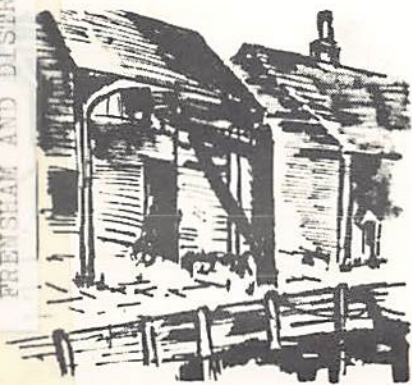


SURREY HISTORY

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Membership on the part of local history societies will help the Council to express with authority the importance of local history in the county.

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SURREY HISTORY

Vol. 1

No. 3

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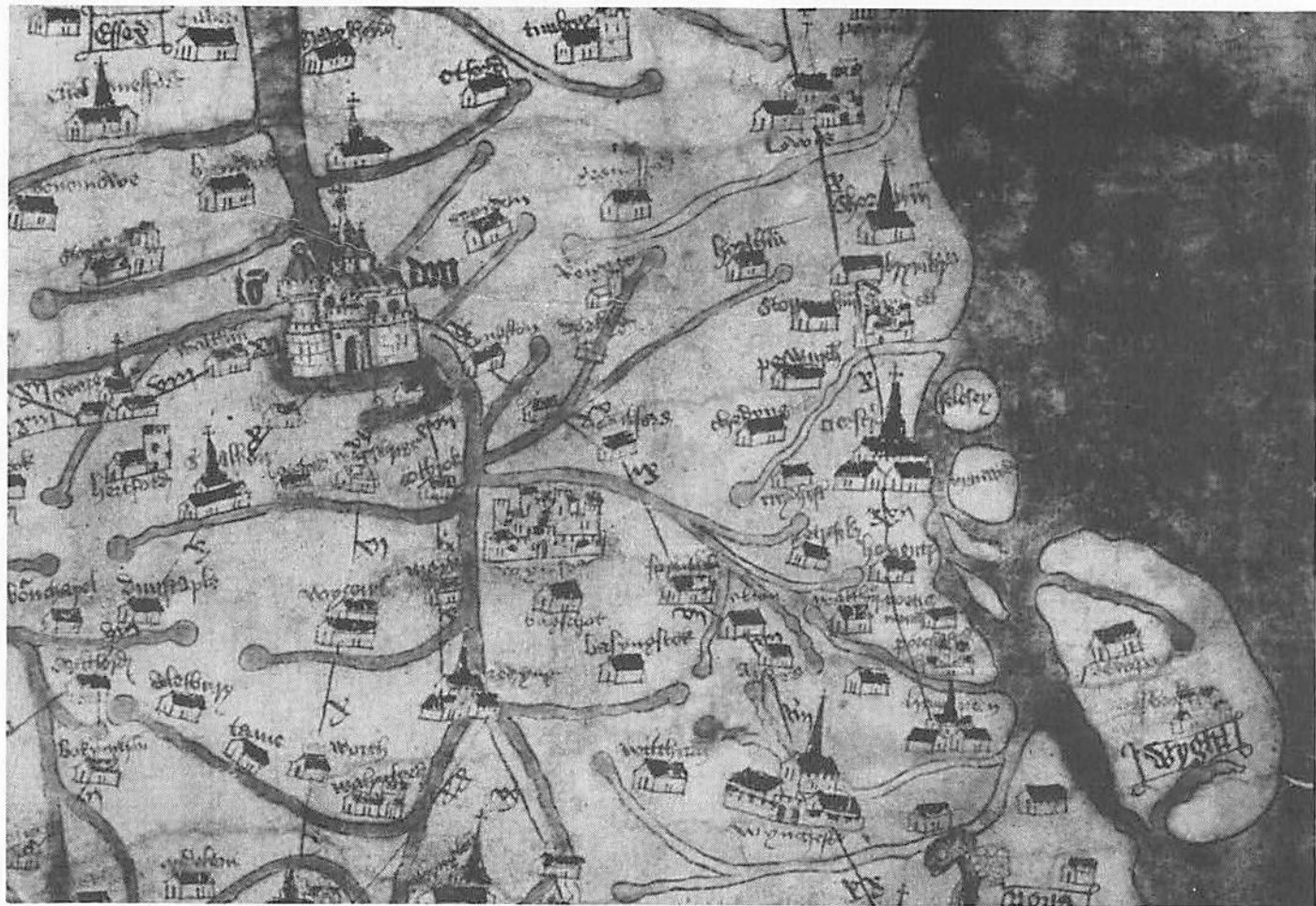
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PHILLIMORE



Section of the Gough Map of Great Britain, showing Surrey, (by kind permission of the Librarian of the Bodleian Library)
 [This shows 'Chedyng' – see paper by C. Robinson on pages 54-7 of Surrey History No. 2]

STONE MINING IN EAST SURREY

Paul W. Sowan

Secretary, Croydon Natural History and
Scientific Society

It usually comes as a surprise, even to Surrey people, to learn that our county once supported an important mining industry. And perhaps as even more of a surprise that the history of this industry, which perhaps commenced about 1100, did not come to a close until so recently as the 1960s. We have, however, excavated galleries and shafts into a number of our geological formations over the years, in search of chalk (as at West Humble), fullers' earth (at Nutfield), sand (at a great many places, including Beddington, Dorking, Godstone and Reigate) and building and refractory stone. This paper concerns the two last-named products, derived from our Upper Greensand of east Surrey, and all but the last 50 years or so of the history of the very extensive series of mines excavated in it between Brockham and Godstone.^{1, 2}

The precise history of much of our Surrey mining has gone un-recorded. The majority of the workings were small, casual affairs. And as the processes of mining are self-evidently very much more concerned with extraction of material than with deposition, there appears to be relatively little scope for the application of archaeological techniques: poorly stratified spoil heaps of waste-material tend to contain depressingly few datable objects.

The history of the building stone mines extending below the escarpment of the North Downs from Reigate to Godstone, however, is something of an exception, and is certainly hinted at in our standard county histories. C. H. Smith tells us³ that 'in almost all old buildings [in London] we find occasionally introduced large portions of stone from the vicinity of Ryegate and Godstone, known by the various names of Rygate Stone, Gatton Stone, Merstham stone, fire stone, and more commonly as hearthstone.* This material must always have been expensive in London, on account of the distance to fetch it, being twenty miles land carriage.' There is some evidence for pre-Conquest use of firestone both at Westminster, and in Surrey churches, such as Fetcham and Stoke D'Abernon, as a result of archaeological and architectural examination. Historical records appear to relate only to post-Conquest use.

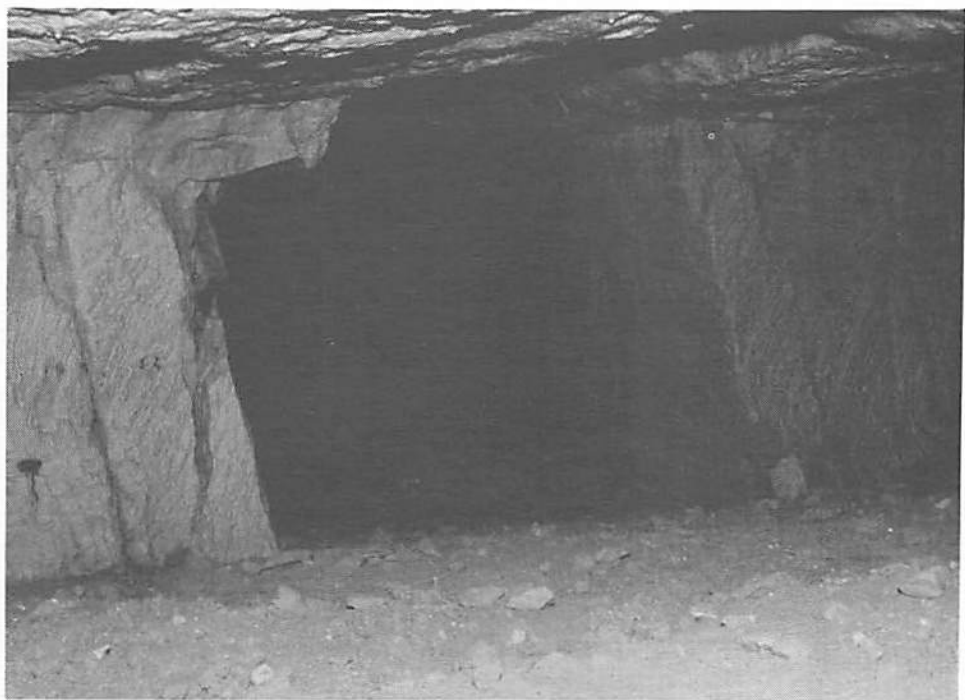
Giuseppe⁴ records a most impressive list of prominent buildings in and around London, and up and down the Thames, in which quantities of Surrey firestone were used, from 1259 at Westminster Palace down to 1571 at Nonsuch. Salzman⁵ lists further examples, culled from building accounts and other such sources. Rackham⁶ tells us that during the whole of the fifteenth century, while the nave of the Abbey

*This usage of the word hearthstone should not be confused with that adopted in connection with the very last stages of the industry, *vide infra*.

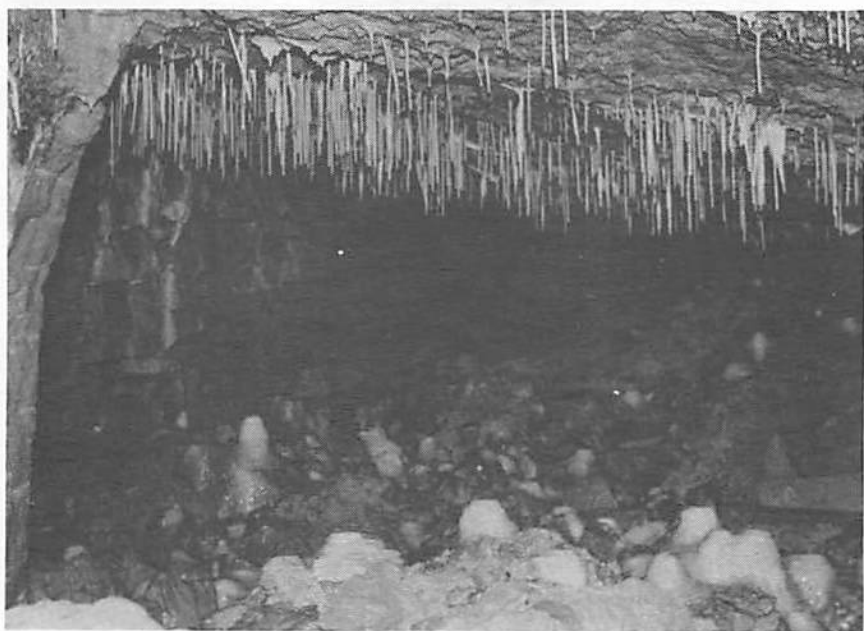
church [of Westminster] was slowly drawing to its completion, 'there flowed every year a stream of stone, of varying volume, from the Reigate hills down to Westminster.' Our Surrey mines supplied, in their day, substantial parts of London Bridge (1176), Southwark (1276), Windsor Castle (1351-56), Rochester Castle (1367-9), Whitgift's Hospital at Croydon (1596), the Tower, the Guildhall, and so forth. It is, indeed, an often quoted fact that stone quarries at Reigate, Merstham and Chaldon were, from time to time, considered to be sufficiently important to be requisitioned by the Crown — an early example of nationalisation!

That the stone was chosen more for its nearness to London and its ease of working, rather than for its suitability, however, may be seen from Wren's Report on the Stonework of Westminster Abbey.⁷ He tells us that 'that which is most to be lamented, is the unhappy choice of materials, the stone is decayed four inches deep, and falls off perpetually in great scales. I find, after the conquest, all our artists were fetched from Normandy; they loved to work in their own Caen stone, which is more beautiful than durable. This was found expensive to bring hither, so they brought Rygate stone in Surrey, the nearest like their own, being a stone that would saw and work like wood, but not durable, as is manifest; and they used this for the ashlar of of the whole fabrick, which is now disfigured in the highest degree; this stone takes in water, which, being frozen, scales off, whereas good stone gathers a crust, and defends itself, as many of our English free-stones do.' Wren, however, was certainly not the first to have his doubts about the quality of our Surrey firestone. Its use in the foundations of Eton College in 1453 was expressly prohibited!⁸ An important subsidiary use for this same stone, as its general appellation 'firestone' indicates, was as a refractory material. Authors from Aubrey onwards mention its use by bakers, chemists, glass manufacturers, lime burners and so forth, for their ovens, furnaces or kilns. The encyclopaedia of 1837⁹ defines firestone as 'a coarse kind of freestone, obtained at Reigate and other places, which is capable of bearing a considerable degree of heat, and is therefore used in the construction of furnaces, ovens &c.' Gilbert White¹⁰ referred to similar stone from the same geological formation at Selborne as 'in great request for hearthstones,* and the beds of ovens; and in lining of lime-kilns it turns to good account.' In 1805, slabs of stone 10 inches thick, of 72 square feet in area, were being obtained at White Hill, Blechingley, for glass furnaces at Vauxhall, and even at Liverpool and elsewhere.¹¹

It is generally assumed that all this stone was taken from 'underground quarries.' This was probably so. Few identifiable large open excavations can be found along the outcrop of the Upper Greensand, and few large spoil heaps such as might be expected from the working of squared and shaped blocks of stone. Below ground, however, it is quite a different story. Where it is still possible to enter some of the older mines, as it is, for example, on the Merstham-Chaldon borders, one may find literally miles of abandoned galleries, and vast quantities of waste stone chippings stacked in them. Serious archaeological examination of these mines is still in its infancy — if, indeed, it can even be said to have been born at all. The concentration *hearthstone here used in the earlier sense of a slab of stone of which a hearth might be made. Cf. the later usage, *infra*.



1. Inside the building stone mines at Ockley Wood, on the borders of Chaldon and Merstham.



2. A long-abandoned section of the Ockley Wood mine.



3. Firestone in chimney at Church Lane Cottage, Godstone.

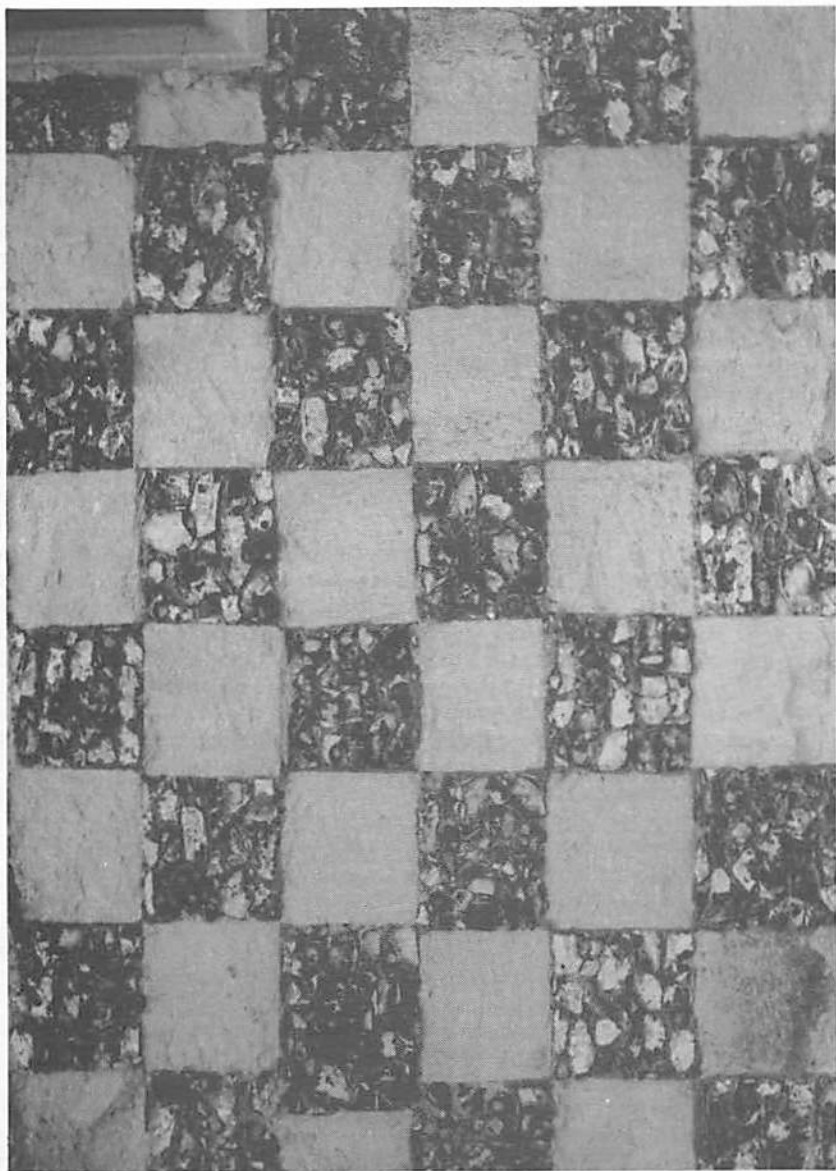
of artefacts (such as clay pipes and broken tools) in the spoil heaps is apparently so low as to be hardly worth while serious archaeological consideration. In this connection, it is very much to be hoped that the fairly numerous chance finds made by the caving fraternity (who make great use of our local mines, and do a great deal to encourage their study and conservation) will in due course come to the notice of competent archaeologists, at least for dating and recording.

As is usually the case, very much more has been recorded in documents concerning the carriage, costing, and ultimate use of this stone than about its extraction from the ground. Historical sources cannot be used to demonstrate underground working conclusively until the 17th century. Some of the earliest references to underground working in Surrey appear in Aubrey's descriptions of Gatton and Chaldon.¹² He says of Chaldon, for example, that 'here are also two Free-Stone Quarries, from whose Maeanders the Country People pretend they draw Stone with their Oxen and Hurdles for above half a Mile.'

There is no very great problem in identifying the majority of the mining areas. They are, of necessity, restricted to the outcrop of the Upper Greensand, which is clearly shewn on the Geological Survey 1" maps, and which is never more than half a mile wide. It is probable that both geological and economic parameters determined the extent of this industry. Although the formation extends right across the centre of the county and, indeed, sweeps back through Selborne to fringe the southern edge of the Weald as far east as Eastbourne, the mines even in their period of greatest activity never extended westwards of the Mole, or eastwards of Godstone. The stone beds dip increasingly steeply as one goes towards the west, setting an effective limit in that direction at Brockham, where the labour of hauking stone up a drift-mine at an angle of 20° was doubtless more than enough like hard work. The formation thins towards Kent, and beyond Godstone is too thin to be worth working. It disappears completely a few miles beyond the Kent border. The two quarries mentioned at Limpsfield in the Domesday Book have been claimed as 'no doubt of this stone',¹³ but this may be dismissed as highly improbable, on geological grounds. Those two quarries are far more likely to have been for carstone or chert in the quite distinct Lower Greensand, such a prominent cliff of which, indeed, overlooks the village street.

Even within the narrow mining belt, however, we find great differences between the very intensively mined parishes of Merstham and Chaldon, where it is doubtful if very much worthwhile stone is left, and the almost untouched Buckland. One must assume that ease of access to the then existing road system must have been a very important factor. Geologically, the stone is not well placed for exploitation. Immediately in front of the outcrop is a wide band of very heavy clay country (the Gault Clay). And the first stage of the journey to London must inevitably have been the ascent of the chalk escarpment of the Downs.

Martin¹⁴ claims the stone was generally quarried by shafts sunk near or even through the chalk, at the foot of the Downs, 'as was anciently done at Merstham quarries, and is now [1828] done at Reigate Hill.' I have been unable to confirm this picture of primitive 'bell-pits' or the like, either from field observations or from



4. Firestone and flint in the Norbury Chapel, Mickleham Church.

the literature. All the known mines are drift workings, in which tunnels are driven down the dip of the particular bed of stone being worked, widening out into side galleries, or into large areas with massive pillars left to support the roof. There are no vertical workings other than a very few [almost certainly late 19th and early 20th century] ventilation shafts at Betchworth and Godstone. And no adits (cutting across the natural dip of the beds) other than a notorious and much-quoted drainage adit at Merstham (vide infra).

The fortunes of the stone mines in the 18th and 19th centuries are still the subject of some research and speculation. It does seem fairly clear that the occasional major alterations to the roads, and the gradual introduction of railways, influenced things. The opening of the Croydon, Merstham and Godstone Railway to Merstham in 1805¹⁵ brought about a shift in the centre of gravity of the mining. Webster¹⁶ in 1821 comments that 'all these works [Buckland, Reigate and Gatton], however, are wholly abandoned, as the stone is procured in a point more convenient for the market, at the village of Merstham . . . From this place it is carried by a railroad to the Croydon canal.' The ancient quarries at Chaldon, and those nearby at Ockley Wood within the parish of Merstham, would appear to have been abandoned, too, in favour of those opened at Quarry Dean, by the railway terminus. It has been suggested,¹⁷ from the presence of plate rails very closely resembling those of the railway in the mines at Godstone Hill, that the various quarry [i.e. mine] owners between Reigate and Godstone had rather more of an interest in the Croydon, Merstham and Godstone railway than had previously been thought. The main line, in fact, had originally been intended to run to Reigate, as a preliminary to reaching Portsmouth, with a branch from Merstham to Godstone. It had been assumed that Godstone mines purchased the rails when the railway was closed in 1838, for re-use. A tramway is known to have existed in Godstone mines in 1861^{18, 19} and parts of it may still be seen today.

Whatever the immediate effects of the opening of the railway, we do know that mines at Godstone were certainly being worked in 1809²⁰ in 1827,²¹ and continuously from 1843 to 1876²² when careful records were kept of the levels reached each year by flood waters which at times two-thirds filled the workings. Indeed, it is highly probable that Godstone mines worked more or less continuously right into this century. We also know that the quarries at Reigate and Gatton were re-opened, as was that (briefly) at Blechingley. Chaldon mines, though, had been closed for ever. Webster²³ mentions 'wholly abandoned traces of ancient quarries still to be seen at Colley Farm . . .' near Reigate in 1821, but Martin²⁴ indicates some activity in the parish in the first half of last century. The official mining records²⁵ mention the production of stone at Reigate in 1856.

Webster, again, reports that 'traces of ancient quarries may still be seen at Gatton Park'²⁶ and it with some surprise that we find Gatton is the only Surrey quarry considered (amongst 103 up and down the British Isles) for the supply of stone for re-building the Houses of Parliament.²⁷ It is claimed that blocks of stone from '35 to 60 feet cube, from 4 to 10 ft. long' could be produced, at prices of 1s 4d to 1s 6d per cubic foot at the quarry. Although that particular attempt to re-establish trade

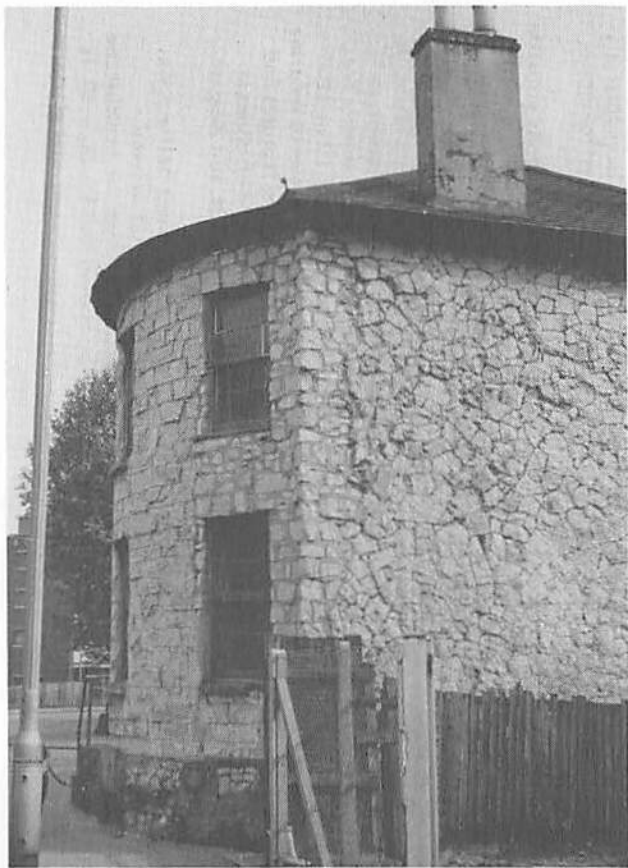
at Gatton was unsuccessful (Bolsover stone was recommended), the official statistics²⁸ do indicate that Lord Monson and his quarryman William Wakefield were producing sandstone at Gatton in 1855, 1856 and 1858, for the prices mentioned.

Developments at Quarry Dean, at Merstham, were not entirely plain sailing, either, as the fortunes of these mines fluctuated somewhat. The creation of a half-mile drainage adit in 1809 has already been mentioned²⁹ and indicates that as also at Godstone the mines tended to suffer from flooding. The distance the tunnels could be driven under the chalk hills was quite severely restricted by the position of the water table. At Godstone, where the dip is less than 5°, the mines extended up to 350 years under the hills, and could only have been worked in their inner-most recesses in exceptionally dry years. At Merstham, where the dip has steepened to 7° or more, the northernmost working faces are hardly below the first rise of the escarpment.

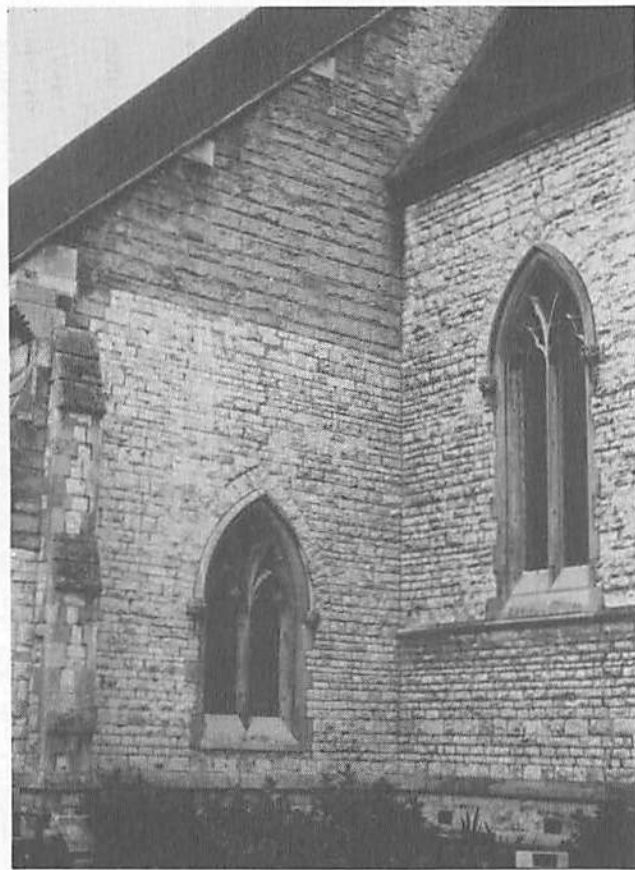
At some time before 1819, at Merstham, a drift was opened up-dip (taking account of a local peculiarity of the configuration of the ground at the Rockshaw Road ridge), from a pit near Quarry Dean, and a steam engine installed for raising the stone.³⁰ In February 1821, however, the quarry was full of water, the drainage adit having been stopped up as a consequence of a successful legal action having been brought by the disgruntled miller whose source of motive power had been inadvertently diverted.^{31,32} Fitton, in 1827, again found that 'the works had been discontinued for some time before I visited the place.'³³ The limeworks and stone quarries, which had since 1788 been worked by the Jolliffe brothers and Edward Banks were leased to George Hall in 1824, and there then appears to have been some re-invigoration of the stone quarrying side of the business, quantities of stone being supplied, by way of the railway, for the construction of the new London Bridge in 1831. J., J. and C. Hall, who ran the works as a co-partnership following their father's death in 1845, continued to exploit the stone, using it in the construction of buildings at Croydon, and for their Redhill office in 1860 or 1861.³⁴

The closure of the iron tramway, and the opening of steam railways to serve the Brighton main line (1841), South Godstone (1842), Reigate (1849) and Caterham (1856), again had its influence on the fortunes of the mines. The first edition of the Ordnance Survey 6" map, surveyed in 1868-69, shows that a standard gauge spur had been laid from the limeworks branch from the main line of the London and Brighton Railway, right up to the Quarry Mouth. As the Hall family's lease expired in 1864, and was not renewed, we may assume that this spur was their doing. It is not reported that the Peters family, who next took on the management of the works at Merstham about 1872, had any substantial dealings in stone.³⁵

There was, however, some sporadic working which never appears to have come to the notice of H.M. Inspectors of Mines, whose published records for the last twenty years of the 19th century are generally very full and complete. N. F. Roberts, for example, reporting on a geological field meeting in 1899, tells us that 'the party then went to the old firestone mine east of the northern part of the [new Quarry Line] cutting, which was found to be abandoned, though it was being worked the year before.'³⁶ The rails were still in place and the entrance still open in 1919 (T. C. Price, pers. comm.).



5. Firestone in number 4 Cherry Orchard Road, Croydon.



6. Firestone in St. Mark's Church, Reigate (1860). Note the upper part completed in another, darker, stone.

It might be thought that the coming of the modern railway network would have put an end to the local building stone industry, particularly when one considers the ease with which bricks and more durable stone could now be transported. It is interesting to note that the price of best Bath stone, delivered by rail to Reigate, Merstham, or Godstone in 1856, was quoted as 1s 4½d, or less, per cubic foot.³⁷ However, Phillips, in 1885, says of the Reigate stone that 'of late years it has again come into favour, and may be seen in numerous local buildings'.³⁸ Dennis Turner (pers. comm.) tells me that it is his impression that until very late in the 18th century, the stone was almost exclusively used in major buildings, such as castles, churches and large houses and in fire places and chimneys. Such stone as occurs in vernacular architecture, as in Reigate High Street, might well be explained as re-use — perhaps from the ruins of Reigate Castle. On the other hand, a great many firestone buildings in Redhill and Reigate appear to date from 1850 to 1900. Some examples are the Redhill Asylum (1853-55), and St. Mark's Church, Reigate (1860). There is quite a strong impression that the building stone industry enjoyed a new lease of life, albeit briefly, before its 20th century decline. Pevsner³⁹ tells us that the part of Reigate north of the railway station was developed almost immediately after the railway came in 1849 with 'an estate of big, detached, clunch-built houses, mostly in bulgy Gothic, with a bulgy church, St. Mark, to go with them . . . Many leases fell in the 1950s'. One of our few surviving Surrey miners, Mr. A. N. Joy, who worked at Colley Hill from 1907 to 1965, has told me that occasional slabs of stone were still worked this century for glass furnaces; and that blocks of building stone had their ends left rough so that the mason had no option but to bed them correctly in the wall (i.e. with the grain horizontal, as it had been in the ground, to minimise the risk of frost-scaling).

The building and refractory stone industry was, these last few exceptions notwithstanding, practically finished by 1900. But the mines were not finally abandoned until over 60 years later. Indeed, new mines had been opened at Bröckham and Betchworth, perhaps in the 1870s, and old mines extended at Reigate and Godstone, to supply a completely different commodity — hearthstone. This is not to be confused with the refractory slabs of which hearths might formerly have been made. It was a softer variety of the same Upper Greensand, sold either as rough lumps, as powder, or as artificial briquettes, for use as a household whitener and abrasive for stone floors, steps and widow sills. The output for the county reached 10 or 12 thousand tons per annum in the late 1890s, but the increasing difficulties of securing servants after the first world war, and in introduction of labour saving features and devices into houses, led to a rapid decline, leading to the final closure of mines at Bröckham in 1925, Godstone in the 1940s, Betchworth in the 1950s, and Reigate, after four years or so of above-ground operation only, in 1965.

This last phase of the mines' history is, not surprisingly, very much better documented, although hardly as yet adequately published. That work is in hand.

A quaint reflection on another aspect of the connection between the hearthstone industry and the old building stone trade is provided by Harper and Kershaw:⁴⁰ 'It is not unlikely that from time to time, after repairs and restorations of that glorious

Chapel of Henry VIIth have been made, London housewives have, all unknowing, purchased fragments of it from grocers in their supplies of domestic hearthstone; for that has been the destination of the removed portions, when the contractors have been left with some tons of them.'

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THE EARLY HISTORY OF GUNPOWDER MANUFACTURE AT CHILWORTH

D. W. Warner

Chilworth Village lies in the valley of the Tillingbourne, one of the most beautiful parts of Surrey. William Cobbett,¹ writing in 1822, says: "This valley, which seems to have been created by a bountiful providence, as one of the choicest retreats of man; which seems formed for a scene of innocence and happiness, has been, by ungrateful man, so perverted as to make it instrumental in effecting two of the most damnable of purposes; in carrying into execution two of the most damnable inventions that ever sprang from the minds of men under the influence of the devil! namely, the making of *gunpowder* and of *banknotes*! Here in this tranquil spot, where the nightingales are to be heard earlier and later in the year than in any other part of England; where the first bursting of the buds is seen in spring, where no rigour of seasons can ever be felt; where everything seems formed for precluding the very thought of wickedness; here has the devil fixed on as one of the seats of his grand manufactory." I have no doubt that Cobbett saw the reason for the siting of these two industries at Chilworth — the Tillingbourne river. This little stream, which rises at Leith Hill, has for many centuries supported industries dependent upon the good water power which it supplies.

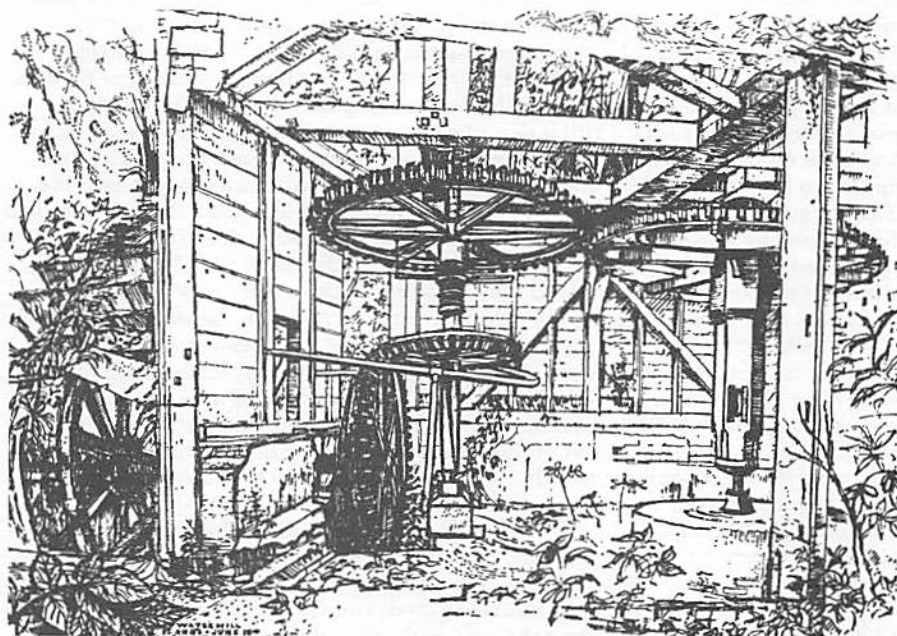
Before starting on the actual history of the Chilworth Gunpowder Mills it may be of benefit to know a little about gunpowder itself. Very few substances have had a greater effect on civilisation. Its employment altered the whole art of war and its influence gradually affected the whole fabric of society, perhaps in its infant years with comparable effects to the nuclear age we have just entered. The basic ingredients of gunpowder are charcoal, sulphur and saltpetre. Charcoal is the chief combustible in the powder. It must burn freely, having as little ash as possible; it must be fireable and grind into a non-gritty powder. The main woods used for charcoal were dogwood, willow and alder; dogwood being mainly used for smallarms powders, which burn more freely than those made from alder and willow. The manufacture of charcoal was a lengthy process. The wood, after cutting, was stripped of bark and allowed to season for two to three years. It was then picked to uniform sizes and charred in cylindrical iron cases or 'slips', provided with openings for the escape of gases and inserted into slightly larger cylinders set in a furnace. The heat rate governed the amount of charcoal produced, the less heat the more charcoal. As a rule, the time of charring was five to seven hours, when the slips were removed from the furnaces and placed into larger iron vessels, where they were kept comparatively air-tight until cold. The charcoal was then sorted and kept for some time before grinding. After grinding it was sieved on a rotating fine-mesh cylinder and then stored in a closed iron vessel.

Sulphur is mined in Sicily and was purified by distillation and then remelting into moulds. It was then ground into powder like the charcoal. Saltpetre is Potassium Nitrate and the chief source was the droppings of doves and pigeons. It is sometimes found in the soil when it is known as nitre. It is much more soluble in hot water than cold and was purified by dissolving to saturation in boiling water and cooling to about 30°C when almost pure nitre crystallizes out. The nitre provides the oxygen for the combustion of the charcoal and sulphur for the explosion to occur, and produces most of the gases.

The invention of gunpowder was impossible until this process of purification of saltpetre was discovered. It has been attributed to a German monk, Berthold Schwartz and also to Roger Bacon, who wrote about gunpowder in 1242, but it is now known to have originated in China and probably reached Europe through the Muslim world.² In 1345 Edward III was purchasing the ingredients for making powder and shipping cannon to France. In 1346, he ordered all available saltpetre to be brought to him. Prior to the reign of Elizabeth I, gunpowder had been made up in England from imported materials and large quantities of foreign powder purchased. It was the practice to store this gunpowder in English-owned stores abroad, chiefly in Antwerp, where it stayed until required, but since the consent of the sovereign, in whose dominions the store was situated, was required for its removal, Elizabeth decided that gunpowder should be made at home. At this time there were a large number of foreign refugees in the kingdom and it was to these people that Englishmen looked for many industrial secrets. The services of a German captain, Gerrard Honrick, who claimed a perfect knowledge in the art of making saltpetre 'in the best fashion and much in use beyond the sea', were requisitioned and on 13th March 1561 an agreement was made between the Queen on one part and Honrick on the other, by which for a sum of £300 Honrick agreed to instruct the subject of the Queen in the art of making saltpetre.³ From that date the history of English gunpowder manufacture begins. The sources of saltpetre were the efflorescence on damp walls and the nitrogenous earth in stables, pig-styes and principally dovecotes, 'the chiefest nurses of saltpetre in the kingdom'. The pigeons were not to be unnecessarily disturbed and the saltpetre contractors were to confine their operations to a half hour in the day and were to compensate the owners for loss of pigeons or eggs or for structural damage. Later in 1625, Charles I allowed the men to work for two hours a day at the convenience of the owner and no more. The kingdom was divided up into districts for saltpetre making, each with a number of men and a quota required. In June 1637, the rector of Knoyle in Wiltshire, Dr. Christopher Wren, the father of the architect, gave to the commissioner a bill for damages done by digging for saltpetre in the pigeon house of the rectory. There had been two diggings, one about eight years before, the other in March 1637. On the first occasion the pigeon-house, which was built of massive stone walls twenty feet high, was so shaken that the rector had to buttress up one side. On the second occasion the foundation was so undermined that the north wall fell in. The saltpetre men refused to make any compensation.⁴ It is not surprising that such drastic measures caused complaint and another cause of discontent was the gunpowder makers 'taking

of carriages' for conveyance of saltpetre and gunpowder and although this was to be paid for at the fixed rate of 4d. a mile, there were disagreements over distance. It is little wonder that the supply of saltpetre showed an increasing tendency to become inadequate. The incorporation of the East India Company and the establishment of trade with India made possible the import of large quantities without political complications and by October 1629 the Company was allowed to export fifty tons of saltpetre, as the King's stores and Mr. Evelyn's were sufficiently supplied.

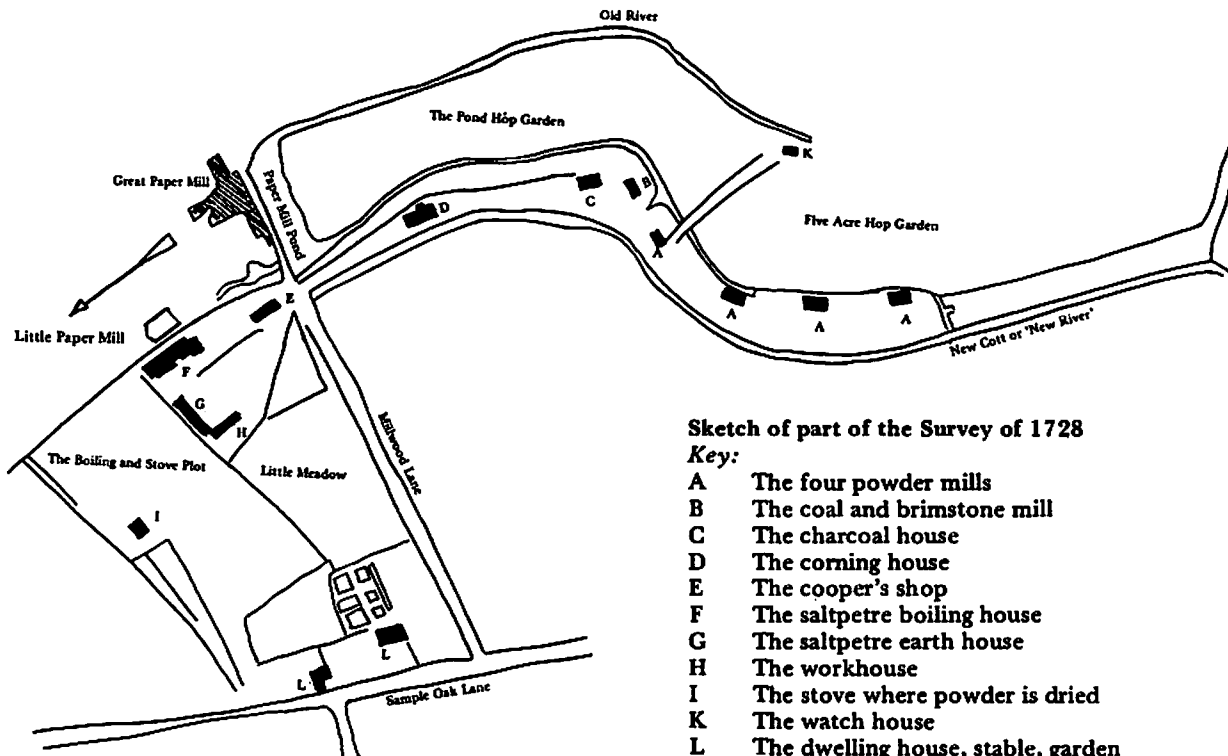
Since the sixteenth century, the making of gunpowder was as follows. The materials were weighed out separately, mixed by passing through a sieve and then uniformly moistened with water whilst on the bed of an incorporating mill. This consisted of two heavy stone or concrete wheels, which were covered with copper and mounted so as to roll around a circular bed. The incorporation needed about four hours. The action of the rollers on the powder paste was a double one, not only crushing but mixing. The paste was deflected, so that it came under one roller then the next, by scrapers, which followed each wheel, set at an angle to the bed.



Remains of Incorporating Mill before restoration at the Faversham Gunpowder Works, (by kind permission of A. Percival, Esq., F.S.A., Hon. Sec. of the Faversham Society).

Although the charge at this stage was still wet it was possible for it to be fired either by the heat developed by the friction of the rollers or by sparks from foreign bodies such as stones or grit. Therefore each mill was provided with a drenching apparatus, so that, if one mill fired, it and its neighbours were drowned by water from a tank immediately above the mill. The product from this stage was called 'Mill Cake'. After the mixing stage the powder was still damp. It could then be granulated or 'corned' by rubbing through a sieve while damp or it could be pressed while drying. These processes were important in regard to the rate of burning and the purpose of the powder. The less dense it was the more rapidly it burned and the more stress it put on the gun.

The earliest reference to a gunpowder mill in Surrey occurs in February 1555, when Henry Reve erected a mill in Rotherhithe.⁵ The year of the Armada, 1588 demonstrated the need for a good supply of gunpowder and on 28th January, 1589 George Evelyn, Richard Hills (or Hill) and John Evelyn, son of George were licensed by Royal Letters Patent to dig and get saltpetre within the realms of England and Ireland, except in London and within two miles radius of the walls, and in the five most northern English counties, and to convert the same into gunpowder for provision of the Queen's stores. The license was to run for eleven years, and the Justices of the Peace and Mayors were ordered to assist them.⁶ Although John Evelyn, in a letter published in Aubrey,⁷ referred to lost powder mills near Wotton, it would appear that the Evelyn's mills were at Long Ditton on the Hogsmill. However, their partner, Richard Hill is described as a gentleman of Shere and may have had mills on the Tillingbourne. These men never worked together as a firm, but appear to have shared the work between them. Of the saltpetre brought into the Tower between 28th February and 25th September, 1589, 45,583 lb. were supplied to the Evelyns and 19,754 lb. to Hill. With various renewals, the Royal Warrant was continued by the Evelyns until 31st October, 1636, the conditions being given in the Victoria County History,⁸ and they built the Godstone Mills. Meanwhile in 1625, the East India Company appear to have set up mills 'on the skirts of Windsor Forest' which at that time reached into Surrey. From a statement of Vincent Randyll in 1654, it would appear that they were at Chilworth, leased from his father, Sir Edward Randyll. The Company may have intended only to supply its own service, but in 1627 Evelyn complained of competition and in 1631 he complained that in spite of prohibition the Company's workman, Collins was making thirty barrels of gunpowder weekly.⁹ But in November 1635, Edward Collins of Chilworth contracted with the Commissioners for Saltpetre and Gunpowder to convert the 100 lasts of saltpetre which the King had arranged for the East India Company to import. He died before the contract was completed and arrangements were made to pay his widow. On 1st November 1636, the appointment of powdermaker to the King was given to Samuel Cordwell and George Collins, tenants of the Chilworth Mills and they became the only authorised makers in the kingdom. A sum of £2,000 was impressed from the Crown for building mills, storehouses and workhouses, and for providing utensils, but all of these on the expiry of the contract were to be delivered to the King, who was also to pay the rent for the



Sketch of part of the Survey of 1728

Key:

- A The four powder mills
- B The coal and brimstone mill
- C The charcoal house
- D The corning house
- E The cooper's shop
- F The saltpetre boiling house
- G The saltpetre earth house
- H The workhouse
- I The stove where powder is dried
- K The watch house
- L The dwelling house, stable, garden and orchard

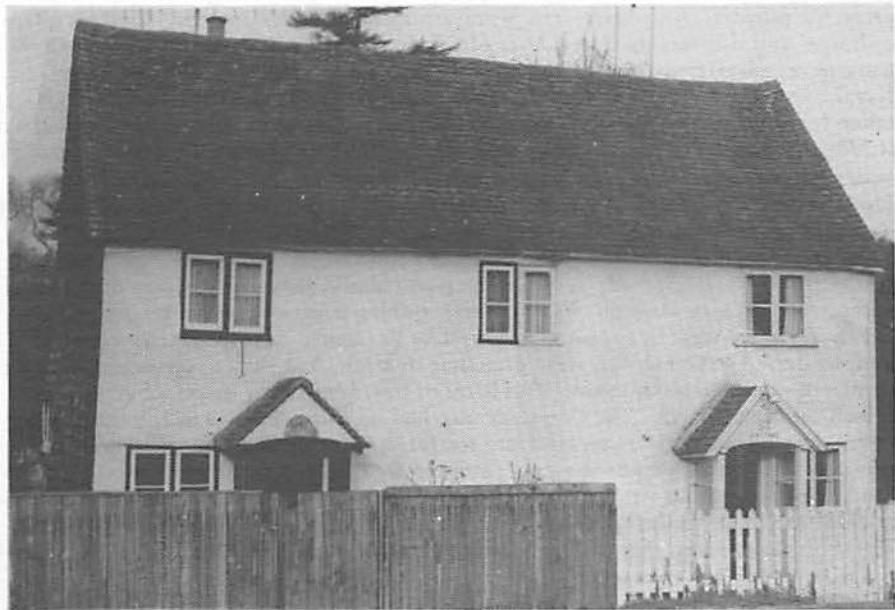
waters and lands, hired for the work, for the residue of the term of the lease, should he employ any other maker for the service. They were to supply 240 lasts a year, (a last being 24 cwt.). On the 25th September 1636, a few days before this contract came into operation, an order sent by Council to the mayors, sheriffs, justices and other local officers, directing them that as there was occasion of carriage of powder from His Majesty's powder mills at Chilworth to Hamhew and thence to London, they were to assist Cordwell in taking up at the King's prices such carts, hoys and barges as should be necessary for the purpose.¹⁰ About this time the King's saltpetre house was moved to Kingston. Cordwell seems to have become sole manager of the works and succeeded in carrying out the contract, supplying 240 lasts in the first and third years, but only 200 in the other years when he petitioned for all the saltpetre the East India Company could bring. A fire at his works in 1638 lost him his store and 2,000 cwt. of powder. In February 1639 he found himself obliged to ask the Council to release the £2,000 to him to rebuild his works and offered in return to disclaim all his interest in the buildings used by him in his industry. The gunpowder industry was destined to be changed in 1641, for the Act 16 Charles I. c. 21, "for the free bringing in of gunpowder and saltpetre from foreign parts and for the free making of gunpowder in this realm", brought to an end the Crown monopoly, but the mills at Chilworth continued to function. They were important to Parliament in the Civil War. Samuel Cordwell died in 1648 and was succeeded by his brother Robert and then by a succession of makers within the next few years¹¹ and it is likely that the mills were allowed to run down.

Aubrey visited Chilworth sometime before 1692. He says:¹² "Was the Seat of . . . Randyll, Esq; Master of the Gun-powder Works, for which in this little Romancy Vale are sixteen Powder Mills erected: It now belongs to Morgan Randyll, Esq; one of the Representatives in Parliament for the Town of Guildford . . . 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". Aubrey's book was published by Rawlinson in 1719. He continues: "The Powder-Mills of this Place were the first in England; and before they were erected, all our Gun-powder was imported at a great Expence from foreign Parts: [as has been seen above, this is not true] Since which time, the Place itself being so proper for such dangerous and useful Undertakings, the Mills have been farm'd out to several Hands, amongst the rest of the Gentlemen, Sir Polycarpus Wharton, Bart. . . . was for some Years Tenant."

When Sir Polycarpus Wharton took out a lease on the mills for a term of 21 years, they were in such a bad state that he had to pay out £1,500 to make them servicable. This came out of his own pocket. The rent, growing charges, repairs and incidental charges amounted to £1,000 a year but this was paid by the Ordance under the terms of his contract. This was dated 1st January 1677, and ran until 1898, when Sir



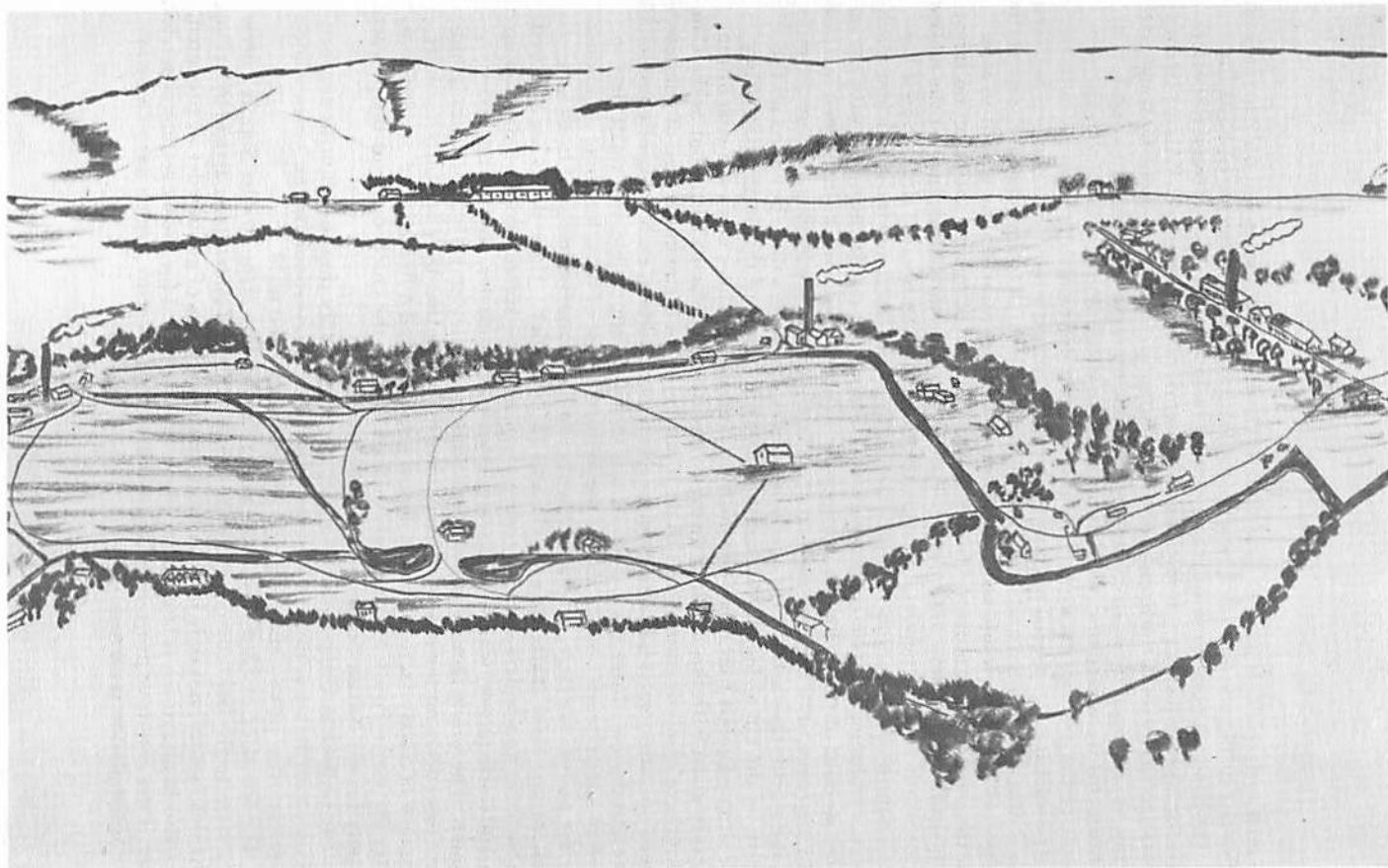
Roller millstone for an incorporating mill now half buried on the Chilworth site.



Pair of Cottages, now privately owned but once included in the grounds of the gunpowder works. They are believed to date from the early seventeenth century.

Polycarpus lost his fortune over this venture and ended up in debtors prison.¹³ After this the mills do not appear to be occupied until July 1728, when a survey was carried out for Francis Grueber. Morgan Randyll had sold the estate to Richard Houlditch, who lost his fortune in the South Sea Bubble, and the estate was bought by Sarah, Duchess of Marlborough. Mr. Grueber, proposed to build a new powder mill in the five acre bank meadow, 150 feet eastwards from the furthest mill in meadow. 'The ditch that must be dug for supplying the mill with water and carrying it under the stream must be nine feet broad and 260 ft. in length and will spoil five perches of the meadow, valued at 3 shillings a year. The other part of the ditch, with a road or way continued to the mill, the damage valued at 3 shillings a year. The whole damage of building this new powder mill will amount to six shillings yearly.' Apparently Grueber was responsible for the ditch on the southern side of the factory site. The manor was sold to Edmund Hill in 1796, then to William Tinkler before 1817, and in 1845 to Henry Drummond of Albury from whom it passed to the Dukes of Northumberland. Tinkler worked the mills himself until 4th March 1819, when they were leased to John Sharp and the business was carried on in the name of J. T. & S. Sharp until 1881 when it was sold to C. M. Westfield, trading as Westfield Brothers until 1885, when The Chilworth Gunpowder Company was formed with C. Marcus Westfield and Edward Kraftmeier as managing directors.¹⁴

There had recently been many developments in heavy guns and these gave rise to changes in gunpowder, particularly for heavy guns a slower-burning form with less sulphur and a lighter coloured charcoal, known as brown or cocoa powder. It was often supplied formed into hexagonal prisms with a central hole, when it was called prismatic powder. Another recent invention was smokeless powder, based on nitro-cellulose, and this was the forerunner of Cordite. The Chilworth Gunpowder Company never advertised directly, but they did attend, as exhibit 5149, The Royal Naval Exhibition of 1891 at Camperdown Gallery. The following information is taken from the leaflet prepared for the exhibition. The Company claimed that they stood partly on the site of a works established in 1570. "The factory is of course very different now from what it was when purchased by the Company in 1885. Modern requirements have demanded many changes, and the place has been changed and enlarged and improved from time to time, until now many times the size it was six years ago." In their exhibit the Company showed not only a full assortment of sporting and blasting powders, but, more particularly, they had samples of the chief varieties of Military Powder. The harmless looking prisms of black, brown and E.X.E. powders were in appearance more like hexagonal nuts for machinery than gunpowder. All the exhibits were of course dummies but they nevertheless were a source of considerable interest. This form of powder was for use in all guns from 6-inch calibre upwards. The Company also had on show samples of the cases and cylinders which were used on land and sea for the storing and transporting of the powder. The prismatic powder case patented by Ritter, was the most modern of its kind being strong and yet perfectly airtight. The exhibit which had perhaps the greatest interest was the collection of various size dummies of Smokeless Powder. The sizes varied from that of fine Sporting powder to that of cubes three-quarters of



A Birds-eye View of the Chilworth Factory, 1891.
(from the exhibition leaflet).

an inch surface. This powder gave the most satisfactory results, not only in magazine rifles but in all guns up to 9·2 inch breech loaders firing a projectile of 3801 lbs.

The handout goes on to quote an extract from Wyman's *Commercial Encyclopedia* for 1888, which gave some idea of the work of the Company. "About twenty years ago nearly all the processes of the manufacture were carried out by rough and ready rules, passed by word of mouth from one manager or foreman to another; no instruments were used nor calculations made to determine the velocity or the projectile or the pressure exerted in the gun; nor was there much thought given to fit the powder for any special purpose; indeed, the only distinction drawn was between the powder for cannon and that for smallarms. All this has now changed, and as the subject is at once new and very interesting it behoves us in dealing with it to look for the most successful factory to describe. The task of making the selection is not a difficult one; we have in Chilworth Factory, at once the oldest, and yet the newest in England. It is the newest, or rather the most modern because since 1884 it has been almost rebuilt, and is now provided with all the latest and most efficient machinery, combining the two great desiderata of rapid and regular turn-out, with the utmost amount of safety for the workpeople. The extensive works have been increased and improved until they are now most certainly one of the leading gunpowder mills in the world; they stretch for nearly two miles along the valley, bounded on the north by the hill of St. Martha; south and east by spurs of the Surrey Hills. They are situated about four miles distant from Guildford. There was a drawing of the factory given with this handout giving a view from St. Martha's Hill, but as the Company were ready to admit "fails to do it justice, as, in the manufacture of gunpowder every operation must be carried out in a separate building, each being of considerable size and distance from any others. It was therefore impossible, in a small view to give an adequate idea of the size of the factory. Most of what look like small dots on the picture are large, substantial, and even handsome buildings of brick and cement; the three shafts are each close to 150 feet high. These shafts are attached to furnaces and boilers working twelve steam engines, several of which develop up to 100 horse power, which, with water-wheels and turbines, give the necessary power. The whole factory lies in a well timbered valley and is almost entirely hidden; passengers on the nearby railway have little idea that they are within a short distance of a busy factory employing between 300 and 400 men, and one which is, after the Royal Powder Factory at Waltham Abbey, the chief source of the powder supply for the British Colonial Governments."

The Chilworth Gunpowder Company grew so rapidly that they bought another factory near Buxton, they also owned magazines at Liverpool, on the Thames and in many other places, and work was carried on day and night.

The *Standard* of 23rd May 1888, under the heading "Our Powder Supply" drew attention to the importance of the Chilworth Mills and ended their article by saying, "At this factory, not only can the most improved kinds of gunpowder be procured, but also in quantities as large as are likely to be required for the Government service, even if the extensive programme, for making England secure, which has so long in contemplation is carried out".

So complicated had the manufacture of gunpowder become, by reason of the accuracy and uniformity required by the modern guns, that it was necessary to test each operation from the very receipt of the raw materials. For this purpose many branches of chemistry, electricity and optics, including the chronograph, densimeter, microscope, polariscope, etc., were constantly in use. No practicable improvement or suggestion was left untried to ensure that in each phase of its manufacture the powder was of the best possible quality. It was stated that the Company's lists contained no fewer than seventy-two brands of powder, some of which were tested in at least thirteen different stages of their manufacture.

"It was therefore, with the confidence born of success, that the Company supplied powders which acted as surely in the mammoth 110 ton guns as in the beautiful match rifle or powerful Express. They were as successful with ammunition for the delicate sporting guns of Greener, Purdy etc., as when they were required to supply the explosives for Armstrong, Nordenfelt, Hotchkiss and Maxim. The quartz rocks of Australia, the trapp and basalt of India, the slates of Wales and the coal of England, all in their turn yielded to the Chilworth Blasting Powder."

- 1 W. Cobbett, *Rural Rides*. Everyman Edition I. 150
- 2 A. R. Hall. 'A Note on Military Pyrotechnics'. *History of Technology*. II. 374
- 3 V. C. H. Surrey. II. 307.
- 4 *Ibid.* 308.
- 5 *Ibid.* 310.
- 6 *Ibid.* 312.
- 7 Aubrey. I. Introduction.
- 8 V. C. H. Surrey. II..312-318.
- 9 *Ibid.* 318.
- 10 *Ibid.* 319-20.
- 11 *Ibid.* 322-3.
- 12 Aubrey. IV. 56.
- 13 His case is given in Aubrey. IV. 58-65.
- 14 V. C. H. Surrey. II. 328

A VICTORIAN STONE LETTER BOX

Mrs. V. G. Steward

Holmesdale Natural History Club

Just before the buildings of 106 and 108 Station Road, Redhill were finally demolished in April 1973, the remains of a stone Victorian posting box were noticed on the east wall of 106. It was decided to make a record of this, including a rubbing from which the diagram has been made. As the wall was of soft Reigate stone, accurate measurement was difficult, but the following dimensions were taken:

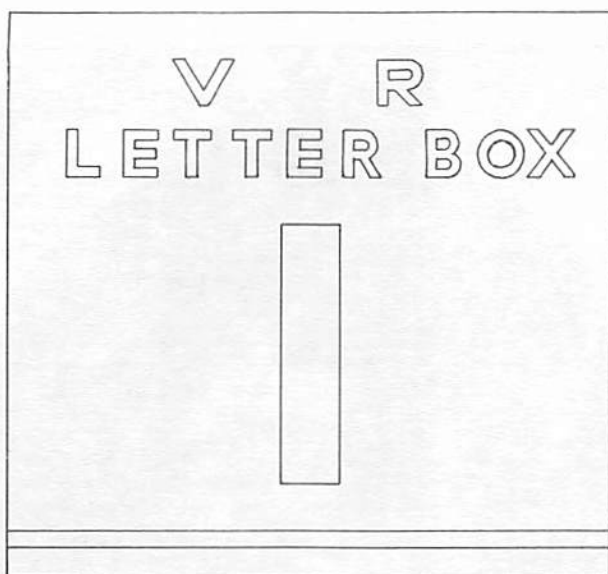
Height of box:	12 in.
Width of box:	13 in.
Height of top of box from ground:	47in.

The box was set in a brick-framed window, of width 33 in. and height $67\frac{1}{4}$ in. The bricks were $9\frac{1}{2}$ in. long.

Miss Warren, who lived nearby, told us that she had lived in 106 from 1903 to 1934, with her parents, who ran a drapery business there, chiefly selling gloves, stockings and uniforms for domestic servants, until they were bought out by Messrs. Pendred in 1934. The last occupiers of 106 were the British School of Motoring. Miss Warren told us that there had always been a right of way on this east side of 106 between them and the Sussex Arms P.H. as the stables for the bakery shop at 108 had this as their only access. The bakery ceased in 1909 and the shop became a stationers run by the Misses Smith. During the 1914-18 war the stables were commandeered for use by the army.

The original Rehill P.O. was a sub-office of Reigate, but in an advertisement in Palgrave's Handbook to Reigate (1860), it formed a separate district with John Markham, Postmaster. In R. Phillips' Reigate Guide of 1885 (map opposite page 68), the Post Office is shown in Station Road, just where 106 was. It moved to the Market Hall in 1891.

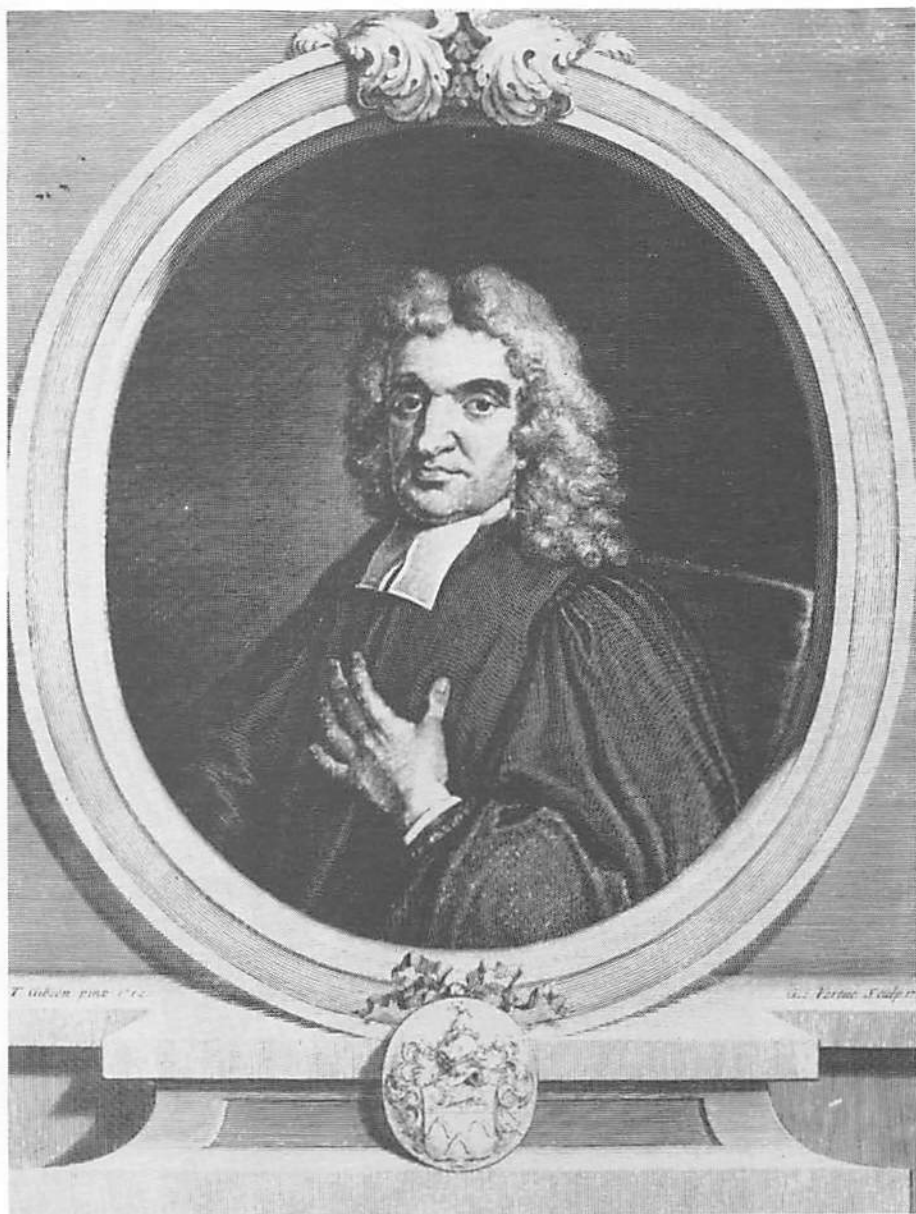
The Post Office was informed of the find and hoped to save some of the stone work, but alas demolition was complete.



Incised lettering and slot reconstructed from a rubbing



Exterior of 106, showing window and letterbox in east wall.



JOHN FLAMSTEED. [by kind permission of the Director, Royal Greenwich Observatory]

REV. JOHN FLAMSTEED, 1646-1719,
THE FIRST ASTRONOMER ROYAL AND
RECTOR OF BURSTOW

E. R. Turner

Horley Local History Society

John Flamsteed was the first Astronomer Royal and for many years he was the Rector of Burstow. He was born at Denby in Derbyshire on the 19th August 1646. His father, Stephen, was a maltster and his mother, Mary, the daughter of John Spateman, an ironmonger of Derby. He was weak from birth and, when he was only two years old, his mother died leaving a daughter of one month. Two years later, in 1652, his father was married again, to Elizabeth Bates, but she also died two months after the birth of a daughter in 1654.

At ten years of age Flamsteed learned Latin and advanced to studying Plutarch's *Lives*, Appianus's and Tacitus's Roman Histories and any other such works to which he could gain access. He was educated at the Free School in Derby. In 1660, at the age of 14, he contracted rheumatic disease. After two years, during which he was unable to go to school regularly, he learned mathematics at home and read technical books in Latin, commenced studying astronomy, observing and recording the eclipse of the sun in 1662, when he finally left school. He continued studying astronomy at home with considerable advancement, but was unable to go to University as planned.

Unable to obtain any relief owing to the medical profession's very limited knowledge at that time, his father sent him to Ireland when he was 19, for treatment by the 'laying-on-of-hands', or 'stroking', by one Valentine Greatrakes. He travelled via Liverpool and was much delayed by medical checks owing to the prevalence of plague. He hired a horse in Dublin and took four weeks for the return journey, without any beneficial results. The land journeys were made by hacking on hired horses, the best speed being a jog trot.

On returning home, he continued with more advanced study and recording of astronomical observations and also some astrology, which he abandoned, although suffering from long periods of weakness and pain. In 1668 he printed his observations of the solar eclipse of October 25th, having discovered that current tables differed very much from his observations. He then compiled an *Astronomical Almanac* for the year 1669, correcting the previously accepted predictions, and this was submitted to and accepted by the Royal Society. This led to recognition by influential circles and on a visit to London he was taken to see Sir Jonas Moore, Surveyor General of Ordnance at the Tower of London. Here he was presented with a micrometer and the promise of lenses for a telescope. From the very commencement of his studies of astronomy, Flamsteed was handicapped by the lack of instruments which he knew would be essential for the advancement of the subject. Only the crudest of telescopes were in use and he had no pendulum movement for

the exact measurement of time. The pendulum clock was invented by Huygens in 1655, but not in common use for a good many years. He met Isaac Newton at Cambridge and entered his name at Jesus College in October 1671. Three years later he took a degree of M.A. *per litteras regius*, designing to take Holy Orders and settle in a small living near Derby, which was the gift of a friend of his father's. Pending ordination, he stayed in London as a guest of Sir Jonas Moore in his apartment at the Tower, and was ordained by Bishop Gunning in Ely House at Easter 1675.

To appreciate the importance of the next stage in his life, it is necessary to glance back at the history of astronomy. Observations must have begun in the very cradle of civilisation. Observatories existed in very ancient times in China and the Babylonians had obtained sufficient data to prepare records of regular movements of the heavenly bodies. Studies were continued during the Dark Ages and the Middle Ages. The foundation in 1576 of Tycho Brake's observatory at Hveen in Denmark may be regarded as a milestone in observational astronomy. For example, he made a catalogue of fixed stars, more accurate than any which preceded it and greatly improved and extended instrumentation and observing methods. His work with and encouragement of Kepler led to the latter's great discovery of the laws of astronomical motion.

The telescope, which was not invented until 1608, led to a great advance. New observatories were founded, mostly in connection with Universities. The Paris observatory was founded in 1667, and it is from there that we return to the story of Flamsteed. At this period of time there was no means of calculating longitude other than by dead reckoning. Once out of sight of land, a ship's crew had no way of ascertaining their true position. This accounted for the great loss of ships and their crews. In 1674 the Duchess of Portsmouth, a member of the Court of Charles II, introduced a young Frenchman to the King with a plan for determining the longitude. The King accordingly appointed a small committee of learned men to investigate the claim. One of the members was Sir Jonas Moore and he co-opted John Flamsteed, who was staying at his house at the time. Flamsteed demonstrated the impracticability of the plan, pointing out that the first step towards solving the problem was the compilation of an accurate star catalogue and tables of the moon's motions. The existing catalogues were too inaccurate to be of serious use. The King thereupon exclaimed with vehemence that he 'must have them anew observed, examined and corrected for the use of my seamen'.

Immediately following Flamsteed's report, the Royal Society, headed by Lord Broucker, Principal Office of the Navy Board, and Sir Jonas Moore made recommendations to the King. This resulted in the King ordering an Observatory to be built in Greenwich Park, with Flamsteed to be appointed as Astronomical Observer at £100 per annum with one labourer as assistant.

The Warrant of Appointment, issued by his Majesty's command, addressed to the officers of his Ordnance was dated from the Court at Whitehall on the 4th March 1674/5:

"Whereas we have appointed our trusty and well-beloved John Flamsteed, Master of Arts, our Astronomical Observer forthwith to apply himself with the

most exact care and diligence to the rectifying the tables of the motions of the heavens, and the places of the fixed stars, so as to find out the so much desired LONGITUDE of places, for the perfecting the art of NAVIGATION, and our will and pleasure is, and we do hereby require and authorise you, for the support and maintenance of the said John Flamsteed of whose ability in astronomy we have good testimony, and are well satisfied that, from time to time, you pay or cause to be paid unto him, the said John Flamsteed, or his assigns the yearly salary or allowance of one hundred pounds; the same to be charged and borne upon the quarter books of the Office or Ordnance, and paid to him quarterly by even and equal portions, by the Treasurer of our said Office, the first quarter to begin and be accounted from the feast of ST. MICHAEL THE ARCHANGEL last past and so to continue during our pleasure. And for doing this shall be as well unto you, as to the Auditors of the Exchequer, for allowing the same, and all other our officers and ministers whom it may concern, a full and sufficient warrant."

Three months later, on 22nd June 1675, a further Warrant was issued by His Majesty's command, addressed to Sir Thomas Chicheley, Knt. Master of Ordnance:

"Whereas in order to the finding out of the longitude of places for perfecting Navigation and Astronomy, we have resolved to build a small Observatory within our park at Greenwich, upon the highest ground, at or near the place where the Castle stood, with lodging rooms for our Astronomical Observator and assistant. Our will and pleasure is that according to such plot and design as shall be given you by our trusty and well-beloved Sir Christopher Wren, Knight. our Surveyor General of the place and scite of the said Observatory, you cause the same to be fenced in, built and finished with all convenient speed, by such artificers and workmen as you shall appoint thereto, and that you give order unto our Treasurer of the Ordnance for the paying of such materials and workmen as shall be used and employed therein out of such monies as shall come to your hand for old and decayed powder which hath or shall be sold by our order of the 1st January last, provided that the whole sum, so to be expended and paid, shall not exceed £500, and our pleasure is, that all our officers and servants belonging to our said Park be assisting to those that you shall appoint, for the doing thereof, and for so doing, this shall be to you and to all others whom it may concern a sufficient warrant."

The Observatory was built from Wren's design at a cost of £520. In the meantime, Flamsteed continued his observations from the Tower and afterwards at the Queen's house in Greenwich Park until 10th July 1676, when he moved to the Observatory. He found it destitute of any instrument provided by the Government; but Sir Jonas Moore gave him an iron sextant of seven feet radius, with two clocks by Tompion, and he brought from Derby a three-foot quadrant and two telescopes. His salary was £100 a year, cut down by taxation to £90 and for this pittance he was expected not only to reform astronomy but to instruct two boys from Christ's Hospital. To try and cover his expenses and improve his instruments, he was obliged



The Octagon Room at the Royal Observatory, from a contemporary engraving by Francis Place. [by kind permission of the Director, Royal Greenwich Observatory]

to take private pupils numbering, between 1676 and 1709, about 140, many of them of highest rank. Under these multiple handicaps and in spite of continued ill-health he achieved amazing results.

The whole of the theories and tables of the heavenly bodies then in use were visibly and widely erroneous. Flamsteed undertook the herculean task of revising them single-handed. 'My chief design', he wrote on 31st January 1680, 'is to rectify the places of the fixed stars, and of them, chiefly those near the ecliptic and in the moon's way.' For this purpose he had executed some twenty thousand observations by 1689.

His patron, Sir Jonas Moore, died in 1679 and the King in 1685, but that year Flamsteed was presented by Lord North to the living of Burstow in Surrey, and his financial position was further improved when his father died four years later. He was at least enabled to construct a mural arc, with which all his most valuable work was executed. Its completion marked a great advance in the art of mathematical instrument making, and it is recorded that from that moment everything that Flamsteed did was available to some useful purpose. He determined the exact latitude of the Observatory and other basic factors upon which modern astronomy has been based.

His observations on the great comet, extending from 22nd December 1680 to 15th February 1681, were transmitted to Newton and turned to account in the 'Principia'. He firmly held that they referred to the body already seen in November, which reappeared after passing the sun, while Newton believed that there were two comets, and only acknowledged his error in 1685. The records indicate many cases of Newton, supported by other members of the Royal Society, putting pressure on Flamsteed to make the results of his observations available, without giving him the backing he needed. There is little doubt that Newton was one of the greatest scientists of all time; he was elected President of the Royal Society in 1705 and knighted the same year. But it was Flamsteed who provided a great deal of the ground work, and in 1711 Flamsteed complained that he had been robbed of the fruit of his labours, having spent above £2,000 of his own money on instruments and assistance. He was often ill and always overworked.

When Flamsteed was appointed to the living at Burstow in 1684, he succeeded Ralph Cooke, who had been the rector since 1637 and who, with his wife, who died the following year, is buried under the altar in Burstow Church. It may have been at her funeral that Flamsteed met their son, also named Ralph Cooke (of Lincoln's Inn), whose daughter Margaret married Flamsteed at the Church of St. Lawrence Jewry, London, on 23rd October, 1692.

From that date of his appointment at Greenwich, Flamsteed applied himself assiduously to his task. Although severely hampered by inadequate facilities, basically through lack of funds to supply equipment, instruments or assistance, he insisted on a high degree of accuracy in building up his star catalogue. He was continually pressed to publish his findings annually, which demand he persistently resisted. No stage was ever complete, as further observations called for continuous verification and correction. Further pressure was added in 1710, when a Board of Visitors was

appointed to inspect the Observatory and his records. Despite his opposition, these were published in an edition known as *Historia Coelestis* in 1712. Flamsteed's portrait was painted by Thomas Gibson in 1712. An engraving by George Vertue made from it was prefixed to the *Historia Coelestis Britannica* and the original was bequeathed by Mrs. Flamsteed to the Royal Society. A copy is preserved in the Bodleian Library. The features are strongly marked and bear little trace of age or infirmity: the expression is intelligent and sensitive.

The energy displayed by Flamsteed during the last seven years of his life, in the midst of growing infirmities, was extraordinary. He was afflicted by a painful disease, prostrated by periodic headaches and crippled with gout. In many respects he was an excellent man, pious and conscientious, patient in suffering, of unimpeachable morality, and rigidly abstemious habits. His wife and servants were devoted to him living, and dead. His naturally irritable temper, aggravated by disease, could not brook rivalry. He was keenly jealous of his professional reputation. He was taken very ill on 27th December 1719, died on the 31st. and was buried in the chancel of Burstow Church, with no monument to mark his grave, although funds were appropriated for this purpose in Mrs. Flamsteed's will. This omission is now being rectified and a memorial bust, to be placed in the chancel, is now being sculpted by Mr. Honey of Cranleigh.

His devoted assistant of some years, Joseph Crosthwait, after reporting the last hours and death of his principal to Abraham Sharp, the famous instrument maker and a long-established friend of Flamsteed, wrote that no arrangements had been made for its continuation. He says "This is what made him so uneasy the last day of his life, — his speech failed, . . . he has not left me in a capacity to serve him, . . . but the honour and esteem I have, and shall always, for his memory and everything that belongs to him, will not permit me to leave Greenwich or London before I hope the three volumes are finished. I shall always lament the loss the public will have of so valuable a man." An enormous amount of work had been done and recorded, but the mammoth task had not been completed nor had arrangements been made to this effect. However Joseph Crosthwait undertook the task and continued to edit his master's work, assisted by Abraham Sharp. With Mrs. Flamsteed's support, but without any financial reward, they overcame difficulties through lack of funds and problems with engravers and Flamsteed's *Historia Coelestis Britannica* was at last produced in 1725, six years after his death. It has been described as one of the most significant productions of the Royal Greenwich Observatory.

John Flamsteed left to his wife £120 per annum in Exchequer and South Sea bonds for life, and in addition about £50 per annum 'which came to her to be solely at her disposal'. He also left about £350 in ready money, but made no arrangements about his books, manuscripts and printed copies of his works, which presumably remained in the hands of Mrs. Flamsteed and a niece, Mrs. Hodson, who were named as his executrices.

A great deal of information about his work in the forty-four years up to his death in 1719 is recorded in his voluminous correspondence published in 1835 by Francis Baily in *An Account of the Rev. John Flamsteed*. The author has drawn upon this

and also on the account of Flamsteed in the *Dictionary of National Biography* for the above section of his paper. However, this life story would not be complete without trying to piece together the Burstow connection. The ancient wealden parish of 4,850 acres extends from the Surrey-Sussex border in the south almost to Bletchingly in the north. It was served by the 11th century church until near the end of the 19th, when Outwood and Copthorne churches were built, and it is recorded that the population in 1800 was 606 persons.¹ The rural communities were mainly grouped round the four moated manor houses; the oldest and most important being Burstow Court adjacent to the church. The living at Burstow not only provided Flamsteed with an occasional respite from his arduous duties, but also a very welcome addition to his income. Old accounts indicate that the direct financial returns were very small after paying all expenses, including the income for his curates. However, in addition to the Tithes, he did receive goods in kind, all of which materially assisted in financing his work at the Observatory.

Reference has already been made to Francis Baily's book, but there also exist original letters, mostly between Flamsteed and his curates, which refer to his living at Burstow. They are held in the archives of the Royal Greenwich Observatory at Herstmonceux Castle. By kind permission of Dr. Alan Hunter, Director of the R.G.O., copies have been made available to the author by Mr. P. S. Laurie, without whose help and encouragement this history would have been very incomplete and unauthenticated.

From these letters and entries in the church registers, it would appear that Flamsteed usually visited his parish twice a year. In letters to Isaac Newton² dated 28th March 1700 and again in July 1705, he says "I am going into Surrey for six or seven days" and "I must go into Surrey to reap my harvest as I usually do about this time". It is revealed that he took a great interest in the details of the conduct of his parish affairs and the care and maintenance of the 100 acres of Glebe.

Communications were undoubtedly difficult. There is a reference in 1700 that 'the penny post comes something quicker than the General Post' and writing to his curate Timothy Stileman, he says³ 'Last Monday I received two letters from you. THE IDLE POST GIRL had kept one of yours by her some days to save herself the labour of a journey to the Observatory with it alone and brought it, your second others together, two days after your latin letter arrived'. Letters for Burstow were dealt with by the Postmaster at Reigate and arrangements had to be made for them to be sent on to Horley for collection.

The network of roads we know today did not exist. The very few tracks and bridleways were mainly for local use and very hazardous throughout the Weald in winter. It was not for another 100 years that highways to take wheeled vehicles were put in hand to link towns and villages. Unfortunately no details have come to light of the route and conditions experienced by Flamsteed on his many journeys between Greenwich and Burstow. Occasional references are made in his letters, but hacking for more than 30 miles under the prevailing conditions by a bulky man in poor health must have been a very arduous undertaking. At the age of 60 he wrote to Mr. Stileman and rebuked him for his absence from his duties at Burstow without

authority or notification, when he went to Oxford to take his degree.⁴ He goes on to say 'I write to acquaint you of the badness of the ways. I dare not yet take my journey for I am scarce yet well of my illness and the pains of my foot. I am much afraid of the cold and the wet which I must necessarily meet below the hills may cause a relapse worse then the first distemper. I shall therefor save my journey for a fortnight or three weeks after the holiday'. Also 'advise Michael Todd, Mrs. Smith and my tenants I expect my rent when I come down'.

The reference in a later letter to goods sent by carrier many indicate that the road from Lewes via East Grinstead and Godstone was in limited use. On 22nd November 1706⁵ he writes 'Yours of the 9th inst. I received as I was going to London in the coach on Wednesday was seven-night with my wife. We sent the boy back that night to look after the fruit, but not returning ourselves till Fryday night, I could not give you an account of its arrival before this. We found it safe and on opening it, the apples on the top were very good but the pears underneath were injured by reason of the weight lay upon them or that they had been too long put up before they were brought by the carrier.'

Flamsteed also reprimanded Stileman for not visiting him at the Observatory on his journey back from Oxford. He says 'Mr. Green was lately in town – if the ways are not so abominable bad but he can travel them, I suppose it will not be worse for you than to him and you are not so heavy as he is, this is no good excuse.' It was part of the curate's duties to care for the Glebe lands for he goes on to say 'I am very sorry the thatching of the barn was so long delayed. I fear the straw is injured by too much wet. This ought to have been done before you went to Oxford . . . My respects to your sister, uncle and aunt . . . We are told King Augustus of Poland marches for Italy with 1,900 men to Assist Prince Eugene.' Goodman Chart the Parish Clerk was also involved for in a duplicate to the letter to the curate he was told, 'I think it advisable to let my copse stand for another year before I cut it and therefore desire you to make up the gaps round it vey well to prevent John Steers cattle from getting into it and making any further waste.' In a postscript he continues 'I think it my turn to choose the Churchwarden, pray look into your book and see if it be, let me know by your Reigate post and who of my neighbours who have been longest out and I will order you who to pitch upon.'

Two more letters in that year introduce a note of sadness and the problem of keeping a curate to look after his benefice.⁶ From the observatory he writes to his friend, Abraham Sharp, of Little Horton, Yorkshire, 'My friends here die apace. I grow gouty and the pains of my feet hinder me from stirring much abroad so I am confined in a manner to my business.' In August he writes, 'Mr. Witty I have dismissed from the Observatory and he is now chaplian and companion to a young gentleman in Hampshire on better terms that I could afford him'. The problems of suitable replacements also occurred at Burstow and is referred to in a letter from Bishop W. H. Kennett who signs himself as 'your affectionate friend.'⁷ '1st November 1715: I have been so anxious to provide a safe and honest curate for you and I think at last I have fixed upon a man against whom I know of no objection. I sent to Peterborough for him where I knew him well to be a sober quiet man, and now

happens to be lately out of business; I have proposed your curacy to him at the terms of forty pounds per annum and perquisite of a small parish. He is one Mr. Francis Peck, a single man of our side with good modest sens and very sufficient learning'. If you let me know when he shall attend you and go down to residence, I will send for him and I believe he will fully answer your desires. I am now in waiting at court and should be glad you would dine with me.' There follows a letter of introduction with the comment 'There is but one objection, he is only Deacon but that defect shall be supplied by my care of getting him into Priests orders as soon as maybe'.

It would appear that the Rector was not always received with open arms when he visited Burstow. The year following his installation, Mr. Peck writes,⁸ 'I had the favour of your kind letter, and the next day brewed the drink you ordered and gave the Clerk directions to acquaint everybody of your intended resolution to be at Burstow as on this day sennight, and what you expected from them, but I find they murmur and grumble at ye proposal. When you come down pray please let 'em put up the Fryingpan and Warmingpan you promised me'. 'Mr. Clark began to teach school at his house the Monday after Easter. Mr. Rebow allows him for two, and I for one poor child to learn to read, and he hopes you will send him some more'. The Rebow family were substantial land owners in the parish, having come to Smallfield in 1703.⁹

In that same year of 1716 two letters¹⁰ were written to his friend, Mr. Sharp, which fix the date for the alterations to the vicarage. In August he writes, 'I have now completed the 70th year of my age: a little business now lies heavily upon me than a great deal did formerly. My Parsonage House is part of it, plucked down and rebuilding . . . My strength impairs daily, so that I can now walk but once a day to church on Sundays. My memory and reason continue still – praise be to God.' In the second letter of 28th December, he says, 'I have rebuilt three quarters of my Parsonage house at Burstow at about £120 charge, so that it is now the best in the country. I am feeble and have swimming in the head. I praise God for the health I enjoy'. With all his suffering he invariably ended his correspondence with thanks to God for his ability to carry on, as in what was probably his last letter to his friend dated the 13th September 1718, 'I have voided another small stone yesterday, and without much pain. I am now complete 72 years of age, and entered on my 73rd. I thank God I have my health well for my years, and I doubt not he will continue it that I may finish what I have in my hands'.

The name of Flamsteed is perpetuated in the memorial east window of Burstow Church and by their charities.¹¹ John Flamsteed, by his will dated 1717, left the income from £25 for two coats for two old poor folks, and Margaret, his wife, by her will dated 1728, left income from £25 for two gowns and petticoats for two poor widows. These gifts have now been amalgamated with other bequests dating from 1626 and are managed today by the Trustees of Burstow Parochial Charities.

1 Manning & Bray, II. 288.

2 F. Baily, *op. cit.*, in text.

3 RGO vol. 33 f. 104.

4 RGO vol. 35 f. 156.

5 RGO vol. 33 f. 104.

6 R. Baily, *op. cit.*

7 RGO vol. 37 f. 66-7.

8 RGO vol. 37 f. 104.

9 SRO 214/2/21 & 22

10 F. Baily, *op. cit.*

11 Manning & Bray. II. 288.

EXHIBITS AT THE 1974 SYMPOSIUM

James Batley
The Bourne Society

To the organiser, the great attraction of the exhibits at the Dorking Symposium has always been its diversity. The Ninth Symposium had 'Road Transport' as its theme and some twenty organisations met the challenge in a pleasant variety of ways. Every year there are surprises amongst the exhibitors and absentees. 1974 was no exception.

The Surrey Record Office chose the topic of 'County Bridges' and demonstrated how, in the development of road transport, the County Authorities (the Court of Quarter Sessions and, later, the County Council) took over the responsibility for bridges from the Manor and the Parish. Miss Marguerite Gollancz, on her last attendance as County Archivist, chose the bridges at Betchworth, Chertsey and Cobham as examples, producing a well-documented docket in explanation.

Surrey County Library, exhibiting for the first time, had a stand showing the range of materials useful to students of local history which can be obtained through a modern library system, including maps, illustrations, periodicals and so-called ephemera, as well as books.

Guildford Museum, a faithful contributor over the years, had an exhibition on river transport, illustrated by a plan and photographs of the Wey Navigation, and a model of a Wey barge made by one of the barge-builders.

Shere and Gomshall Local History Society's display illustrated the building and running of their railway line with photographs, documents, maps and a written history.

Esher and District Local History Society chose as its theme the Portsmouth Road as it runs through Thames Ditton, Esher and Cobham. It included photographs of inns along the road, such as *The Bear* at Esher and *The White Lion* at Cobham; travellers' aids such as milestones; means of transport; also a model of Esher Parish Church near the Road.

The Bourne Society had a table display illustrating the old Lewes Road (now A 22) with Ogilby's 1675 map, two turnpikes, a milestone, a relief model of the Godstone Gap and the historic split-level Wapses Lodge Roundabout (1939). Their board display showed the Arms, map and Seven Wonders of the new District of Tandridge, later distributed to 7,500 schoolchildren.

The Mayford History Society showed (1) models of road vehicles of the 1920s and photographs of vehicles 1829-1957. (2) Fords and bridges over the Stanford Brook. (3) A project in progress 'Erosion of History' showing sites of historical interest in Woking, plotted on a six-inch map with cross-references to record cards.

The Omnibus Society, under the aegis of the Symposium speaker Mr. A. G. Newman, showed examples of timetables, tickets, photographs and the first Minute Book of the East Surrey Motor Company; some personal relics of Mr. Hawkins' association with the company, the topic of the talk, and a 1902 horse-bus ticket-punch.

The Nonsuch Antiquarian Society in association with Bourne Hall Museum (represented for the first time), used *Illustrated London News* pictures of a wide variety of road transport going to Epsom races between 1843 and 1866; the Roman road at Ewell; coaches, timetables, milestones and tollgates on the London-Dorking Road; the Ewell pack horse bridge and the 1821 Ewell fire-engine, to depict road use through the ages.

The Surrey Archaeological Society contrasted a section of Roman Stane Street with Motorway Rescue work in North-west Surrey. Finds from a local excavation in the crypt of St. Martin's Church, Dorking in 1974 were also shown.

The Dorking Preservation Society's Historical Group showed pictures of Broad and Walker coaches, two friendly rivals in the town from 1820 to 1840; and models of vehicles ancient and modern. Mr. J. E. Walker thus commemorated the coaches of his ancestors.

The Croydon Natural History and Scientific Society embraced the many forms of transport seen by Croydon – as a busy coaching centre in the 18th century, terminus of the world's first public railway in the 19th, the canal, experiments with atmospheric traction, its first conventional steam railway, tramways and the famous pre-war Airport.

The Surrey Domestic Building Research Group's exhibit showed milestones, bridges, a tollhouse and *The Coach and Horses* at Egham. The inn was swept away by the M 25 works, but not before the Group had recorded it on their card and retrieval system.

The Walton and Weybridge Local History Society's display detailed the history of the road bridge at Walton-on-Thames: the first (wooden) bridge opened in 1750, the second bridge completed in 1786 and collapsed in 1854, the third (toll) bridge of 1864, freed from toll in 1870 and the temporary bridge built after bomb damage to the third bridge in World War II.

The Local History Group of Holmesdale Natural History Club showed a plan of Turnpike Roads through Reigate and Redhill and pictures of tollgates, also a strip-map of the Brighton Road and four coaching prints. Pictures of the two-hundred-year-old Coach-building firm of West Street, Reigate – George Burtenshaw and Sons – were also shown.

Farnham Museum Society, with customary originality, illustrated the conflict between modern traffic and ancient towns. Two Farnham businesses evolved to meet modern needs – George Sturt's wheelwright's shop became a lorry construction firm, and Abbots, coach-builders, attempted glider and aeroplane construction.

Sutton Public Libraries chose pictures from their collections to show examples of wheeled vehicles from 1740 to 1950; the South Metropolitan Croydon-Sutton trams; the change from tram to trolleybus in Sutton.

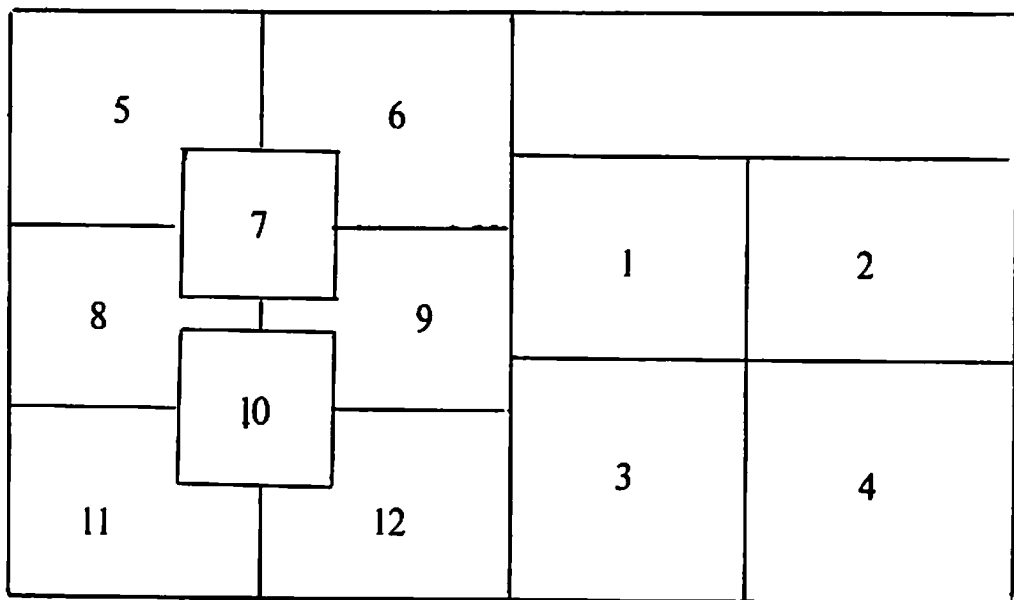
The Surrey County Council Planning Department showed examples from its collection of 15,000 photographs of buildings, coaching inns and milestones, structures associated with road transport and also post-cards of pre-1914 horse-drawn vehicles in town and village settings. Maps and photographs of Ripley Conservation Area and its relationship to the Ripley By-Pass now under construction were also displayed.

The above exhibits are described largely in the words of their exhibitors because I have learnt over the years how much thought, hard work and heart-searching goes into these displays which are only on show for a few hours on a single day. Whilst grateful to the Surrey Local History Council for giving them this shop-window to publicise their work, to sell their books and to learn from one another, I have sometimes wished that some enterprising authority could give the display a home for a week or so. Any offers?

I have always been impressed by the versatility of the bigger organisations in coping with a new topic each year. I have also been aware, as organiser, that there is often a conflict between the topic chosen by the Council and what the exhibitors would like to show. My last words after some nine years association with the Symposium must be of thanks to my many friends amongst the exhibitors for their art, industry and good temper in the efforts for a one-day Symposium. They have made Surrey History — in more senses than one.

I would like to convey to Mr. Batley our thanks for his nine years of hard work in organising the Symposium exhibits.

Kenneth Gravett



KEY TO COVER ILLUSTRATIONS

1. Outwood Post Mill
2. Gravel Hill, Leatherhead
3. Old Crane, Guildford Wharf, Guildford
4. Old Boarden Bridge, Godalming
5. Stocks and Whipping Post, Alford
6. The Old Jolly Farmer, Farnham, now William Cobbett
(Cobbett's birthplace)
7. Coal Tax Post, Esher
8. Alfold House
9. Brickworks, Hambledon
10. Nicholas Woolmer's Cottage, Blechingley
11. Newark Priory, Ripley
12. St. Peter's Cross and Cage, Lingfield

