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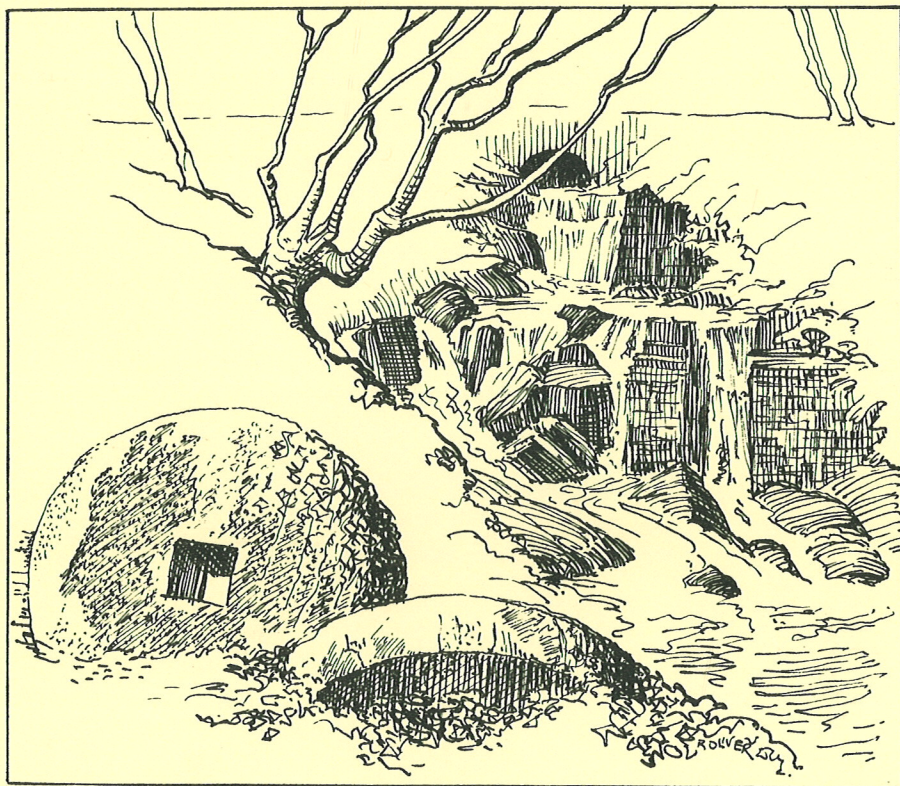
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A GUIDE TO THE CHILWORTH GUNPOWDER MILLS

by Glenys Crocker

with drawings by Rowena Oliver



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"In this little pleasant Valley, the Springs serve not only to water the Grounds, but for the driving of 18 Powder Mills, 5 whereof were blown up in a little more than half a Years Time. 'Tis a little Commonwealth of Powdermakers, who are as black as Negroes. Here is a Nursery of Earth for the making of *Salt-Petre*: There is also here a Boyling-House, where the *Salt-Petre* is made, and shoots; a Corneing House, and separating and finishing Houses, all very well worth the seeing of the Ingenious. I had almost forgot the Brimstone Mill, and the Engine to search it."

John Aubrey, late 17th century

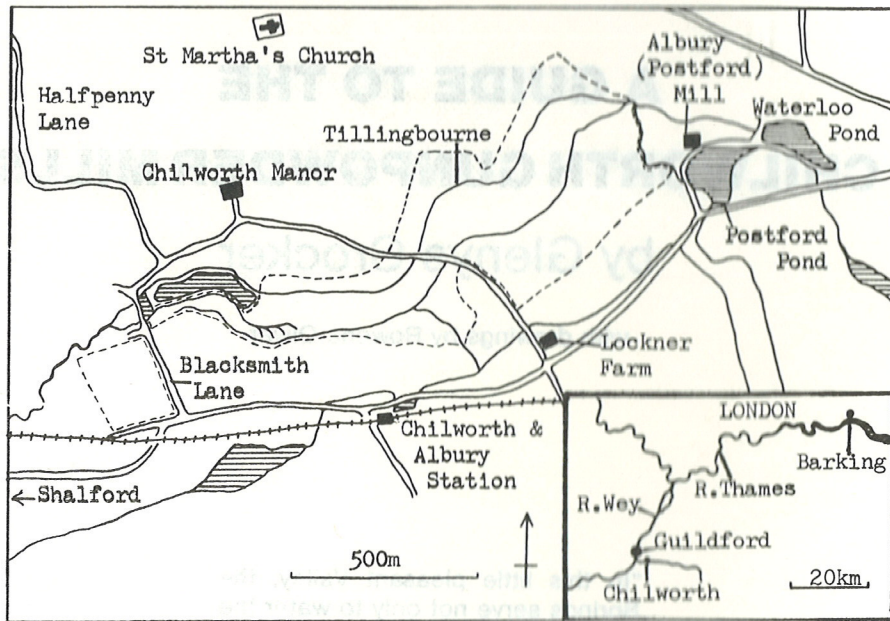


Figure 1. Location map. The mills were situated on the Tillingbourne, a tributary of the River Wey, which originally provided water power for the various manufacturing processes. Barges brought saltpetre and sulphur up the Thames and the Wey and Godalming Navigations and in return took gunpowder to a magazine at Barking Creek on the Thames estuary. The railway was also used after 1888 when an agreement was made to link the works' tramway with Chilworth & Albury station. The area within the broken line shows the maximum extent of the factory in the early 20th century.

This booklet is based on the Field Guide section of the author's book *Chilworth Gunpowder*, 1984, with a new introduction and illustrations.

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Front cover: stone edge runners and derelict water wheel pit (18).

HISTORY

Gunpowder was made in England by hand from the 14th century onwards and a mechanised industry using water power was established in the 16th century, in the reign of Elizabeth I. Beginning in 1589 manufacturers were appointed by Royal letters patent and in the 17th century the industry became a Crown monopoly. The early industry was concentrated in Surrey, with the Evelyn family holding most of the appointments and later the monopoly. Their mills were at Tolworth and Godstone and also at Wotton, 10km up the valley from Chilworth.

The Chilworth mills appear to have been started in 1625 by the East India Company, which was licensed to manufacture gunpowder for its own use. The Company had trouble with the mill dam and was in dispute with the landowners, the Randylls of Chilworth Manor, over repeated flooding. Its venture lasted only ten years but the mills continued to operate under new proprietors, Collins and Cordwell, who were appointed sole powder makers to the King in 1636.

When the monopoly system was abolished in 1641, the industry began to develop in other parts of south-east England, but Surrey continued for a time to be the main producer. Chilworth supplied the Parliamentary side in the Civil War of 1642-52. From the 1650s the mills were run by Vincent Randyll, who owned the manor of Chilworth. Then in 1677 they were leased to Sir Polycarpus Wharton, who greatly expanded the works in order to carry out contracts for the Board of Ordnance and eventually found himself imprisoned for debt. The mills at this time stretched from west of the modern Blacksmith Lane to Postford Pond and comprised Lower, Middle and Upper works (Figure 2).

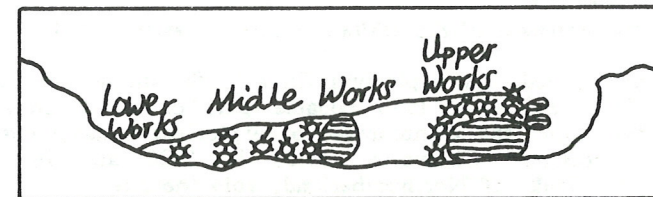


Figure 2. Sketch plan from John Seller's map of Surrey, c. 1693.

After Sir Polycarpus, Chilworth declined and throughout the 18th century and much of the 19th, only the Middle works survived. The Lower works became paper mills in 1704 and the Upper ones were abandoned (back cover) until the 19th century when paper mills were built also at Postford and Paynes (Waterloo) Ponds. Proprietors of the powder mills included Francis Grueber in 1728, Isaac Dent in 1778 and up to 1790, William Tinkler from 1790 to 1819, the Sharp family from 1819 to 1881 and C. Marcus Westfield from 1881 to 1885.

Figure 3 shows developments from the early 19th century onwards. The first significant expansion was in the early 1860s when steam power was introduced. Then in 1885 Chilworth was at the forefront of the development of a new type of powder for use with heavy guns. The Chilworth Gunpowder Company was formed as a subsidiary of a German company and the works were extended to the east. However this phase was short-lived because of the introduction of high explosives and propellants based on new chemical technology. In order to manufacture these products, a new 'smokeless powder' factory was built in the 1890s east of the gunpowder works. A further area was developed by the Admiralty during the First World War of 1914-18.

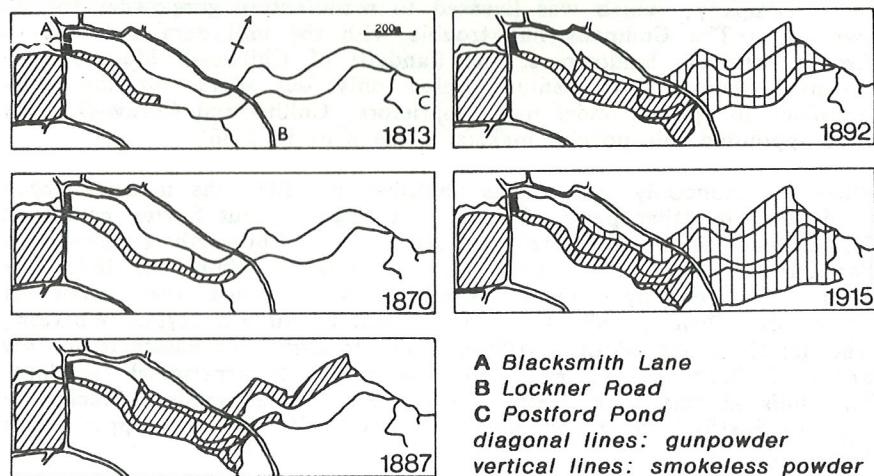


Figure 3. Development of the Chilworth powder works 1813 - 1915.

After the war ended, the explosives firms in Britain merged into Nobel Industries Ltd, which in 1926 became part of ICI. Most of the factories closed and the manufacture of explosives became concentrated largely in Scotland. Chilworth closed in 1920 and in 1922 the landowner, the Duke of Northumberland, sold the site.

HOW GUNPOWDER WAS MADE

Gunpowder is a mixture consisting of about 75% saltpetre or potassium nitrate, 15% charcoal and 10% sulphur. Saltpetre was imported from India from the late 17th century onwards and was earlier made from manure which was collected mainly from pigeon houses. Sulphur was imported from Italy and Sicily and charcoal was made from alder, willow and dogwood (alder buckthorn) from local coppices. The wood was charred in stacks until the late 18th century but from then on superior 'cylinder charcoal' was made in cast iron retorts. At Chilworth the ingredients were prepared and refined west of Blacksmith Lane.

The ingredients were separately pulverised and then mixed to produce the charge for the incorporating mills. Until the 18th century stamping mills were used which had rows of mortars and pestles worked by a cam shaft. These were then replaced by edge runner mills (figure 4). The charge of 40lbs (18kg) and later 60lbs (27kg) was moistened, placed on the bedstone and worked under the revolving edge runners for several hours to form a paste known as mill cake. Incorporating mills provide the most common and distinctive remains of the industry, of which some can be seen in the central area at Chilworth.

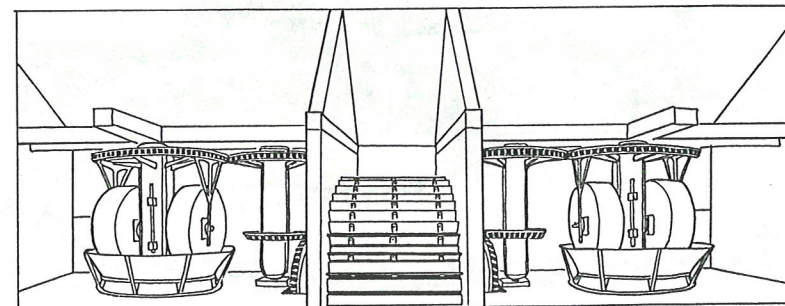


Figure 4. A pair of incorporating mills driven by a central water wheel, based on a drawing from the Royal Gunpowder Factory at Waltham Abbey, Essex, 1830. The water wheels at Chilworth were greater in diameter but narrower.

The mill cake was pressed between stacks of copper sheets to make hard, dense slabs of press cake. This was then corned or granulated, originally by forcing it through sieves and later by passing it through machines with toothed gunmetal rollers. The granulated powder was dusted by tumbling it in silk-covered cylinders, glazed to give it a moisture-resistant surface, sometimes with the addition of black lead, and dried in stoves. It was then packed in oak barrels and stored in the factory magazine to await dispatch.

Powder for heavy guns in the late 19th century was formed into the shape of cylinders and prisms. The Chilworth Gunpowder Company in the 1880s made brown prismatic or 'cocoa' powder which was produced with brown charcoal made from straw and was nearly smokeless. Traditional gunpowder became known as black powder in the late 19th century, to distinguish it from newer products.

The high explosives which were made from the 1890s onwards were based on the nitration of glycerine, cellulose and other organic compounds. Cordite for example was made by kneading together nitroglycerine, guncotton (nitrocellulose) and mineral jelly with acetone as a solvent. The resulting paste was forced through dies to make long cords which were then grouped together, or blended, and dried.

THE WESTERN END: THE LOWER WORKS

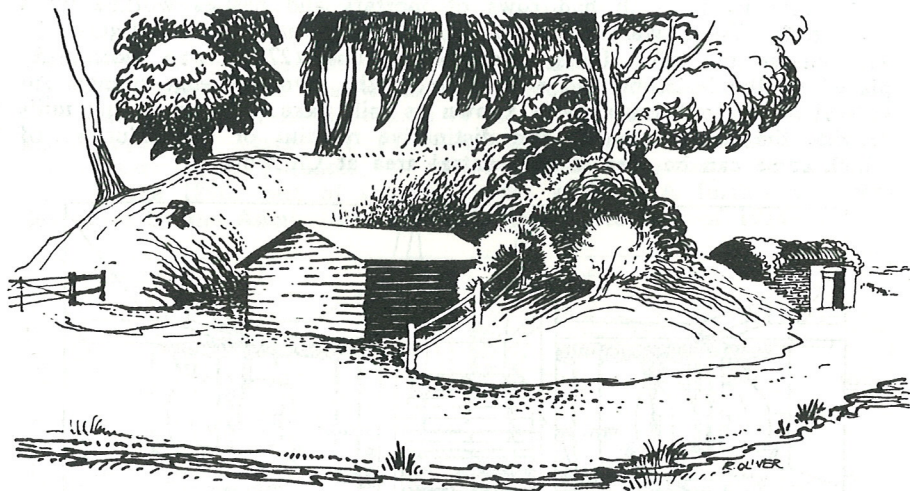


Figure 5. Mound of the factory magazine (9). The powder was unloaded at the small building on the right, at the end of the tramway.

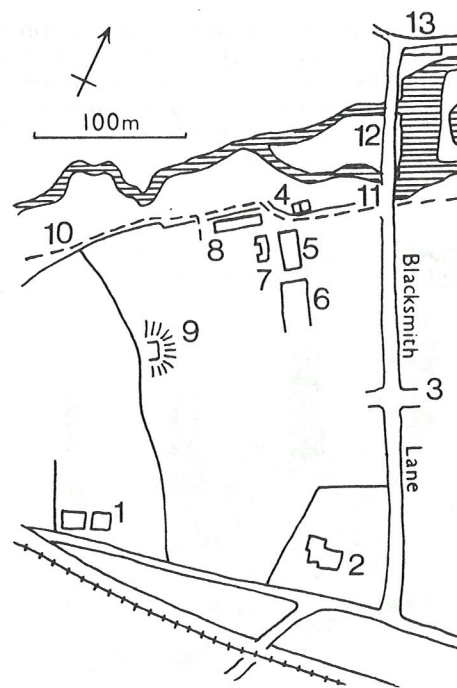
The area west of Blacksmith Lane has been redeveloped for residential and industrial use but some features of the gunpowder works can be seen from the road and the public footpath leading to East Shalford.

Starting from the railway level crossing, Magazine Cottages (1) were built in about 1890 for gunpowder workers. The Old Manor House (2) has the date 1609 over the porch but has been much altered. It was formerly called 'Powder Mill House' and acquired its present name by the 1880s. The German manager of the Chilworth Gunpowder Company lived here from 1887 to 1906.

Proceed NNW along Blacksmith Lane. The works' cricket field was on the right where now there are houses. The 25in Ordnance Survey Map of 1896 shows a tramway crossing the road near the present Halfpenny Close (3) and leading to the magazine (9). Turn left along the footpath (11). The Old Cottage and Rose Cottage (4) appear to have been converted from the drying loft of a paper mill, known as the Little paper mill, which was behind them but of which no trace now remains. The present shed factory (5) is on the site of the saltpetre refining house and the building behind it (6) corresponds to the charcoal house. The Bungalow (7) was an office and laboratory and the long re-roofed building was the workshop and stores (8). The factory magazine (9 and figure 5) was surrounded on three sides by a crescent shaped mound now enclosing a stable. This is in a private garden but can be seen from the footpath (10).

Return to Blacksmith Lane and view the mill dam. This was probably the site of the corn mill listed in the Domesday survey of 1086 and of a fulling mill recorded in the 16th century. There were also wire mills at Chilworth at the beginning of the 17th century. The mill pond served the original Lower powder works and the paper mills which replaced them in 1704. These became Unwin's Printing Works in 1871 but were destroyed by fire in 1895. Fortunately the fire was prevented from spreading to the powder mills. Unwins then moved to Old Woking and the site became a garden.

There was a leat to the Little paper mill from the south end of the dam, where some old brickwork can be seen (11). Beside this is a former pumping station of the St Martha's Waterworks of the Hambledon Rural District Council which used a turbine to pump water to a reservoir on St Martha's Hill for distribution to local villages. On the bridge, facing the pumphouse, is the inscription 'W T 1842', presumably referring to William Tinkler the younger, who then owned Chilworth Manor. The position of the water wheels can be seen over the wall (12). The cottages (13) are on the site of the paper mill rag house on a map of 1728 and of stables on the 1847 tithe map. The millstones nearby were not used locally.



The mill pond is a small rectangular pond which is dammed at both ends and fed by two streams. The one at the north side is the 'official' Tillingbourne and the one on the south is the accumulated tail-water of a series of powder mills ranged along the valley. Both streams however are above the valley floor so they must be artificial. The northern one is probably the original mill stream which served the early corn mill. The water in the valley bottom is culverted under the mill pond and the road. Until about 1980 there was little water here, and in the past there were hop gardens, but the area has been excavated and flooded to form a large pond for fishing.

Figure 6. The western end. Footpaths on this and following maps are shown by broken lines.

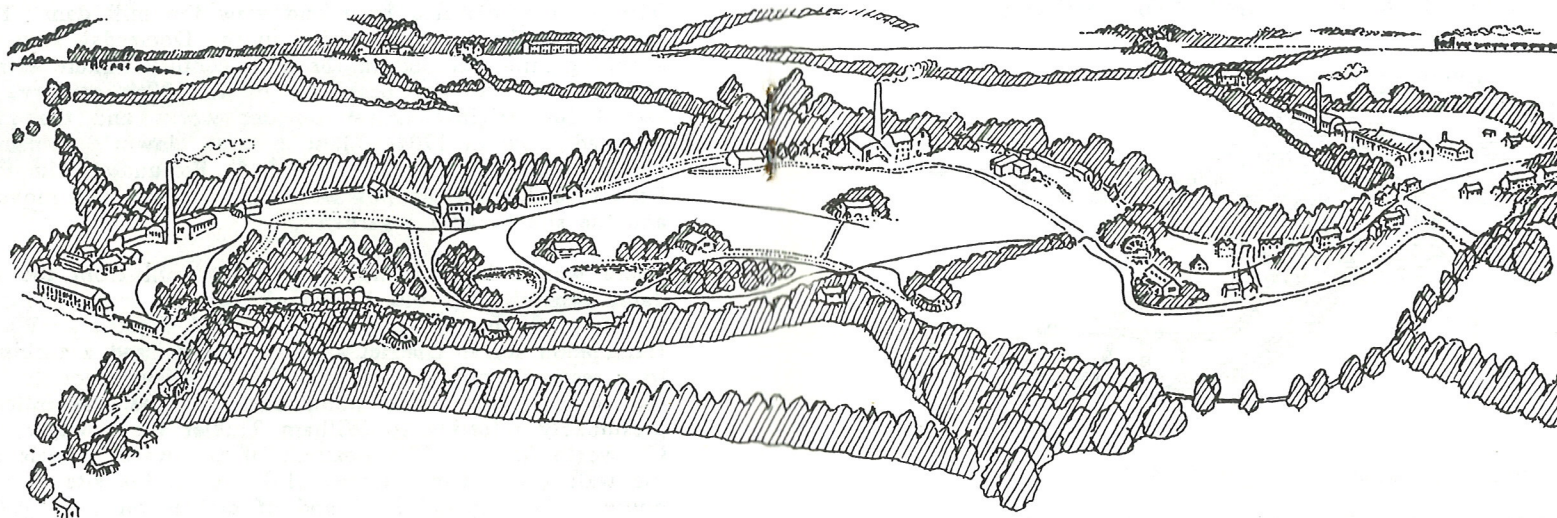


Figure 7. The Chilworth Gunpowder Company factory in about 1887, looking south from St Martha's. The chimney stack on the right is at the charcoal house. The central one is at the steam powered incorporating mills (20 and figure 8). Between the two a water wheel is shown (18). The chimney stack on the left is at the large concrete incorporating mills (27 and figure 9).

The drawing above also shows the works tramway, which was of 2ft 7¹/₂in (800mm) gauge. The mill stream was also used for transport, by punts, but is hidden by trees. The site was well wooded and the buildings were widely spaced in order to minimise the effects of any explosion. The drawing is based on an illustration in Wyman's Commercial Encyclopaedia for 1888.

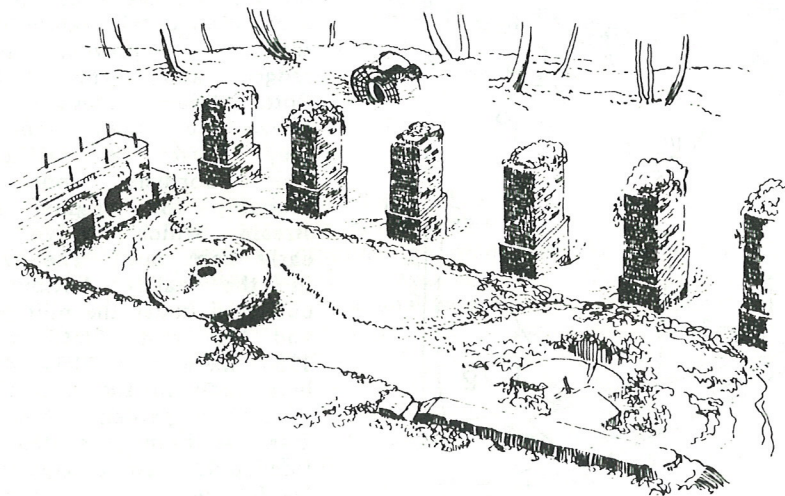


Figure 8. Remains of steam powered incorporating mills (20), showing two bedstones, a steam engine bed and the remains of the top of a chimney shaft in the background.

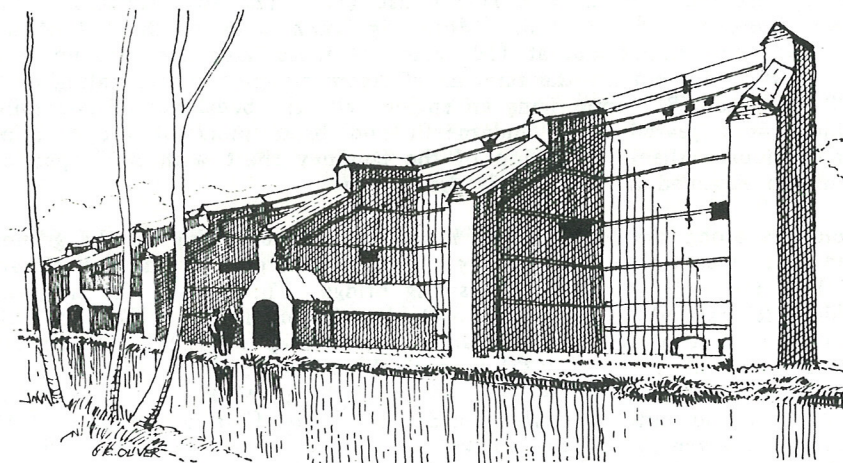


Figure 9. Row of six steam powered incorporating mills (27), c. 1885.

THE CENTRAL AREA: THE GUNPOWDER WORKS

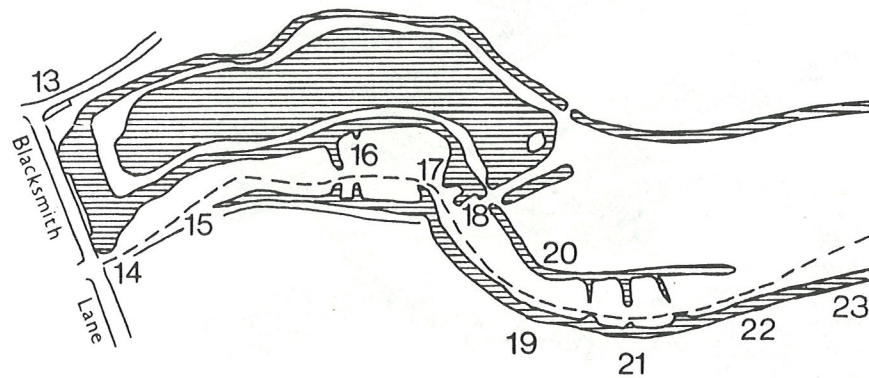


Figure 10. The central area, west.

This area is owned by Guildford Borough Council. Enter by the gate at the West Lodge of the old factory which is now part of a cottage (14). The footpath crosses a series of mill races which flow from the mill stream on the right to the tail water on the left. The mill stream peters out at its western end and first appears as a dry ditch along the fence.

The footpath crosses scant remains of the dusting house (15). After the first mill race, note the overgrown remains of a corning house (16) which exploded in 1901, killing six men. Before the next group of mill races there are ruins of a mixing house (17). The edge runners in the cover illustration are at (18). More edge runners lie to the left of the path as it continues and at (19) some of these have been set up in a row. Behind them are the remains of steam powered incorporating mills (20 and figure 8), comprising an engine bed, the bedstones of two mills which were geared from underneath and brick piers of the building which housed them. The top of the chimney shaft with its inspection platform attached is lying beside the stream.

Continue along the path, noting more edge runners lying on the ground and mill races which are now dry. A small iron post by the mill stream (21) is the only remnant of a swing bridge. The line of the tramway which it carried crosses the footpath diagonally. At (22) is the abutment of a bridge which is shown on a map of 1728. Just beyond the remains of a wharf (23) a path branches right, crosses the mill stream and leads to the A248 road to Dorking. Make a detour to the footbridge and note the swing bridge alongside (24) which after 1888 carried an extension of the works' tramway to a siding at the railway station. The moveable part is made of iron and the rest of wood.

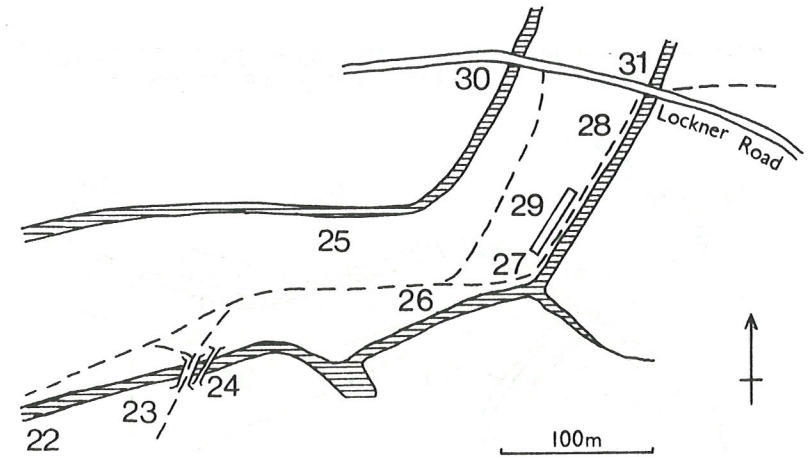


Figure 11. The central area, east.

Return to the main footpath and continue along the line of a tramway, noting some sleepers embedded in the path. The gauge was 2ft 7¹/₂ in. (800mm). The area ahead was developed largely by the Chilworth Gunpowder Company after 1885 for the manufacture of brown prismatic powder. An overgrown mound (25) represents a prismatic press house. Along the north side of the valley there are overgrown ruins of magazines and blending houses of the later smokeless powder works, but these are inaccessible. Just before the path forks, foundations of a corning house with a steam engine bed can be seen on the right (26). These date from the 1860s.

Take the right fork through a protective earth and corrugated iron embankment and reach a row of six concrete incorporating mills of c.1885 (27 and figure 9). Note the line of the flimsy roof structure, the wooden battens in the wall to which matchboarding was fixed, to guard against grit falling into the charge, and the lever system at roof level whereby an explosion in one chamber triggered a drenching mechanism in all six. When the factory closed, the edge runners, which at this period were made of iron, were taken to Ardeer in Ayrshire to be reused. Next are the remains of charcoal mills, a mixing house and a charge house (28).

Return to where the paths diverged and take the left fork which goes behind the incorporating mills. The boiler house for the steam engines and its associated chimney shaft were in this area (29). The path approaches Lockner Road where, on the right, were laboratories and stores and the East Lodge. These can be seen in the view of the factory in figure 7. Over on the left, near the road, are the overgrown remains of a stove (30) of the 1890s smokeless powder factory whose main location was east of Lockner Road.

**THE EASTERN END: THE SMOKELESS POWDER WORKS
AND THE ADMIRALTY CORDITE FACTORY**

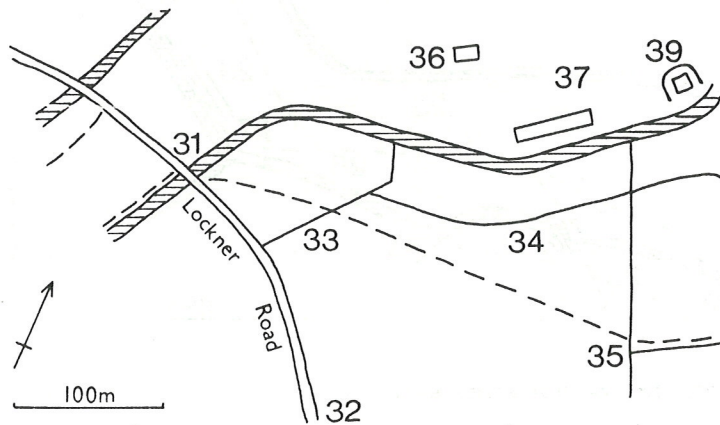


Figure 12. The eastern end, west.

On reaching Lockner Road, turn right and follow the lane SE, passing a gate on the left and stone sets in the road which mark the path of a tramway (31) and passing a public footpath sign on the left. Note the foundations of the men's and women's mess rooms of the Admiralty cordite works of 1915 (32). The women's mess room was removed to Peaslake where, as 'the Hut', it served as the village dance hall and cinema before being converted into cottages.

Turn back down the lane and take the public footpath to Postford Pond, over a stile, diagonally across the first field and over a second stile. Foundations only remain of most of the Admiralty buildings because these were largely demolished after the First World War. There was a magazine near the second stile (33), blending houses to the left of the footpath (34) and another magazine just before the next stile (35). Over on the left, beside the stream and on private land, are buildings of the 1890s smokeless powder works. The low white timber building with the corrugated iron roof (36) was a packing house and is now stables and the long red brick building (37 and figure 14) housed kneading equipment and hydraulic presses. Beyond is a house with five gables named 'Longfrey' (38) which was converted to a single dwelling in the 1920s. It was called 'Factory Cottages' in the 1880s and there was a barn on the site on the 1847 tithe map. The brick building with the large protective embankment (39) has the inscription 'DRYING AND EXTRACTION OF SOLVENTS' over the door. At (40) are two stoves for drying smokeless powder (figure 15) but these are on private land and are obscured from view by foliage during much of the year.

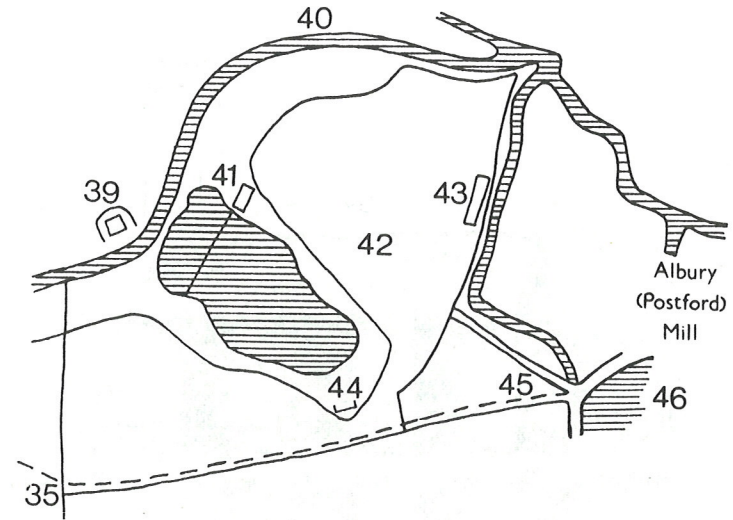


Figure 13. The eastern end, east.

The remaining features, which can be seen from the footpath, belonged to the Admiralty works built in 1915. The pond which comes into view was created in 1983. On its far side is the substantial ruin of a stove (41 and figure 16) which was converted into a dwelling after the factory closed. To the right of this are a few remains of the acetone recovery house (42) and further to the right is a row of cottages (43) converted from the former cordite press house by the Duke of Northumberland before he sold the site in 1922. These are still occupied. Note the line of the former rounded roof in the end gable. Close to the footpath on the left, just before the next stile, are the remains of another stove (44). Continue over the stile and follow the footpath alongside the fence. Join the former Factory Road of the Admiralty cordite works (45) near Postford Pond (46 and back cover).

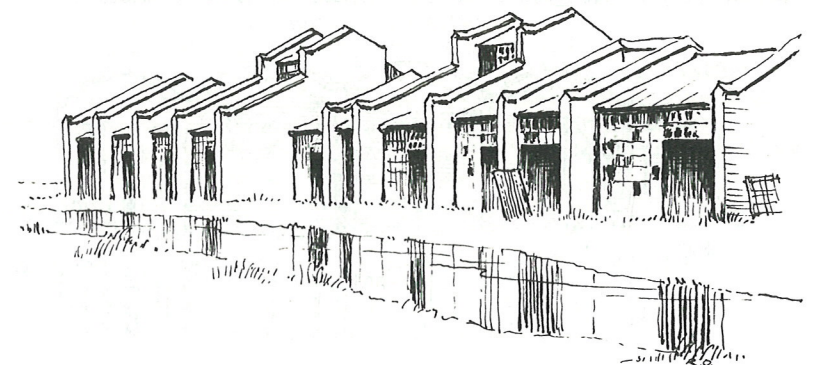


Figure 14. Kneading and press houses (37).

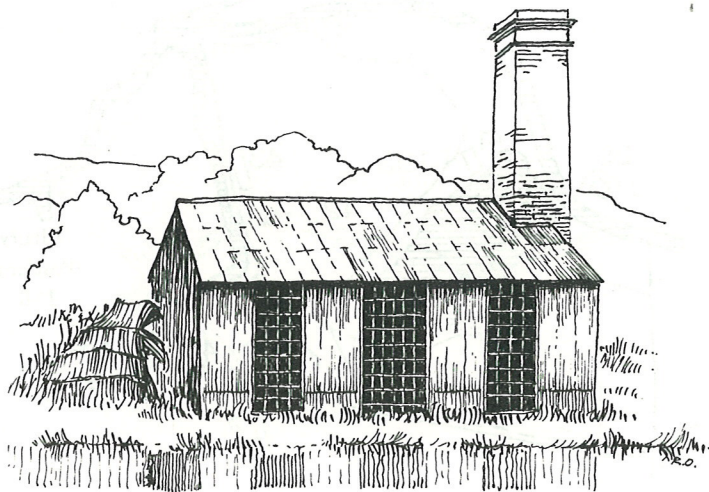


Figure 15. Stove of the 1890s smokeless powder factory with a protective mound of earth and corrugated iron (40). Embankments of this type were known in the explosives world as 'Chilworth mounds'.

At Postford Pond and at Waterloo Pond (formerly Pens or Paynes Pond), 200m upstream, there were powder mills in the late 17th century. These lay derelict in the 18th century (back cover) and then paper mills operated there from 1809 to about 1870. These were known as Postford Lower and Upper mills and they made paper for banknotes. The lower one, at Postford Pond, later became a flock mill and in 1909 was taken over by the Botting family who still run it as a corn mill and trout farm. On the hillside behind the ponds there were coppices of dogwood (alder buckthorn, *Rhamnus frangula*) which supplied some of the charcoal for the powder works. The wood there is called Colyers Hanger, after the colliers or charcoal burners.

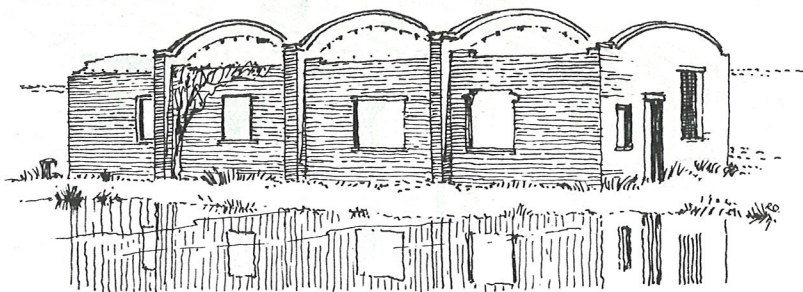


Figure 16. Stove of the Admiralty cordite works (41).

CHRONOLOGY

- 1625 The East India Company set up powder mills at Chilworth. Three mills blew up soon afterwards and two were rebuilt.
- 1636 George Collins and Samuel Cordwell appointed sole powder makers to the King.
- 1641 Monopoly system abolished by Long Parliament.
- 1642-52 Chilworth supplied the Parliamentary side in the Civil War.
- 1655 Vincent Randyll of Chilworth, George Duncombe and John Woodroff were masters of the powder mills.
- c.1673 Mills visited by John Aubrey and described in his *Natural History and Antiquities of the County of Surrey*, 1718-19.
- 1677 Sir Polycarpus Wharton directed by the Board of Ordnance to take a 21 year lease. He repaired and expanded the mills and was later imprisoned for debt.
- 1704 Chilworth Lower works converted to paper mills.
- 1710 Broadsheet issued: *The hard case of Sir Polycarpus Wharton, baronet*. This was reprinted in Aubrey's *History*.
- 1728 Survey carried out for Sarah, Duchess of Marlborough, who had bought the Manor. Mills leased to Francis Grueber, a member of a Huguenot family which owned several powder mills in Britain.
- 1755 Body blown over paper mill in an explosion.
- c.1763 St Martha's church tower said to be destroyed by explosion.
- 1778 Three men killed in an explosion. Isaac Dent was proprietor.
- 1790 William Tinkler succeeded Isaac Dent.
- 1796 Manor bought by Edmund Hill, powder maker of Hounslow.
- 1813 Manor purchased by William Tinkler.
- 1819 Powder mills leased to John Sharp.
- 1845 Manor purchased by Henry Drummond. It formed part of the marriage settlement of Louisa Drummond and Lord Lovaine, later 7th Duke of Northumberland.
- 1864 Explosion at press house, two men killed. Two also killed in explosion of a powder barge on the Godalming Navigation.
- 1874 Explosion at incorporating mill, one killed.
- 1879 Explosion at press house, two killed.
- 1883 Explosion at incorporating mill, one injured.
- 1881 Mills bought from J, T & S Sharp by C Marcus Westfield.
- 1885 Chilworth Gunpowder Company formed as a subsidiary of *Vereingte Rheinisch-Westphälische Pulverfabriken*.
- 1888 Agreement with South East Railway Company to link works' tramway with Chilworth & Albury station.
- 1892 Smokeless Powder Factory built.
- 1895 Fire at Unwins' printing works.
- 1901 Explosion at black powder corning house. Six killed.
- 1915 Cordite factory built by the Admiralty.
- 1920 Works closed.
- 1922 Site sold by Duke of Northumberland.

Note: explosions were frequent and the above list includes only the most serious known accidents.

ACKNOWLEDGEMENTS

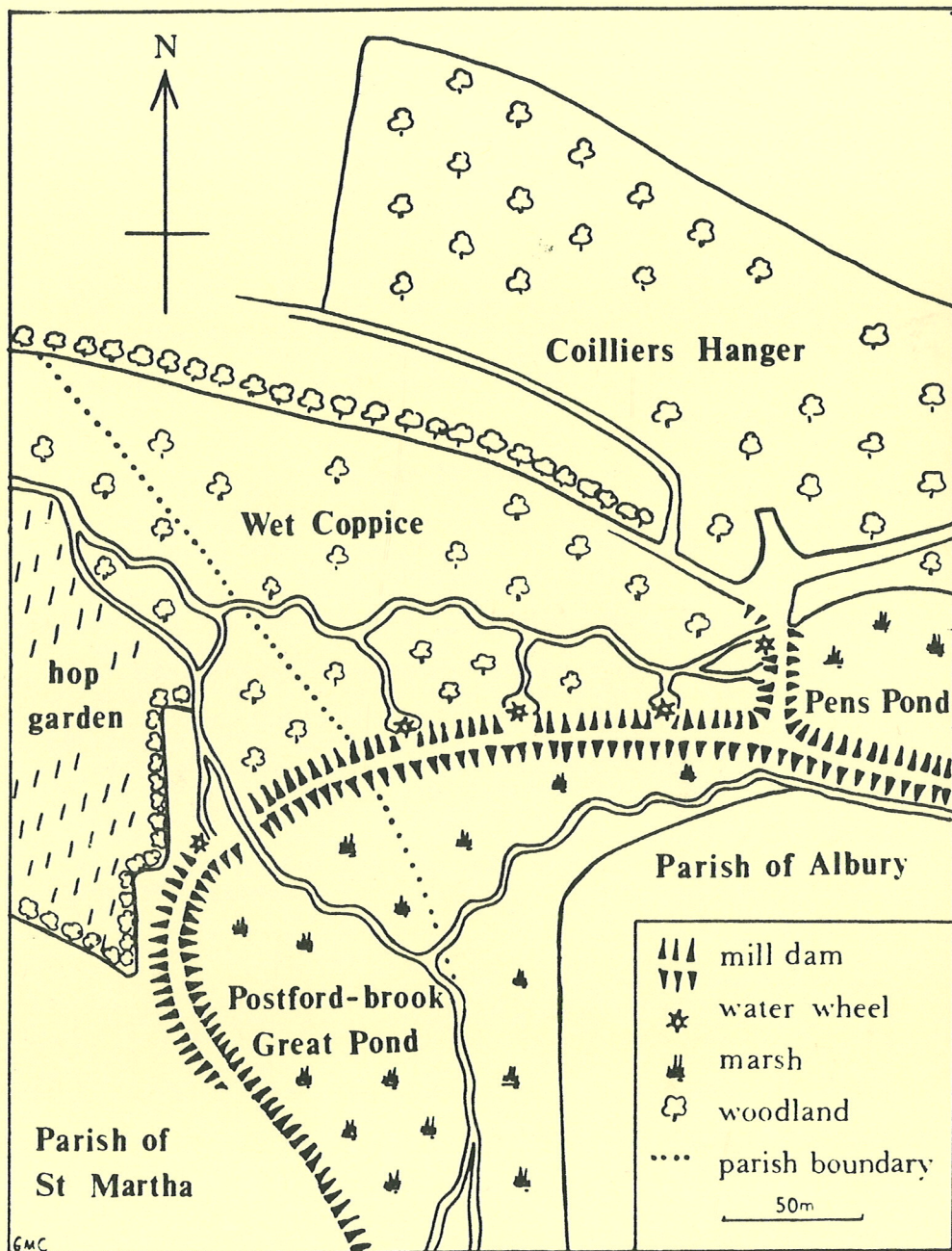
The author wishes to thank members of the Gunpowder Mills Study Group, who have provided information and helped in interpreting some of the remains. The help is also acknowledged of former workers at the site and their descendants. Features have been identified from maps in the Northumberland Estate Office at Alnwick Castle which show the gunpowder and smokeless powder works in about 1892 and the Admiralty cordite works as proposed in 1915. Access to a copy of the 1728 survey, on which the sketch map on the back cover is based, has been kindly provided by Mr and Mrs John Baden. The author wishes particularly to thank Alan Crocker who has helped with both the research for this booklet and its presentation.

FURTHER READING

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Detailed bibliographic references are given in the author's book *Chilworth gunpowder*.

The Surrey Industrial History Group, which is a group of the Surrey Archaeological Society, aims to study, record and where appropriate preserve the remains of the former industries of Surrey. It holds meetings, lectures, visits and social events and publishes a regular Newsletter. Further information may be obtained from the Membership Secretary, SIHG, c/o The Surrey Archaeological Society, Castle Arch, Guildford.



Sketch map of the derelict Upper powder mills site in the 18th century, as shown in the 'General Survey of Chillworth St. Martha', undertaken for Sarah, Duchess of Marlborough in 1728. Postford-brook Great Pond, now Postford Pond (46 in figure 13) has been drained following a breach in the mill dam.