



GUNPOWDER

INVENTION

Ingredients: saltpetre (potassium nitrate to supply the oxygen), charcoal and sulphur (brimstone) to provide the fuel, the sulphur serving to inflame at a relatively low temperature. The quantities were normally 75:15:10, but there were variations.

Gunpowder originated in China prior to the ninth century AD. By 1044 they knew how to make simple bombs and grenades. By about 1280 they had developed a true gun able to shoot missiles such as arrows. Greek fire was introduced in Byzantium in the 7th century but this was based on distilled petroleum and was a totally different method from that of the Chinese which was based on the use of saltpetre. This latter method was introduced to Europe via the Arab world in the 13th century.

HISTORY

In the thirteenth century it seems the west only understood the explosive and pyrotechnics and not the propellant form of saltpetre mixtures (i.e. gunpowder). This was developed in Europe in the 14th century and by 1350 small cannon were fairly common.

The first recorded use of gunpowder by English soldiers was at the battle of Crecy in 1346, but there was no plant for proper manufacture and small quantities were made by hand with a pestle and mortar. Most was made by gunners in the arsenals and some was made as required in the field as the early product did not travel well, separating into its constituent ingredients. Even when water-driven mills were used the supply was still inadequate and at the time of the Armada ships had to cease firing while tenders were sent into bays to collect more powder.

It was obvious that proper organisation was necessary and a system of contracting with manufacturers was introduced. From 1589 certain makers were licensed by letters patent. Interestingly it seems that these appointments were held almost exclusively by Surrey men and this, coupled with the county's share in the iron ordnance trade, made Surrey of particular strategic value to both sides in the Civil War. One of the licensed families was the Evelyns of Tolworth, Wotton and Godstone.

THE EVELYNS

John Evelyn claimed that his ancestors introduced the gunpowder mill into England and, although this is not strictly correct, nevertheless the family does appear to have been involved significantly in the development of the industry.

As part of the new organisation of the industry, and the Royal appointment of manufacturers, in 1589 the Government contracted with George Evelyn, his son John, and Richard Hill, granting them a licence for eleven years to dig and obtain saltpetre and to manufacture gunpowder.

Under James I the appointments of gunpowder makers became a monopoly. Separate commissioners were appointed and by 1621 the obtaining of saltpetre and gunpowder was the responsibility of the Admiralty.

From 1607 to 1617 the monopoly was held by the Earl of Worcester, keeper of Nonsuch, who subcontracted to the Evelyns. Their Tolworth mills probably closed in 1606-7 but they also had established mills at Wotton and Godstone. The former were run by Richard Evelyn, the youngest son of George, and closed sometime before 1625.

The Godstone mill was operated by George Evelyn's sons, John and Robert, who held the monopoly until 1636 when it was given to the mills run at Chilworth, near Albury. The Godstone mill was originally a corn mill until George Evelyn acquired the property. It closed shortly after 1636, it is said because of a dispute with Charles I over non-payment. Frustratingly there seems to be little information available regarding the time the Evelyns operated the mill.

MANUFACTURE

The saltpetre and sulphur were refined, wood was burned for charcoal. These ingredients were pulverised, weighed, mixed and incorporated by grinding and crushing them into a mixture known as mill cake. This was broken down, pressed into hard slate-like sheets of press cake, corned (formed into grains), dusted, glazed and finally dried.

Roll sulphur rather than flowers of sulphur were used for the explosive manufacture and John Evelyn had definite ideas about the type of wood used to produce the charcoal. Of hazel he said 'it makes one of the best coals used for gunpowder, being very fine and light'. He then continues that alder was later found to be 'more fit'. Others did not remark on any preference between hazel, alder, willow or dogwood..

Preparation The saltpetre was dissolved, boiled and re-crystallised. Sulphur, imported from Italy and Sicily was distilled

Incorporating The early method was by pestle and mortar, originally by hand then by horse-driven or water powered camshaft. It was in the later manufacturing process of the 17th century that mills with stone edge runners were introduced.

The charge was moistened from time to time during incorporation which took about 2 hours for blasting powder and 8 hours for the sporting grades. Like the iron industry production was continuous with the workforce on shiftwork. In the 19th century steam engines and then water turbines were introduced.

Breaking down When mills with edge runners replaced the pestle mills, to increase the density the mill cake was crushed into a convenient form for loading into the press.

Corning Originally gunpowder was simply incorporated and dried but this meant it did not explode consistently and the ingredients could separate out. In the 16th century, therefore, the practice began of forcing it through punched parchment sieves to form 'corn powder'. Later this method of corning by hand was replaced by mechanisation.

Glazing and Drying From about 1680 glazing was done by tumbling the powder in barrels in order to round the grains and cause inferior ones to disintegrate. In the 19th century black lead was used to coat the grains to make them resistant to moisture.

Packing and transport Traditionally packed in oak barrels and kegs, the 100lb (44kg) barrel being used as the standard unit of weight. Most mills had their own cooperage, employing a large number of the workforce. Small quantities of powder were sold in metal flasks and canisters and cartridges, which were packed in boxes. Transport within factories was by punt on millstreams and tramways to connect different buildings, with trams pulled by horses or pushed by men. Storage was in magazines where it awaited collection. Buildings were spread over a wide area for safety reasons.

Long after 'black powder' had been superseded by cordite the trade for the blasting type for quarries continued. Compared with the narrow area round the charge affected by dynamite a charge of 'blasting' fractured large faces of slate, granite, sandstone, limestone and chalk and shattered the rock to a great depth.

SALTPETRE MEN

Saltpetre is found naturally in India and the Far East, but not in Europe, so it had to be made artificially.

We did not know the secret here in England but while Mary was on the throne we were able to either store ingredients, or the gunpowder itself, in wharves in Antwerp. As this was a Spanish possession, presumably a licence from the King of Spain was required, so when Elizabeth came to the throne for obvious reasons we lost the facility and had a dire need to learn how to make saltpetre ourselves. Fortunately we had a considerable number of refugees from religious or political prosecution who had sought asylum in this country and among them was a German captain by the name of Gerrard Honrick. He knew how to make the artificial substance and his services were requisitioned by the Government. On the 13th March 1560 an agreement was made between him and the Queen and for the sum of £300 he agreed to pass on his knowledge.

The ingredients were earth 'the blacker the better', animal excrement, lime and ashes. The lye had to be exposed to the air in dry and cold places and watered at intervals with urine. From time to time it had to be turned.

This gave rise to an extraordinary new trade - the saltpetre man - and as the Evelyns at Godstone would have employed their own, there must have been local men who were part of the trade.

It was vital that the supply of saltpetre was maintained and to ensure this the patents of appointment of the men meant that they had the right of access to private property, to all dove houses, barns, stables, outhouses, cellars, vaults, warehouses, latrines, pigpens and manure heaps. They then had to dig out the excrement and the rich dark soil around it and cart it away in barrels.

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Once the lye was ready it was dissolved in water, brought to the boil and allowed to crystallise. These crystals were mixed with blood or glue, the scum taken off the top and then the mixture re-crystallised and washed. Finally the refined saltpetre was delivered to the State-licensed gunpowder makers.

Inevitably there were complaints about the behaviour of the men involved and about the rules which applied. The men also submitted complaints regarding the difficulties put in their way to prevent them carrying out their work.

So that pigeons, for example, would not be unnecessarily disturbed, the operations were to be confined to half an hour in the day, with compensation to owners for any pair of pigeons or eggs lost. In 1625, however, the saltpetre men could work two hours a day in the dove or pigeon houses. The owners were strictly prohibited from paving the floors of such houses with stone or brick.

The men were ordered to re-erect, at their own expense, any building that might be pulled down or under-mined. Disputes were referred to JPs.

No place from which earth had been dug was to be disturbed again for a specified number of years - in 1604 John Evelyn fixed this at six years, except in the case of unusually increased demand. It was, therefore, very 'rich' when it could be collected again.

The men were badly paid, most money going to the gang masters.

It must all have become much easier when saltpetre could simply be imported from India, but it seems a little ridiculous to think that an industry generating such wealth, and upon which the defence of the realm relied, depended totally on excrement and urine.

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