THE ROYAL GUNPOWDER FACTORY.

WALTHAM ABBEY.

THE ROYAL GUNPOWDER FACTORY.

WALTHAM ABBEY.

Appendix

The North Site Cordite Buildings

Bld. No.	Built for Cordite	Cordite Function	Converted to Cordite	Cordite Function	Previous Function	Built
L101	1910	Paste Store				
L105	1910	Paste Store				
L108	1910	Paste Store				
107) 108)	–		1898	Blending Ho.	Moulding Ho.	1882
L134	1915	Press Ho. No.2				
L143	1915-17	Incorp.Ho.				
L145	-		1898	Incorp.Ho.	GP Inc.Mill F	1879
L146	1915-17	Incorp Ho.				
L148	-		1898	Incorp.Ho.	GP Inc.Mill G	1889
L149	-		1898	Incorp.Ho	Hydraul.Accum. GP Inc.Mill E	1867 1877
L151	1915-17	Incorp.Ho.				
L153	-		1898 1908	Press Ho. Incorp.Ho.	GP Inc.Mill D	1868
L155	1915-17	Incorp.Ho.				
L157	-		1898	Press Ho.	GP Inc.Mill C	1861
L159	1915	Press Ho. No. 5				
L165	1916	Mineral Jelly Store				
L167	-		1898	Reel Drying Stove	Charcoal Store	1889
76	-		1898	Mixing Ho.No.4	Press Ho.	1856
S27	1904	Weighing Ho.				
46	1904	Mixing Ho.No.2 - destroyed 1940				
46A	1940	Mixing Ho.				
46R	1940	Mixing Ho.				
62	1904	Mixing Ho.No.3				
63	1904	Mixing Ho.No.5 - destroyed 1940				
H7	1904	Reel Drying Stove				
H8	1904	Reel Drying Stove				
H10	1904	Reeling Ho.				
H12	1904	Reel Magazine				

CORDITE.

CORDITE.

NORTH SITE.
THE GUNCOTTON & CORDITE BUILDINGS from 1897.

GUNCOTTON.

Guncotton was at the heart of chemical explosive development in the latter part of the 19th and first half of the 20th century, both in direct use and as one of the two components of cordite. The research led by Sir Frederick Abel and crystallised in manufacturing procedure at Waltham Abbey was fundamental to its development into a safe and effective product, with Waltham Abbey methods being widely influential in outside manufacturing practise, and enabled the South Site Guncotton Factory to successfully supply an important part of the requirements of the British Forces over 50 years, including two world wars.

THE ROYAL GUNPOWDER FACTORY.

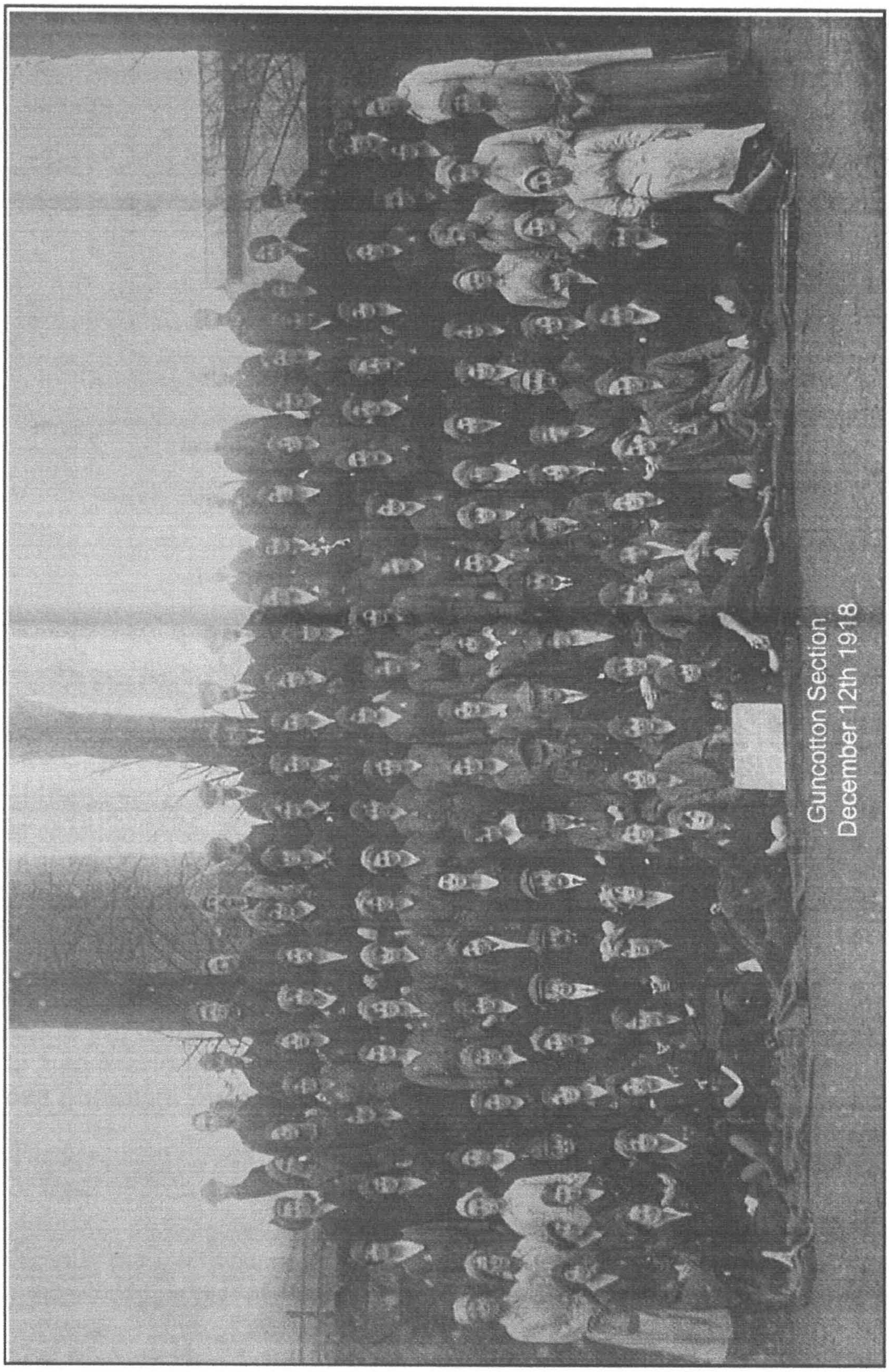
THE SOUTH SITE GUNCOTTON FACTORY 1890.

In 1885 the Mills land holding had been extended to the south of the town by the purchase of 100 acres at Quinton Hill, later termed the South Site.

Demand for guncotton for use in military demolition, sea mine and torpedo warhead filling was steadily increasing and in 1890 a guncotton factory, constructed on land along Cobbins Brook to the north of Quinton Hill, commenced production. At this time the forerunner plant at Highbridge Street closed.

The guncotton manufacturing process involved:-
Raw waste cotton which had previously been degreased
and washed picked over by hand-
Teasing out by machine - Drying and cooling - Nitration -
Boiling - Beating (pulping) - Potching (washing) - Blending -
Pressing (moulding).

GUNCOTTON SECTION
December 12th 1918.



ROYAL GUNPOWDER FACTORY.
GUNCOTTON. MANUFACTURE.

1.Raw Cotton.
The cotton received was waste material in bales from from cotton mills which had previously been used for cleaning etc. and had been degreased and cleaned by boiling and wringing. (Cotton waste was a significant item in the Mills purchase costs; e.g. for the year 1936/37 taken at random the total cost of cotton waste exceeded that of such major items as coal, sulphuric acid and acetone).

2. Hand Picking.
The material was picked over by hand to remove any obvious foreign objects _ string rags, wood etc.

3. Teasing.
It then passed to teasing machines which opened out any knots, lumps etc. in order to allow acid to contact all surfaces..

4. Drying.
The cotton was then dried by a current of warm air to reduce moisture content and cooled..

5. Nitration-Nathan -Thomson - Displacement Process.
The next stage was the core process of nitration. this employed acids bought in from the East London chemical industry. These were purified and concentrated in an acid factory adjoining the guncotton factory.

From 1905 the system employed was the displacement process devised by the brothers W.T. and J.M.Thomson, chemist in charge of guncotton production and factory manager respectively and Bt.Col.F.L.Nathan who was Superindent of the factory. In 1935 in the Transactions of the Institution of Chemical Engineers W.MacNab gave the following graphic descripition of the process:

"In this beautiful process the acid is contained in a series of shallow circular earthenware pans provided with perforated false bottoms. The charge of cotton is forced under the acid and sectional perforated earthenware plates laid on top to keep the cotton down and a thin layer of water is run on top of the acid to prevent the escape of fumes. When nitration is finished the spent acid is allowed to run off slowly from the bottom while water is distributed at the same rate over to run slowly from the bottom while water is distributed at the same rate over the surface and displaces almost completely the acid from the nitrocotton."

Probably only a chemical engineer could call it beautiful but it was extremely effective compared with what had gone before and reflected great credit on the Thomsons. MacNab also emphasised the chemical engineering expertise involved in control of the equipment - pipes, pumps and valves.1905 was a year of particularly successful process innovation at Waltham Abbey since in that for nitroglycerine nitration was patented, again having at its core the principle of displacement.

The displacement process was a notable improvement on the Abel based nitration method previously employed, which involved a laborious process of dipping the cotton into the mixed acids, acid squeezing, immersion in water pots, centrifugal removal of acids, further immersion in water pots, centrifugal removal of acids, further immersion, and centrifugal washing in water.

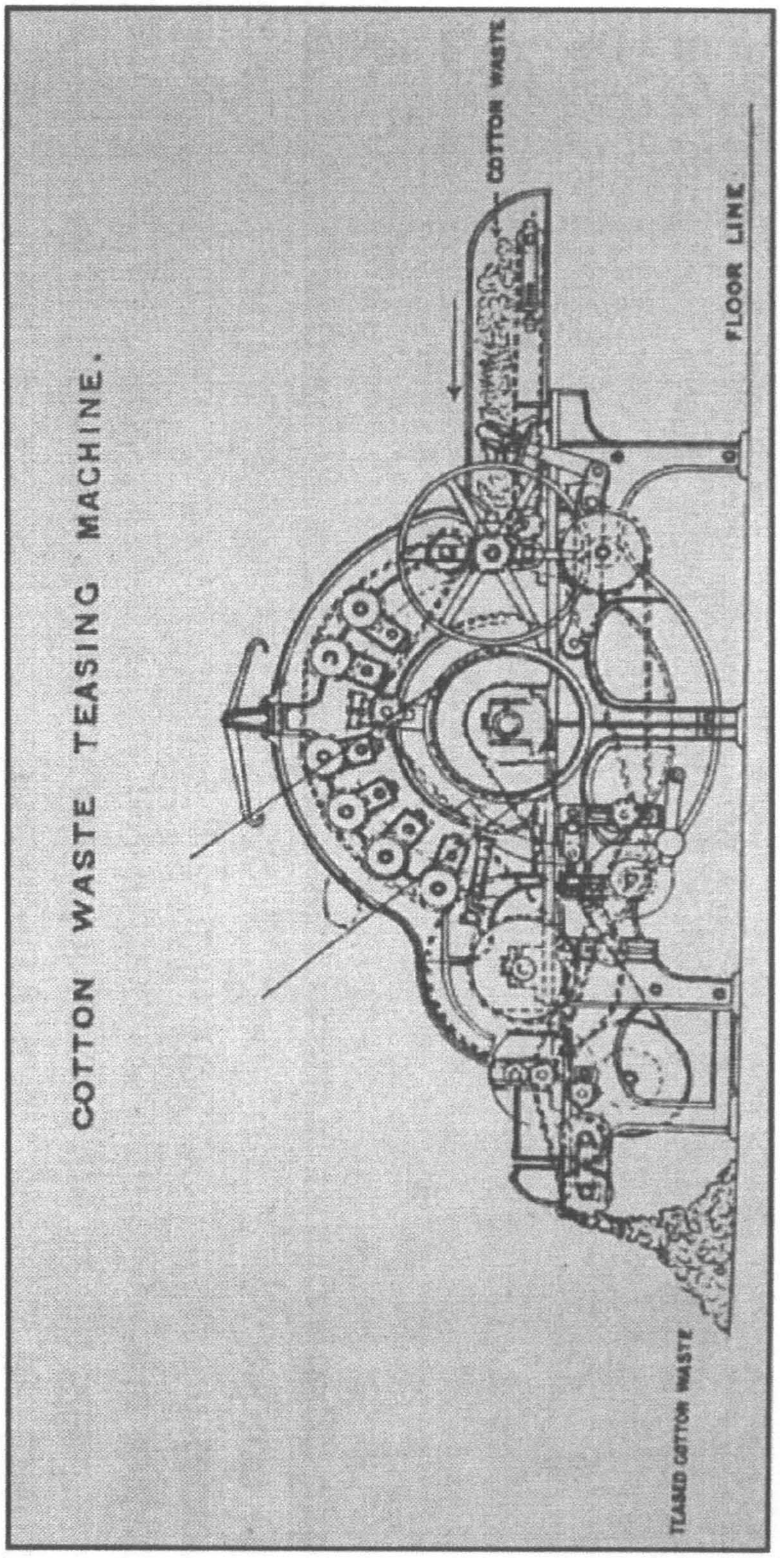
In 1909 Col. Nathan listed the advantages gained by displacement:
Great simplicity compared with the Abel system.
Dipping was much less laborious and heavy labour of acid squeezing eliminated.
Loss of acid and guncotton due to fume-offs and broken pots together with the danger of nitrous fume poisoning almost entirely eliminated.
Process free from fumes compared with Abel system.
Much lower acid usuage.
Less acid pollution of escaping wash water.
Recovered waste acid much cleaner.
Water required for washing reduced by 4/5 and more throrough washing obtained.
Less boiling required.

Saving in power for centrifugals.
labour required cut by 2/3.
Cleaner more stable product of more uniform composition.
Overall cost reduction of 50%.

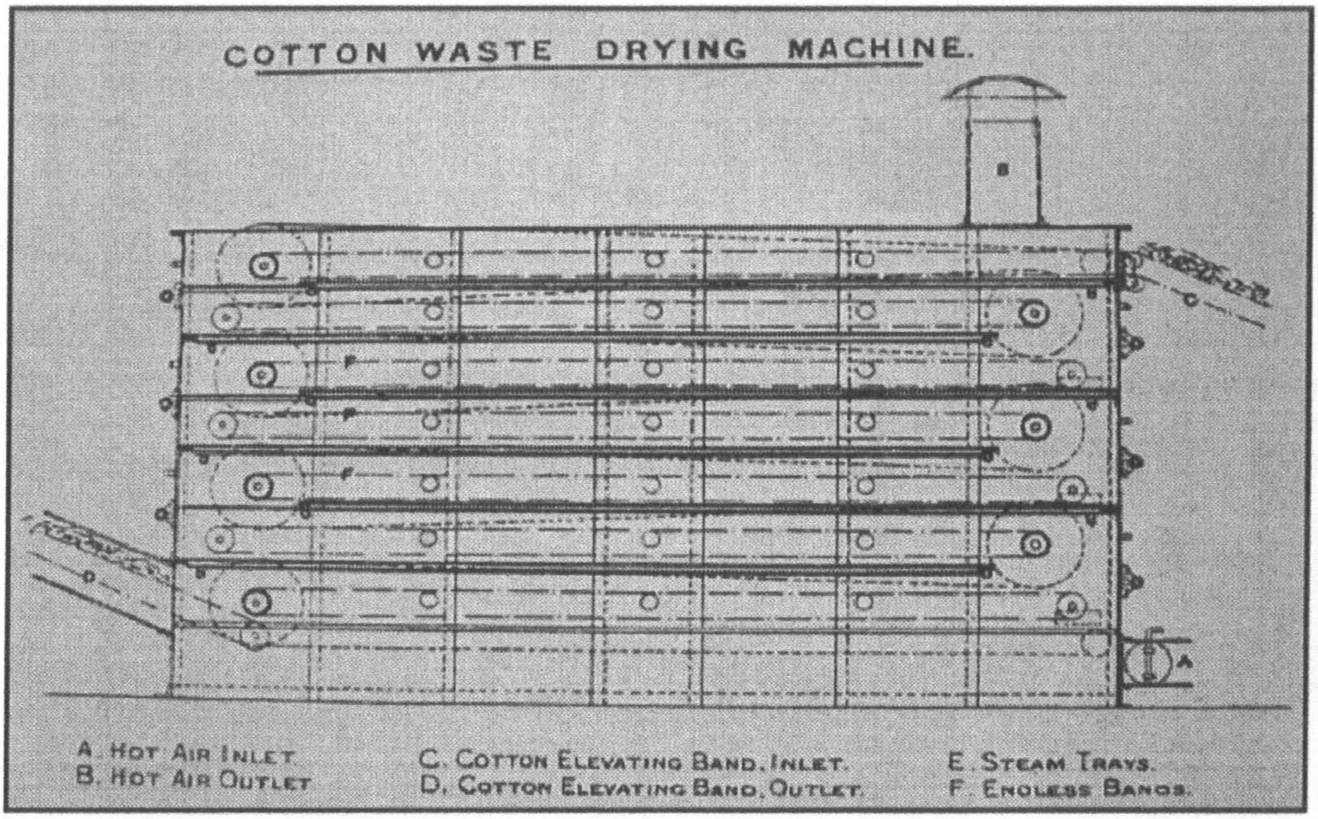
Col.Nathan was careful to state that fumes were lower in terms of comparison with previous. They could not be entirely eliminated and a guncotton nitrating house was not a healthy place to work.
Guncotto had two functions - in finished form for direct service use in demolition etc. and as a mine and torpedo filling and secondly as one of the two components, the other being nitroglycerine, for double base cordite production.
The replacement of gunpowder by cordite had been progressing from the late 1880's and at the same time as the establishment of the guncotton factory in 1890 a cordite factory was erected on the South Site. From 1897 a cordite factory had been built on the North Site and at the same time as introduction of displacement in 1905 the South Site factory was enlarges to serve the growing requirement for guncotton for cordite production at the North Site.

PICKING COTTON.

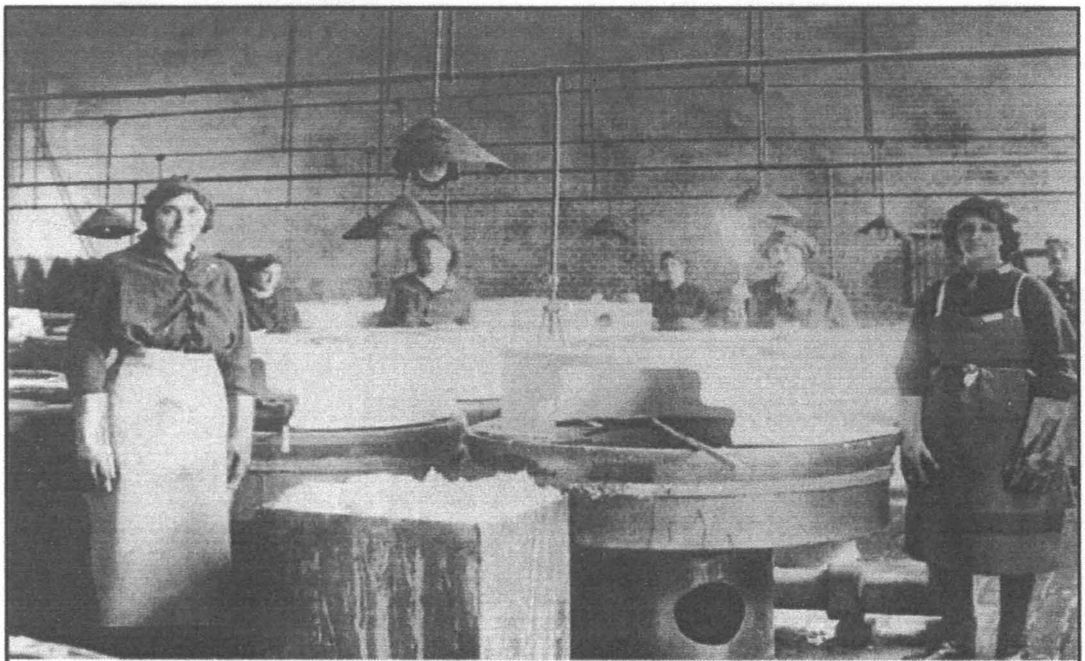
COTTON WASTE TEASING MACHINE.



COTTON WASTE DRYING MACHINE.

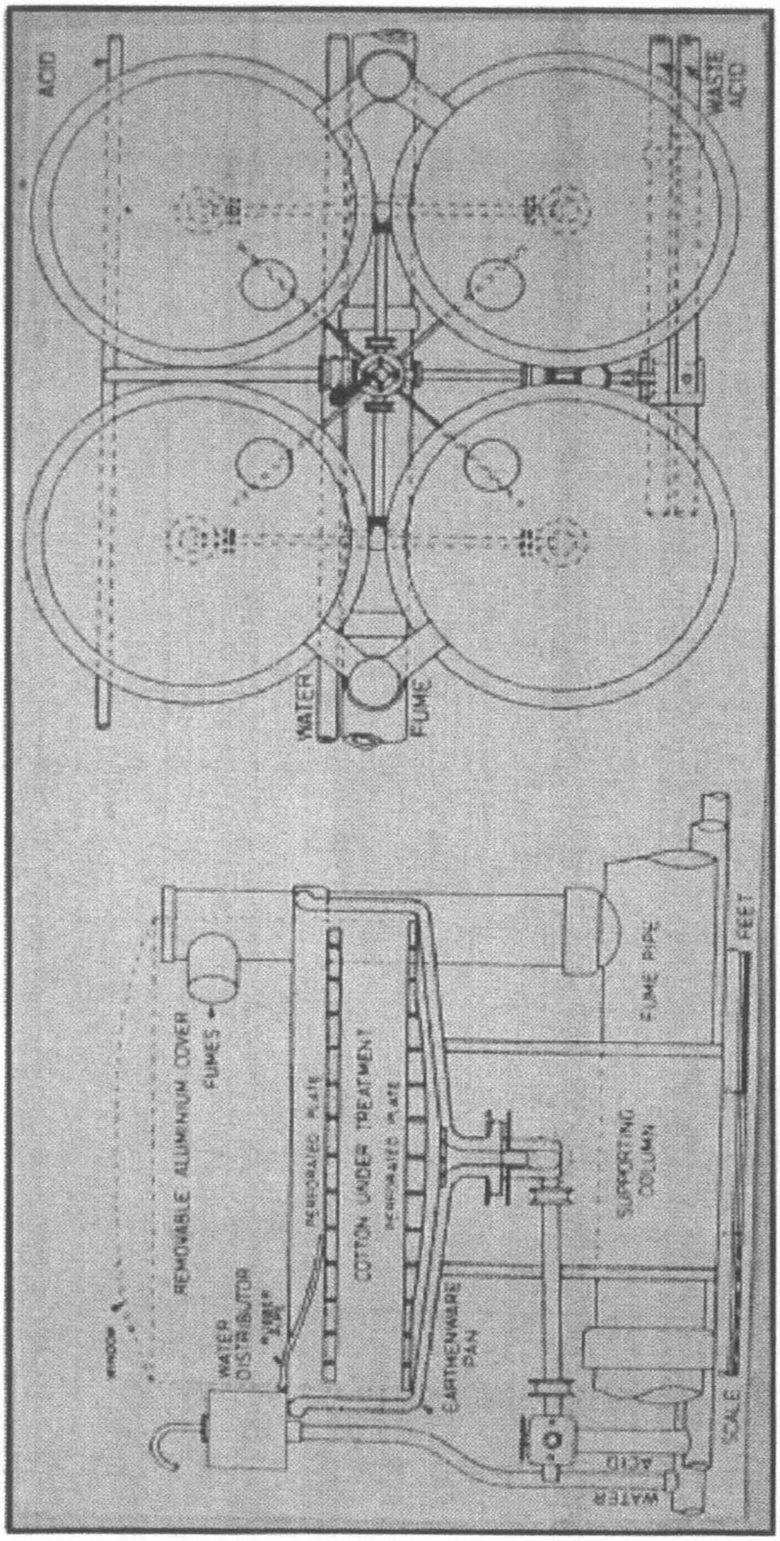


NITRATION OF COTTON (July 1917).



Nitration of Cotton (July 1917).
Background worker is holding aluminium fork used to push cotton under.

NATHAN-THOMSON DISPLACEMENT PROCESS.



Further Purification.
The following stages represent the work of Sir Frederick Abel in achieving the purity of product which made guncotton practicable.

6.Boiling.
The next stage was boiling in water in wooden vats which were lined in anti-corrosive antimony-lead alloy. Apart from explosive performance one of the greatest concerns in explosive development was performance in storage - an unstable product liable to decomposition and combustion in storage would be useless. Acid was the greatest contributor to instability and boiling was the initiator of the processes to remove as completely as possible the acids of nitration.
Extensive investigation by another famous Waltham Abbey name, (later Sir) Robert Robertson refined the process demostrating that 7 boils was the optimum,, with two longer at the commencement: the first acid, the second almost neutral and with the balance alkaline.

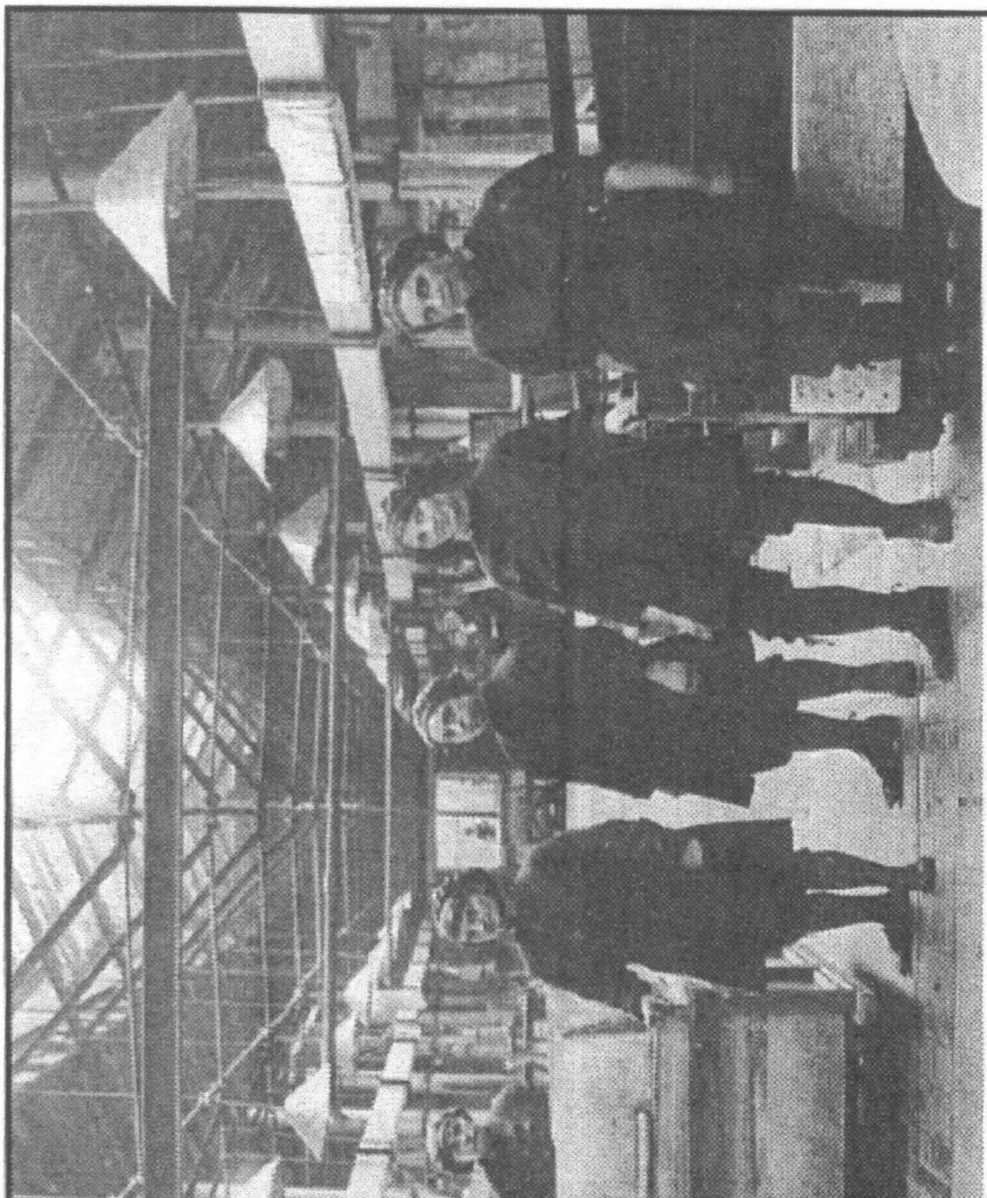
7. Beating (Pulping.)
The boiled material was then pulped underwater in beating machines similiar to those in the paper industry where a roller with steel blades rotated and reduced the guncotton to a pulp between these blades and similar static ones mounted on the machine bedplate. The intention of pulping was to break down the fibrous, capillary structure of guncotton so that washing and boiling could remove all remaing free acid and resinous matter and other unstable impurities remaining.
Waltham Abbey pursued a policy of continuous process improvement, to the benefit of other governmental and private industry. Typical of this was the patenting in 1903 by A.W.Williamson of the Mills of a portable milling cutter driven off the beater shaft. Whilst the equipment was basically as employed in the paper industry guncotton had to be cut into short lengths. This required frequent dismantling for blade sharpening, which was uneconomic. The portable cutter enabled the work to be done more economicall in situ.

8. Potching (Washing), alternatively termed Poaching, and Blending.
The final stage in purification was further washing in vessels termed poachers or potchers. Again methods and equipment reflected paper industry practise. However this was not entirely satisfactory and again a Waltham Abbey development became the explosives industry standard. This was the Bowden Parsons Tangential Potcher which came into operational use for potching of 2 ton batches in 1936.
It had been found that the existing use of a pump to circulate around an elliptical vessel would not cope with a 2 ton batch as it would require an impractically large pump. The tangential potcher achieved the necessay high circulating velocity by injecting the pump discharge of pulp tangentially into a circular vessel. This was later extended to blending to achieve a uniform nitrogen content of 13.2%. After washing the guncotton settled and the wash waters were skimmed off, removing insoluble impurities and any soluble materials released from the centres of the nitrated fibre by pulpin.

9. Foreign Matter Removal.
After washing any remaining foreign matter, such as grit or metal, was removed by centrifuging.

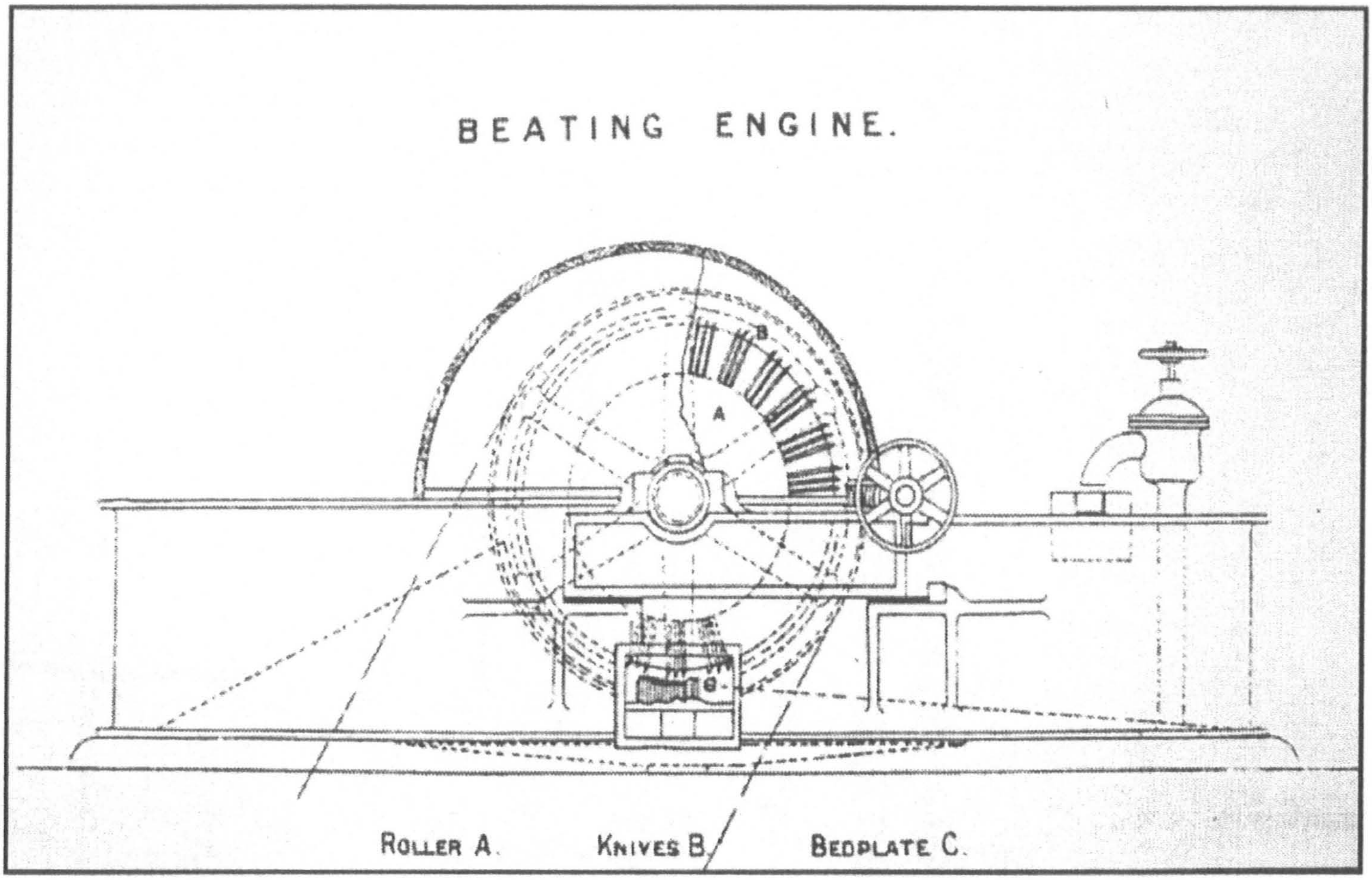
10. Moulding. (Pressing).
The final stage was moulding the moist material into slabs, which with detonator inserted would be for direct use in demolition, or cylinders of around 5-inches diameter, termed primers, which moved initially for storage to the Wet Guncotton Magazine at the Grand Magazine in the north.
The result was a moist material compressed into blocks or cylinders as hard as wood which was so stable that it could be cut, turned or drilled and therefore it could be shaped for optimum performance either in mine or torpedo filling or in use in slab form for military demolition or in civil use in mines, quarries, construction etc.

BOILING VATS.



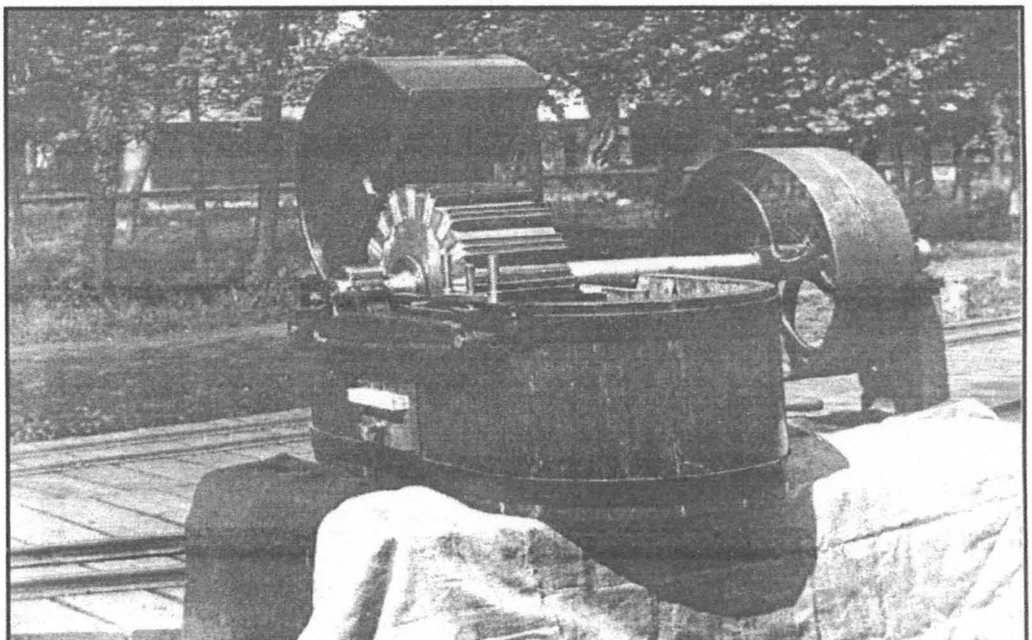
Boiling Vats (July 1917)

BEATING MACHINE.



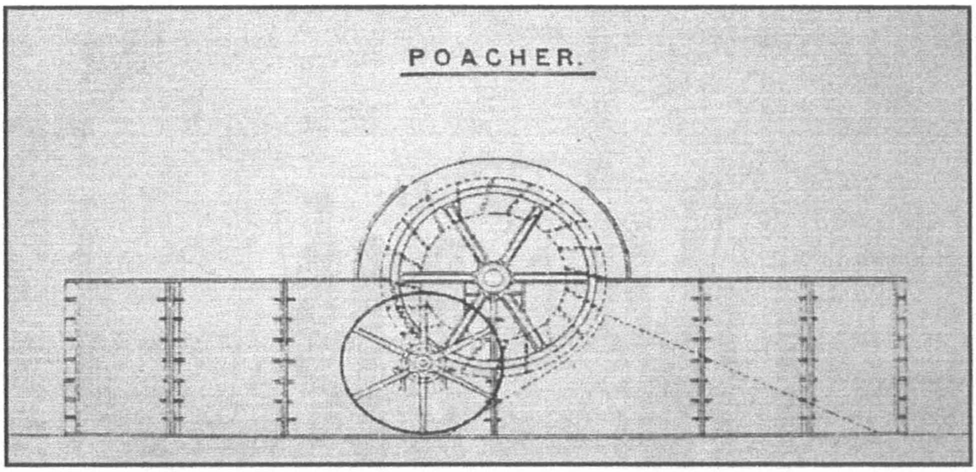
PULPING (july 1917).

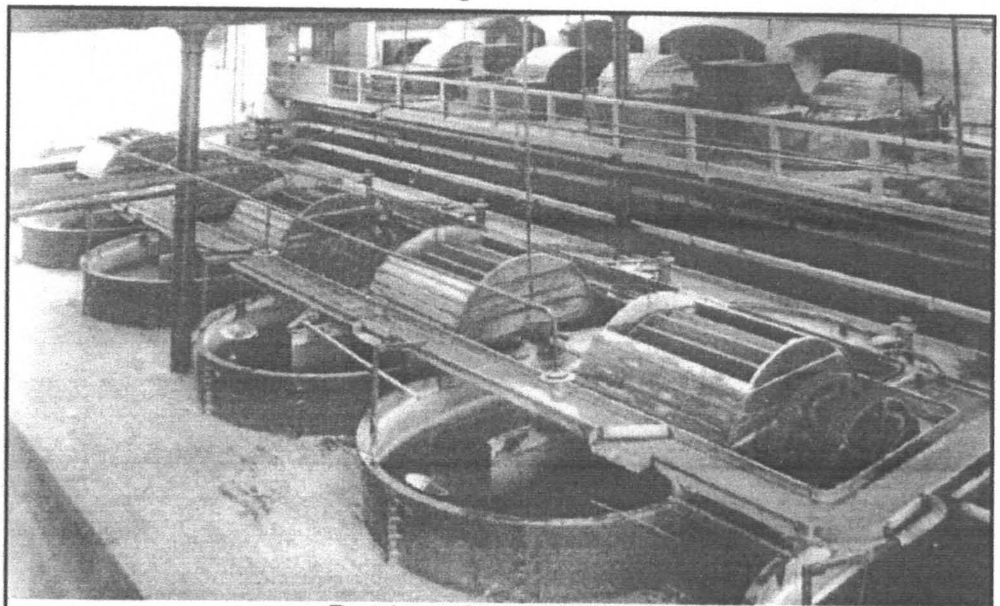
Pulping (July 1917)



GC Pulping Machine (Beater) -destined for India

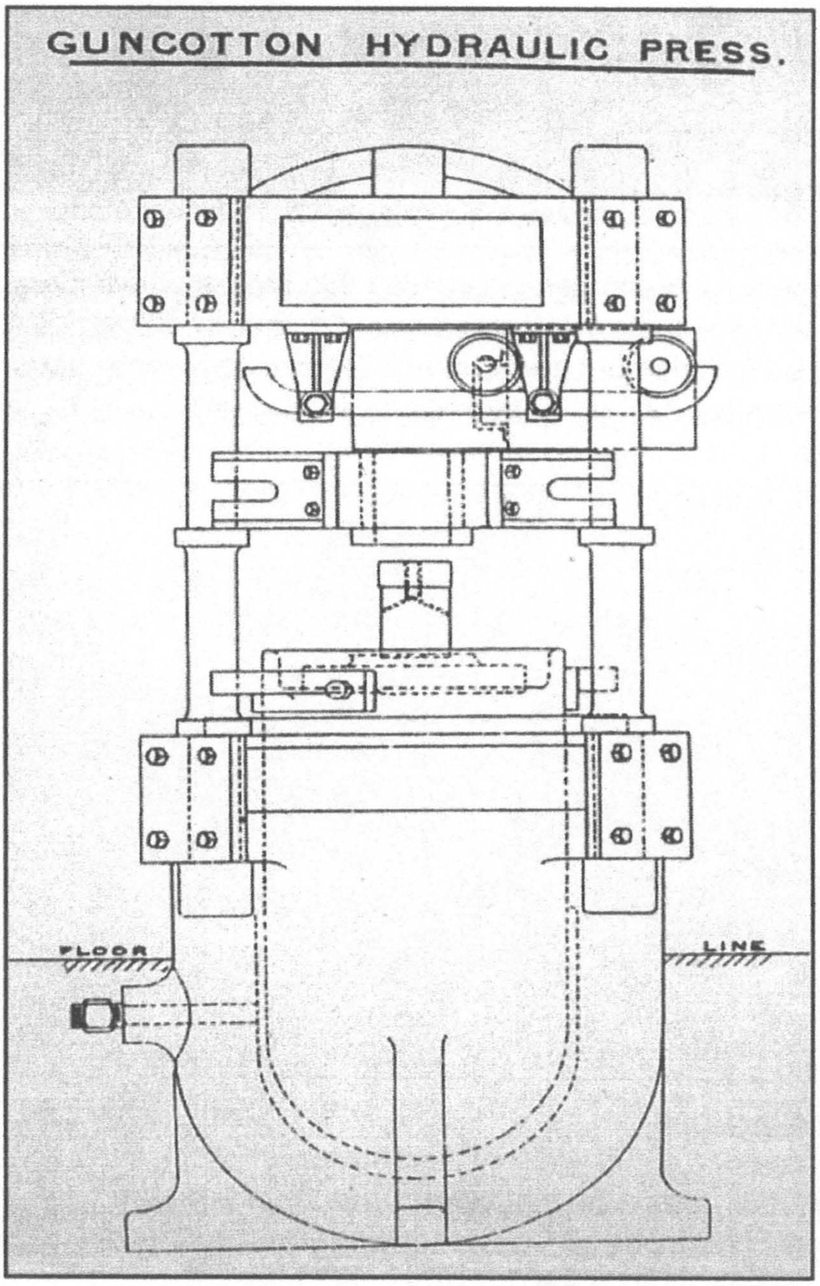
POACHERS (July 1917).





Potchers (July 1917)

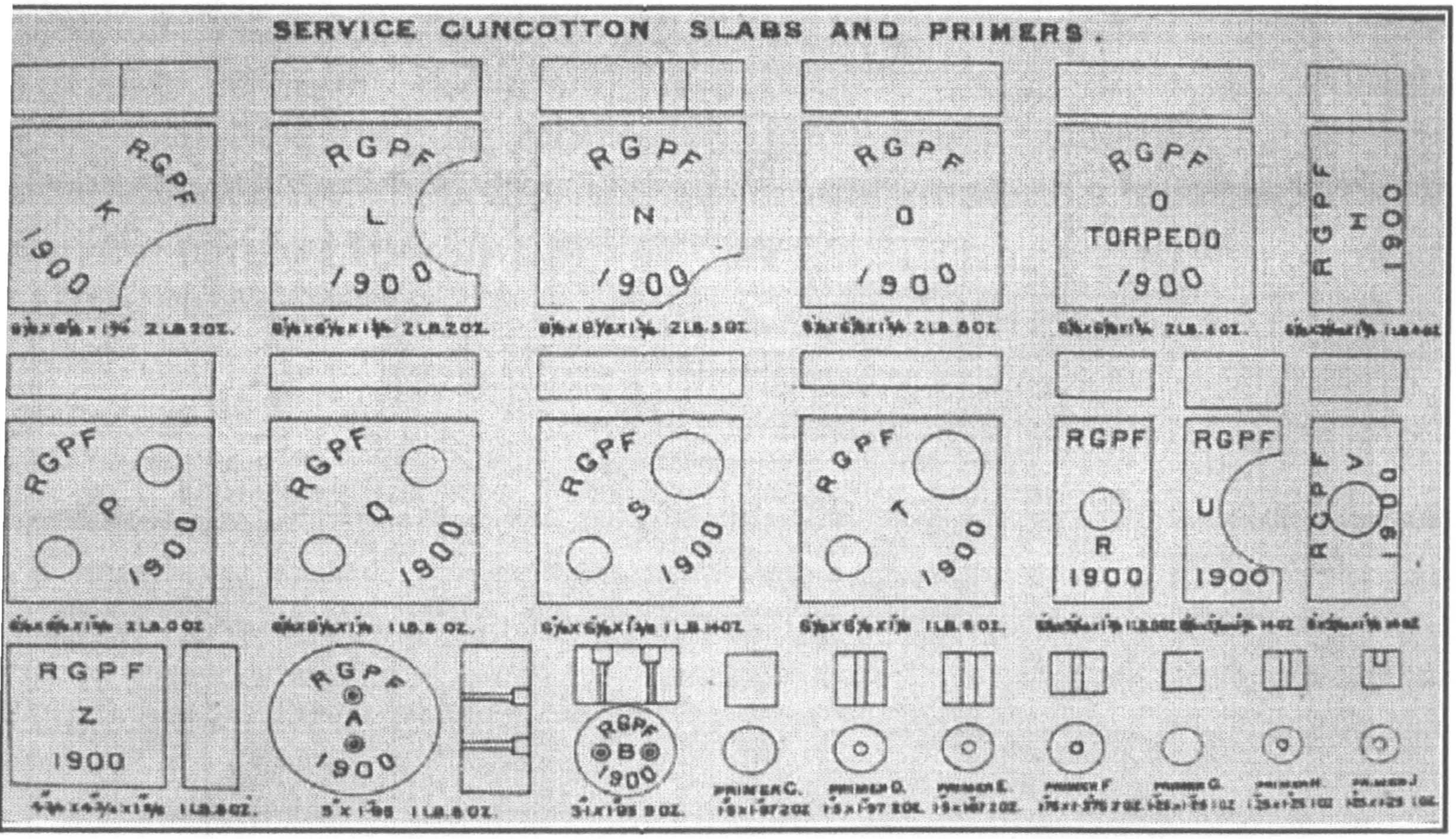
GUNCOTTON HYDRAULIC PRESS.



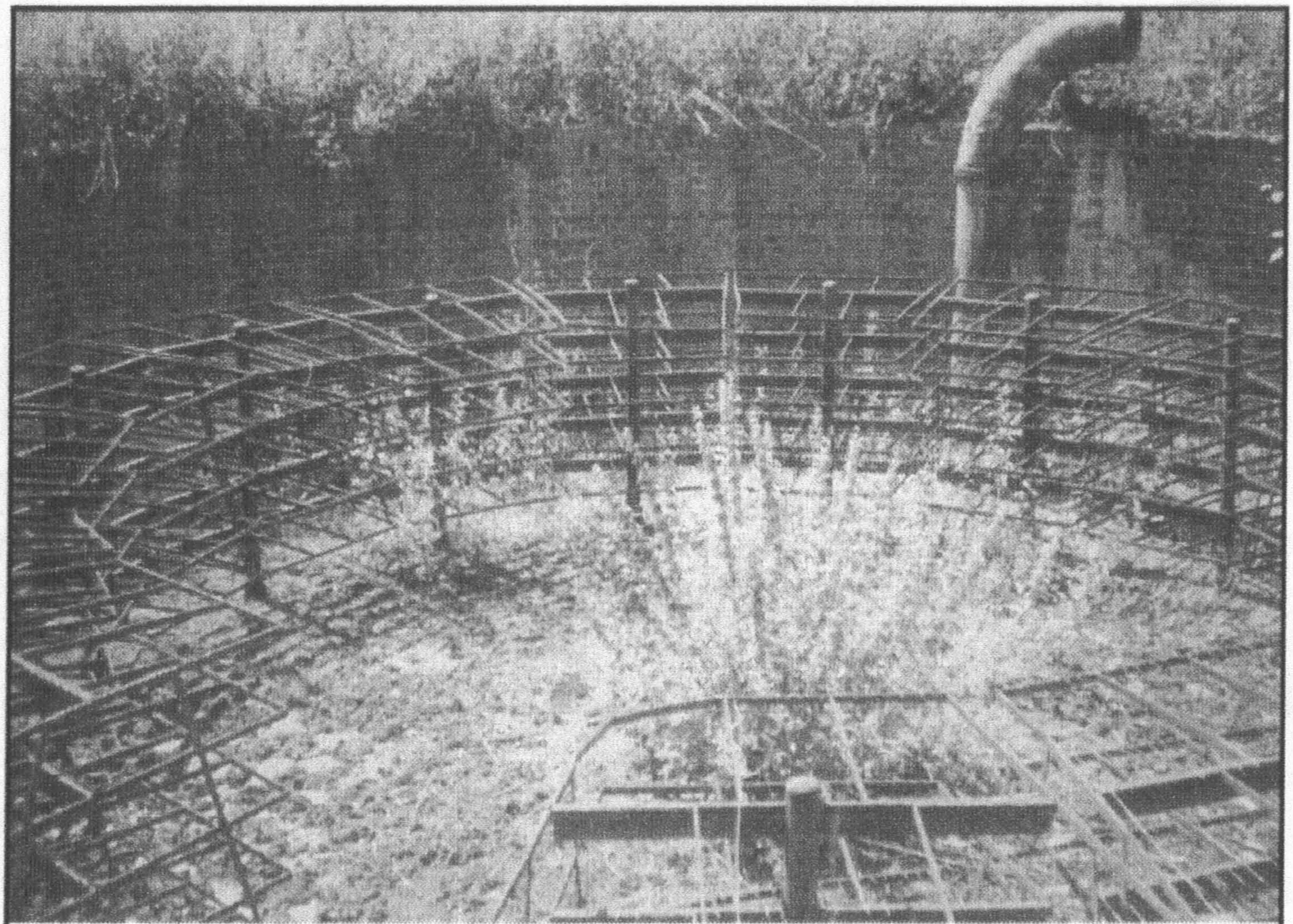
MOULDING (July 1917).

Moulding (July 1917)

SERVICE GUNCOTTON SLABS AND PRIMERS.



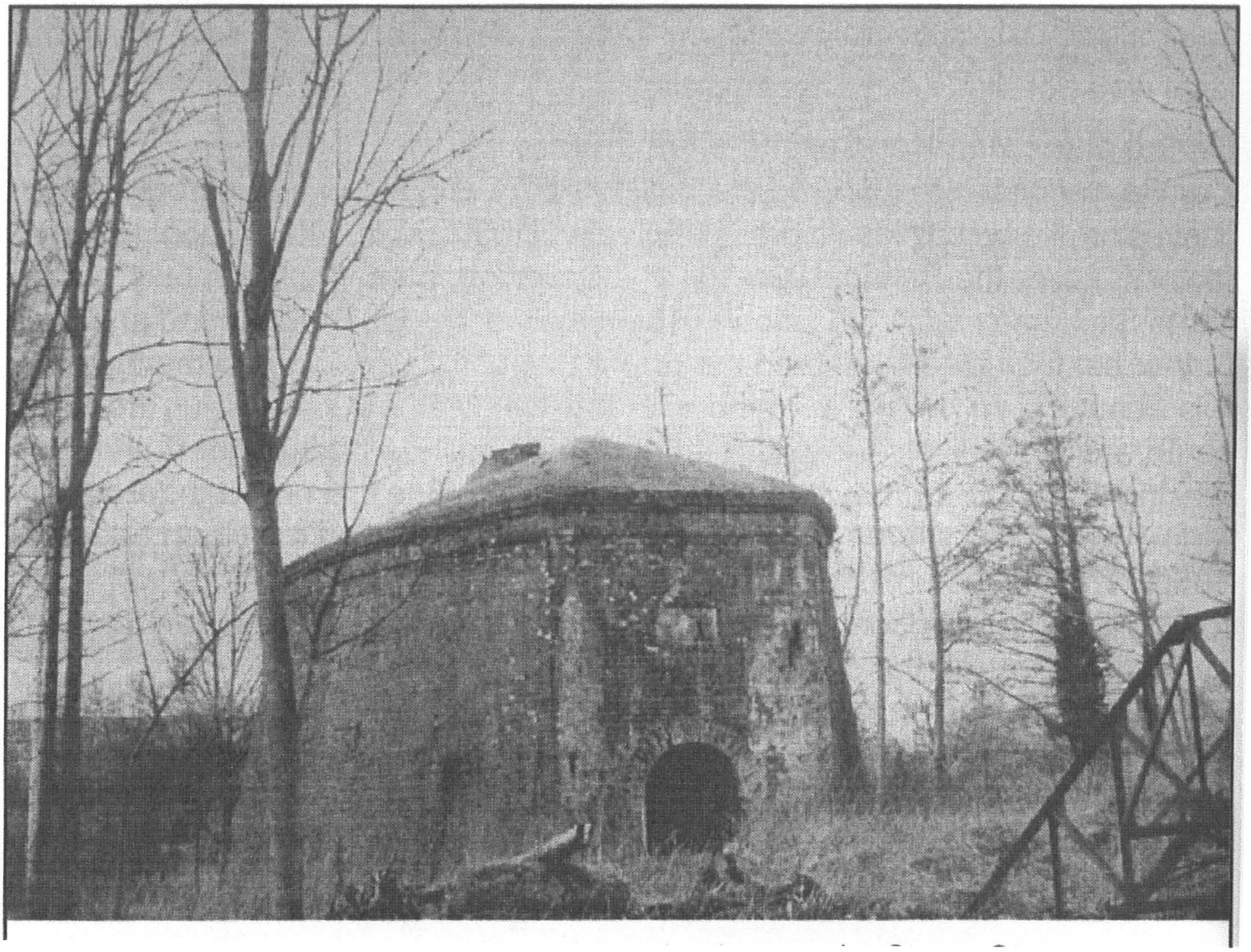
DRYING RACKS.
Building 29-GC Stove No.12 (1897).



Drying Racks in Bldg 29 - GC Stove No.12 (1897)

BUILDING 26.

Orignaly Boiler House for Gunpowder Steam Stoves. Converted (1894) to Engine and Fan House for GC Store No.1 Guncotton Section December 12th 1918.



Transport.

Road transport replaced the earlier use of the canal system for transport to the Magazine in the north and subsequent movement back down the system. To improve on the lengthy canal route involved a lock was built in 1896 linking the high level Millhead, leading to the Magazine and the lower level water of the South Site.

Drying Guncotton for Cordite Manufacture.

Cordite manufacture involved the mixing of dry guncotton and nitroglycerine. Stoves had to be built therefore to dry the wet material from the Cobbins Brook factory. Over the period 1894-1914 21 guncotton stoves were built on the North Site, -13 on the west along the Millhead and later further east. Of these 6 served the South Site cordite factory. On the face of it this seems a surprising decision with the wet material moving up from the south and up virtually the entire length of the Millhead being dried and then making the whole journey back again to the South Site in a now dangerous dry form. The other 7 served the cordite factory operational on the North Site from 1898. The balance of 8 in the 21, all serving the North Site factory, were built to the east along the Cornmill Stream. This group was served by a new tramway system linking the canals. Earlier stoves were rectangular. Later a circular shape became standard. Each roundhouse was surrounded by a brick revetment surrounded by an earth traverse. The dust created by drying guncotton was extremely hazardous and to prevent the gathering of dust in crevasses the stoves were lined with zinc sheeting and the floors covered in lead. The stoves were normally in pairs with an engine house between them fans which drew air over a heat exchanger into the stoves. For drying the guncotton was placed on trays stacked on metal racks.

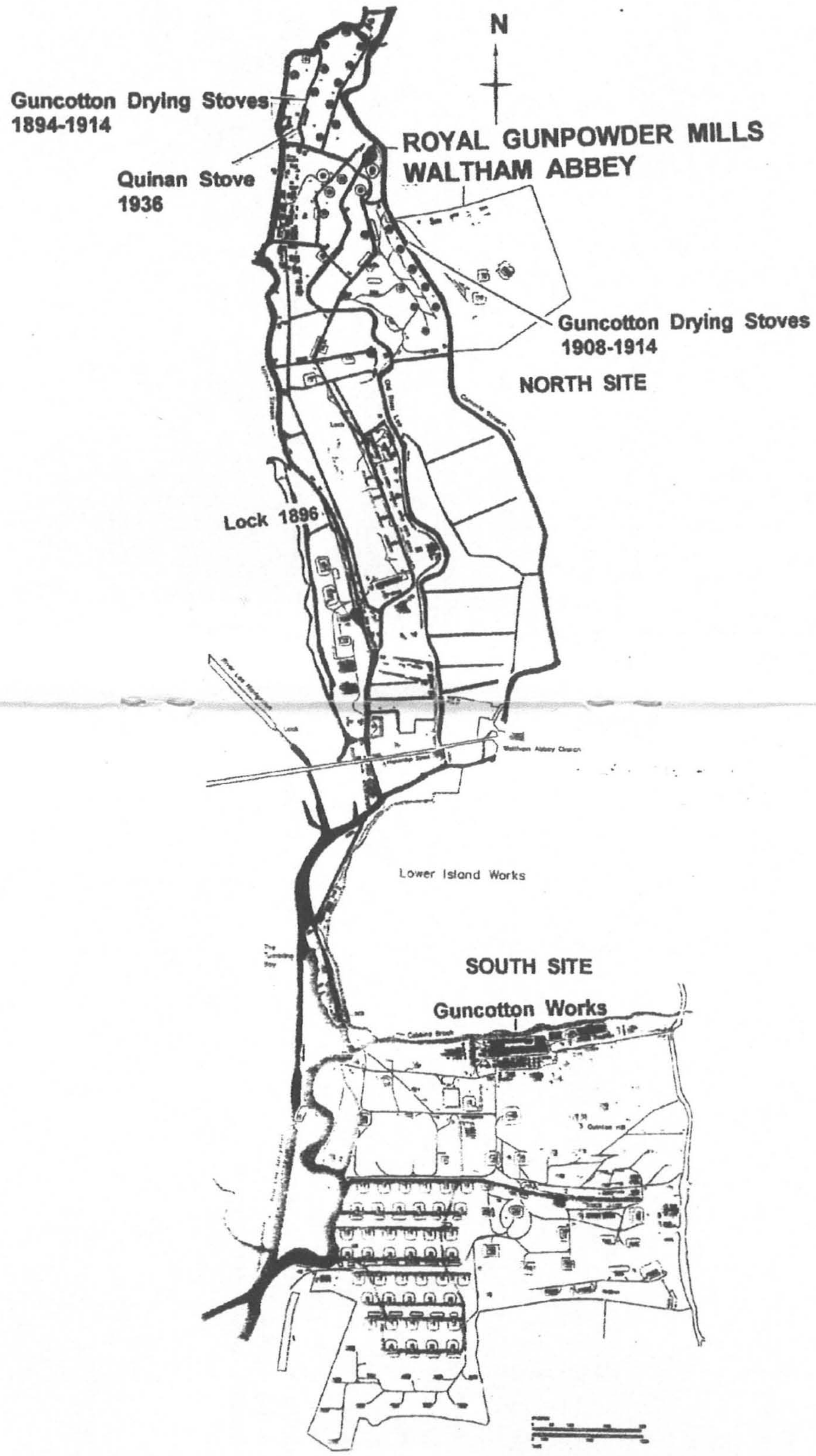
This system continued as standard until the introduction of the Quinan stove in 1938. Originally developed in WW1 this design was intended to improve the safety of the procedure and increase output. Although later overtaken by the development of a process involving the pumping of a wet nitrocellulose slurry to the cordite facility, thus avoiding the need to dry guncotton, the Quinan system was highly innovative and productive in its day.

With the onset of WW1 the Cobbins Brook factory became of core significance and in 1915 was enlarged to cope with demand placed on it. Until closure in 1943, when newer factories in the west took over from Waltham Abbey, it played a vital part in supplying the Forces guncotton requirements, both for direct use and for cordite production, and by 1940 was producing around 120 tons per week.

GUNCOTTON WORKERS.
Late 19th Century.
(Acid Carboy in front).

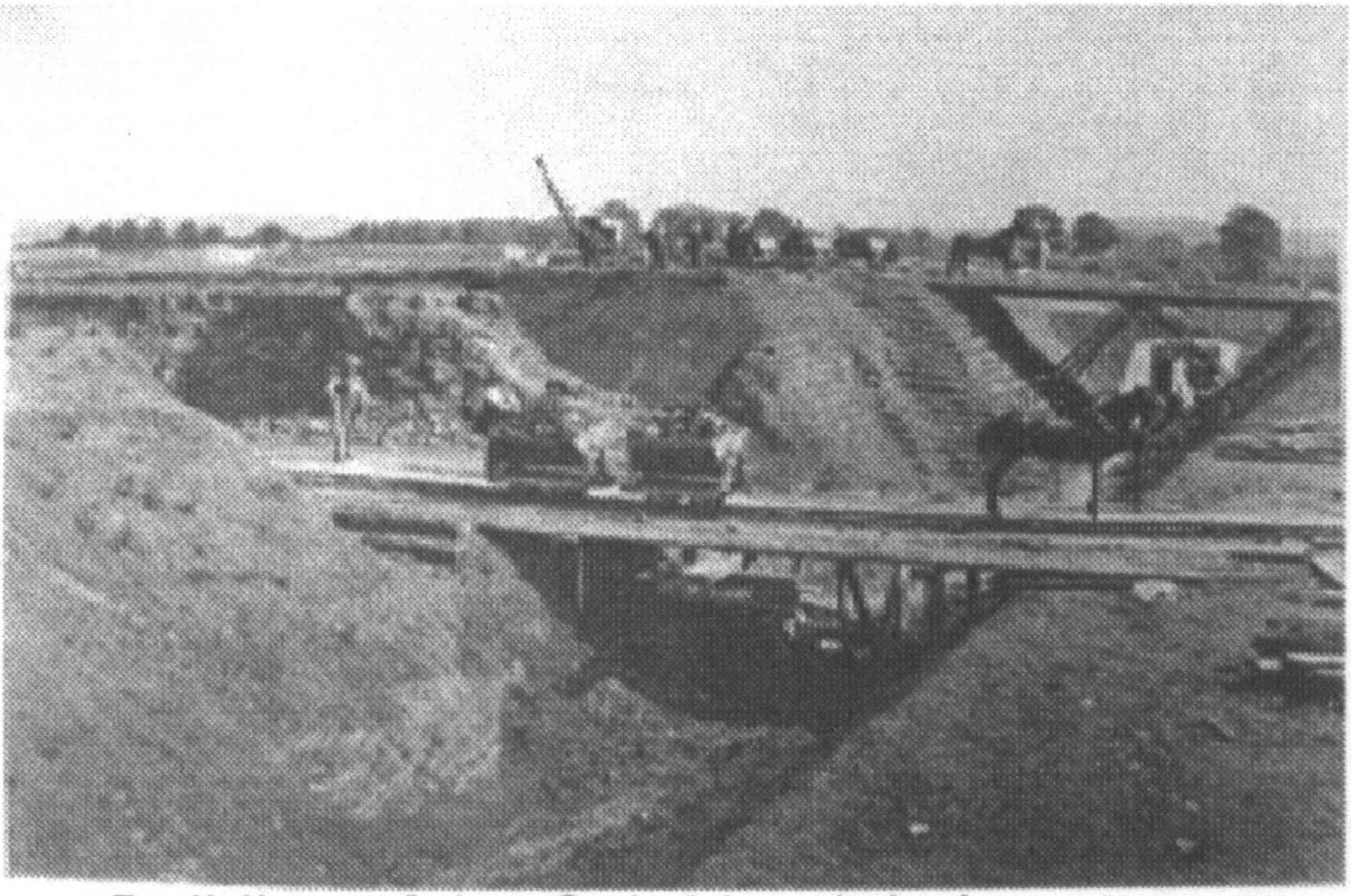
"Guncotton Workers' Late 19th Century.
(Acid Carboy in front)

ROYAL GUNPOWDER MILLS.
WALTHAM ABBEY.



THE ROYAL GUNPOWDER MILLS.

Building of the Cob Mead drying stoves.



Building of the Cob Mead drying stoves

THE DEVELOPMENT OF CHEMICAL EXPLOSIVES AT WALTHAM ABBEY.

By the end of the 19th century the 600 year reign of natural based gunpowder in the West as the universal civil and military explosive was coming to an end.
Gunpowder science had risen to the challenge of larger guns and larger charges with moulded pieced prismatic powders, but it was not enough.
By the late 1880's the new organic chemical science was bringing changes which were to remove the old ways in military propellants for ever.

The 'Chemical Powders'.

By the mid 1860's the new science of organic chemistry had, by the action of nitric and sulphuric acids on cellulose, produced practicable nitrocellulose explosives, more powerful than gunpowder collodion cotton and guncotton, the latter with a nitrogen content of around 13.1% and collodion lower at around 12.6%.

However whilst suitable for applications such as naval mine and torpedo filling and general demolition a major difficulty stood in the way of use in the military propellant function. The nitrocottons were fibrous in form and in confined combustion the hot gases were forced by the pressure into the pores of the material, producing an excessive rate of burning and an uneven and excessive pressure on the gun.

The rate of burning can be reduced by mixing with cooling agents but the most effective method is to gelatinise the nitrocotton making it non porous.

The Smokeless Powders.

Chemically based military propellants were termed smokeless powders. The Frenchman Vieille pointed the way to solution of the porosity problem in 1886 by gelatinising a mix of collodion cotton and guncotton with the solvent ether alcohol. the resultant paste was worked into a horn like materia termed Poudre B, about three times as powerful as gunpowder. This was the first smokeless powder, apart from greater power conferring significant advantages of reduced gun calibre, greater range, better gun design. This development not surprisingly aroused considerable interest amongst the military worldwide.

Alfred Nobel produced the solution most relevant to the British experience. In 1864 he had produced the gunpowder detonated nitroglycerine based blasting oil and by 1867 had replaced this with the more effective mercury fulminate detonator. In 1887 he produced a military smokeless powder 'Ballistite'. The basic principle was again to eliminate the porosity of nitrocellulose, in this case collodion cotton, by gelatinising. The material which Nobel employed to gelatinise was characteristic of his scientific boldness and vision. In an action 'so startling that it was received with incredulity, which soon gave place to extreme astonishment' Nobel employed nitroglycerine as the gelatinising agent - thus using one powerful explosive to produce a more controlled rate of burning in another.

After the announcement of Poudre B the British Government had set up in July 1888 and Explosives Committee comprising Sir Frederick Abel, Prof.Dewar and Dr.Dupre to monitor develops and carry out their own experiments. They invited submissions from scientists and in December 1888 Nobel submitted samples of Ballistite, doubtless in the hope of Government contracts.

Cordite.

Nobel's formulation included camphor, which was found to be the subject to rapid evaporation, rendering the product unstable. the Committee pointed this out to Nobel, but for some reason he did not react. after intensive investigation the Committee produced and in 1889 patented what was originally called cord powder but later Cordite.

The core of the composition was a mix of nitrocellulose and nitroglycerine which then had the solvent acetone added to put it into a state suitable for extrusion, with vaseline added to reduce barrel fouling. The grade of nitrocellulose employed was dry guncotton. This was a hazardous material and it is possible the Committee were forced into using this by a wish to avoid a clash with Nobel's system which employed a safer aqueous slurry process for mixing.

The title cordite arose from the method of manufacture which was to extrude the material under pressure through dies to form threads and cords or hollow tubes in a rubbery state .

CORDITE AT WALTHAM ABBEY.

Terminology.
Where the cordite process had a broad similarity to an operation in gunpowder, the gunpowder term was translated to cordite, although the actual physical operation was of course quite different - incorporation for closer mixing, pressing for compressing, blending to obtain uniformity. This preservation of the old extended to the title of the establishment. Although the term cordite factory was used internally to describe what had become the main function the overall title of the establishment remained THE ROYAL GUNPOWDER FACTORY to the end.

Chronology.
Initial development of the cordite manufacturing process was undertaken at the Research Department at Woolwich, with incorporated material transported from the Waltham Abbey nitroglycerine and guncotton facility at Quinton Hill, pressed at Woolwich and then back to Waltham Abbey for blending and transport out. The first shipment of incorporated material from Waltham Abbey to Woolwich was in March 1891. by May 1891 the necessary presses had been installed at Quinton Hill to enable the whole process to be carried out there.

CORDITE AT WALTHAM ABBEY.

The Start-Quinton Hill 17th June 1891.
Pressing started at Quinton Hill on 17th June 1891.

The North Site Cordite Factory 1898.
Manufacture at Quinton Hill progressed steadily until a serious explosion occurred in May 1894, destroying or damaging many buildings, including No.2 Nitrating House. Following this although the Nitrator was re-built it was decided to build a separate Nitrator and production facilities on the original North Site. The work was completed by 1898, much of it consisting of conversion of existing gunpowder buildings, and gradually became the core cordite facility.

2nd Stage 1904, 1910 North Site.
In 1904 three additional mixing houses and reel drying, reeling houses and reel magazine were built on the North Site and in 1910 three paste stores.

South Site Cob Mead Drying Stoves 1902-1904.
Cordite had to be dried to remove acetone. Over 1902-1904 a battery of 40 drying stoves were built on Cob Mead at the southern boundary of the South Site.

The WW1 Buildings 1815-1917 North Site.
To cope with the massive increase in demand in WW1 a series of cordite buildings-press houses and incorporating mills, were constructed along the eastern flank of the Middle Stream between 1915 and 1917, thus extending the factory southwards. These and the majority of the other cordite buildings were converted to laboratories when the Research Establishment took over after WW11.

Replacement Mixing Houses 1940 North Site.
Following explosions in 1940, two replacement mixing houses were built in the same year.

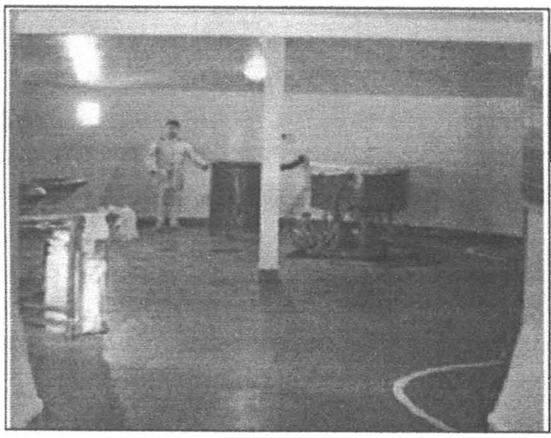
The Manufacturing Process and its Buildings.
The cordite manufacturing process involved:-
Dry guncotton from stoves to weighing house-mixed with nitroglycerine in mixing houses - incorporated with acetone in incorporating mills, mineral jelly (vaseline) added -pressed (extruded)- dried/ acetone recovered - stored.

(1) S27 The Weighing House.
Dry guncotton for combination with nitroglycerine was transported from the guncotton drying stoves in hand pushed leather lined trucks to the weighing house. There it was weighed into rubberised bags and taken to mixing houses.

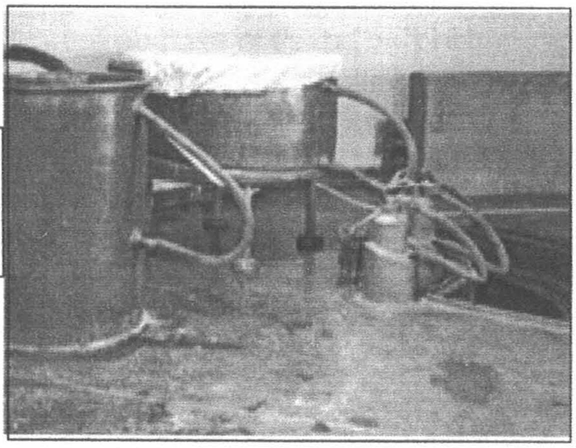
(2) 46A, 46R, 62, 76 Mixing Houses.
The mixing houses containing the tables at which operatives combined nitroglycerine and guncotton had lead floors and zinc lined walls. Radiators were encased in zinc boxes to exclude guncotton dust. Arising from the handling of fry guncotton the floors were subject to deposit of guncotton dust and no footwear was allowed, only socks.

Production was by batch. A typical batch of combined nitroglycerine and guncotton was around 3,800-lb. Sufficient nitroglycerine for one batch was run down guttering from the nitroglycerine wash house and led through the earth mound surrounding the mixing house and held in a storage tank in the mixing house. As soon as sufficient for the batch had been received the nitroglycerine supply inlet pipe was closed and outside staff called hillmen would immediately clean the guttering to avoid any explosive chain. At this stage a sample of the nitroglycerine was placed in a 2oz lead sample bottle to be taken to the laboratory for quality testing.
From the storage tank the nitroglycerine was measured into lead burettes, each of a different capacity according to the specification of the grade being prepared, and poured on to the guncotton in bags which were held in a well in the floor about 14-inches deep. The mixture was then emptied on to a lead mixing table, which was in a steel frame welded to the floor. There it was given a preliminary knead, much like a domestic bakery. It was then pressed and hand

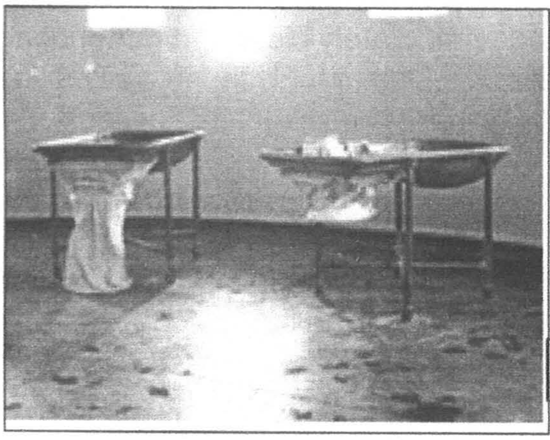
worked through a phosphor bronze ½-inch sieve into a hopper mounted calico bag below.
The material was now termed 'paste'. As the dry guncotton had now been moistened and the nitroglycerine made less liquid the two ingredients were in paste form to a degree less dangerous.
Each mixing house had a canal-side loading bay protected by a porch and at intervals a barge would call to load the bags for onward trasportation to the next stage - incorporation. Hillmen called at the mixing houses to collect the sample bottles for quality testing at the laboratory. The handover was always in the porch with each operative keeping to his side of the demarcation line between 'clean' and 'dirty' areas.
Mixing was therefore a somewhat crude process with a strong danger element, relying for safe operation on experienced staff and stringent safety discipline. In the overall production line by its nature it resembled a constricting into a narrow point after the relatively broader processes after and following it. It meant that at this point a substantial proportion of the propellant requirement of the British Forces all passed through the hands, literally, of a total of about ten men.



Interior of mixing house at Waltham Abbey

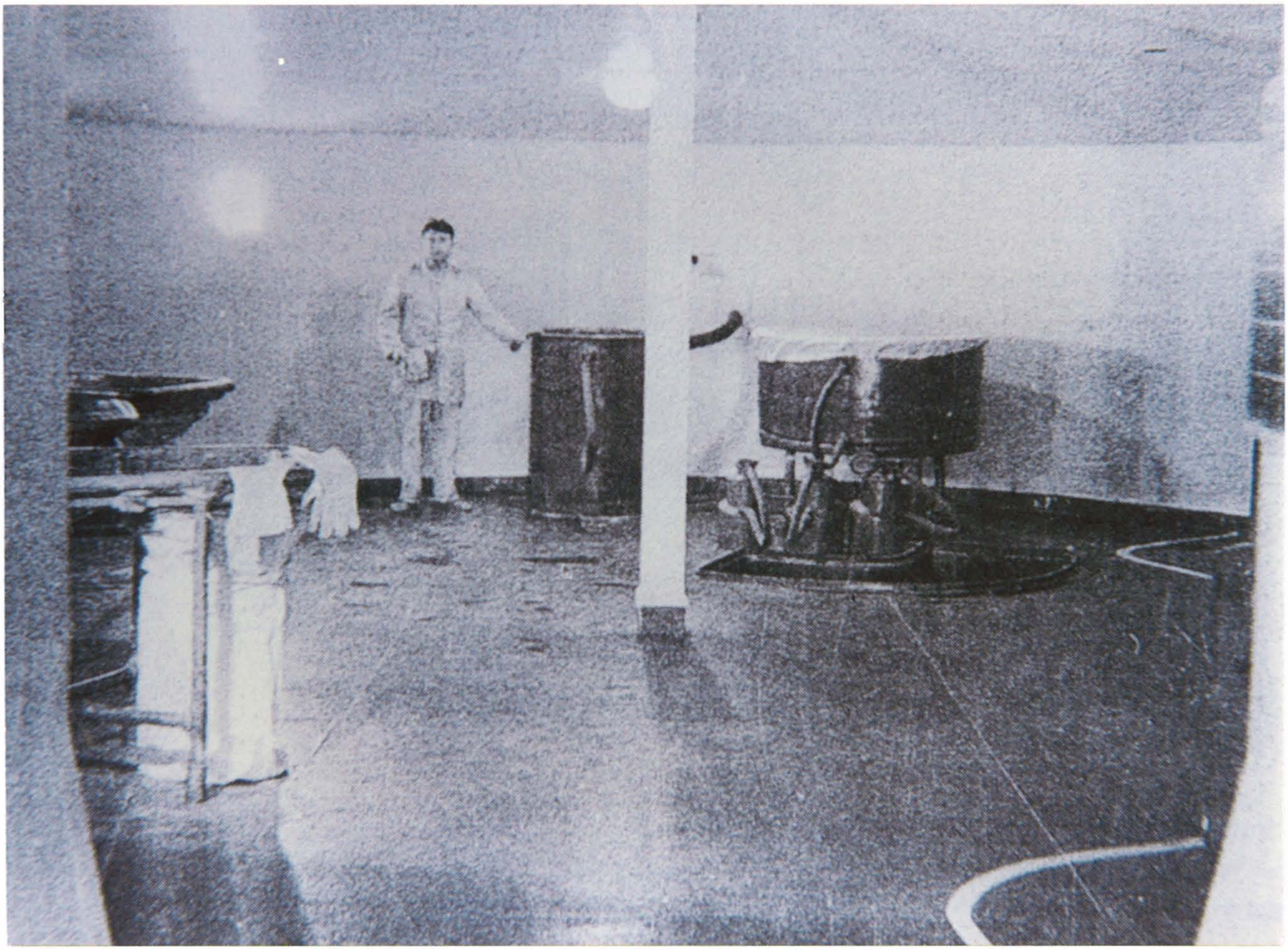


Mixing house interior showing arrangement of burettes and pouring on well



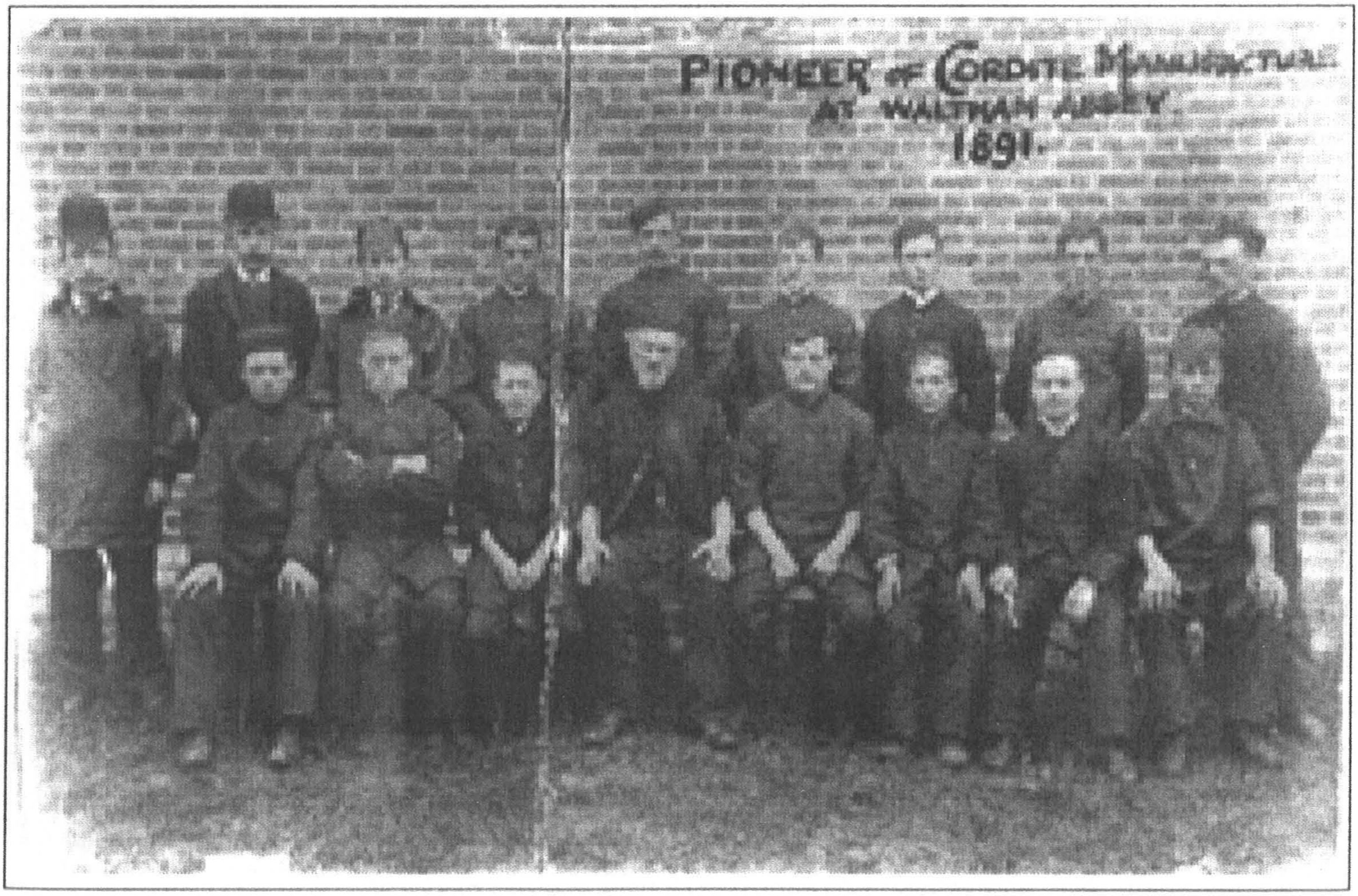
Mixing tables

INTERIOR OF MIXING HOUSE.
WALTHAM ABBEY.



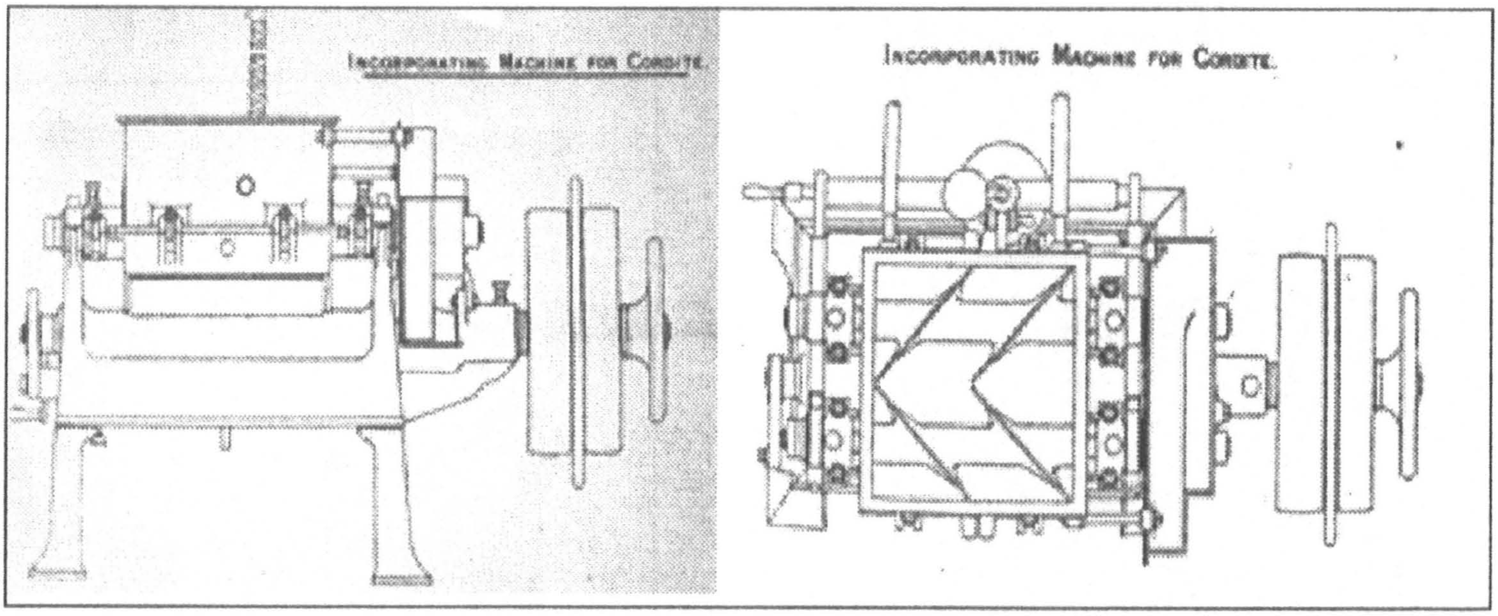
THE ROYAL GUNPOWDER MILLS.

The small band of workers who were responsible for the initial production of cordite at Quinton Hill on 17th June 1891.



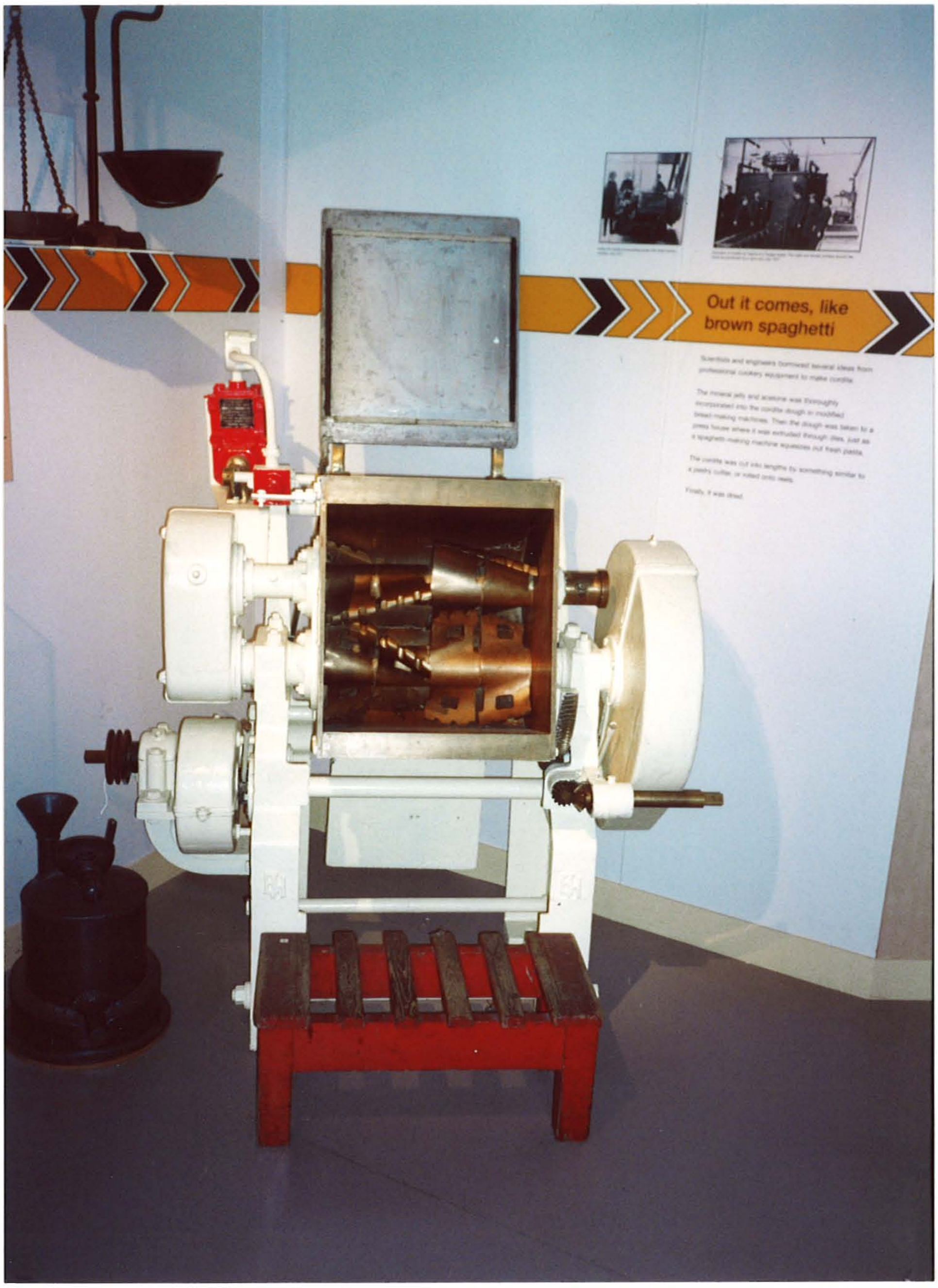
Incorporating Mills.

The paste was taken to the incorporating mills either by barge and tramway via an interchange or tramway direct. There it was placed in an incorporator. These were modified bread dough mixers manufactured by Werner Pfleiderer Perkins of Peterborough. This pattern was extensively employed in the explosives industry. To put the material into the plastic state necessary for pressing, the solvent acetone was added and the mixture blended and kneaded for about three hours. Then the mineral jelly stabiliser was added and incorporation continued for a further three hours. Continuing the analogy with the baking industry, the material was now termed 'dough' and could now be taken to the pressing house.



CORDITE INCORPORATION MACHINERY

CORDITE INCORPORATION MACHINERY.



Press House.

Cordite pressing was an extrusion process, in screw presses, hydraulically fed and belt driven for rifle grades and direct hydraulic for larger sizes.

The operatives of the presses were protected by a heavy rope barrier, a 'mantlet' hung between them and the press with the cordite emerging from an aperture in the mantlet.

The presses extruded the dough through dies to produce the strands or cords of cordite. Again the process bore a similarity to a catering process, in this case spaghetti making. The dies for the rifle grades had a needle fixed in the middle to create a thin centre hole. the larger grades had as many as six holes. The finest grade was revolver cordite which was hairlike.

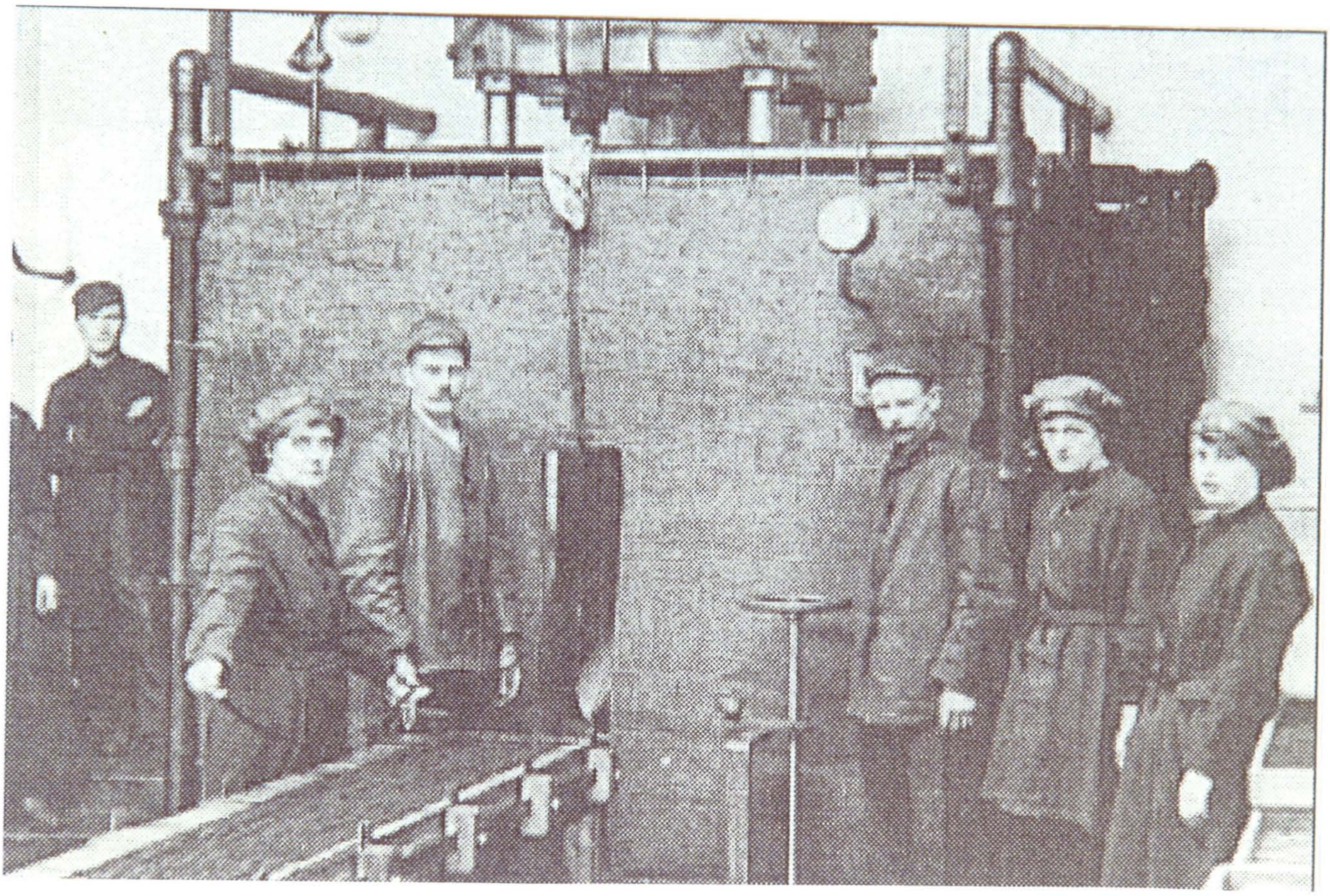
The thicker grades were collected by hand as they emerged and cut into lengths with a knife not dissimilar to a pastry cutter. These lengths were placed on wooden trays and taken by truck to the drying stoves.

the thinner rifle grades were wound on to reels as they emerged from extrusion and taken to reel drying stoves.

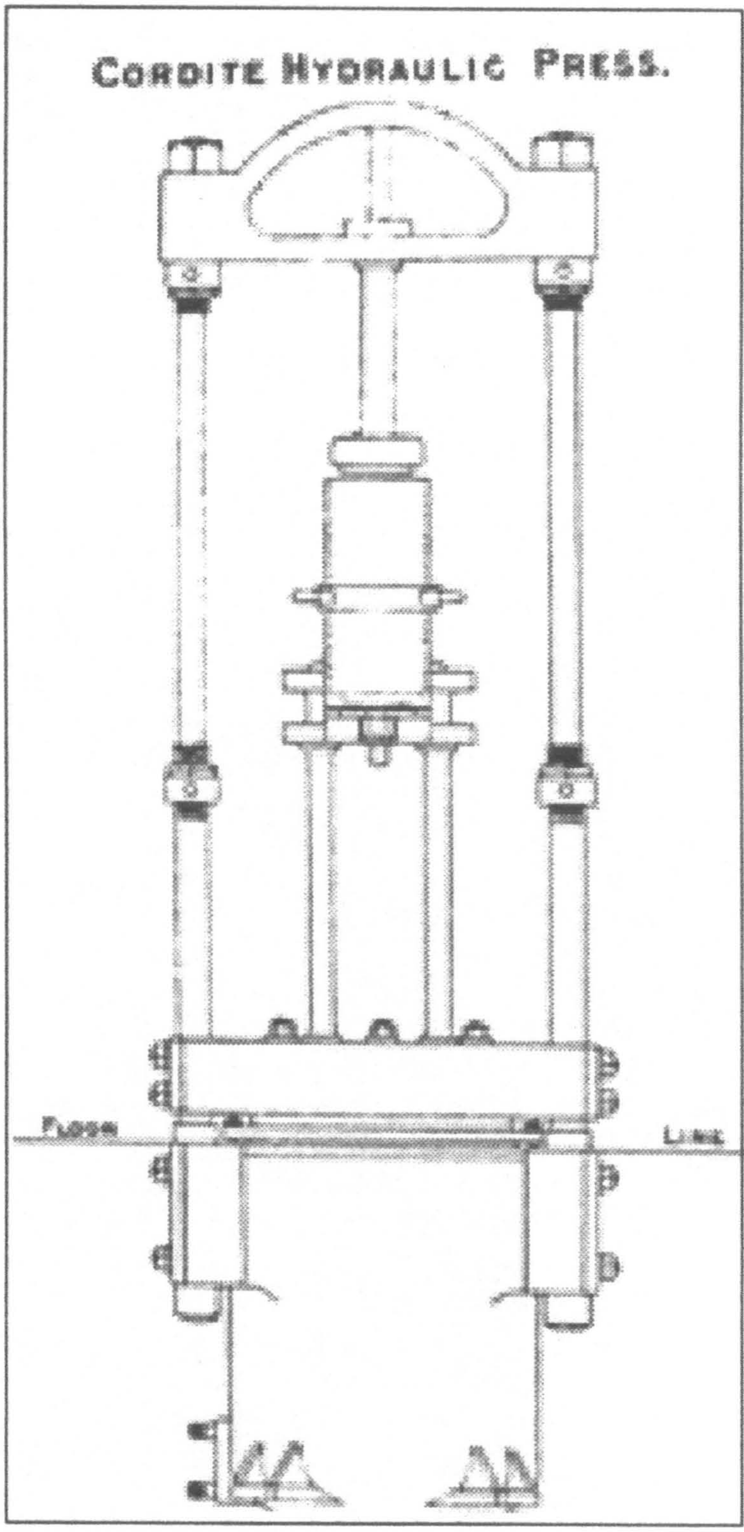
Reeling House.
The reeling house took the reels of thinner cordite from the reel drying stove and wound it on to larger spools for thicker grades.

Blending House.
The Blending House comprised Buildings 107 and 108, which were amongst the last of the gunpowder buildings built, moulding prismatic powders. Their life in this role lasted only about 15 years before conversion to cordite blending.
In order to obtain uniformity of performance cords of equal length had to be packed together. The matching of lengths was done by hand selection in the Blending House.

After blending the cordite was then ready for storage in magazines and ultimate use, in silk bags for large gun charges or the thinner rifle grades pressed into cartridge cases.



CORDITE HYDRAULIC PRESS.



THE ROYAL GUNPOWDER MILLS.

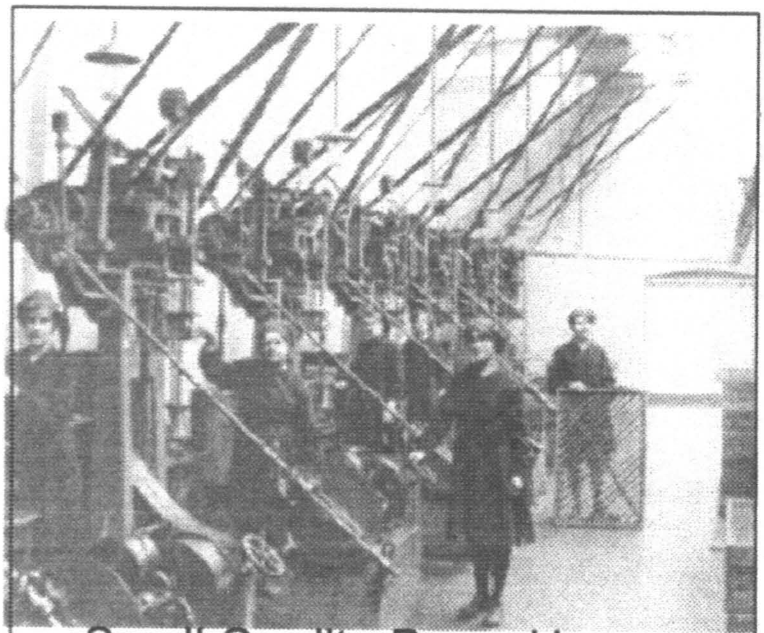
HYDRAULIC CORDITE PRESS.

Waltham Abbey July 1917.

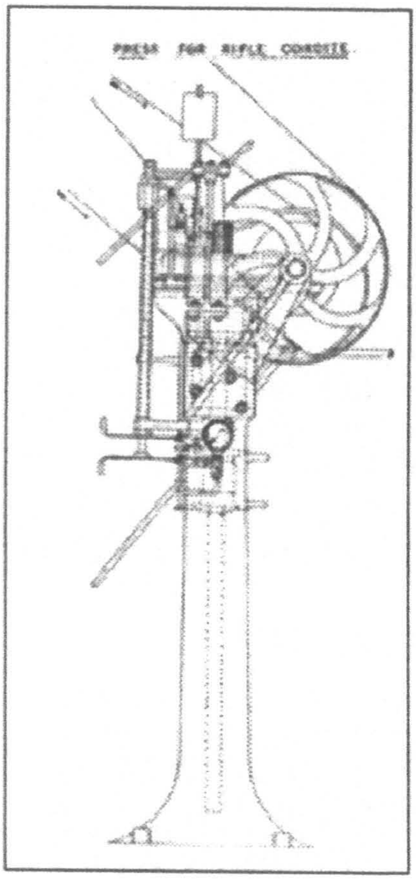
The presses extruded the dough through dies to produce the strands or cords of cordite. The dies for the rifle grades had a needle fixed in the middle to create a thin centre hole. The finest grade was revolver cordite which was hairlike.

The thicker grades were collected by hand as they emerged and cut into lengths with a knife not dissimilar to a pastry cutter. These lengths were placed on wooden trays and taken by truck to the drying stoves.

The thinner grades were wound onto brass reels as they emerged from extrusion and taken to reel drying stoves.



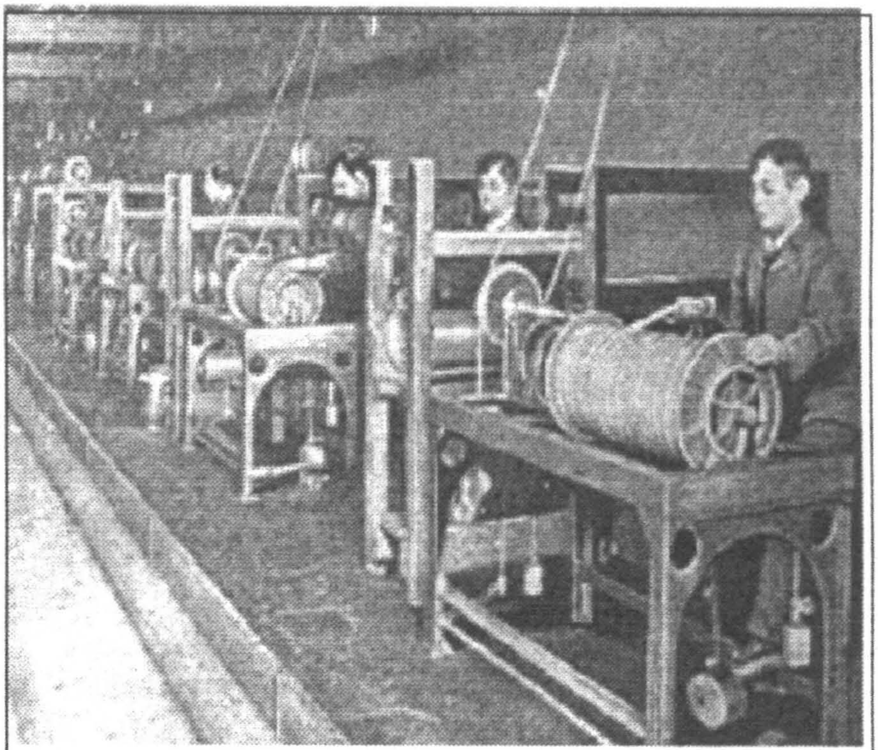
Small Cordite Press House
Waltham Abbey July 1917



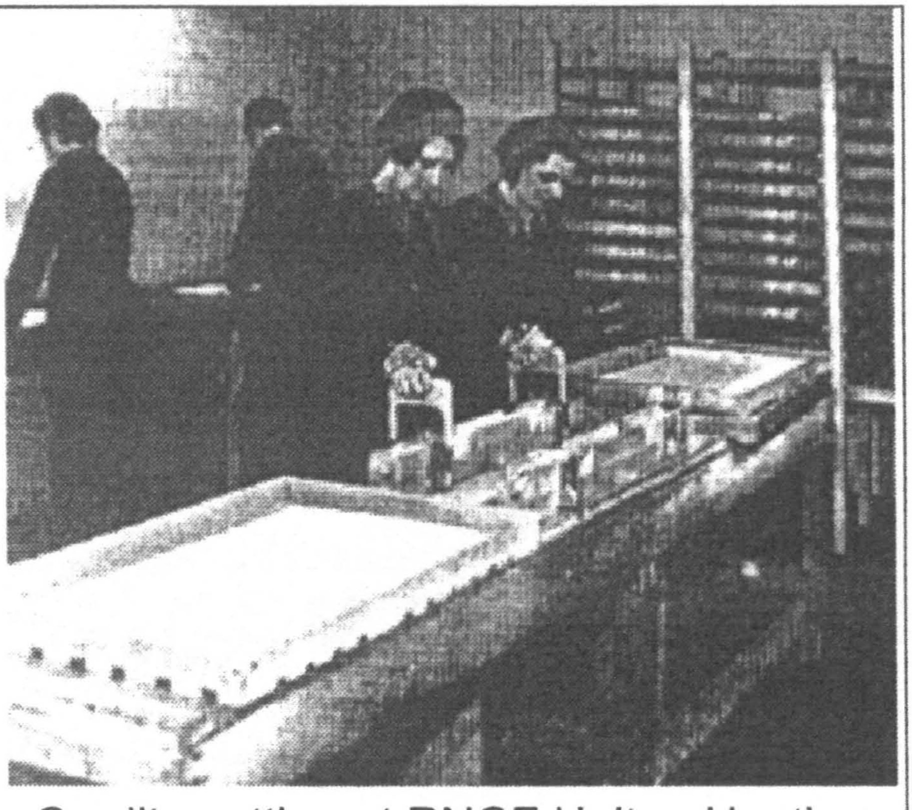
WALTHAM ABBEY.
SOUTH SITE, QUINTON HILL.

Interior of cordite reeling house after the explosion in 1894, with machinery in situ. Note the toe-boards definining the dirty area with tramway rails and clean areas.

CORDITE.



Cordite winding on to reels



Cordite cutting at RNCF Holton Heath

COBB MEAD DRYING STOVES.
REEL DRYING STOVES.

Acetone Recovery Plant.
The acetone having fulfilled its incorporating purpose it was necessary to drive it from the cordite by drying. Cordite was first taken to the acetone recovery stoves which sent driven off acetone vapour to an acetone recovery plant. After acetone recovery there was a final drying in the Cobb Mead stoves. Thinner grades went to Reel Drying Stoves H7,H8, L167.

Acetone.
Acetone was a scarce and valuable solvent and considerable effort was devoted to recovering it. Acetone was obtained from the distillation of calcium acetate derived from the distillation of wood by lime. In the early stages of cordite production on the South Site Waltham Abbey obtained its acetone from Germany then in 1895 erected its own acetone plant in part of the original guncotton factory at Highbridge Street, which had become redundant in 1890. WW1 brought intense pressure on supply, with competition for the product coming from other industries such as aircraft manufacture using dope and varnish. By 1915 the UK was burning 1400 tons of wood a week to obtain acetone. It was therefore of prime importance to recover as much as possible from cordite drying.

ACETONE RECOVERY.

Dr. (later Sir) Robert Robertson, the Chemist in Charge of the Laboratory at Waltham Abbey, and W.Rintoul developed and in December 1901 patented an acetone recovery process and this played an important part in assisting supply.

(N.B. The Main Lab building at the north end of Queens Mead was originally named the Robertson Laboratory in his honour).

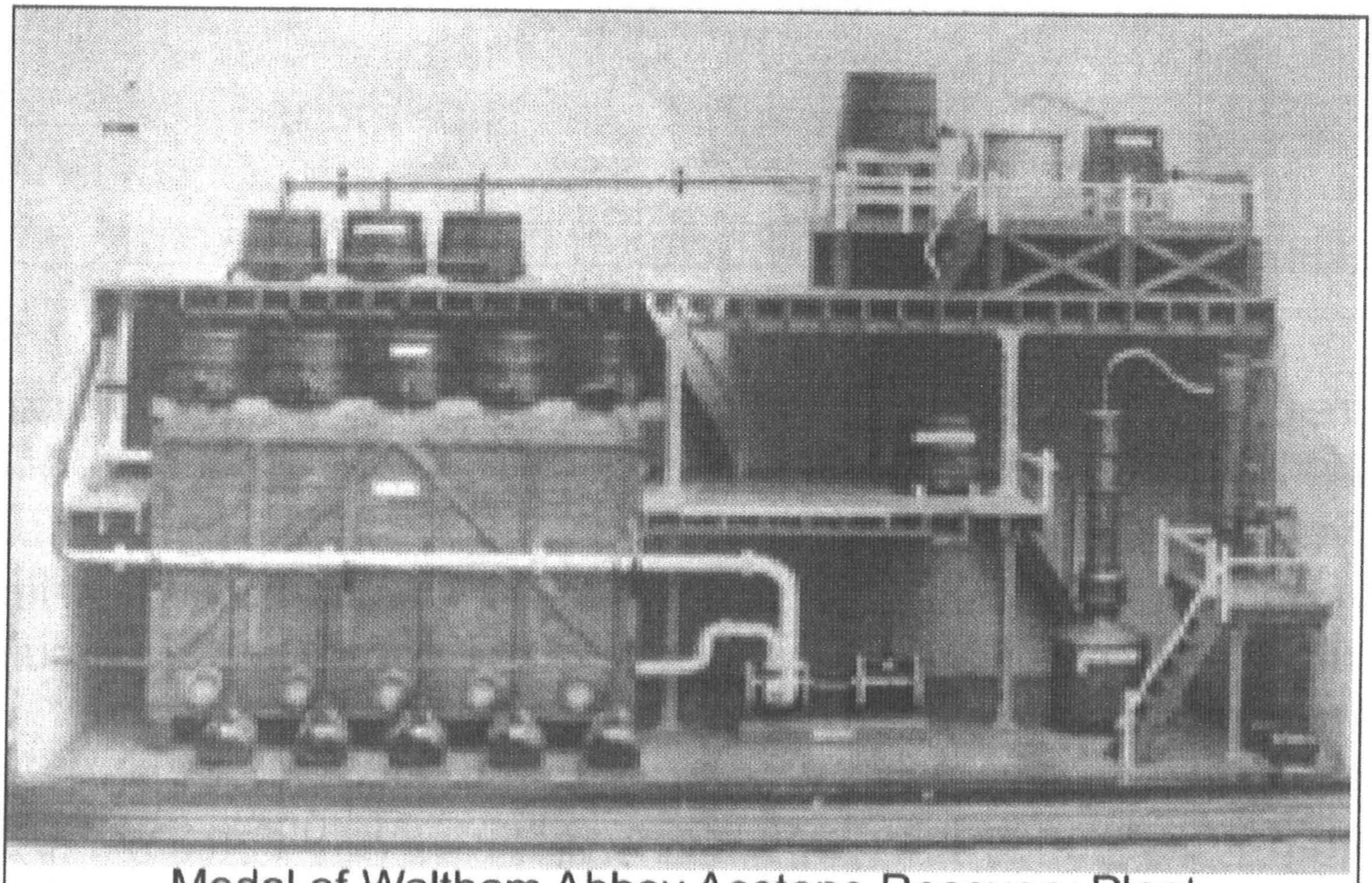
The Mills Archive holds a copy of a brief diary manuscript note which Dr.Robertson wrote at the time describing the process:

'This apparatus was made at home and consisted of zig-zag descending fibres held in a tall box. Solution of sodium sulphite descended the fibres and absorbed the acetone from its solution in air. The liquor at the foot of the tower could be distilled for acetone with little decomposition.

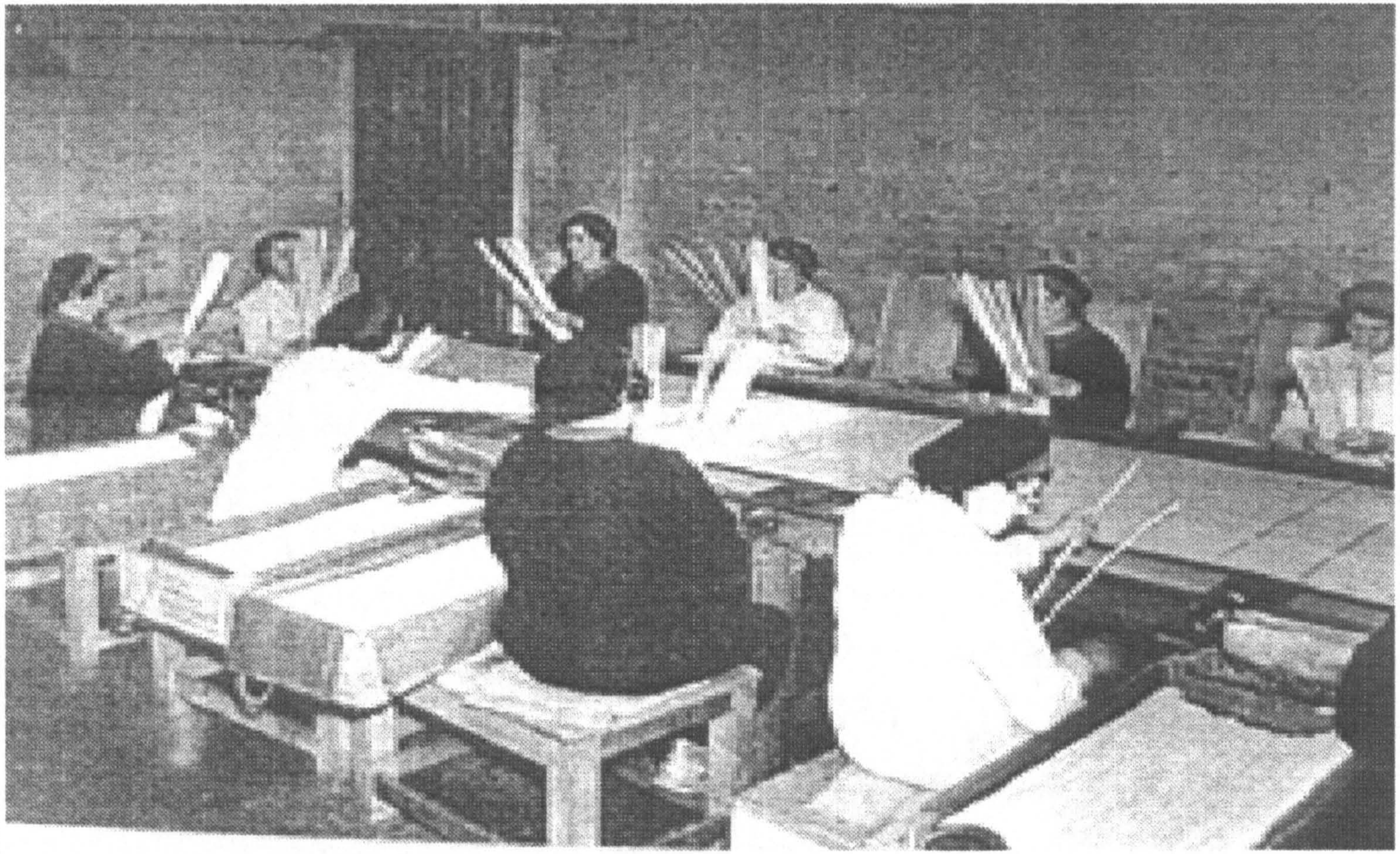
After a demonstration of the process in the RGPF a full scale acetone recovery plant linked up to all cordite stoves was erected and worked at the RGPF.'

The design was later employed at the Royal Naval Cordite Factory at Holton Heath and the Curtis and Harvey cordite factory at Cliffe.

After a seven year delay the Government awarded £4,000 to Robertson and Rintoul. The Inland Revenue promptly took back £233 in income tax. An appeal against this was not successful.



Model of Waltham Abbey Acetone Recovery Plant.
Brussels Exhibition 1910



Cordite blending at RNCF Holton Heath

SAFETY.

By the nature of the product explosives manufacture was replete with hazards and the closest attention was paid to lessening the risk. A wide spectrum of measures was employed - ranging from the familiar traverses, zinc lining of internal walls, leather covering on floors, clean and dirty areas, special footwear, limitation of personnel number in each building etc,etc., with a safety culture inculcated into all staff, all reinforced by a system of Danger Building Visitors.

In cordite manufacture the mixing process had particular dangers.

In cordite manufacture the mixing process had particular dangers.

Dry Guncotton- dry guncotton was a dusty material very sensitive to friction and shock, requiring extreme care in handling, prone to gathering a thin film of dust on the mixing house floor..

Weather - In some cases pouring on was done in a separate building from mixing. That meant that the poured on material had to be transported outside to the mixing house. Nitroglycerine had a very high freezing point and was therefore vulnerable to freezing in transporting in very cold weather, putting it into a dangerous condition for hand mixing.

Samples - Nitroglycerine had a very high freezing point and was therefore vulnerable to freezing in transportation in very cold weather, putting it a dangerous condition for hand mixing.

Samples -Nitroglycerine sampling procedure meant that sample bottles had to be physically handed over at the mixing house and carried to the laboratory, with attendant danger of dropping or tripping - one slip would be one too many.

Physical Handling - Outside observers might view with incredulity the hand forcing, however careful, of two powerful explosives, the product of the most advanced chemical science of the day, through a small sieve, smacking more of a dangerous mediaeval craft of the 20th century, with zero margin for error. However the view was that provided the staff were well trained and strict safety discipline was observed the work could be carried out safety.

Two serious explosions in the mixing houses in 1940 cast a blot over the scene. It is beyond the scope of this article to go into the conclusions of the subsequent Court of Inquiry. not surprisingly it was found difficult to reach a totally firm conclusion since the staff who could have provided the answer regrettably had died but it is worth mentioning that all the hazardous conditions outlined above figured in reports on one or other of explosions.

However taking a broad historical view and bearing in mind the material that was being dealt with the explosives industry reached a level of safety which matched many other industries - a particular achievement at Waltham Abbey was getting through the WW1 period of massive increase in staff numbers and output without serious mishap, and was certainly superior to e.g. the mining industry.

Cordite Grade Development.

Cordite history was characterised by an ongoing process of examination of formulation, quality, performance in the light of scientific advance and the changing operational demands of the Services. this process was based on co-operation between the Armament Research Department at Woolwich and Waltham Abbey.

Grades.
Mark 1-1889.
The grade patented in 1889 was mixture No.128 and was termed Cordite Mark 1. its composition was:

Nitroglycerine	58.
Guncotton	37.
Vaseline	5,

The intention of the vaseline was to reduce barrel fouling from cupro nickle deposited from passage of the bullet along the barrel, but it was later discovered to have the very significant effect of preserving the chemical stability of cordite, which was susceptible to exposure to direct sunlight and high temperatures. Manufacture of Mark 1 commenced at Waltham Abbey commenced at Waltham Abbey in 1891 and it quickly became adopted for British Service use.

MD-1901.
Mark 1 gave good service, but gun life was short, arising from the very high gas temperatures generated. The higher the nitroglycerine content the higher the temperature and in 1901 in order to reduce the temperature of explosion grade MD (modified) was introduced, with the proportions of nitroglycerine and guncotton virtually being reversed. The composition was:

Nitroglycerine	30.
Guncotton	65
Vaseline	5.

The lower nitroglycerine content meant a longer drying time and the Cob Mead stove building programme was instituted as a result.

RDB-1915.
WW1 placed enormous pressure on acetone supplies and the Research Department at Woolwich developed a grade which utilised the more readily available solvent ether alcohol in place of acetone. This grade, introduced in 1915, was termed RDB - Research Department formula B. Ether alcohol was a less powerful solvent than acetone and correspondingly a less nitrated grade of nitrocellulose with lower nitrogen content, collodion cotton, was produced. To compensate and maintain the ballistic properties of the cordite the proportion of nitroglycerine had to be increased. the composition was:

Nitrogycerine	42.
Collodion Cotton	52
Vaseline	6

By 1916 RDB was being used for all larger gun sizes, i.e. cannon, with MDB continuing for rifle graded.
RDB served well in WW1 however it was still a passing expedient as it did not have good storage qualities.

W-1933.
Whilst mineral jelly was a useful contribution to chemical stability, a further problem was encountered in storage - 'corrosion spots' arising from small particles of included foreign matter, particularly those containing sulphur, which caused rapid local decomposition with accompanying rise in temperature and possible spontaneous explosion if this spread from stick to stick.
To meet this problem a new filtering and straining method during pressing was developed at Waltham Abbey (the description in reports of the work which had to be put in associated with straining improvement on such aspects as pressing pressures, die design etc. is a reflection of the constant process detail improvement which went on at Waltham Abbey).
In parallel with this experiments by H.A.Phillips and P.G.Knapman demonstrated that significantly greater chemical stability could be achieved by replacing vaseline with diphenyl

diethyl urea, given the name Carbamite or in some areas Centralite. Reflecting both the above developments in 1933 the grade W-Waltham was introduced containing 6% carbamite in place of vaseline. This became the standard grade for cannon, with MD continuing for rifle grades.

RDN & PICRITE- 1930's.

As the 1920's moved into the late 1930's with growing pressure from the Forces attention came to be increasingly focussed on the problem of flash produced at the gun muzzle. This had two major disadvantages - it gave away the position of guns and it blocked the vision of gunlayers.

Flash was due to hot gases from the exploded propellant re-igniting . Consequently a means of reducing flash by introducing a composition which cooled the gases and/or contained a lower proportion of flammable material was investigated. Sir G.Beilhy had discovered in 1904 that a compound rich in nitrogen would achieve a flash suppressant effect. In 1912 Vieille, originator of Poudre B, found that such a material, nitroguadine, when included in the propellant reduced barrel erosion by a factor of two and in 1914 Wm.MacNab, later President of the Institution of Chemical Engineers, postulated that nitroguanidine combined with a tetranitro compound bound with rubber produced an effective flashless propellant. The idea was not pursued at the time - about 40 years later it reared its head again in composite propellant for rocket motors.

The high cost of the basic product required for nitroguanidine manufacture had militated against further consideration but advances in chemical engineering brought the price down and in 1921 Sir Robert Robertson, by now Chemist in Charge of the Woolwich Laboratory, decided that the time had come to reinvestigate. he deputed J.N.Pring to carry out the research programme. This demonstrated that nitroguanidine was indeed an effective flash suppressant, but that it would be difficult to produce crystals of the fineness required to secure good ballistic performance. Nevertheless it was decided that trials at Waltham Abbey should continue with the relatively coarse form and from 1925 Waltham Abbey was producing coarse grains.

The manufacturing method was gradually refined to the following-

Water on calcium cyanamide fertiliser producing calcium bicyanamide

Reacted with hot water to produce after cooling and treatment in a centrifugal machine crystals of dicyandiamide.

Dicyandiamide reacted in an autoclave with ammonium nitrate to yield guanidine nitrate.

Guanidine nitrate treated with sulphuric acid in a nitrator to remove water elements and cooled to produce crystals of nitroguanidine.

Nitroguaidine dissolved in boiling water, filtered, and sprayed on to a revolving metal cylinder cooled with refrigerated brine. Crystals separated by centrifugal machine, dried and fine crystals separated by passing through a Schutz O'Neill disintegrator and milled. At this time the product was termed Petrolite.

Work continued and a series of process and crystalliser advances were made, e.g. a new vortex crystalliser was introduced, and by the late 1930's the crystals were fine enough to be incorporated in a new grade- RDN, with the crystals now termed Picrite.

This started a long chain of picrite based development, with plant being built at the Royal Naval Cordite Factory and ICI Ardeer and extending in recent times into rocketry.

RDN also contained carbamite and by the 1940's the composition had settled at:

Picrite	55
Guncotton	20
Nitroglycerine	20
Carbamite	4.7
Cryolite	0.3.

SC-1927.

The use of the solvent acetone continued to present difficulties - supply shortages, lengthy and expensive drying times, and in 1927 the SC-Solventless Carbamite grade was introduced at the Royal Naval Cordite Factory. The key factor was the carbamite. It had been found that this had the important property of reinforcing gelatinisation, to the extent that solvent was not required. In addition it was found possible to avoid the use of dangerous dry guncotton by employing an aqueous slurry of nitrocellulose for mixing with the nitroglycerine. Another advantage of SC was that it was less prone to the irregular shrinkage which had been a problem with the older grades. SC became the main RNCF grade, but it was not produced at Waltham Abbey, although experimental work was done.

Staff Numbers/ Output.

The history of staff numbers and cordite at the Mills over the period 1931 to 1939 provided a neat snapshot of what was happening in the outside world over that time:-

	Staff employed.	Cordite Output (tons).
1831/2	274	207.
1935/6	819	662.
1838/9	2263	3970

Although the usual warnings about proving anything with stastics apply, it is interesting to see the reversal of the staff/output ratio in the later year.

THE ROYAL GUNPOWDER MILLS.

Trays of Cordite being pulled by Ruston Proctor petrol/paraffin loco.

Appendix
The North Site Cordite Buildings

Bld. No.	Built for Cordite	Cordite Function	Converted to Cordite	Cordite Function	Previous Function	Built
L101	1910	Paste Store				
L105	1910	Paste Store				
L108	1910	Paste Store				
107) 108)	_		1898	Blending Ho.	Moulding Ho.	1882
L134	1915	Press Ho. No.2				
L143	1915-17	Incorp.Ho.				
L145	-		1898	Incorp.Ho.	GP Inc.Mill F	1879
L146	1915-17	Incorp Ho.				
L148	-		1898	Incorp.Ho.	GP Inc.Mill G	1889
L149	-		1898	Incorp.Ho	Hydraul.Accum. GP Inc.Mill E	1867 1877
L151	1915-17	Incorp.Ho.				
L153	-		1898 1908	Press Ho. Incorp.Ho.	GP Inc.Mill D	1868
L155	1915-17	Incorp.Ho.				
L157	-		1898	Press Ho.	GP Inc.Mill C	1861
L159	1915	Press Ho. No. 5				
L165	1916	Mineral Jelly Store				
L167	-		1898	Reel Drying Stove	Charcoal Store	1889
76	-		1898	Mixing Ho.No.4	Press Ho.	1856
S27	1904	Weighing Ho.				
46	1904	Mixing Ho.No.2 - destroyed 1940				
46A	1940	Mixing Ho.				
46R	1940	Mixing Ho.				
62	1904	Mixing Ho.No.3				
63	1904	Mixing Ho.No.5 - destroyed 1940				
H7	1904	Reel Drying Stove				
H8	1904	Reel Drying Stove				
H10	1904	Reeling Ho.				
H12	1904	Reel Magazine				

Published by the Friends Association of the
Royal Gunpowder Mills Waltham Abbey
March 2004

THE ROYAL GUNPOWDER MILLS.

BUILDING 149.

This building was successively: Hydraulic Accumulator House, Gunpowder Incorporating House, and Laboratory.

DEVELOPMENT OF CHEMICAL EXPLOSIVES.

20th Century- Guncotton Drying.

The history of K.B.Quinan and the Quinan Stove.

K.B.Quinan

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, licensing, 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 manger of Somerset West and he accepted, bringing with him vital supervisory staff and technicians.

In 1803 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 explosive 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. Two of his achievements and innovations. 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 lines 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.

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 to come to London to aid the 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.

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 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 accomodation 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 Dornoch 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.

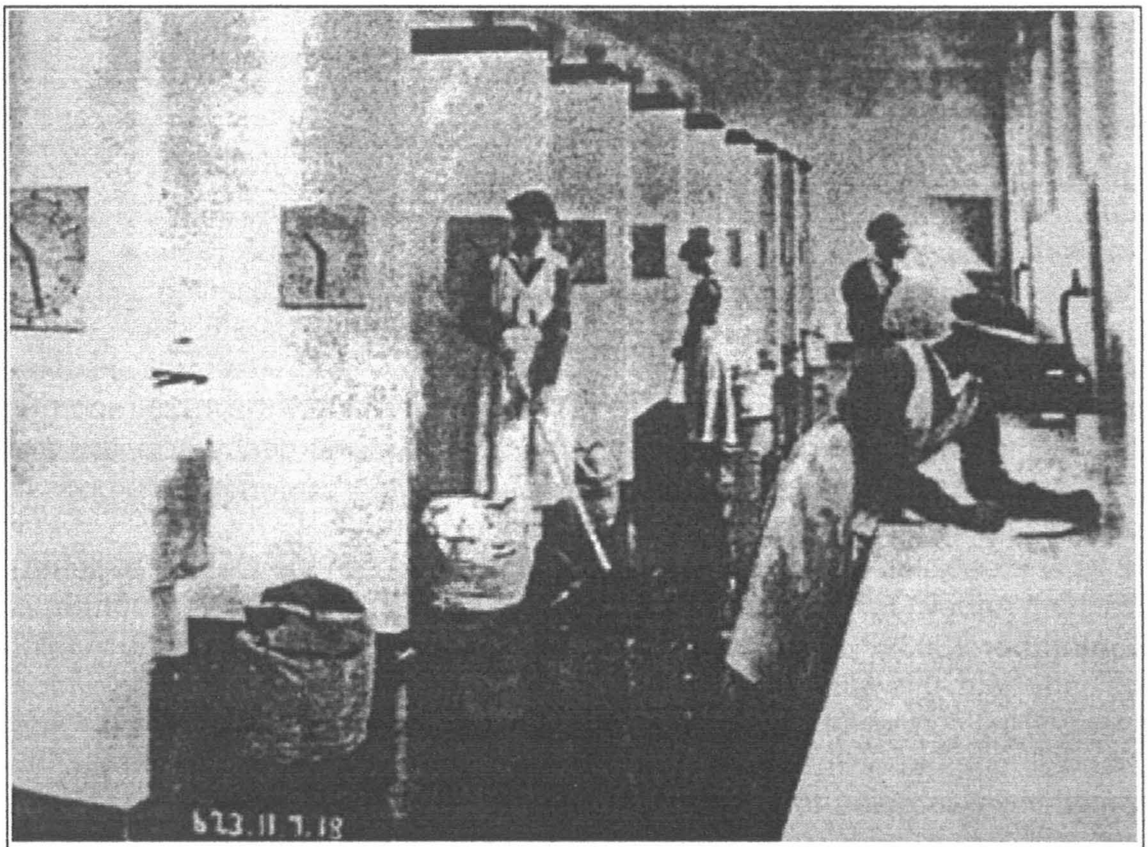
The first cordite left the works in August 1916. The pressure for output was intense. In the initial stages the works did not permit itself the luxury of any set breaks for meals.

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 1920's.

Quinan Guncotton Drying at Gretna 1918.
(Drying time clock on each bay)



Quinan guncotton drying at Gretna 1918
(Drying time clock on each bay)

Installation of the Quinan Stove at Waltham Abbey.

After the War the explosives industry turned again to civil use with the military side becoming a largely unknown low key activity. By the 1930's 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.Chamberlain, 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 buildings 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. A worker speaks of the atmosphere influencing work in 1936 -'They knew something was going to happen'.

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

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 inscription '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 included 'The dredging of shoals at Quinan Stove Cut'.

The Quinan Stove was built on the site of the previous 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 iron rails.
Traverse 22a/1 was between the Stove and the Engine/Fan House and 22a/2 protected by the general area to the south of the Stove.

What emerged, in 1936, was a building of decidedly modern appearance amongst what were becoming relics of the late 19th century. At that time in the wider world much experimentation was taken place in the use of concrete, both in the domestic and commercial fields, and this extended to the Quinan Stove. it was constructed of precast concrete with a barrel shaped roof, bitumen coated. The walls consisted of concrete panels 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.
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 no further Quinan Stoves were built at Waltham Abbey. Instead this became the test template for the new factories.

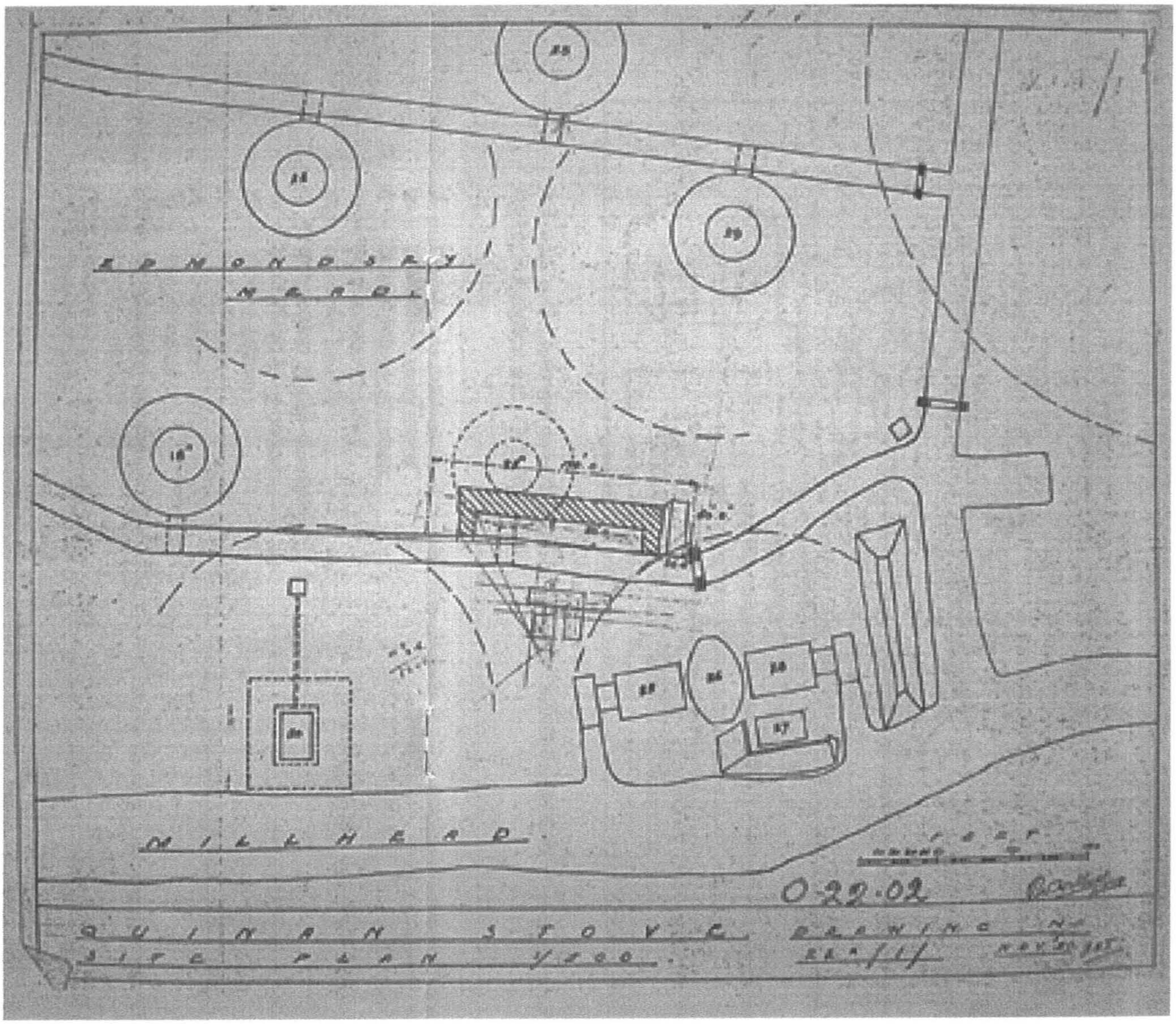
It succeeded in this function. In 1938 it produced 177-tons of dried guncotton and it was reported that 'the experience gained in operation has proved invaluable in the planning of the new cordite factory' (which would have been ROF Bishopton, Renfrewshire). Smaller size pans, quicker drying and increased effeciency of the new installation of the design's successful transfer to Bishopton (extract from a oral history archive).

Some doubt has been raised as to the validity of perpetuating the Quinan system of drying when a system of cordite manufacture has been evolved which avoided the need for drying entirely 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?

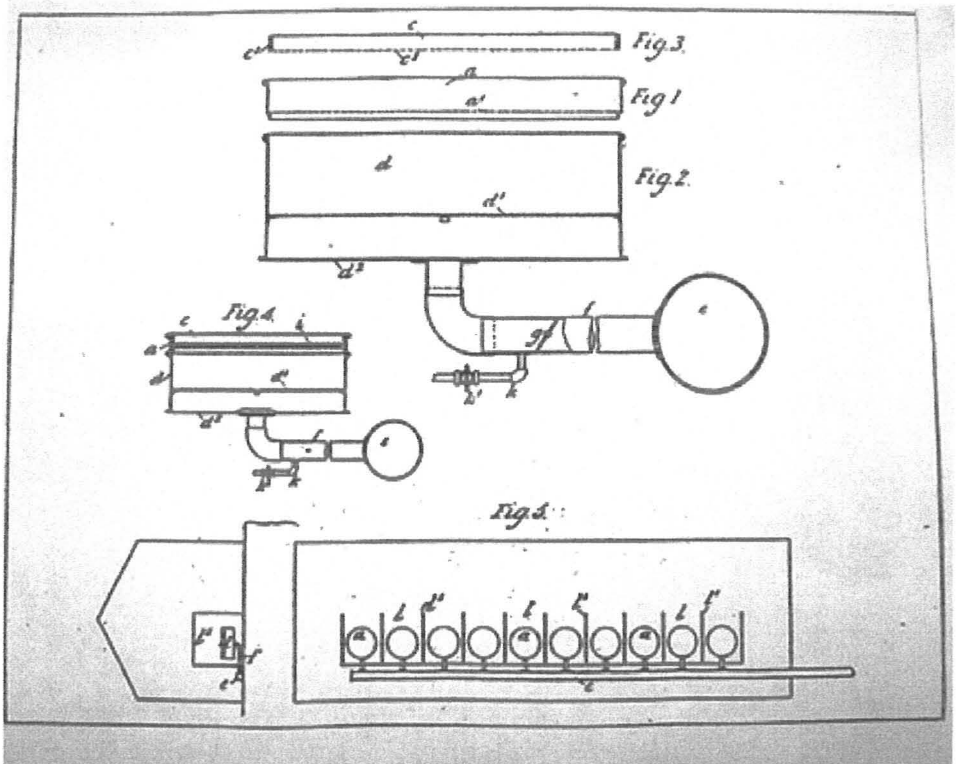
To-day and the Future.
The Quinan Stove stands to-day in the deserted north of the site, threatened by encroaching vegetation, still looking modern compared with the surrounding relics.
As more explosives facilities disappear it is possible it is the sole surviving building of its type in Britain.
Until 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 structural frame is rusting. Without attention to this the building will eventually collapse.

QUINAN SITE PLAN.

Originally drawn in 1934, the year the Quinan development was decided.
The stove, with its canal cut and the dotted line denoting the previous guncotton stove No.17, is the centre of the plan surrounded by older guncotton stoves.



A FRASER AND CHALMERS SCHEMATIC DIAGRAM OF A QUINAN GUNCOTTON DRYING INSTALLATION WITH 10 DRYING BAYS.



A Fraser and Chalmers schematic diagram of a Quinan Guncotton drying installation with 10 drying bays

KEY:

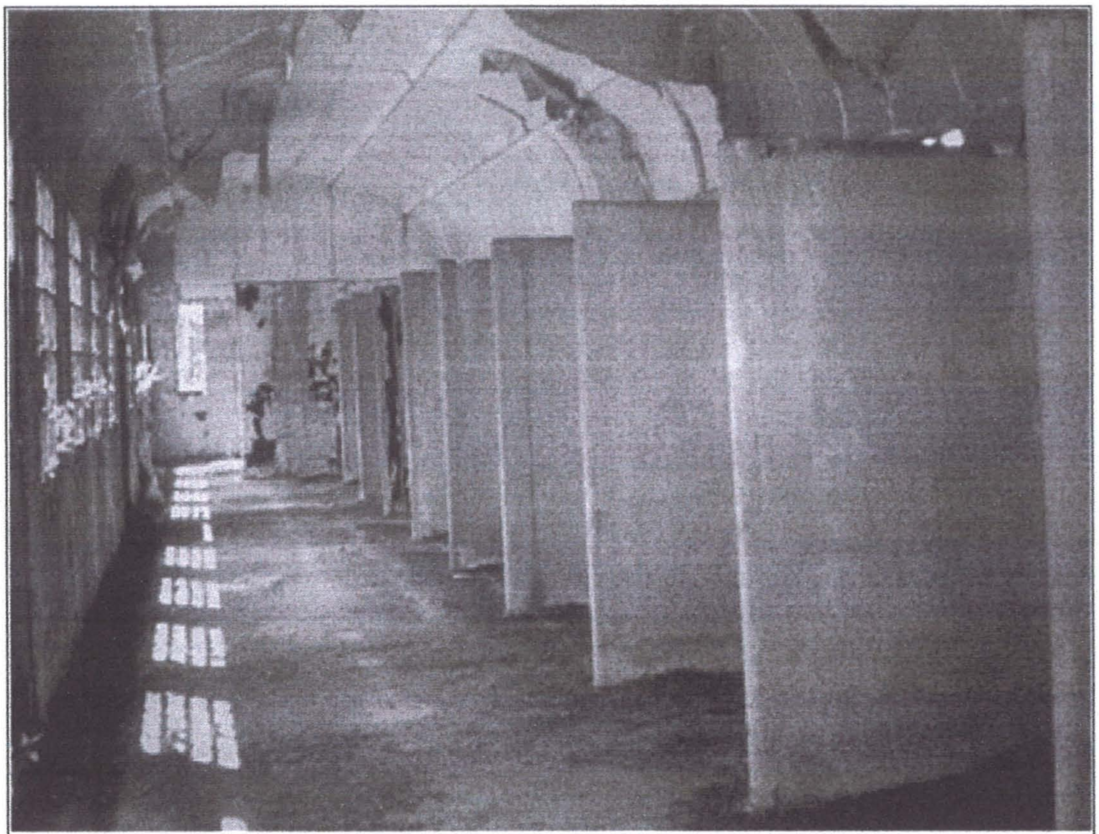
a - basket
a1 - perforated metal sheet
c - basket retaining screen
c1 - basket retaining ring
c2 - cover for basket
d - galavanised iron air distributor/basket support
d1 - perforated false bottom
d2 - closed bottom
e - hot air main
f - hot air pipe
g - hot air valve
k - compressed air pipe
k1 - compressed air valve
i - alcoves
i1 - fireproof walls

QUINAN STOVE-WALTHAM ABBEY.
picture taken 2003.

Quinan Stove - Waltham Abbey
(picture taken 2003)

QUINAN STOVE-WALTHAM ABBEY.

Interior of Quinan Stove showing drying bays and peeling painted calico, 2003.



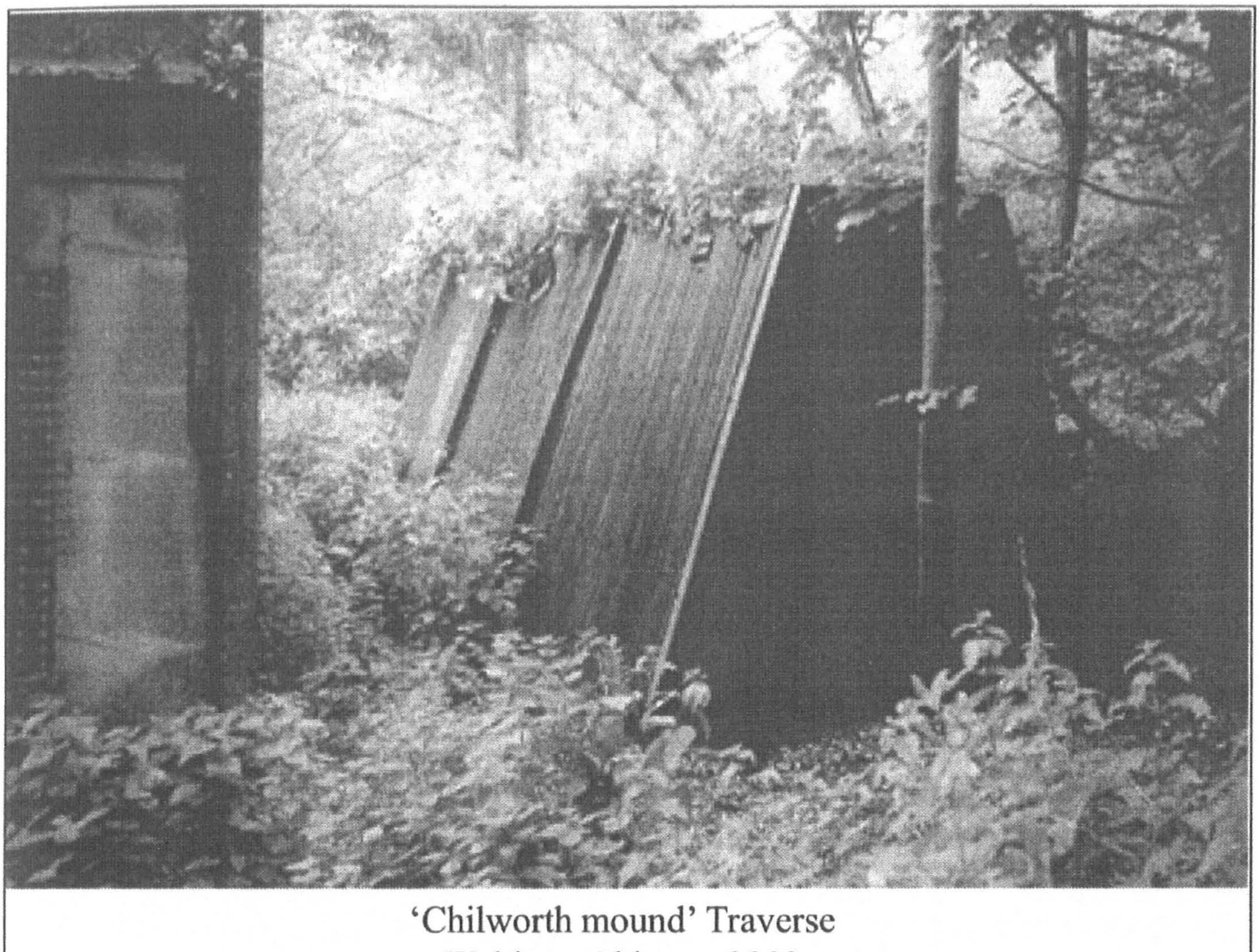
Interior of Waltham Abbey Quinan Stove
showing drying bays and peeling painted calico.

'CHILWORTH MOUND' TRAVERSE. WALTHAM ABBEY-2003.

The Quinan Stove was built on the site of the previous 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.



'Chilworth mound' Traverse
Waltham Abbey - 2003

QUINAN STOVE-WALTHAM ABBEY

TODAY AND THE FUTURE.

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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 1930's precast concrete techniques to the very specialised industrial function of danger buildings.

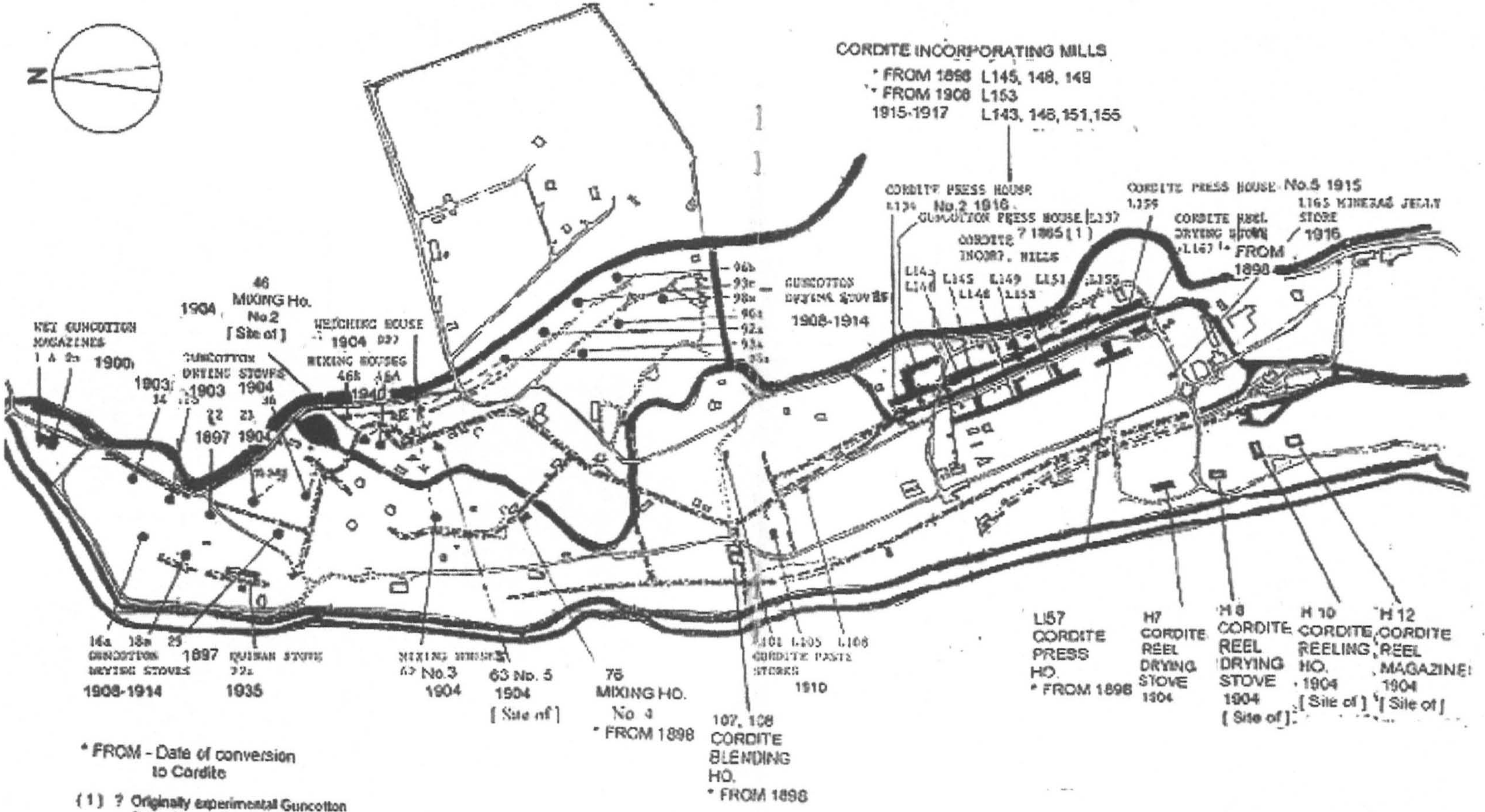
A memorial to the man of whom the Times said - 'It would be hard to point to anyone who did more to win the 1914-1918 was than K.B.Quinan.

ROYAL GUNPOWDER MILLS
WALTHAM ABBEY

NORTH SITE
THE GUNCOTTON &
CORDITE BUILDINGS - FROM 1897

DIRECTION OF CORDITE PROCESS →

MAGAZINE → DRYING STOVE → WEIGHING HOUSE → MIXING HOUSE → INCORPORATING MILL → PRESS HOUSE → DRYING HOUSE → REELING HOUSE → CORDITE REEL MAGAZINE



* FROM - Date of conversion to Cordite

(1) ? Originally experimental Guncotton Press House, later serving 1872 Highbridge St. Guncotton Factory

ROYAL GUNPOWDER MILLS.
WALTHAM ABBEY.