressed air, agitation in the tank also being by compressed air. A fume pipe led from the cover of the tank to a battery of Guttmann ball towers, named after the leading explosives scientist O.Guttmann. One of his devices was the Guttmann ball, a hollow pottery sphere about the size of a cricket ball with six holes punched in the middle. These avoided the 'clogging' problems associated with the use of coke filling in condenser towers. The acid mix was then conveyed in a bogie on a tramway to a lift at the base of the nitrating hill, which raised the bogie to the Charge House. The lift was later replaced by the use of compressed air to push acid by pipeline from store tanks in the Acid House to the Charge House. The acid store tank was a cylindrical steel vessel standing vertically, termed an 'egg'. Glycerine was similarly conveyed from store tanks at the Acid Factory.



E2 Nitrating House No.1 *(circa 1900)*
showing Acid/Glycerine lift with 'Tramway' in foreground

(1) E1 The Acid House

The Acid House stored acids prior to transmission to the Charge House.

(2) The Charge House

The Charge House was at the highest point of the nitrating hill. The incoming acid level was observed through a gauge glass and when it was slightly above the required charge level the compressed air was shut off, with any surplus above the level being drawn off in an overflow pipe, similarly with glycerine, which had been made fluid for blowing by heating. The glycerine tank in the Charge House had coils for cooling or heating as required. Wash waters and soda solution were prepared in the Charge House (see below).

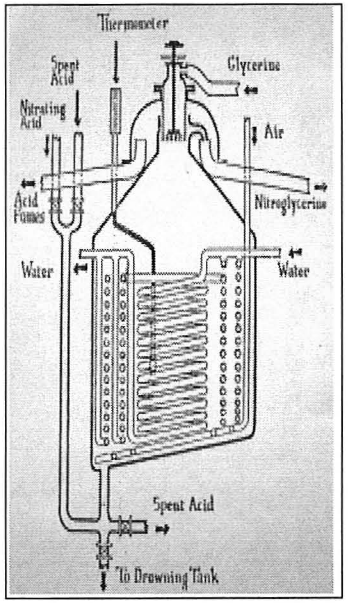
Earthenware Stopcocks

As with many chemical processes nitroglycerine manufacture involved the flow and taking off of separated liquids at various stages, involving the stopping and restart of the flow. The prevalent mode of control was by earthenware stopcock. In normal use these did not present any serious problems but their characteristics and performance became of prime importance when a product of an extremely sensitive nature such as nitroglycerine was involved. A spectrum of potentially dangerous situations was identified - friction and consequently heat could be generated between the body of the cock and key when turned if any grit had lodged in the cock, similarly if nitroglycerine had frozen in the cock and any force was used to free it, droplets of nitroglycerine could lodge in the cock after use.

By 1901 Waltham Abbey had succeeded in eliminating stopcocks from all plant subsequent to the separator but they still remained in use controlling nitroglycerine transmission in the nitrator and separator.

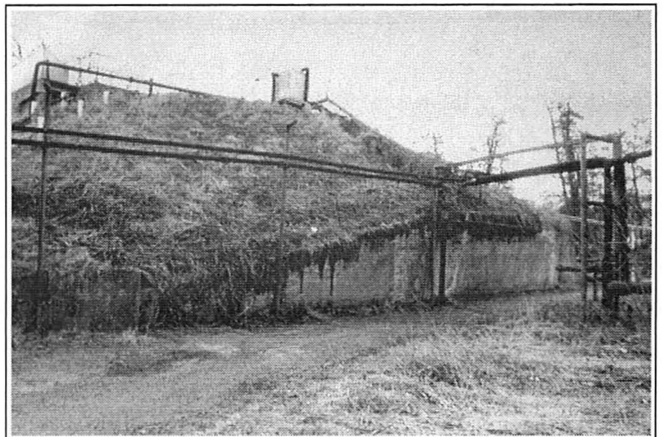
(3) E2 Nitrating House No. 1 - The 'Grand Nitrator' incorporating the Nitrator-Separator

After much development work a patent was issued in 1905 under the names of Nathan - Thomson - Rintoul for a nitrating apparatus in the Nitrating House which eliminated the use of earthenware stopcocks for removal of nitroglycerine (for the sake of brevity this will be referred to as NTR). Bt.Col.Sir F.L.Nathan was Superintendent of Waltham Abbey, J.M.Thomson was Superintendent of the nitroglycerine facility and W.Rintoul was a senior scientist. This combined the functions of the nitrator and the separator and was termed the nitrator-separator. It was concluded that as the problem lay in stopcocks controlling drawing off of nitroglycerine from the base of the tank it could be solved by turning the system on its head, pushing the liquid from the top of the tank, and that the pushing force could be provided by another liquid already in the system - inert spent acid remaining from the previous batch.

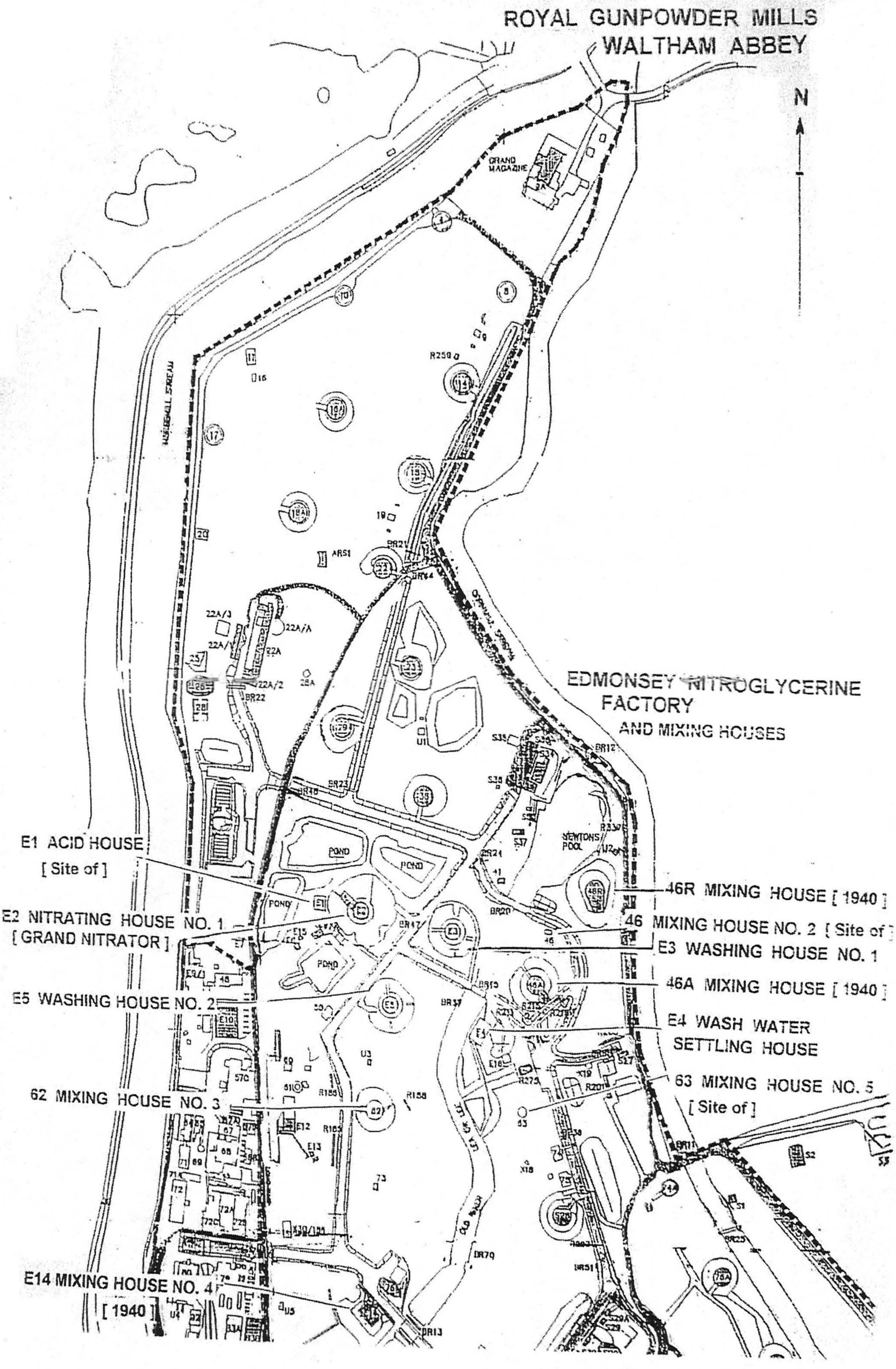


The nitrator-separator was a cylindrical lead vessel with a sloping base and conical cover, containing cooling coils containing water and brine and air pipes. A glass observation panel and thermometer were set into the cover. The nitrating acid was led in through a pipe at the base. The pipe had two branches - one controlled by a rod to the operating platform leading to a drowning tank into which the charge could be discharged in an emergency and the other to the spent acid egg. The nitrating acid was air stirred and cooled by the water in the cooling coils, refrigerated if necessary and nitration commenced by direct injection of the cooled acid through the top of the apparatus. Glycerine normally thinned by heating was gradually admitted in the form of a fine spray on the surface of the cooled and stirred acid. The rate of inflow was controlled to keep the temperature of the liquid near to the optimum of 10°C. 15°C was regarded as the maximum limit for safe operation and if the temperature exceeded this the charge was 'drowned', only a quarter turn of the control being needed to open the drowning stopcock releasing the charge into the drowning tank underneath, which was kept permanently filled with water. The operating of the stopcock automatically operated a water supply to the tank, which had an overflow, so that the water was continually renewed during drowning,keeping the temperature down. Nitric acid fumes from volatilisation were carried to the Guttmann condensing tower.

The glycerine charge for a batch of nitroglycerine at Edmonsey was 1400 lbs. This took about 45 minutes to nitrate, with subsequent separation taking about an hour.



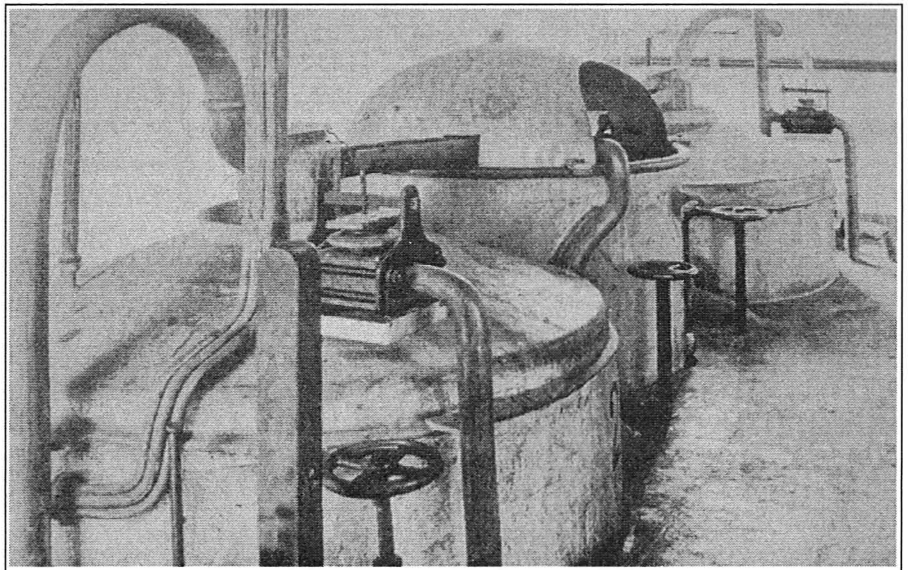
E2 Nitrating House (1981)


ROYAL GUNPOWDER MILLS
WALTHAM ABBEY
N
GRAND MAGAZINE
EDMONSEY NITROGLYCERINE FACTORY
AND MIXING HOUSES
E1 ACID HOUSE
[Site of]
E2 NITRATING HOUSE NO. 1
[GRAND NITRATOR]
E5 WASHING HOUSE NO. 2
62 MIXING HOUSE NO. 3
E14 MIXING HOUSE NO. 4
[1940]
46R MIXING HOUSE [1940]
46 MIXING HOUSE NO. 2 [Site of]
E3 WASHING HOUSE NO. 1
46A MIXING HOUSE [1940]
E4 WASH WATER
SETTLING HOUSE
63 MIXING HOUSE NO. 5
[Site of]
POND
NEWTONS POOL

When nitration was complete the mixture was allowed to settle, with the lower density nitroglycerine separating from the acid. Spent acid from the previous charge was then admitted through the inlet pipe in the base. The upper layer of nitroglycerine gradually moved to its exit, the demarcation line between the two liquids being monitored constantly through the observation panel. When the line was seen to be at the correct level, i.e.before any acid could pass over, the spent acid supply was closed off with the nitroglycerine flowing over and out via short guttering to the pre-wash tank. Until it was required for the next charge spent acid was left in the nitrator. The purpose of this was to avoid damage to the interior by exposure to spent acid fumes. The effectiveness of this practise was demonstrated by an inspection of the apparatus after 21/4 years use when the whole interior including cooling coils and pipes was found to be in excellent condition.

The Edmonsey nitrator had a fine safety record and as far as is known no charge had to be drowned. However the human element could not be left out. Glycerine injection was a critical operation and the rate of injection was subject within some bounds to the individual attitude of the operator. Inevitably some had a more dashing temperament than others. One operator at the Royal Naval Cordite Factory, Mr. A. Webster, achieved fame if not notoriety when he was cited somewhat sourly by Dr. Ramsay, the Government Inspector commenting on irregularities in nitroglycerine factories, as 'a notoriously fast nitrator'.

Apart from the principal achievement of removal of use of stopcocks for nitroglycerine movement, the advantages of the NTR process over earlier plant were manifold.



2 Nitrator-Separators with Pre-Wash Tank in between
(Royal Naval Cordite Factory - 1930's)

1. Reduced total elevation from top of nitrator to bottom of wash water settling tank of 16ft. against 331/2ft.
2. Less total ground area.
3. Elimination of separating house removed undesirable operation of guttering carrying mixture of acids and nitroglycerine.
4. Elimination of after-separating houe.
5. Nitroglycerine is removed from the acid as quickly as it separates, reducing possibility of contamination.
6. Introduction of cooling coils substantially lessened risk of overheating.
7. Fewer pieces of apparatus.
8. Measurement of acids, glycerine and nitroglycerine instead of weighing.
9. Fewer personnel required, giving more economic operation and less total risk.
10. Better working conditions - fume removal
11. Yield increase. Theoretically 100 parts of glycerine should produce 246.74parts of nitroglycerine. This is the optimum and plant limitations mean that something less will actually be achieved. However the NTR process did produce a significant yield increase over earlier systems. The earliest plant produced around 200%. Later improvements led to around 210% (based on weight of glycerine). At Waltham Abbey pre NTR the average yield over 8 years was 214.25%. Post NTR the average over 2 years was 220.18% (see later comment on yields).

<u>Pre-Washing (within Nitrating House)</u>

The nitroglycerine was pre-washed of acid with water by agitation with compressed air injection into the tank. There were several pre-washes, the last being of soda solution to render the nitroglycerine alkaline before settling to the bottom of the tank and run down by guttering to the Washing House. By means of a rubber 'skimmer' the wash waters were run into a 'labyrinth' where any remaining nitroglycerine separated out. There were no stopcocks on the pre-wash tank. Runoff was by disconnection of a rubber runoff pipe and connection to a fixed nozzle on the end of the guttering to the Washing House. No clamp was employed on the pipe, regulation being entirely with 'kinking' by hand pressure.

<u>Water Quality and Wash Water preparation</u>

The water at Waltham Abbey was hard and could have presented serious limescale problems. To prevent this all wash waters were filtered and softened and the heating of wash waters and preparation of soda solutions was carried out centrally in the Charge House to avoid operating inefficiencies and dis-economy which would arise if this were done individually in each process house.

(4) E3 and E5 Nitroglycerine Washing Houses

Prior to running down the nitroglycerine from the pre-wash warm soda solution was run down the gutter to the Washing Houses, then the nitroglycerine was sent down then another run of soda solution.

Procedure was similar to the pre-wash. The nitroglycerine was washed in warm soda solution agitated by compressed air. To remove the sodium carbonate the last two washings were with warm water. A rubber skimmer removed wash waters to a labyrinth to recover remaining nitroglycerine. Again nitroglycerine runoff, to filtering, was by hand kinked rubber tube, eliminating the stopcock.

(5) Filtering (in Mixing House)

The final stage in manufacture of nitroglycerine before it passed into the cordite manufacturing chain was filtering. The filter tanks were situated in the Mixing Houses. The filter tank was of lead with a false bottom of perforated lead. The filter comprised a layer of sponges sewn in flannel laid on the false base. Drawing off of filtered nitroglycerine was again by kinked rubber tube into a lead burette, allowing accurate measurement of the charge, eliminating the weighing scales previously used. The nitroglycerine was then 'poured on' to guncotton in the first stage of cordite production.

(6) E4 Wash Water Settling House

Spent washing water from the Washing Houses run in guttering to a tank in the Wash Water Settling House, agitated by compressed air. At the end of each day the air was shut off and any nitroglycerine allowed to settle out, again removed by rubber tube and taken back to the pre-wash tank. A mud comprising mainly lead sulphates and some nitroglycerine remained. At the end of each week the mud was taken to the Mud Washing Shed for final washing.

(7) Mud Washing Shed

The mud was passed through flannel filters suspended over a lead washing tank. Washing to remove nitroglycerine and to render the mud alkaline by converting to lead carbonate was again by warm soda solution. Finally the mud was wrung in flannel to remove any vestiges of nitroglycerine, mixed with paraffin and burnt.

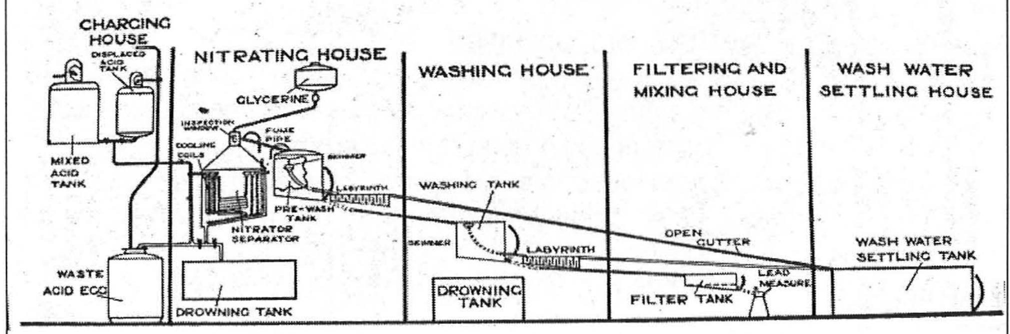
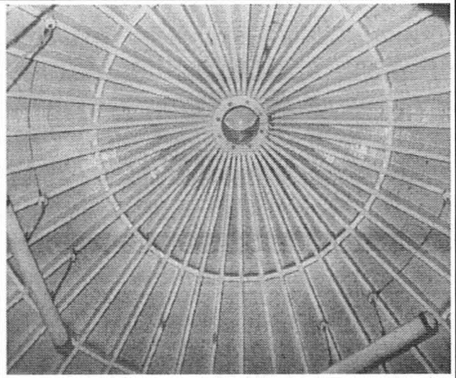
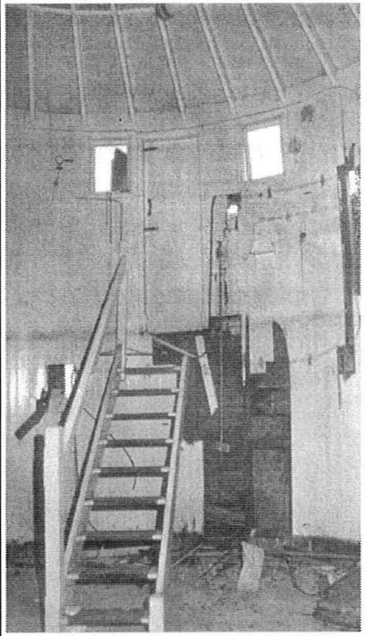


Diagram of NG Plant (Displacement Process) at RGPF Waltham Abbey

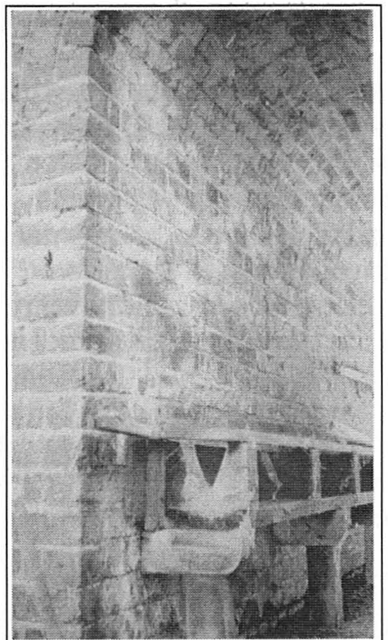
Washing House No.2 (1981)



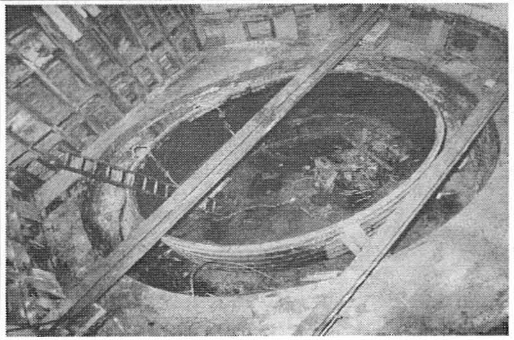
Roof Interior of Washing House



Washing House No.1 (1981)



V shaped guttering on trestles



Nitrating House Drowning Tank (1981)

(8) Wash Water Settling Ponds

The above is the conclusion of the Edmonsey nitroglycerine process except for one final stage. Contaminated wash waters were drained into settling ponds,which surrounded the Nitrator. To finally remove any nitroglycerine the practise, rather startlingly in view of the surroundings, was for the foreman, each Saturday morning in what must have been regarded as a pleasant weekend diversion, to blow up each pond with a dynamite charge.

Communication to Industry

In February 1908 Messrs. Nathan and Rintoul read a paper on their nitrating plant to the Society of Chemical Industry. Apart from the extensive scientific detail of the paper there were several interesting nuances in the comments from the audience at the end of the address which give the flavour of activity in the explosives industry at the time.

Interestingly the authors chose in their concluding remarks to refer to what they considered was of 'paramount importance' - 'the absolute necessity of entirely dispensing with the use of any heavy or hard loose tools and implements in the houses', and a 'Use List' of authorised articles for the various buildings was given.

Is there a note of wistfulness in the remark by the splendidly named Lt.Col.Sir Hilaro Barlow that Sir Frederick Nathan had 'reduced to a fine art' the fastening to the wall of everything that could so be fastened and 'All who had to do with the British workman would know the extraordinary importance of making, if possible, every safety appliance in a factory automatic'.

Mr.W.F.Reid, presumably a representative of private industry, commented that the introduction of NTR as well as contributing greatly to the safety of the workers had achieved a substantial improvement in economy (meaning improvement in yield). He claimed that they (not specified) were now achieving a yield of 229% or more. This was extremely high and substantially exceeded Nathan's figure for Waltham Abbey of 220%. Mr.R.B.Pollitt commented that 220% was too low and industry was achieving well over this figure. Mr.H.de Mosenthal forthrightly stated that it would not be right to give the impression that the yield performance of private industry was not as good as Waltham Abbey.

It could be inferred from the above that although freely diffused Waltham Abbey technology was of great benefit to the private sector there was a certain amount of creative tension between the two and that on occasion commercial producers considered that their achievements were not given sufficient recognition.

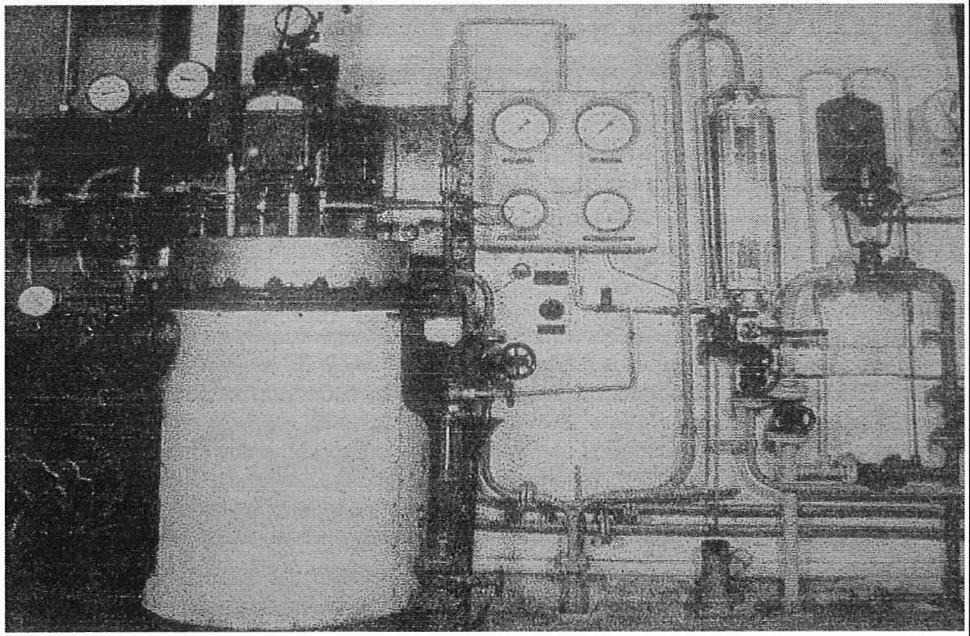
Mr.de Mosenthal, clearly sensitive about Waltham Abbey's assumed superiority, pointed out that fuming sulphuric acid for nitroglycerine manufacture had been introduced in eight countries before Waltham Abbey, including privately in Britain. Finally on a note of 'credit where it's due' Mr.O.Guttmann said that the 'labyrinth' had been originated by A.Liedbeck 40 years previously and that he (Guttmann) had supplied improved drawings of it to Waltham Abbey.

The Final Chapter

The NTR plant operated until 1951. After this nitroglyvcerine for Waltham Abbey was obtained by leaching out of dynamite. In the early 1960's for a time there was some restoration of production, on a small scale, to supply research laboratory requirements.

The Schmid Continuous Process

Whilst it was a major success in the context of its day the NTR system had one fundamental drawback - it was a batch process, with the resultant bulk quantities of material present at each stage presenting a safety hazard. In the 1930's the Schmid process was developed in Germany. This reflected the same basic elements of nitration but differed fundamentally from NTR, being a continuous production process, thus eliminating the disadvantage of batch production. In the early 1960's at Waltham Abbey building E5, previously Washing House No.2, was converted to conduct experiments on a Schmid plant.



Schmid Nitrator (Royal Naval Cordite Factory 1930's)

The following are examples of a "Use Lists" for various houses and are the only authorised articles permitted:

ARTICLES	Nitrating house	Washing house	Washwater settling house	Filtering and mixing house
Bags, rubber	-	-	-	1
Bottles, guttapercha.	-	-	-	12
Buckets, rubber	3	6	6	-
Covers, bucket, guttapercha.	-	6	6	-
Flannels	4	3	2	2
Gauntlets, rubber	1	-	-	-
Gauntlets, leather	-	-	-	2
Overshoes, rubber	4	3	2	-
Socks	-	-	-	2
Thermometers	3	3	2	-

Lists were posted on a board outside each house and also showed the quantity of explosives and the number of men allowed in accordance with the usual practice in explosive factories as required by HM Inspectors of Explosives.

Chemical engineering was in its infancy in the early 20thcentury and the Nathan-Thomson-Rintoul nitration process was in the context of the day a fine example of advanced explosive and chemical engineering, based on rigorous scientific experiment. It had a whole spectrum of advantages over previous plant, it materially advanced working safety, efficiency and economy of operation and substantially influenced explosive plant design in Governmental and commercial establishments. Nitration was an important process also in the civil field of fine organic chemicals, e.g the nitration of coal tar derived benzene to produce the intermediate nitrobenzene for the important dyestuffs industry, antiseptics, photographic chemicals, and it is likely that diffused Waltham Abbey technology also influenced plant developments in the civil area.

The future

What could be termed the Chemical Revolution of the early 20thcentury was a fundamental enabler of the second Industrial Revolution, e.g. the genesis of ICI lay in an amalgamation of explosives producers. The Edmonsey nitroglycerine factory is a significant surviving example of the explosives chemical industry in an 'industrial landscape'. Increasingly English Heritage are having to grapple with how far such industrial landscapes can or should be preserved and a preliminary study has been made of the size and scope of the chemical industry architectural and archaeological heritage in England. It is to be hoped that Edmonsey might ultimately benefit from any initiative which results, as the scale involved means that only a national body such as English Heritage would be able to provide the resources necessary for proper conservation.

Les Tucker

PERSONAL RECOLLECTIONS

The Friends oral history archive of the Mills, compiled by Ron Treadgold, includes the recollections of Arthur Witham, employed at the Mills from 1933 to 1982. In 1936 Arthur commenced an apprenticeship as a chemical plumber, working mainly in lead, the predominant plant material in the acid and nitroglycerine factories, opting for this occcupation partly because it carried a wage premium of 2d (2 old pence) per hour, reflecting the danger element in the work, average pay being about £3 per week.

He was then posted to the nitroglycerine section, with some work in the acid factory, being continuously engaged in the high amount of repair and maintenance work generated by the high wear associated with chemical plant.

He recalls the acid factory as a place of arduous and dangerous working conditions, where even to walk through the plant could result in some form of burn with 'incidents' commonplace, some major, such as the bursting of a retort, leading to a catalogue of injuries, with little protection, e.g. choking nitrous fumes could be released but face masks were not available until later, workers had to make do with a piece of cloth over the face. The coming of war brought reduced lighting, which added to the hazard of working in a dangerous environment, particularly since repair work often had to be done at night. Arthur evokes memories of working on the nitroglycerine plant at night in what must have been a very eerie atmosphere with the implications of any sudden noise magnified by the surroundings.

To enter the Nitrating House required a pass signed by the foreman and to enter it when nitrating was in progress required a further pass. Although as far as is known there was never an emergency at Edmonsey requiring the dumping of a charge into the drowning tank Arthur recalls some occasions when the operating temperature became very worrying, including one instance when the nitrating tank began to bulge! He did not entirely share Management's confidence in the drowning system, which took 5 minutes through a 3in pipe, - "What happens in the five minutes?"

Les Tucker

Editor's note:

This series on the unlisted principal buildings has now reached a point in time where some Friends might be able, from their own experience or recollection of others, to add to the information we have. Some might already be available on the other archive tapes and we hope to return to this at a later date, but there might be others who can recall some experience with the acid or nitroglycerine factories. This type of information becomes progressively more valuable as time moves on with increasing distance from the events recalled and in industrial archaeology can sometimes provide a unique record and letters on this and any other aspect of the Mills work would be most welcome.

FURTHER RECOLLECTIONS

In the last Touchpaper the article on the manufacture of Guncotton contained one or two pieces of misinformation:

1. The caption to the photo of women workers should be the nitration of cotton waste.

2. After nitration guncotton was boiled seven times in fresh water, the water being supplied from our own artesian well on site, which was sufficiently alkaline to need no further addition of chalk. The seven boils were reduced to four in wartime since the shelf life of the cordite was not expected to be as long as 10 years! Also, a sample of the water after each boiling was sent to the laboratory. As far as I remember the first boil water was required to be acid but the remainder were alkaline.
Jim Jeacocke will recall being confronted with something like 150 samples of vat water on arrival at work each morning early in 1940, all to be titrated and the bottles emptied, rinsed and returned to the Vat House.

3. After boiling the wet guncotton was pulped in 'Beaters' then further washed in 'Potchers' before being centrifuged and then lightly pressed or moulded into right cylinders about 5 inches in diameter in the P&M Room (Pulping and Moulding).

4. These lightly pressed cylinders were placed in aluminium boxes holding about 25-30 each and transported to the Grand Magazine at Fishers Green by road (that is Sewardstone Road and the Crooked Mile) in vans.
It is worth noting that the 1lb Wet Slabs for demolition work were soldered into tin plate containers with ahole in the centre to accomodate the 1oz primer (also made by pressing at Quinton Hill) then dried in stores before being dipped in acetone to gelatinise the surface.These products were also exported by road vehicles to Waltham Cross Station and thence by rail.

Some of the older members may remember Bert Suckling who was the Senior Foreman at Quinton Hill in the late 1930's. It was told to me by Percy Smith that Bert's father was killed in the1894 nitroglycerine explosion and Bert was employed as soon as he was old enough as a lab boy in the Main Lab.

While I have stirred myself to putting pen to paper I may as well record one of the japes we played on new entrants in the late 1930's which had rather unforseen consequences. A large funnel was stuffed down the waistband of the victim's trousers and a coin placed on his forehead, which was tipped back, and he was required to tip the coin in to the funnel. Before he could do so a beaker full of water was emptied into the funnel. We soon found that acetone was much more effective since it froze the nether regions rather than just making him wet! Unfortunately, Gary Cooper joined when he was several years older than most of us and he was wealthy enough to have invested in the new fashionable Celanese underwear, so he not only got very cold but was enclosed in a sticky mess as Celanese was somewhat soluble in acetone. Dick Doe

Colin Lawson

8th March 1914 - 3rd March 2003

Colin died on 3rd March 2003, 5 days short of his 89th Birthday. Colin grew up in Woolwich and attended Woolwich Polytechnic, moving to study Physical Chemistry at Imperial College and attaining his Ph.D. at 21 years of age. He joined the staff at Woolwich Arsenal in 1937 at about the time that the first 'cordite' rockets were being developed. He was still at Woolwich when war broke out and spent 2-3 years at Ardrossan before returning to Woolwich and then Fort Halstead. The transfer to Waltham Abbey took place in about 1949. Between 1953 and 1956 he served in the British Joint Services Mission in Washington DC and on his return to waltham Abbey he worked as Section Leader under George Williams, Superintendent Propellants I (SPRI). When George Williams retired Colin became Superintendent of the Branch until his own retirement in 1974. It was for his period as Section Leader and later, Superintendent that I remember him with a great deal of gratitude. He had a remarkable ability to relate aspects of his long experience to current problems. My fondest recollection is the occasion of a visit he made to Propellant Small Scale Plant where he had just taken delivery of a new cordite incorporator. Told that it had arrived but not yet assembled Colin asked if we had checked the phosphor bronze blades for porosity. Sheepishly I said 'No" but that I'd get them to send an X-Ray. At this point Colin, with some heat, suggested that dunking them in warm water would be cheaper and quicker and left. "Bloody Fool" I said to Mike Kennedy but "I suppose we'd better do it as he'll be asking". Result - streams of bubbles and the swift return of blades to the manufacturer for failing to meet the 'contract requirement'. I later learned that Colin often cycled to work from home at Chingford and I suspect his experience of mending punctures was greater than mine. **Eric Baker**

When I joined the Research Department in the Royal Arsenal in 1937 I was aware that there was a Dr. C Lawson on the staff but my first 'encounter' with him was on the Polytechnic rugby pitch. Later, during the was, we had an enjoyable meal in Bournemouth when Colin provided the transport after a game against the Royal Naval Cordite Factory at Holton Heath. When we moved to Waltham Abbey (ERDE) we were, for a time, neighbours in the Sandhurst Flats and there we shared an interest in bridge and swimming in the Mill Head Stream.
Following retirement we visited Connie and Colin at Bury St. Edmunds where he was an active member at Probus and the Bridge Club. They also enjoyed bird watching and long walks in the country. Colin was always a great enthusiast for everything he tackled but the trait that I admired most was that he never compromised truth for tact or discretion. **Vic Clifford.**

His daughter, Pat and Son, Ken would be pleased to hear from any of his ex-colleagues and if anyone would like to mark his death the family request donations to the Alzheimer Society

TOUCH

Where are they now? .... I was surprised to hear of the death of Eileen Henshaw in December. I got to know Eileen when I joined E.R.D.E. back in March 1975. I regret to say that I had not been in touch with her since moving up to Lowestoft in 1991.
It got me wondering how many other old workmates are no longer with us, or even what has happened to those who are still around. It would be really nice to find out what people are up to these days. Would anyone care to write in to Touchpaper to bring us up to date with their lives since the site closed ? Also, is there any chance of publishing a complete list of subscribers to Touchpaper? I would particularly like to hear from anyone who knows anything about Ron Tuckey and Doug Penny. They were both G.O.A's when I joined E.R.D.E. and must be getting on in years now.
If anyone would like to get in touch with me directly, my e-mail address is: sandyday@connectfree.co.uk
I am a newcomer to all this technology, but I am enjoying learning how to use it. I am also trying to teach myself the Russian language, because one of my brothers has married a Russian lady and gone to live in St.Petersburg. So if anyone has any useful tips or experiences to share I would love to hear from them. Sandra Day.
Something I have been meaning to do for some time. See last 2 pages. Ed.

More on the Deer .... Another note on the deer on North Site. Last summer I was cycling up New Hill, turned right at the Bungalow and at the far end a deer stood in the roadway. I stopped and watched it, then as I cycled towards it, it stamped its foot and walked down the small side road, followed by the rest of the herd. They walked in file, either one or two at a time so that I was able to count them easily; total 23. I reported this to Brian Harvey and Lynne Lennard as I felt it worthwhile recording.
George Savill.

Faversham news ..... The Faversham Society have published a new 'Faversham Gunpowder Trail'. Copies can be ordered from the Society at Preston Street, Faversham, Kent ME13 8NS and although free a contribution to postage would be appreciated.
If you are within easy reach of Faversham you may like to come and follow the new Trail. If so, you might want to time your visit to coincide with one of the town's forthcoming special events; Secret Gardens (7-8 June & 19-20 July), Open House (5, 12, 19 July), Davington Fair in the grounds of Bob Geldorf's medieval home (12 July), Hop Festival (29-31 August) and Evening Carnival (18 October). For more details of these, ring the Society's networked Tourist Information Centre on 01795 534542.
Best Wishes, Arthur Percival (Honorary Director)

DON'T FORGET
DEADLINE FOR THE September 2003 ISSUE:
15th August 2003

BYTES

MORE ON THE GREEN LIGHT ...Further to the note about the green light in the last issue of Touchpaper, I thought Id share with you some information about the Meridian Line in Waltham Abbey, which I gleaned when I worked for the Lee Valley Regional Park Authority. This line is marked, where it crosses Sun Street in the town centre and again heading north, by a mosaic in the Abbey Gardens. In 1984, to mark the 100th Anniversary of its adoption as the line of zero longitude, the Prime Meridian, Epping Forest District Council planted a line of trees across the district. One or two only are left in Waltham Abbey, see if you can spot them in the Cornmill Meadows, to the east of the Gunpowder Mills. Marking a stretch of the line is a mown pathway through the meadows marked by granite obelisks. The stone probably originally came from Dartmoor, but was then part of Rennie's London Bridge, most of which was relocated in Arizona after its sale. An art student in 1994 had a bit of fun trying to get people to think about this invisible line. She marked the line as it crosses the Abbey Gardens with bird seed and then watched as it disappeared as it was eaten by the birds and blown in the wind. Also, on April 1st a notice appeared asking people to find another route without crossing the Meridian line! It was of course an April fool, but certainly got people thinking about this concept still used internationally for navigation and timekeeping. Every time you go from the Gunpowder Mills into Waltham Abbey, do you realise that you cross from the Western to the Eastern Hemisphere! Cathy Morton Lloyd

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NETTLES ...I have always enjoyed the countryside and really appreciated working in such a rich environment as the Royal Gunpowder Mills. One of my many memories will always be of the abundance of nettles on site and the height they grew to.
Did you know Some Fascinating Facts about Stinging Nettles?
Nettles are one of the most important native plants for wildlife in the UK supporting over 40 species of insect, including some of our most colourful butterflies, such as Small Tortoiseshell and Peacock.
In the organic garden the nettle is responsible for rearing an army of ladybirds in the early part of the year ready to march on the aphids attacking the crop plants later in the summer.
Cloth made from nettle fibres was widely used by the German army during the First World War when there was a shortage of cotton for the soldiers' uniforms.
Nutritionally the nettle is an excellent source of calcium, magnesium, iron and numerous trace elements, as well as a range of vitamins. The young shoots can be used in soups and stews and in place of spinach.
Each sting is a hollow hair stiffened by silica with a swollen base that contains the venom. The tip of this hair is very brittle and when brushed against, no matter how lightly, it breaks off exposing a sharp point that penetrates the skin and delivers its stinging payload. Remember when stung a natural remedy will often be found close at hand. The leaves of the dock contain chemicals that neutralise the sting and also cool the skin.
Formic acid is present in the sting, but recent research has shown that the main chemicals are histamine, acetylcholine and 5-hydroxytryptamine (serotonin). A fourth ingredient has yet to be identified. Want to know more? - see the web site Be Nice to Nettles www.nettles.org.uk
Cathy (Again!)

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