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## The Faversham Gunpowder Industry

(A revised version of an article originally published by the Faversham Society as No 4 of its *Faversham Papers*, 1967.)

## Origins

FAVERSHAM may well have been the birthplace of the national gunpowder industry. According to Edward Jacob, whose *History of the Town and Port of Faversham* was published in 1774, the first gunpowder works in the town was established 'in the reign of Queen Elizabeth, if not before her time'.

The only other early works were at Long Ditton in Surrey and Rotherhithe. Those at Long Ditton were built by George Evelyn, grandfather of the diarist, perhaps as early as 1561. Those at Rotherhithe, worked by Henry and Thomas Lee (father and son), were already in operation in 1555, and may have been in existence as early as 1536, at which time the site belonged to Bermondsey Abbey. It was from Bermondsey Priory, as it then was, that King Stephen had brought Prior Clarembald and twelve monks to Faversham when he founded the Royal Abbey of the Holy Saviour in 1147; and it is tempting, but probably unwise in the absence of specific evidence to support the hypothesis, to suppose that both in Bermondsey and in Faversham monastic initiative lay behind the introduction of the gunpowder industry. Whether the first works to open was at Rotherhithe or Faversham remains uncertain, but Faversham could certainly claim precedence if, as Jacob seems to suggest, its first factory started work some time before 1558.

It was probably in the thirteenth century that gunpowder was first made in Europe, and for a long time England relied on foreign sources of supply. In time of war this was hardly satisfactory, and the first manufacturers to establish themselves could look forward to a rich return on their investments. Before they could begin, however, they

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had to find suitable sites. These were dictated by the economics of the industry.

First, there was the consumer demand. To meet the needs of the army and navy, a site in the south of England was needed if transport costs were not to be prohibitive. Within this area a seaboard or riverside site was preferable to one with no access by water.

Then there was the question of raw materials. Gunpowder is a mixture of three substances—saltpetre, charcoal and sulphur—normally in the proportion of seventy-five parts of saltpetre to fifteen of charcoal and ten of sulphur. Though saltpetre could be made in this country, the process was slow and unsavoury, and much was imported (eg from Italy and India). With sulphur there was not even any choice: it had to be imported from Sicily and Italy. In 1584, however, some effort seems to have been made to reduce this dependence on foreign sources of supply; there was a project, probably fruitless, for refining sulphur from the copperas (iron sulphate) washed up on the shore at Whitstable and on the coast of Sheppey.

Thus two of the ingredients of gunpowder came from overseas, and clearly anyone establishing a factory did well to find a site near a seaport, to prevent his production costs being considerably increased by transport charges. The third ingredient, charcoal, was derived from coppice wood, usually alder, willow or dogwood, which was charred in open pits. It took about 180 lb of fresh green wood to make 15 lb of charcoal, and nearly 2 tons of wood to make enough charcoal for 1 ton of gunpowder. So a factory also needed to be within easy reach of suitable woodland.

Finally, a reliable water supply was needed to supply power for watermills, to provide the water needed when the ingredients of the powder were incorporated (ie mixed under pressure) and to float the punts and other vessels that for reasons of safety were used wherever feasible for moving powder from process to process within the works.

Given these prerequisites, few sites were as suitable as Faversham. It was a seaport, with a manageable-sized stream feeding its creek (Page 33), it was surrounded by woodland, and it was well placed



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between London and the Channel ports. It is hardly surprising that it became one of the leading centres of the national gunpowder industry. Another factor which, if it did not assist in the selection of Faversham in the first place, must have contributed materially to the expansion of its gunpowder industry was the existence at Chatham, less than twenty miles away, of the dockyard founded by Elizabeth I in 1558, described by Camden as 'the best-appointed arsenal the sun ever saw'. However, one of Faversham's advantages—its proximity to the Continent—was also a liability, rendering it vulnerable to attack in the event of war. Though this was not to prove a fatal handicap till the present century, there were forebodings of it as early as 1649, when in September the naval commander in the Downs was ordered to escort vessels with Faversham powder as far as the Hope, as they were liable to attack from 'pickeroons lying at the mouth of the river'.

#### An Early Owner: Daniel Judd

Who had the enterprise to recognise and harness Faversham's advantages for gunpowder making we cannot be sure, but for a time in the seventeenth century the works were the property of Daniel Judd. Described by Hasted as 'a busy committee man and sequestrator of the royalists' estates' during the Commonwealth, Judd rode in on the crest of a wave of prosperity in the national gunpowder industry.

In a hostile Europe, Cromwell's new republican government could not hope to survive for long unless it held the undisputed mastery of the seas. Within two years (1649–51) the size of the navy was doubled, and in 1651 a Navigation Act was passed requiring that cargoes imported from America, Asia and Africa into England, Ireland and the colonies should be carried in ships that were English-owned and manned by crews more than half English, and that goods imported from Europe should be carried in English ships or in ships of the country from which the goods came. This Act hit Holland particularly hard, for then (as now) the Dutch were a great shipping nation, and many cargoes imported into England came in Dutch vessels. Holland negotiated for concessions, but before agreement could be reached fighting broke out, and in 1652 the English fleet under Robert Blake was defeated off Dungeness.

It was a crucial time, and one that suited a munition manufacturer like Daniel Judd pretty well. The Admiralty Committee in London constantly pressed him for increased supplies of gunpowder—and he equally constantly struggled to keep pace with the demand. An agent of the Committee visited him at his factory in February 1653 and reported that he was installing an extra mill. This was expected to be in operation by I March and Judd could then guarantee to supply the Government with nearly 100 tons of powder a year. The same representative returned to the factory on 26 March and Judd had been as good as his word: the mills were 'going as fast as the water would carry them', and the weekly quota of nearly 2 tons of powder was to be shipped within a few days to the Tower of London, then used, amongst other things, as a national ordnance depot.

The same summer, in a battle off the Suffolk coast, Blake wrought his vengeance on the Dutch fleet, and no doubt powder from Judd's mill played a vital part in the victory, which marked the turning point of the First Dutch War. A year later, after a blockade, Holland came to terms and agreed to accept the Navigation Act.

But for Daniel Judd in Faversham all was not plain sailing. He was more than enterprising; he was high-handed. There was no Town & Country Planning Act in 1653, and no planning application had to be approved before a change of use took place, but still there were proper courtesies to be observed, and Judd had no time for them. He fell foul of the Borough Council, who complained to the Council of State that he had converted a flour mill into a gunpowder magazine and had tampered with watercourses, and who threatened to take 'proceedings' against him. However, the Borough Council was told quite firmly that the Government had authorised the use of the flour mill as a gunpowder magazine 'to supply the pressing public occasions' and that it should not take action against Judd 'till they inform the Council of the cause thereof'. Nothing more was heard of this particular storm in a millpond, so presumably the Council acknowledged defeat.

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In 1652 Judd built—or began to build—himself a splendid new house just south of the London road outside Ospringe. But his time of glory was soon to end, for the mansion was confiscated from him after the Restoration of Charles II—and hence earned the name Judd's Folly.

Some time in the nineteenth century, probably when it was reconstructed by John Hyde, the house was genteelly renamed Syndale House, but tradition dies hard and we still have Judd Folly Hill. Later in the same century the mansion again became the home of a gunpowder magnate, William Hall, of John Hall & Son. In recent times the house became a hotel, the Mumford Arms, and during this phase (in 1961) it was severely damaged by fire. Most of the original house has now (1967) almost disappeared.

#### Early Development of the Industry

The original works was established with its centre on what is now known as St Ann's Estate. This takes its name from St Ann's House built in 1764 and demolished in April–May 1963, which in turn was called after the medieval St Ann's or St Agnes' Cross, demolished with the other three Rogationtide crosses in the town in 1571. The cross is also recalled by the public house of the same name in South Road, nearly opposite the entrance to St Ann's Estate and St Ann's and Upper St Ann's Roads.

Over the years this first works, later known as the Home Works to distinguish it from the others that followed, gradually expanded, till in its final form, reached about the end of the eighteenth century, it stretched alongside the stream from near the north side of Ospringe Street, just west of the Maison Dieu, as far as the head of the creek, at the foot of Flood Lane. The channels north of Lower Road, used till recently as watercress beds, and Stonebridge Pond were both part of the works, and part of the Lion Field council housing estate now occupies the site of the Ospringe millpond.

To the west of the stream that feeds Faversham Creek, and roughly parallel with it, is a similar stream flowing into Oare Creek. Its potential did not go unnoticed by the gunpowder makers, and some time after the establishment of the Home Works another factory, usually known as Oare Works, but also called Davington Works or Mills, was built alongside it. It stretched from Bysing Wood Road as far as the head of Oare Creek, below Oare Pond and Meadow.

When Jacob wrote in 1774, powder from this works was being supplied to the East India Company and to wholesalers. The management, clearly progressive, had recently introduced an improved method of drying powder, in which it was laid on a copper frame suspended over a stream of hot water. The earlier and more hazardous method had been to use gloom stoves, in which hot air from a live fire was circulated under the powder.

It is not known when this factory was established, but by 1719 it was being operated, with the Home Works, by one of the Grueber family, which later had an interest in the Hounslow powder mills in Middlesex. Like most other factories before and since, it had its troubles. One of them was the problem of pilfering by staff. In 1728, during the management of Francis Grueber the elder and Francis Grueber the younger, evidence was given that a former employee at the works, John Wilson, had been trying to sell gunpowder of which he was not the rightful owner. James Le Feaver, a millwright at the factory gave testimony that

one Bull, a soldier in Col Kirk's Regiment, as he was informed by the said Bull on Sunday last, asked the said Wilson to lend him a Razor; and, the said Wilson opening a Chest, the soldier perceived a Bagg or Two of powder therein, said 'You are well stockt with Powder, give me a Charge or Two', which he did; and afterwards this Deponent found in the said Chest a parcell of powder containing about Three pounds and a half, the property as this Deponent verily believes of his master Francis Grueber the Elder. And this Deponent saith that the said powder is worth Two shillings and sixpence.

The story was corroborated by Samuel Bull, the soldier concerned, but whether Wilson was convicted we do not know.

But worse trouble—this time of their own making—was in store for the Gruebers. About ten years later the firm began to take loose gunpowder through the town centre in open carts, and local people

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naturally became uneasy about the risk of explosion. It was suggested that it would be safer and just as convenient for the carts to take an alternative route, but the Gruebers took no notice. The Borough Council took advice about the possibility of making an appropriate bylaw or, if this were impossible, of prosecuting the firm under some general power. It was advised that it could make a bylaw, and in April 1742 laid down that

If any person or persons shall at any time hereafter Carry or Convey in or through any of the streets or lanes within this Town any Gun-powder in any Waggon Cart or Carriage other than what is close covered with Boards or in any Waggon Cart or Carriage shoed with Iron every such person and persons shall forfeit and pay unto the Mayor Juratts and Commonalty of this Town the sum of forty shillings for every such offence to be recovered by Action of Debt in any of his Majesties Courts of Record by the Mayor Juratts and Commonalty of this Town in which action no Wager of Law shall be allowed.

Additional powers of control of the carriage of gunpowder were later conferred by a general Act of 1771, which among other things extended to the whole country restrictions which had been in force in the London area since 1725. Little more is known about the Grueber management at the Home and Oare factories, but in 1809 Henry Grueber, of Sloane Street, Chelsea—presumably another member of the family—died, leaving bequests to Mendfield's Almshouses and the National Schools in Faversham. At the end of the eighteenth century the Oare Works were the property of Miles Peter Andrews and Frederick Pigou, who were also the owners of gunpowder mills at Dartford, which they had bought in 1788 from Pike & Edsall, who had opened them in 1732.

Meanwhile expansion and improvements went on at the Home Works. Following the revocation of the Edict of Nantes in 1685, Huguenot refugees settled in Faversham, as in several other towns in East Kent, and some found employment in the works. Possibly James Le Feaver, the millwright who gave evidence against John Wilson, was the son of one of them.

In the period 1650–1750 recorded shipments of gunpowder through the creek were often well over 40 tons a year, though it seems that additional consignments were smuggled out and evaded the Customs men. In 1673 they complained rather sheepishly that every week large quantities were being exported 'without cocquet or security under pretence of His Majesty's goods, but what it is or where it goes we are not able to give any account'. Bearing in mind that twenty years earlier the capacity of Judd's mills had been increased to nearly 100 tons a year, one feels the Customs men were indeed being well and truly hoodwinked, and quite clearly Faversham's reputation as a hotbed of smuggling was not unearned. This reputation was well established by 1724, when Defoe wrote

most notorious smuggling trade, carry'd on partly by the assistance of the Dutch, in their oyster-boats, and partly by other arts, in which they say, the people hereabouts are arriv'd to such a proficiency, that they are grown monstrous rich by that wicked trade.

With the journalist's nose for a sensational real-life story, Defoe also recalled a serious accident at the Faversham powder-mills:

While I was near this town some years ago, a most surprising accident happen'd, namely, the blowing up of a powder-mill, which stood upon the river, close to the town; the blast was not only frightful, but it shatter'd the whole town, broke the windows, blew down chimneys, and gable-ends not a few; also several people were killed at the powder-house it self, tho' not any, as I remember, in the town; but what was most remarkable in it all, was, that the eldest son of the master of the powder-mill, a youth of about fifteen years of age, who was not in the mill, or near it, when it blew up; but in a boat upon the river, rowing cross for his diversion, was kill'd by a piece of the building of the mill, which blew up into the air by the force of the powder, and fell down upon him in the boat.

This graphic account is the first that we have of an explosion at the Faversham factories, but probably there were earlier incidents, for the manufacture of gunpowder was a particularly hazardous business in the early days, with primitive equipment and sketchy safety precautions.

In the very early days of the Faversham industry, the gunpowder may have been mixed by hand with pestle and mortar. Later, manufacture was carried out in what Jacob calls 'pestil-mills' (Page 33), ie stampmills in which the powder was pounded by mechanical hammers driven by horse or water power. About 1734 these began to be super-

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seded by edge-runner mills, also worked by horse or water power (Page 33); the charge of powder was placed in a trough on top of a circular stone bed, round which rolled one or two very heavy stones, or edge-runners, with their axes horizontal. In watermills power was transmitted from the waterwheel by a train of gears alongside and over the stone bed, but when steam power was introduced the gears were beneath the mill. The use of the old-fashioned stampmills, except for the manufacture of fine sporting powder, was finally prohibited by Act of Parliament in 1772.

#### The Home Works Acquired by the Government

All this time gunpowder for the navy and army was being supplied by private firms, but in 1760 the Government decided that it might be more economical to open a factory of its own. To avoid unnecessary expense and delay, it also decided to take over an existing factory rather than build a new one, and the choice fell on the Home Works at Faversham. After being in private hands for many generations (the Waterman family were among the owners) the works was bought by the Government from Thomas Pearse in 1760, and became the Royal Gunpowder Factory, under the control of the Board of Ordnance.

In the grounds there was already a residence, which had been the property of Sir Roger Twisden, Bt, and had previously been occupied by Francis Grueber (presumably one or other of the two of this name who had been working the Home and Oare Factories in 1728); but in 1764 this was superseded by a new house for the Storekeeper (director) of the Royal Factory. This was St Ann's House (Page 34), and here in 1799 was born George Finlay, who fought with the Greeks in their War of Independence and subsequently wrote a history of it. He died in 1875.

Immediately after the Government took control a programme of extensions and improvements was put in hand, and by 1774 the factory's annual output at full capacity had increased to 364 tons per annum. The plant comprised eleven watermills and five horse-worked mills used for mixing and incorporating the powder, as well as others for grinding the individual ingredients and granulating the powder. After being incorporated, the charge of powder, known as 'mill-cake', was compressed into thin slabs of 'press-cake', which was broken down into grains of the required size in the 'granulating' or 'corning' process. Each charge of powder was mixed in an incorporating mill for six hours, though three hours had been considered sufficient before the Government took over.

A visitor to the mills at this time might have begun his tour by turning off Ospringe Street into what is now Grove Place and its continuation Wallers Road. On the right he would see the headwater to the Ospringe Mills and then, just south of Lower Road, the mills themselves. Walking another 600 yd, to the junction of Lower Road and Ospringe Road, he might just catch a glimpse of the next group, Chart Mills, through the young trees on his left. Then, entering the factory across a bridge over the stream, he would come to St Ann's House and the offices, with the crest of Davington Hill overlooking them. Walking through the grounds towards Stonebridge Pond, he would notice King's Mills on the right, just the other side of the stream from 50, 51 and 52 Tanners Street. Crossing West Street into Stonebridge Pond, he would pass a crane and come to the Factory Watchhouse. Above him on his left, as the pond curved round, would come into view more houses and offices on Brents Hill. Last of all he could watch two more sets of mills, Lower Mills and Bennet's Mills, at the head of the creek before striding out on to the Government wharf, with its crane at work loading barges with barrels of powder.

Jacob records that in the horse-worked mills the animals were protected from injury in the event of mishap by a continuous leather curtain suspended round the mill mechanism. There was no difficulty in finding labour, as the work was light, the factory offered secure employment, and workers were sure of proper care in the event of accident. Jacob also describes the construction of the mills:

The contrivance in the erection of the mill-houses, though simple is very proper, the covering being made with fir boards, lightly fastened, so that when by accidents, no way to be accounted for, they blow up, the blast, meeting

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with little resistance, hath sometimes done no other injury to the buildings, than blowing off the roof; though at other times much greater damage hath ensued.

Other measures were taken with the aim of confining, or at any rate reducing, the effect of blast should a mishap occur-and the need for precautions is evident from Defoe's account of the damage done by an explosion. One method was to build tall, thick screen walls in strategic positions. Another method, simpler but not so immediately effective, was to plant trees. Once mature, these could help to absorb and dissipate any blast from an explosion; and at the same time they assimilated the various process-houses into the landscape, virtually camouflaging them, though this was not the intention. So it happens that many disused gunpowder works, such as Home Works and Oare Works, are beautifully endowed with fine trees in their prime. At the Home Works, for example, are at least twelve types of tree-ash, beech, copper beech, cedar of Lebanon, elm, Cornish elm, horse chestnut, lime, plane, oak, poplar, sycamore and Scots pine. On a number of these the Borough Council has wisely placed a Tree Preservation Order. It is a sobering thought that few other industrial developments can be said to have actually improved their settings: even today many factories only sully their surroundings, reminding us that the crusade against Blake's 'dark satanic mills' is not yet half-won.

But whatever precautions were taken to mitigate the effect of small accidents, nothing could prevent damage over a wide area when a large explosion occurred. The history of the gunpowder industry in Faversham, as elsewhere, is studded with a long series of accidents of this kind. Seven years before Jacob's *History* was published, one had damaged the monastic buildings of Davington Priory, and in April 1781 there was a far worse one, which destroyed many of these buildings and did widespread damage in the west of the town. Over 3 tons of powder exploded, destroying the corning mill and the dusting house, where dust was removed from the powder after corning. A house in Tanners Street was blown down, many others lost their tiles, and West Street was blocked with debris. The explosion, in which three men were killed, was heard as far away as London; in Canterbury many people thought there had been an earthquake; and the pillar of flame was seen in distant Thanet. The cost of the damage was estimated at nearly  $f_{1,500}$ .

#### Expansion of the Royal Factory

The Faversham Gunpowder Industry

Following this disaster the future of the Royal Gunpowder Factory was re-assessed. One view was that the Government would do better to abandon it and revert to buying powder from private firms, and by 1783 Pitt, the Prime Minister, was on the point of recommending to Parliament that the factory should be sold. At the eleventh hour, however, Major (later Lt-Gen Sir) William Congreve, the Deputy Comptroller of the Royal Laboratory at Woolwich, produced hard facts and figures to show that the Faversham factory ran at a profit, and suggested that if this were ploughed back to provide for improvements much better powder could be produced. His advice was taken, and in 1786 work on the more dangerous processes was transferred to a new site, the Marsh Works, well north of the town, between what we know now as Oare Road and Ham Road.

Within the factory, safety precautions were tightened and in October 1785 a stringent set of works regulations was issued. These were soundly formulated, and indeed were to serve as the basis for all later rule-books in the industry. They are worth quoting in full.

I If any workman belonging to the Royal Mills wears his slippers out of those parts of the Works where they are intended to be used for safety, or wears his own shoes<sup>1</sup> into any of the said works, any such workman is to be chequed a day's pay for the first offence and if they should so far forget the duty they owe their country as a second time to run the risque of blowing the works up through such negligence they are to be discharged and on no account to be entered again.

2 The respective officers will please to give the strictest orders for having the several works cleaned out whenever they require it, and the cleaning is not to be confined to the floors only but to every part of the machinery and buildings to prevent any accumulation of dust, which in a powder manufactory must be attended with the greatest danger.

3 The hinges of all doors and window shutters are to be kept well oiled, also

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the pulleys over which the window lines go and the grooves in which the sashes slide to be brushed and scraped as often as occasion requires to prevent any dangerous friction. The cogs, axles and other parts of the machinery to be kept well soaped and oiled as has hitherto been the custom.

4 The pulleys belonging to the valves of the powder stoves<sup>2</sup> must be carefully examined and if there is a possibility of the ropes rubbing against wood or if the sheaves of the pulleys are made of wood they must be altered, so that the ropes may rub against copper, and the sheaves be made of the same metal.

5 Whenever the powder tumbrils are required to come near a building in which powder is contained, brick rubbish must be laid on the ground after it has been very carefully examined that no flint or other stones remain therein. 6 Each of the corning houses are to be completed with canvas receivers in the dust troughs and a canvas curtain similar to that ordered for No 1 corning house.

7 When barrels of gunpowder are lifted out of boats to be stored in the magazines or powder vessels, the strictest attention must be paid to have them brushed all over with a soft brush to prevent any grit hanging to them. The wheelbarrows on which they are to be carried, the hold of the vessel in which it is to be laid to be cleaned in the same manner.

8 All the wheelbarrows which are used to carry powder are to be fitted with copper hoops and gudgeons instead of iron.

9 The floors of the cooperage must be kept as clean from sand or gravel as the magazine and the coopers must work in their magazine slippers to prevent any grit adhering to the barrels or charge tubs, and before any of the articles are issued from the cooperage they must be well brushed and cleaned.

Even with all the expansion that had taken place, the Faversham factory soon failed to keep pace with Government demand, and in 1787 the Board of Ordnance acquired another old-established private works at Waltham Abbey. Here, as at Faversham, a programme of modernisation was found necessary, and workers were sent to the Faversham factory to study up-to-date methods. That at this period Faversham was well in the lead in gunpowder technology is also clear from the fact that J. Stevens, one of the staff, was asked to give expert advice in 1798 when a consortium won a licence for the manufacture of gunpowder at Lowwood, near Haverthwaite, in Furness.

It was in the same year, and possibly even in connection with the same venture, that John Ticking, the Master Worker at the Faversham factory, drew a series of sketches of the various processes in use (Page 35). This is the earliest graphic survey of its kind, and though the originals seem to have been lost, they were fortunately reproduced in 1909 in *The Rise and Progress of the British Explosives Industry*, edited by E. A. Brayley Hodgetts and published by Whitaker & Company. Later, more sophisticated, and invaluable to the historian, is the *Treatise on Gunpowder* written in 1830 for the Board of Ordnance when the future of the Waltham Abbey factory was in the balance. It exists only in manuscript and can be consulted in the Public Record Office (reference Supply 5/672). Though the exquisite scale plans and drawings illustrate plant and equipment at Waltham Abbey, they can also be taken as fairly accurate illustration of practice at Faversham (Page 35). Nothing is known about Frederick Drayson, the author of the *Treatise*, but it is just possible that he was a Faversham man, for in the parish church is a monument to Charles Drayson, who died on 31 December 1830.

By the time of the Napoleonic Wars output at Faversham had been stepped up to between 535 and 580 tons per annum. The labour force numbered nearly 400, or just under a quarter of the total male population of the parish of Faversham at the time (1,878). Nearly £250 a week was drawn in salaries and wages, the most highly paid employees being the Storekeeper (£100 a year) and the Master Worker (£90). The two carpenters (£62) were better paid than the two clerks (£54 and £36), and bottom of the scale came the Hoy Master (£31) and his mate (£23). Production was continuous, shift-work being in operation; and, as in most powder factories by this time, an assembly-line technique was in use, the manufacture of the powder being gradually completed as it passed down the stream. Despite all the safety measures, explosions still occasionally occurred, and following one in 1810 it was planned to sink some of the process houses below ground level.

In 1794 the Royal Factory raised its own Company of Volunteers under the command of the then Storekeeper, William Sumpter. The same year the Royal Powdermill Volunteers, as they were called, paraded before George III at Maidstone. Two hundred strong, they were armed with four 6 lb pieces of artillery. The unit was disbanded in 1810.

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the pulleys over which the window lines go and the grooves in which the sashes slide to be brushed and scraped as often as occasion requires to prevent any dangerous friction. The cogs, axles and other parts of the machinery to be kept well soaped and oiled as has hitherto been the custom.

4 The pulleys belonging to the valves of the powder stoves<sup>2</sup> must be carefully examined and if there is a possibility of the ropes rubbing against wood or if the sheaves of the pulleys are made of wood they must be altered, so that the ropes may rub against copper, and the sheaves be made of the same metal.

5 Whenever the powder tumbrils are required to come near a building in which powder is contained, brick rubbish must be laid on the ground after it has been very carefully examined that no flint or other stones remain therein. 6 Each of the corning houses are to be completed with canvas receivers in the dust troughs and a canvas curtain similar to that ordered for No I corning house.

7 When barrels of gunpowder are lifted out of boats to be stored in the magazines or powder vessels, the strictest attention must be paid to have them brushed all over with a soft brush to prevent any grit hanging to them. The wheelbarrows on which they are to be carried, the hold of the vessel in which it is to be laid to be cleaned in the same manner.

8 All the wheelbarrows which are used to carry powder are to be fitted with copper hoops and gudgeons instead of iron.

9 The floors of the cooperage must be kept as clean from sand or gravel as the magazine and the coopers must work in their magazine slippers to prevent any grit adhering to the barrels or charge tubs, and before any of the articles are issued from the cooperage they must be well brushed and cleaned.

Even with all the expansion that had taken place, the Faversham factory soon failed to keep pace with Government demand, and in 1787 the Board of Ordnance acquired another old-established private works at Waltham Abbey. Here, as at Faversham, a programme of modernisation was found necessary, and workers were sent to the Faversham factory to study up-to-date methods. That at this period Faversham was well in the lead in gunpowder technology is also clear from the fact that J. Stevens, one of the staff, was asked to give expert advice in 1798 when a consortium won a licence for the manufacture of gunpowder at Lowwood, near Haverthwaite, in Furness.

It was in the same year, and possibly even in connection with the same venture, that John Ticking, the Master Worker at the Faversham factory, drew a series of sketches of the various processes in use (Page 35). This is the earliest graphic survey of its kind, and though the originals seem to have been lost, they were fortunately reproduced in 1909 in *The Rise and Progress of the British Explosives Industry*, edited by E. A. Brayley Hodgetts and published by Whitaker & Company. Later, more sophisticated, and invaluable to the historian, is the *Treatise on Gunpowder* written in 1830 for the Board of Ordnance when the future of the Waltham Abbey factory was in the balance. It exists only in manuscript and can be consulted in the Public Record Office (reference Supply 5/672). Though the exquisite scale plans and drawings illustrate plant and equipment at Waltham Abbey, they can also be taken as fairly accurate illustration of practice at Faversham (Page 35). Nothing is known about Frederick Drayson, the author of the *Treatise*, but it is just possible that he was a Faversham man, for in the parish church is a monument to Charles Drayson, who died on 31 December 1830.

By the time of the Napoleonic Wars output at Faversham had been stepped up to between 535 and 580 tons per annum. The labour force numbered nearly 400, or just under a quarter of the total male population of the parish of Faversham at the time (1,878). Nearly £250 a week was drawn in salaries and wages, the most highly paid employees being the Storekeeper (£100 a year) and the Master Worker (£90). The two carpenters (£62) were better paid than the two clerks (£54 and £36), and bottom of the scale came the Hoy Master (£31) and his mate (£23). Production was continuous, shift-work being in operation; and, as in most powder factories by this time, an assembly-line technique was in use, the manufacture of the powder being gradually completed as it passed down the stream. Despite all the safety measures, explosions still occasionally occurred, and following one in 1810 it was planned to sink some of the process houses below ground level.

In 1794 the Royal Factory raised its own Company of Volunteers under the command of the then Storekeeper, William Sumpter. The same year the Royal Powdermill Volunteers, as they were called, paraded before George III at Maidstone. Two hundred strong, they were armed with four 6 lb pieces of artillery. The unit was disbanded in 1810.

#### The Royal Factory sold to John Hall

At the end of the Napoleonic Wars the demand for gunpowder dropped, and the Government leased the Home Works to John Hall of Dartford. Hall, an engineer who also founded the Dartford engineering firm of J. & E. Hall Ltd (still in existence today), had become interested in the gunpowder industry, no doubt owing to the success of the Dartford factory, and in 1812 had acquired the still-independent Oare Works from the heirs of Stephen Gillow, of Cooksditch in East Street. But as well as continuing to own the freehold of the Home Works, the Government retained possession of the Marsh Works-a course which (predictably) earned the contempt of William Cobbett and Joseph Hume, who were always on the look-out for bureaucratic extravagance. For Cobbett, who visited Faversham late in 1821, the town was memorable chiefly for 'the powder-affairs that Mr Hume so well exposed'. Branding them as 'an immensity of buildings and expensive things', he called for them to be let or sold, taking them as a cue for his familiar plea for a drastic reduction in the level of taxation. The Government was not to be stampeded, however, and not until more than thirty years later did it relinquish its last interest in the Faversham industry.

The process of withdrawal was cautious. In 1825 the Home Works was auctioned at the Ship Hotel to John Hall & Son for £17,935. Seven years later the Marsh Works was let to the same firm, who bought it outright in 1854; thus the original (Home) Works, the Oare Works and the Marsh Works were now in common ownership.

Production continued, but at first—in peacetime conditions—at a lower level, and in 1835 the Municipal Corporations Commission in its report on the Borough of Faversham found that the value of cottage property in the town had decreased as a result of the withdrawal of the Government interest. More uncertain conditions of employment were probably reflected in the formation in 1830 of the Davington (ie Oare) Factory Friendly Society, a workers' benefit society, which in 1882 was still in existence and holding its meetings at the White Horse in West Street.

#### The Faversham Gunpowder Industry

Not that the employers did nothing for the welfare of their workers. In 1848 one of the Hall family, William Hall, who lived at Syndale, Daniel Judd's old house, established a girls' school in the building now occupied as a bungalow on the edge of Stonebridge Pond, almost opposite the entrance to St Ann's Estate. In 1861 the school moved to new and larger premises in Tanners Street, on land provided by Hall, and it remained in use until the present Ethelbert Road schools opened in 1907. The vacated building became the Empire Picture Hall, Faversham's first cinema, in 1910, and much later it was converted for its present use as the town's Roman Catholic church. Another local church, the Brents Parish Church, was built by William Hall's wife in his memory in 1881; Mrs Harcourt Rose, as she became after her remarriage, also built the Cottage Hospital in memory of her husband in 1887.

#### The First Guncotton Factory in the World

Scientists were constantly seeking explosives more powerful than gunpowder, and in 1846 guncotton was introduced. It consists of purified cotton, steeped in a mixture of equal parts of nitric acid and sulphuric acid, and afterwards dried, retaining the appearance of cotton wool. John Hall & Son was quick to obtain patent rights and in October 1846 decided to build a guncotton factory—the first in the world—at the Marsh Works. Within a month the firm was advertising the new product, which it claimed was six times as powerful as ordinary gunpowder.

Production started shortly afterwards, but about six months later, on 14 July 1847, came a disastrous explosion in which some twenty people lost their lives. Two buildings at the western end of the works blew up in quick succession, and the noise was heard within two miles of Maidstone. An eyewitness account of the scene of the disaster was published in *The Times* and reprinted in the *Illustrated London News*.

The roofs of all the buildings within about a quarter of a mile of the explosion are completely stripped of their tiles, and the walls are much shaken. Even in the town of Faversham, fully a mile distant from the scene of the disaster, windows were broken, and the houses otherwise damaged in some instances. On the opposite side of the stream which forms the northern boundary of the Marsh Works is a field of wheat of some extent. The explosion

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has completely blasted this over a space of about two acres, and the ears, drooping and discoloured, present a scene of desolation in perfect character with the adjoining ruins. The willow-trees which skirt the bank of the stream referred to, and, indeed, all the trees within about fifty yards of the buildings Nos 3 and 4, are torn up by the roots, and scattered about in all directions. Those more distant are less seriously injured, but the foliage of all within a very large circle is wholly destroyed. One of the most remarkable effects of the explosion is the removal, as it appears almost bodily of the enormous mound of earth skirting the No 4 store. Another instance of its power was shown in the forcible ejection from a deep well of two massive pumps, the leaden pipes of which, nearly twenty feet long, were drawn up and thrown to a very considerable distance.

The guncotton factory was immediately closed, and the new invention was not taken up anywhere else for nearly ten years. Remaining stocks of the explosive were buried in the vicinity.

The manufacture of gunpowder at the Marsh Works continued, however, and indeed the factory expanded to cope with the increased demand for the Crimean War (1854–6). With factories belonging to two other firms, it met the bulk of the Government's requirements. Another new explosive—dynamite—made its appearance in the 1860s, and the inventor, Alfred Nobel, offered the British patent rights to John Hall & Son for £500. This time, however, deciding that discretion was the better part of valour, it declined the offer. With less fundamental new developments, however, the firm was not so cautious, and in 1876 began the manufacture in this country of pellets (ie gunpowder in the form of compressed cartridges), which enabled the effective strength of blasting charges to be increased by 25 per cent. Meanwhile, on 28 December 1867, there was a serious explosion at the press-house and corning-house at the Marsh Works, and following this the works was completely remodelled.

For a long period in the 1870s John Hall & Son had difficulties with Major (later Colonel Sir) V. D. Majendie, RA (KCB), who had been appointed HM Inspector of Gunpowder Works in 1870. Evidently an officer of great diligence, Majendie refused to turn a blind eye to any apparent infringement of the gunpowder legislation, be it serious or seemingly insignificant. Clearly he believed—and with every justification, in the light of experience—that even the smallest lapse might have disastrous results. But to John Hall & Son he appeared overzealous and officious, and at last in 1876, when the effects of the Explosives Act 1875 were beginning to be felt, the firm took the unusual step of printing extracts from the correspondence it had had with him over the past three years. Beneath the velvet prose the iron determination of either party is ill-concealed, and as models of nasty letters written in a nice way these would be hard to surpass. Most of them concern technical matters which, though of much interest, are outside the scope of this paper. One exchange, however, is of more general interest.

29th October 1874

Home Office Whitehall S.W.

#### To John Hall & Son, Faversham Gentlemen,

I have the honour to inform you that a report was recently received by this Department from the Chief Commissioner of the Police of the Metropolis, relative to a van containing twenty barrels of Gunpowder, which had been loaded at Blackwall Stairs for conveyance to Paddington, and which was observed on the 5th inst by Police-Constable 147, K. Pope, who found that the head of one of the barrels had come out, and that the driver was placing it in again. I caused further inquiry to be made, and it appears that the powder in question was consigned by you to a customer in Birmingham. The carman was John Yeo, No. 35, Nelson Street, Long Lane, Bermondsey. On being questioned, he stated that he placed the barrel on end and another barrel on the top of it, and that the head gave way.

It is my duty to lay the whole case before the Home Secretary, and I am instructed by him to call your immediate and serious attention to the matter, and to point out to you that a barrel which admits of being broached so readily (according to the carman, by the simple placing of another barrel upon it) is not a safe or proper barrel in which to issue powder; and I am further directed to inform you that in the event of a similar occurence being repeated the Home Secretary will feel it necessary to institute proceedings against you for sending out Gunpowder in barrels not secured as to prevent the powder being scattered in the passage (see Section 20 of the Gunpowder Act).

I have the honour to be, Gentlemen, Your obedient Servant,

(signed) V. D. Majendie, Major, R.A. H.M.'s Inspector of Gunpowder Works.

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Faversham

2nd November 1874 To Major Majendie, R.A. Sir,

We have had forwarded to us from our London Office your letter of the 29th ultimo, giving us the details of the enquiry you had made as to a broken powder cask which had been observed by the police on the 5th ultimo.

We had heard of the incident in question, and had made it the subject of grave consideration with all concerned, and we have now again assembled all our coopers and headers-up of casks, and in the presence of our Manager and Foreman have read your letter to them and enforced all its points in the most emphatic manner.

We pay the highest wages to coopers, we use only the best oak staves, and we endeavour to retain in our employ as coopers only men who have a sense of responsibility and character, on purpose to ensure the best casks that can be made. We are taking additional measures to ensure still further inspection and supervision in this department, and we can assure you that no expense and no trouble shall stand in the way of our attaining as nearly perfection as possible in this important branch of our business.

We have the honour to be, Sir, Your obedient humble Servants,

(signed) John Hall & Son.

## A visit to the Faversham Factory in 1897

In 1896, on the retirement of the existing partners, John Hall & Son was converted into a private limited company. By now a large number of gunpowder manufacturers, big and small, were all selling in competition with one another, and the climate was ripe for a measure of rationalisation. The first firm to make a series of successful take-over bids could expect to reap a rich reward from the economies that would undoubtedly follow.

The lead was taken by the firm of Curtis's & Harvey, which had been formed in 1820 to take over the Hounslow mills then owned by Messrs W. G. Harvey & Grueber. From the very start it had pursued an aggressive policy of expansion, acquiring existing businesses in Bedfont, Middlesex; Glenlean, Argyllshire (1844); Tonbridge (1859); Glyn Neath, Breconshire (1864); and Millhouse, Kyles of Bute (1886). The climax to this period of growth came in 1898, when Curtis's & Harvey Limited was incorporated as a public company. At the same time it took over eight more firms, including both John Hall & Son Ltd of Faversham and Pigou, Wilks & Laurence Ltd of Dartford. The new firm had an issued capital of £458,000 in £1 shares (£600,000 authorised), as well as a similar amount of mortgage  $4\frac{1}{4}$  per cent debenture stock, and in all its factories employed a total labour force of about 1,500. The only larger private firm was Nobel's Explosives Company Ltd, which had been originally formed in 1877 to exploit the British patent rights of the innovations introduced by Alfred Nobel, the Swedish inventor (1833-96) who endowed the famous Nobel Peace Prize and other international awards. Its main factory was at Ardeer in Ayrshire. Its abortive attempt in 1913 to become established in the Faversham area is mentioned later.

Some time between 1896, when the firm became a private limited company, and 1898, when it was taken over by Curtis's & Harvey Ltd, the Faversham works of John Hall & Son Ltd was the subject of an article in the *British Journal of Commerce*. As *A Visit to Messrs John Hall & Son, Limited: Works at Faversham, Kent*, this feature was reprinted as a little thirty-two page illustrated booklet, complete with fetching advertisements, from one of which we learn that

Lord Walsingham set out last August in order to beat record by killing 1,000 grouse to his own gun or guns, and when one would have thought that smoke would be an item to be reckoned with, he had his cartridges loaded with  $3\frac{1}{3}$  drs of Hall's FIELD B POWDER, and his lordship managed to kill 1,070 head of driven grouse.

As a full account of an explosives factory of the period, this booklet is of considerable value, and it is worth quoting several passages from it.

'The works, as at present existing, extend to more than 250 acres in area, and encroach on no less than six different parishes. The number of operatives is some three hundred. The business connection is ubiquitous and world-wide, and includes the supply of several governments. The issue of many battles has, doubtless, been largely aided by the innocent-looking black and brown powder from Faversham, whose





appeal is generally found to be of more avail than either argument or arbitration.'

'It must not be assumed, though, that the dogs of war alone watch over the interests and productions of the firm. The manufacture of sporting and blasting powders is immense. Big game hunters and other sportsmen of all degrees are fully aware of the importance attached to the quality of the powder on whose trustworthiness they stake their reputation, and railway and mining companies, and many other undertakings whose operations require the use of Gunpowder, and who realise how much depends upon its manufacture, have long looked to Faversham for the supply of the most carefully prepared and skilfully blended that can be obtained. . . .

'The main works . . . are situated at about a mile from the quaint old-world Kentish town of Faversham. The nature of the manufacture of Gunpowder demands the precaution of careful isolation. Some of the mills, known as the home works, are almost in the town itself; the remainder occupy an extended semi-circle to the north and west.

'We were met at the station by Mr J W Cook, the works manager, who, after our visit to the home works, forearmed us with a general description and explanation of the various operations of the business. The elements of Gunpowder are, as is generally known, saltpetre, charcoal and brimstone, thoroughly mixed, in the percentage proportions of 75, 15 and 10 respectively...

'Saltpetre... is a natural product gathered from the surface of the earth. It is comparatively impure on importation from Bengal, and there are large departments at Faversham where it is freed by steam and filtration from the chlorides and sulphates whose presence is undesirable. [Page 36.]

'Charcoal, chiefly burnt from the wood of young alder trees, is made by the firm themselves in large cylindrical chambers. This operation demands great care and skill, as the rate of combustion of the charcoal, when incorporated in the Gunpowder, depends on the temperature at which it was originally charred. Charcoal which has been prepared at

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great heat is, by the expulsion of most of its hydrogen and oxygen, converted into almost pure carbon, and is proportionately dense and incombustible; whilst, if charred at a lower temperature, it is more volatile and burns freely.

'Sulphur, the third ingredient of Gunpowder, is used to assist combustion, because of the low temperature at which it ignites. The sulphur is first melted in a copper and run into moulds, from whence it is taken and broken up for further melting in a chamber, whence the fumes, known as flowers of sulphur, pass into a dome, whilst the sublimated and purified portion for use runs out in a consistency somewhat resembling that of treacle.

'Sufficient stress cannot be laid on the urgency of the utmost skill in the preparing and purifying of these three elements of Gunpowder... Charcoal, in particular, plays a most important part, and the enormous quantity of wood in growth by the firm betokens the value they attach to wide selection.

'The three ingredients being thus fitted for use, are mixed in proper proportions in a cylindrical mixing machine, which revolves in reverse direction to interior spindles. The mixture then passes in charges of sixty pounds to the incorporating mills. The firm have no less than fifty pairs of the latter in different clusters.

'An incorporating mill [Page 36] consists of a circular stone or iron bed on the floor of a small shed, and the powder is thoroughly mixed by two stone or iron edge runners of about four tons each in weight, which revolve in the bed by means of gearing under the floor. A couple of ploughs throw the mixture continually in the path of the runners. The powder is occasionally moistened by water, and in the ultimate finishing of the Gunpowder a certain percentage of moisture must remain, as the absence of presence thereof has a considerable effect in the variation of quality required. A decimal fraction of moisture above or below regulation proof in powder supplied to the Government would ensure rejection. The presence of moisture in the mills also prevents dust and minimises danger.

'The mills, which run day and night, require otherwise little atten-

tion. Above each pair of runners is a water tank, which, in the event of an explosion, immediately empties and floods the mill automatically, and each other mill in the cluster would be simultaneously treated likewise.

'Every possible precaution against accident is, in fact, rigidly observed throughout the works. The operatives are clothed in fireproof garments, no speck of dust or foreign matter is anywhere visible, and the various mills, magazines, and workshops are all isolated, and protected by traverses and tree clumps.

'Fire buckets are everywhere, and moreover, a waterway system interlaces the whole area in every direction. Most of the convoy of powder is by water [Page 37], and it is everywhere present. The remarkable immunity the works have long enjoyed from any serious accident is a testimony to the care taken for the operatives; and one must also comment upon the extremely kindly and cordial relations between employers and employed which are everywhere apparent.

'To proceed to the course of manufacture. The Gunpowder after leaving the mills, where it is ground for a time varying with the quality and description required, passes to the breaking-down sheds, and thence to the sheds, where it is pressed [Page 37] between plates into cakes by hydraulic rams.

'These cakes are then granulated [Page 37] by a machine with gunmetal teeth, and the powder is subsequently polished with Spanish graphite by revolution in tubs in rows on long axles. The powder is finished by "stoving" or drying on racks heated by steam pipes, and is then ready for flasking, casing and packing. Messrs HALL have their own coopering and tin-makers' departments, which are always kept busy. There is much ingenious machinery in the tin-making room, and we saw a powder-flask completed in a few minutes from the sheet metal.

'The firm employ a large number of women operatives. We visited many sheds where these were making the compressed cartridges for blasting purposes, in which Messrs HALL do an enormous trade, and

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of which they were the original makers in Great Britain; and others where cartridge filling, wadding, and shotting were proceeding.

'Many also were occupied in cartridge filling with the firm's speciality—the new, but already world known, "Cannonite" smokeless sporting and rifle powder. This powder is not only smokeless, but is unaffected by heat or damp; and even if immersed in water, it is as sound as ever on drying. The grain is very fine and even, rapid in ignition and almost free from fouling. . . .

'We entered other sheds where "Field B" and other well-known cartridges of the firm were being loaded, and included in the tour were a number of magazines and glazing sheds. We passed several large woodstacks for charcoal making, and on a creek, connected with the sea, was floating one of the private barges which convey the powder to Messrs HALL'S large magazine at Tilbury.

'Messrs JOHN HALL & SON LIMITED, have a very great output of all kinds of powders—military, blasting, and sporting, which are again subdivided into many classes and qualities, each of which has its department of skilled labour. We saw in the offices at Faversham several specimens of the firm's productions, which range in size from enormous cartridges to dust-like powder.... The house of one of the Managing Directors, Mr C L Watson-Smith, stands prettily embowered at the home works.... [The Factory has] been quoted by an eminent expert as the most model extant....

'The works themselves, with their almost idyllic setting of winding waterways and leafy glades, are more akin to a beautiful private park than one's idea of an industrial centre.'

One of the most notable achievements at the Faversham factory came in 1899, shortly after the amalgamation with Messrs Curtis's & Harvey, when it succeeded in devising the only explosive of the gunpowder type which passed the Woolwich test for the 'Permitted List'. This list was issued by the Home Office under the provisions of the Coal Mines Regulation Act 1896, and it included only those charges which could be used for blasting purposes without risk of igniting fire-damp. First produced in the form of 'Bulldog' pellets, and later known as 'Bobbinite', it was the only low explosive on the 'Permitted List', and was in great demand from the start.

#### Expansion at Uplees: The Cotton Powder Company

After the Faversham disaster of 1847 improvements were gradually made in the processes used for the manufacture of guncotton, and after a time its manufacture was resumed in this country. One of the earlier firms in the field was the Cotton Powder Company Ltd, which was registered in 1872 and in the following year established its first factory on the shore of the Swale, about half a mile north of the hamlet of Uplees. The site was in the parish of Oare, and for this reason it was sometimes referred to as the Oare Works.

The choice of this position had more to do with its flatness and isolation and the availability of skilled and experienced labour than with other considerations, such as the local availability of raw materials. Water power was no longer a factor, as machinery could be driven by steam engines, which could if necessary be sited well away from it. Transport was no problem, as the new works faced a navigable tideway.

At first the new concern made Punshon's Patent Controllable Cotton Gunpowder or Guncotton, in which sugar was used to 'control' the action of guncotton. Owing to its tendency to absorb moisture, however, this compound proved a complete failure, and in 1874 it gave way to 'Tonite', an improved version of guncotton, which was patented in the same year by George Trench, the Faversham factory manager, in conjunction with two other explosives experts. 'Tonite' was an introduction of great and lasting importance which assured the future of the new factory. There were three different varieties, but the one generally used was an intimate mixture, in approximately equal parts, of guncotton and barium nitrate. These ingredients were ground together in an edge-runner mill and the mixture was formed into blocks or slabs of any desired size or shape by means of hydraulic presses.

Commercially, 'Tonite' won prompt acceptance in the mining in-

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dustry, for which it was made in the form of candle-shaped cartridges, fitted at one end with a recess to take a detonator, and covered with paraffined paper. A dense explosive, containing its own oxygen for complete combustion, it was safe in action, and for many years had the advantage that the railways would carry it under the same conditions as gunpowder while they would not accept dynamite. To cope with the demand another factory was opened by the company at Melling in Lancashire in 1880, and it was also produced in San Francisco by the Tonite Powder Company. Large quantities were used in the construction of the Manchester Ship Canal from 1887 to 1894.

Shortly after the introduction of 'Tonite', Trench introduced his rocket distress signal containing the new explosive, and this was adopted exclusively by the Board of Trade. Large quantities were produced at Faversham, and in 1938 the 'Tonite' rocket distress signal was still being supplied to the Merchant Navy as the only official signal. The explosive itself also gained official approval, for the Trinity House authorities commenced, and in 1938 were still continuing, to use it for lighthouse sound signals and also for wreck disposal. Devices based on 'Tonite' are still being made and marketed today (1967) by Imperial Chemical Industries Ltd, and the trade name is still used.

On 3 February 1875, not long after the opening of its new Faversham factory, the Cotton Powder Company Ltd arranged a tour and demonstration for a party of over 100 visitors, which was reported at some length in the *Illustrated London News* ten days later. After emphasising the stringency of the safety precautions at the works, the paper's reporter went on to record:

The main feature in the manufacture is the complete pulverisation of the guncotton by powerful steel mills into an impalpable dust, whereby the thorough washing of that material, and its most intimate incorporation with the chemical substances which are added to form the cotton gunpowder, are attained in a manner never before approached. It is this purity of the guncotton, and the peculiar qualities of the oxidising substances added to it, that give to the new powder its excellent qualities, rendering it stable and certain in every climate and under all circumstances. The air-washing of the guncotton, which has proved such an efficient means of cleansing it, was also a

most interesting operation. A ton of the pulverised gun-cotton is put at a time into a huge vat of water, and kept constantly in ebullition by air blasts driven through it.

The demonstrations, which were illustrated in accompanying sketches, were designed to show how powerful even a small charge of guncotton could be. Two 30 lb ground mines made 'huge craters', one 22 ft in diameter and 10 ft deep, while charges of 2 lb and  $2\frac{1}{2}$  lb were used to smash steel ingots 8 in and 11 in square respectively. 'The finale was the throwing up of a beautiful fountain by a sea-torpedo containing 50lb of the powder.' As the contributor was at pains to stress, guncotton could be particularly useful to the engineer, mine operator or quarry owner.

In 1887 Trench, a prolific innovator, invented a fire-extinguishing compound designed to eliminate flame when 'Tonite' cartridges were used in mining operations. Though the composition proved successful, it was another fifty years before attention was given to sheathed explosives of this kind.

But production at Uplees was not limited to 'Tonite' and its derivatives. With spare capacity after the Melling factory opened in 1880, the works began to produce a range of ammonium nitrate explosives, one of them known as 'Faversham Powder', though in the end most of it was made at Melling. In 1892 a nitro-glycerine plant was opened at Faversham, and the manufacture begun of gelatinous blasting explosives for quarries and coalmines. Production of cordite began in 1896, and by 1911 Faversham was also making hand and rifle grenades, fulminate of mercury, detonators and electric detonator fuses.

With all this expansion, the factory grew rapidly. In 1876, within three years of its opening, there were already thirty-three buildings in the works area, and by 1899 the number had risen to about 150. There were over seventy staff in 1882, and 120 in 1889.

Inevitably there were accidents. In 1896 a fire at the factory offices destroyed the firm's books and records. Three years later, after another incident, the works was visited by HM Chief Inspector of Explosives, who described it in the following terms:

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The buildings are for the most part placed at suitable distances apart to provide against the communication of explosion from one to another, some being surrounded by substantial mounds. It would be impracticable to place the buildings of a factory so far apart as to ensure that heavy pieces of wood and parts of machinery could not be expected to be projected by an explosion in one building on to others; the work could not readily be carried on with buildings at such distances from one another, and the area of a site for a factory for explosives would have to be so extended as to be prohibitive to manufacture with profit. Trees have been largely employed as a protection to the buildings against projected debris. Unfortunately, owing to the saltings on which the Cotton Powder Factory is situated, it has hitherto been found impossible to make either trees or shrubs grow there.

By 1909 the Uplees factory had grown still further [Page 38], occupying about 250 acres of land and comprising about 227 buildings of various kinds. Steam, for driving machinery, boiling chemicals and drying explosives, was raised by seven boilers in three separate boiler houses, between them capable of developing 1,800 hp. Owing to the unstable nature of the subsoil chimneys could not be built, and draught was fan-induced. Dispersed about the factory were twenty-five smaller steam engines, rating 400 hp in aggregate, and there was a single gas engine. An electric generator provided current for lighting the plant for the recovery of volatile solvents, but otherwise lighting was by gas, the factory having its own gasworks capable of producing 20,000 cu ft a day. Water was drawn from three artesian wells by pumps with a combined capacity of about 14,000 gallons an hour.

In almost every way it was a very modern factory for its date. As many services as possible were centralised, and there were for example two compressed-air mains (of 80 lb and 40 lb pressure), three hydraulic mains (one high-pressure and two low-pressure), and over three miles of large-bore steam pipes used for drying and boiling purposes. The whole works was served by mains and hydrants from a hydraulicpressure fire installation, and a full head of water could be turned on any building in the course of two minutes.

The company owned a fleet of eight barges, together with a dock and slipway for repairs. Within the works was an extensive system  $(4\frac{1}{2} \text{ track miles})$  of narrow-gauge (3 ft 3 in) tramways, with a suitable range of

rolling-stock. The complexity of this network, with its microcosm of main lines, branches and sidings, is clearly illustrated in the 1921 printing of the 1 in Ordnance Survey plan (sheet 116.)

#### Two more Factories in the Faversham Area

In 1904 Messrs Helcke established a factory near Harty Ferry, also in the parish of Oare, for the manufacture of fulminate of mercury, a product used in detonators. This works was taken over four years later by Messrs Eley Brothers Ltd, an old-established London firm specialising in the production of sporting ammunition. During the 1914–18 war the company expanded its range to include guncotton, and its premises were extended.

In 1913, Nobel's Explosives Company Ltd, a much larger firm, made plans to build a huge factory on a 923-acre site on the other side of the Swale, at Harty itself, with easy access to the Thames estuary. Nobel's main factory at Ardeer had built up a thriving export trade, and it needed additional capacity, preferably in the south of Britain. The site was bought and a draft licence obtained from the Home Office. However, Nobel's underestimated the strength of the feeling the proposals would arouse, and in July 1914 the Sittingbourne magistrates refused permission for the project.

In the meantime one more explosives firm had been established in the Faversham area. This was the Explosives Loading Company, which in 1912 began building and equipping a factory, next to the premises of the Cotton Powder Company Limited, for loading TNT into shells and other munitions. Advice was given by experts from the Cotton Powder Company, and the factory began production towards the end of 1913 under the direction of Capt John Coke, RN. For a time at the beginning of the 1914–18 war this was the only private filling factory for high explosives, but in 1915 a similar works opened at Pembrey, Carmarthenshire, where Nobel's Explosives Company had had to build the TNT factory originally planned for Harty.

On 7 August 1914 (just after the outbreak of war), there was a spectacular explosion at Harty Ferry. Canon W. Telfer recalls it

vividly. A scout troop of which he was in charge had just broken camp near Selling Station ( $3\frac{1}{4}$  miles east of Faversham) and in the dusk he had tipped a bale of blankets on to the platform. Suddenly there was 'a huge flash over the northern sky', followed by a wave of warm air and a roar. Cycling into Faversham, he met with expressions of fear and mystification.

My suggestion that a mine had blown up in the Thames mouth was greeted with relief. But the morning of 8 August brought the truth. It was a detonatorhouse at the gun-cotton works by Harty Ferry that had exploded. The country was full of rumours of German agents making a last-minute 'get-away', and there was ready credence for the story that a bullet fired from the Sheppey shore by a German spy had been the cause of the detonators going up. The detonator-house seems to have been the only casualty. And a detachment from the Guards brigade promptly arrived to take over custody of the stock and to maintain security. And with that the excitement was over.

A much more serious incident—and the worst disaster in the history of the Faversham explosives industry—occurred on 2 April 1916, when over 100 employees lost their lives in a TNT explosion. Like many catastrophes, it was triggered off by a small incident whose significance was not realised until too late. Conditions were very dry, and early in the morning a grass fire was noticed near the premises of the Explosives Loading Company. At first it was not taken seriously, but after a time it was recognised to be out of control and the Volunteer Fire Brigade was summoned from Faversham.

Meanwhile the blaze was coming perilously close to a large shed in which 80 tons of TNT and a quantity of ammonium nitrate were stored. Workers from the factory fought desperately to prevent the flames spreading to the shed, but failed. Though it caught fire, disaster could still have been averted if the flames had been brought under control, and efforts to do this continued; but these too failed, and a couple of relatively small explosions were followed by one of devastating proportions which did vast damage to the factory and the adjacent works of the Cotton Powder Company.

Eyewitness accounts of the effects of the disaster were recorded for the Faversham Society in 1964 by Miss M. Telfer (sister of Canon





Main source of water-power for the home works: the stream in Water Lane, Ospringe, looking N, about 1900

Incorporating gunpowder with pestle and mortar (from an old engraving)



Incorporating gunpowder in a stamp-mill (from an old engraving)



Storekeeper's house (later St Ann's House), Home Works (later St Ann's Estate), in 1963



Aerial view of Marsh Works, looking NE, about 1930



PERSPECTIVE VIEW STUR LATERION.



A pair of incorporating mills at the Royal Gunpowder Factory, Waltham Abbey, 1830

A gunpowder factory eighty years ago: Royal Gunpowder Factory, Waltham Abbey, 1884 (from Walford, Greater London, 1898, i. 397)





Sailing barge in the dock at the Marsh Works, c 1920 (saltpetre store in the background)



Incorporating mill of the type in use at Faversham, c 1920



(Top) Gunpowder being carried by punt at Faversham, c 1920 (Centre) Press house and tramway at Faversham, c 1920 (Bottom) Corning house, Oare Works, Faversham, c 1920



 (Top) Factory staff outside the offices of the Cotton Powder Company Ltd, Uplees, 16 October 1915
(Centre) Mass burial of victims of the Uplees explosion, Faversham Cemetery, 6 April 1916
(Bottom) The head of Oare Creek about 1916, with the level crossing of the Davington Light Railway in the middle distance (left of centre)



(Top) Marsh Works: offices, stores and foreman's cottage in 1965 (Bottom left) Oare Works: remains of Magazine No 1 (Factory Magazine) in 1965 (Bottom right) Site of incorporating mills by foreman's house (now the White House), Oare Works, 1965



Chart Mills, Home Works: volunteers from the Kent Archaeological Research Groups Council clearing the site, March 1967



(Left) Chart Mills, Home Works: machinery of the surviving mill, October 1963 (Right) Chart Mills, Home Works: waterwheel and gearwheel, March 1967

W. Telfer) and the late Sydney Wilson. Mr Wilson, later Town Clerk of Faversham, was a member of the Volunteer Fire Brigade at the time, and recalls that the first big explosion took place before the fireengine had time to get started.

We had an American-type petrol engine, horse-drawn, but on this occasion we lashed it to the back of a . . . lorry, and I stood in the lorry looking over the bonnet, signalling to the fellow who was steering the engine behind. As we passed through Oare village and came up on the Uplees road overlooking the factories, a second terrific explosion occurred; and my only recollection of it really is seeing a fan of flame, the lorry momentarily pausing, and the engine behind coming cracking into it.

Eventually we got down on to the site, but there wasn't much for a fire engine to do, and we were engaged chiefly in picking up whatever we could find to lead to the identification of the people killed. The Lancashire Territorials, who were in the town at the time, sent a company down, and naval contingents came from Chatham and various places, doctors from the Isle of Thanet right the way up, and we were there till dusk, damping down any small outbreaks of fire. . . In the middle of the afternoon, whilst we were there, the nitro-glycerine plant blew up, with a terrific blast. . . When we got back to the town in the evening . . ., we just had time to get something to eat, and then a Zeppelin alarm came and we had to go on watch for the greater part of the night.

Miss Telfer recalls that the last explosion occurred about 1 pm, as she was walking to the Cottage Hospital for afternoon duty. When she got there, she 'found everybody very busy making some arrangements, because they had been rung up to say that there were a lot of men who were injured, and during the afternoon at about 3 o'clock they began to arrive'. People in the town of course had 'realised that something very serious had happened, and so they offered beds, blankets, mattresses, and they duly arrived during the afternoon'.

And the stories one heard were really amazing. One man had been blown through a window—clean through a window—and Mrs Andrews, the [Borough] Surveyor's wife, spent practically the whole afternoon taking small pieces of glass out of his face. Others, we were told to do just whatever we could—we took our scissors and slit up their clothes to get them out. One man had been thrown straight into the water, so you had to get him out of his very wet clothes, in which he was shivering; and one just had to do dressings. We were given more or less *carte blanche* to do whatever we could for them, and

beds and blankets and things all seemed to have arrived, and we just were busy until, oh, quite late at night.

Altogether 109 employees lost their lives in this disaster, and about 70 of the victims were buried in a mass grave, a dignified and notable feature of the Borough cemetery (Plate 9a).

The factory was afterwards rebuilt and remained in operation until the end of the war, after which it only fulfilled small orders. The damage was also made good at the premises of the Cotton Powder Company, where production of cordite during the war was second only to that of the Nobel factory at Ardeer.

The expansion of the three factories in the Uplees/Harty Ferry area during the war brought a large increase in the labour force required. Workers were transported by a light railway built from a station just west of the top of Dark Hill (Davington) (Plate 9b). The remains of this station and of a few earthworks along the line are still visible, though the track was lifted many years ago. One unusual feature of this railway, which was steam-worked, was that whole trains were run for 'Ladies Only' and 'Men Only'. A study of it is being made for the Faversham Society by Mr Michael Minter Taylor. There was no link with the South Eastern & Chatham Railway's main line from Dover and Thanet through Faversham to London.