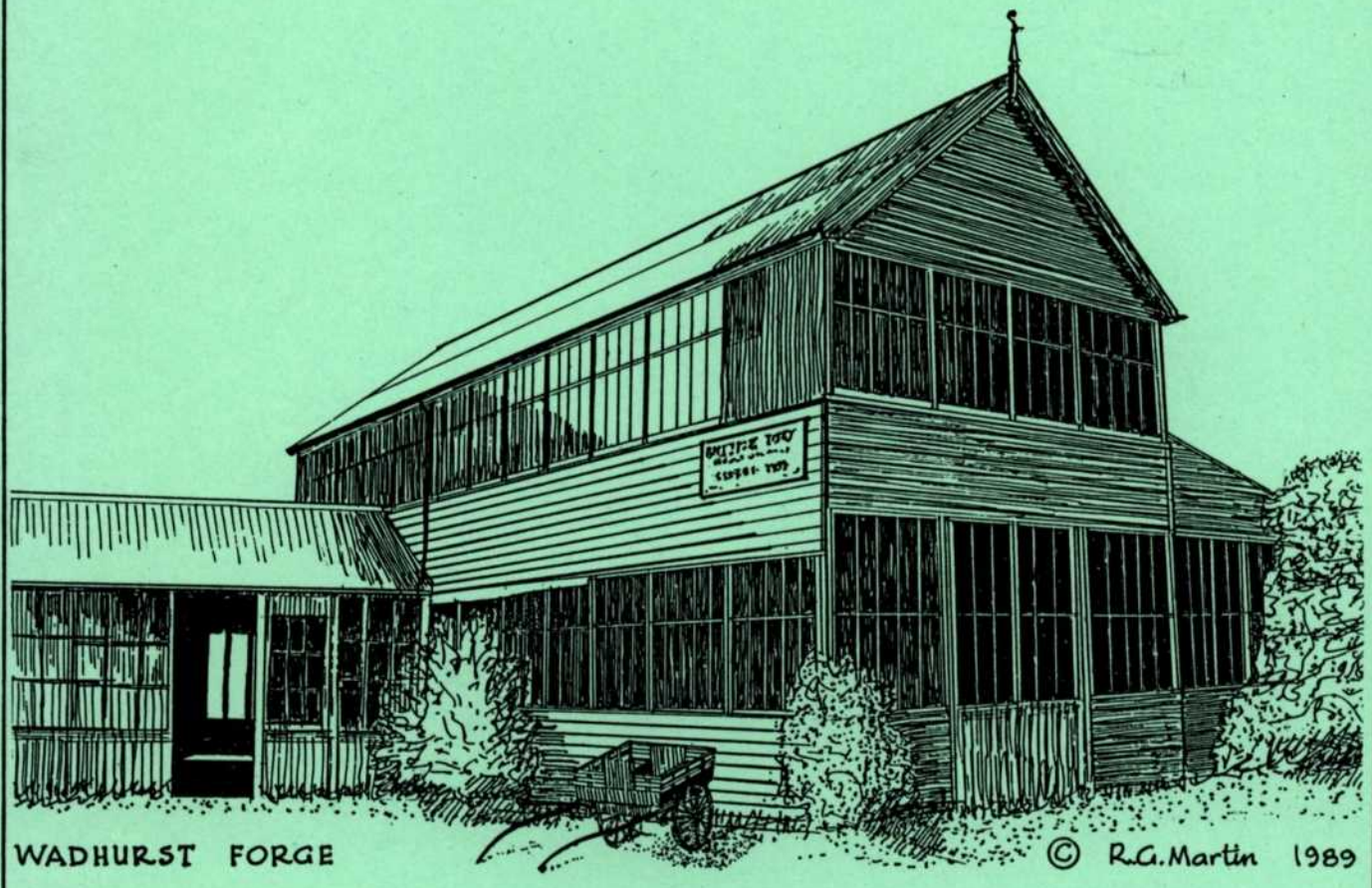
SUSSEX INDUSTRIAL HISTORY



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ERRATA

Please note the following errata to be inserted into S.I.H.19

Page 36 - for TQ 631 051 read TQ 631 015

Page 37 - for TQ 620 990 read TV 618 997

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G. MEAD

The Sussex Leather Industry in the 19th Century.

The leather industry had a role in the national economy greatly overlooked by many economic historians. Even the S.I.A.S. field guide does not mention a single item connected with the industry. During the eighteenth century it was the second biggest industry overall: by 1800 its value of £10½ million was only exceeded by woollen cloth and yarn. It remained a vital component in the nation's wealth throughout the nineteenth century, and in 1907 output by value, as a proportion of total industrial output, was 2.6% equal to the value of shipbuilding, and exceeded only by wool products at 2.8%. Tanning was carried on in 800 yards and the industry employed half a million people.(1)

Products for home and export markets, raw materials of bark, hides, tan and finished goods, leather, footwear and harness, were stimulated by the rapid expansion of British industry in the eighteenth and nineteenth centuries. At all levels of production and usage the products of the leather industry performed vital functions, from supplying machinery driving belts, to linings of gentlemen's hats. The growth of industry, closely linked as it was to the improvements in a wide range of communications, stimulated transport of all kinds, and thereby saddlery and haulage harness. For domestic consumption there was a continuously heavy demand for all types of footwear, clothing and gloves, and articles as diverse as bellows, buckets and bookbindings.(2)

The location of the industry was dependent on a combination of factors - raw materials, markets and the social structure of communities. The raw materials, bark and hides, were both supplied as the waste products of two basic national commodities - meat and timber, and the dependence on outside forces of consumption was a major regulator in the price of both raw materials. The hide of any animal is of no value to the primary purpose of killing a beast - i.e. as a foodstuff; to be of use at all as a valued commodity, biological decomposition of the hide must be arrested and the fibre preserved by means of the addition of a chemical agent - tannin. This is found in the cellular tissue of tree bark in variable quantities, but most abundantly in oak bark, where it forms an average 10% of the volume. As the hide can only be obtained from a slaughtered animal, so the bark can only be obtained as a by-product of the wood trades in fuel or timber.(3)

To varying extents these factors of supply influence locational mobility, but the requirement of a continuous supply of soft water limits the site availability to those calcium free areas although the Chichester and at least one Lewes yard used Downland water. A supply of lime is required for the initial cleansing process, but it is detrimental to the subsequent tanning stages. These requirements have meant limitations on the location of tanning to areas with supplies of bark, hides and water but many areas with these attributes do not support leather industries and a further, social constraint must be considered. Tanning tended to be located in wood-pasture districts where there was a less intensive capitalisation of agriculture, where labour was plentiful, and skilled in a variety of occupations often bound up with small metal working communities, as in South Yorkshire, West Midlands and the Weald. That raw materials alone, were no sure indicator of tanning location, can be seen in the area around Berwick Sussex. This parish, along with neighbouring Glynde, Selmeston and Arlington, had noted herds of Sussex cattle, grazing the adjacent marshlands. Bark from Abbotts Wood Arlington, was brought into Berwick station in the nineteenth century but no tanning industry was located in any of these areas, indeed little leather working of any description. The bark was destined for the big Baxter's tanyard at Cliffe, Lewes. Similarly the large flocks of Downland sheep had no attendant fellmonger businesses, except in the urban areas of Chichester and Lewes.(4)

The Weald was particularly favoured in sustaining a long established, multifaceted, leather industry; the water was generally soft, the agricultural economy provided hides, the Sussex oaks had a high tannin content, up to 16%. The Wealden social composition of small farms with multiple-occupation work-forces, allowed for a seasonal cycle of skilled workers. The river systems enabled products to be moved in bulk relatively easily from the interior, and the north of the area was, especially in the East Grinstead-Edenbridge locality, a branch of the extensive, South London tanning industry.(5)

The importance and volume of the materials required for tanning, especially the London trade, resulted in a complex system of supply. Hides arrived in the capital and all urban markets 'on the hoof', but bark supplies had to be hunted down. Buyers would travel the wooded areas, often far and inaccessible from tanneries, negotiating with wood-dealers and timber merchants during the winter, for the spring bark harvest; oak was the predominant source, but war-time shortages in the eighteenth and nineteenth centuries saw ash, elm and pine bark used. As a rule tanners preferred the bark from young coppice-wood, the tannin being richer the younger the tree, but demands of the wood trades for ship and house timber meant using the dryer bark of older trees. A 20 year coppice-tree would yield about 3 cwt. of bark, rising to 10 cwt. from a 40 year old, though of poorer quality.(6)

A wood dealer such as T. Puttock, bark-merchant of Billingshurst, organised gangs of labourers under a foreman to 'slipe' or 'flaw' the bark, and work would commence in early April in Sussex, later in more northern areas; -

"when the oak buds swell up like bumble-bees"
or "when the 'ringing-bird' (wryneck) appears in the area"

The flawing-gang would precede the wood-cutters by 'rinding' the tree 6 ft. up the stem, removing the bark in 3 ft. sections, enabling the felling to begin with least damage to the bark; as the tree fell, it was leapt on by the flawers who worked at break-neck speed to 'slipe' the the bark at its freshest. Speed was essential, as all flawing was only done in the 8 week period when sap was rising and when the gang of seasonal labourers - mostly local farm workers - could be spared before hay-harvest. Flawing-gangs would travel north with the season - as did many corn harvesters - and whole families travelled with the gang; George Maynard of Copthorne, tells of meeting his wife when she was working on a 'flawing-circuit' in the Weald. Flawers in the St. Leonards Forest area could earn between 2/6d - 6/- (12½p - 30p) a day in 1871; seldom were they paid piece work, as the most suitable tan was obtained from small branches and twigs, which were time consuming to flaw.(7)

The owner of the timber often made deals with bark gangs to fell the trees and 'flaw' the bark in return for a cash discount for the labour involved in tree felling. This suited both parties, the owner having marketable timber and the gang, their bark. A Mr Carpenter of Hooe, in 1837 paid Lord Ashburnham £366.2s.0d. (£336.10) for 183 loads of oak-bark, at 40/- (£2) a load (45 cwt.); he was allowed £131.2s.6d. (£131.12½) (36%) off for felling the timber. The bark price in London was often 3 x the price in Kent and Sussex, reflecting in part the cost of transport overland and by sea, of the bulky but friable material. When timber was in low demand bark prices soared and many trees were felled for that purpose alone. The Rev. Arthur Young blamed bark-dealers for excessive felling of oaks, but also noted -

> "stripping the tree of its bark and allowing it to stand in that state three years, to season before felling it, has the same effect in converting the sap into useful timber, as allowing the tree to stand with the bark on it for 25 years longer would have."(8)

In due course the women and children in the gang would 'hatch' the bark, scraping the moss, lichen and dead, outside bark away from the fibrous inner tan. Hatchers received about 31% of the load price between them 12/6d (62½p) on a 40/- (£2) load, though often this task was given as parish outdoor relief to paupers. The removal of the

Fig.1 Woodmen on oak they have trimmed

Fig.2 Unloading bark from canted timber-wagon

Collecting oak at Bucknell, a Shropshire village, which supported a thriving industry in bark from 1860-1914 ... buting it over a 20 mile radius ... and producing 250-300 tons a year for the tanning of 1000 dozen sheepskins a week.
(The Countryman)

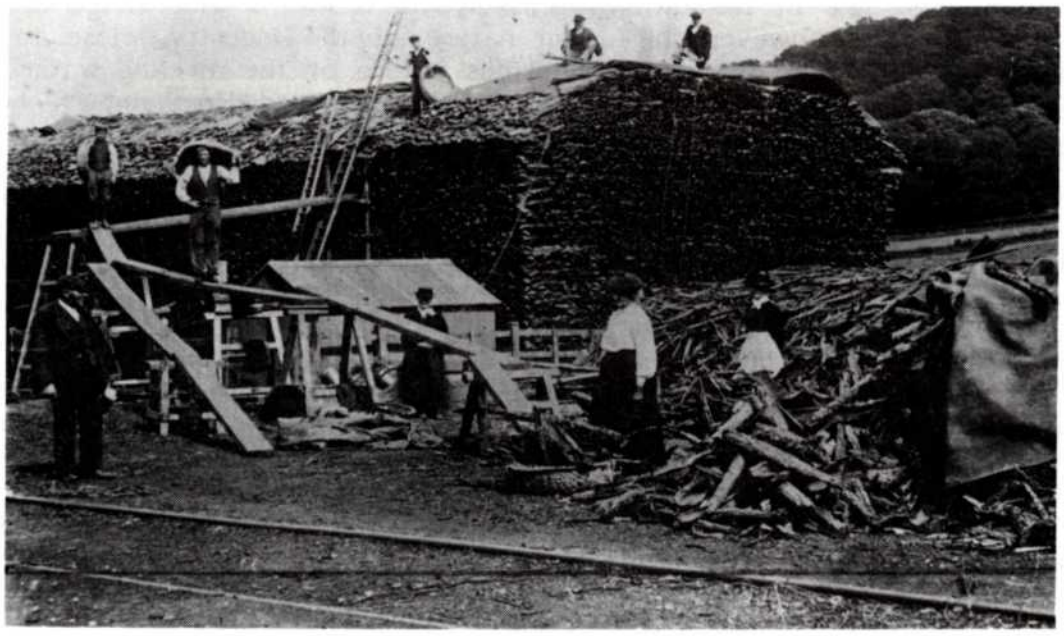

Fig.3 Catwalk for carrying up bark in wiskets

waste has been referred to as 'crapeing' by a contemporary source, and another notes 'Krap'(!) as the waste tissue and moss.(9)

The 'craped' tan was chopped into small pieces, and rammed into large sacks or 'pokes' for carting direct to the tanyard, or to a collection point on a river for transport to London or overseas. Guildford and Maidstone at each end of the Weald served this function, but the south coast ports of Arundel, Lewes and Rye also participated; in 1841 Rye shipped 22 cargoes to Leith alone.(10)

The collection and transport was organised by middlemen who negotiated contracts between woodmen, tanners and shippers; their role was essential when source and market could be often many hundreds of miles apart. Within the county the estates of the great landowners had long standing contracts with local yards, Goodwood and Cowdray for example supplying the Gibbing-Harrison yard at Westgate, Chichester, and Ashburnham, the firms at Battle. Many large yards stockpiled surplus unhatched bark in enormous ricks, selling it themselves to smaller local concerns without access to distant supply sources. A further process required the bark to be milled, either by a water mill as recorded at Midhurst, or a hand turned 'root-chopper'. This gave two grades of bark for use at different stages in the process, lumps for the tanpits, and powder for hide 'dusting'.(11)

The tanning industry thus utilised an otherwise useless by-product of woodland industry; the by-product of the bark trade were similarly re-cycled. The ground up 'krap' was valued as an insecticide by farmers, and the waste 'tan-turves' from the leaching pits were squeezed dry and sold as fuel blocks to industry. No mean achievement in a county as well-wooded as Sussex!(12)

The supply of hides to the tanneries was organised in similar fashion to bark, with dealers assembling consignments from a variety of sources. The overwhelming number were obtained from slaughterhouses and butchers, though the Poole estate at Chailey was selling hides to John Fuller the Lewes butcher in eighteenth century. The heaviness of hides and their propensity to decompose, required tanyards to be only a short distance from the slaughterers; tanning in general, produced a standardised product and was a 'material-orientated' trade. Though increasingly overshadowed by the Bermondsey yards,

which supplied over 12% of the nation's leather, there was a wide range of tanyards throughout the county, however the urban nature of the industry, close to a meat consuming population, was offset by the noxious nature of the air and water pollution accompanying tanning. 'Working' towns such as East Grinstead, Horsham, Chichester, all had yards at urban fringe locations, but the coastal resorts had their tanning done at some distance inland, so Brighton received leather from Cuckfield, Hurstpierpoint, Lewes; Bexhill and Hastings from Battle; and Rye - by nature of its confined area - from upstream Rother, at Salehurst and Etchingham. Eastbourne received its manufactures from Hailsham but this had no tannery and took leather from yards at Hurstmonceux and Heathfield.(13)

From the hide market, skins were sorted, 'fleshed' - sometimes by dogs kept for this purpose - and washed to remove blood and dirt, immersed in a pit of lime and water for a fortnight, removed, scraped, washed and left in a pit of hen, pigeon or dog excrement! This mixture opened the pores of the hide to allow penetration of tan. It was this latter process, that ensured tanning remained top of the league of noxious trades! - keeping yards clear of adjacent housing, as in the Ouse valley at Cliffe Lewes, or at Cuckfield, way out on Staplefield Common.(14)

By-products were already being created, the lime caused hair to fall from the hide, and was sold as wall rendering to plasterers, brush-makers and mattress-makers! The residues in the pit were sought by soap, glue and candle makers, and the final ammonia-rich waste, was sold to farmers as a manure.(15)

Tanyards were 'space-extensive' requiring areas not only for assembly of raw and finished materials, but also large numbers of pits for processing. A yard sold in 1807 at Sedlescombe had 54 pits; about 4% were for washing, containing running water, 8% for lime and ammonia and the remainder for 'leaching'. A quantity of bark was put in, water pumped on to it and left to steep, this liquor was then pumped on to fresh bark in another pit and so on, increasing strength all the time. This was a continuous process in established yards, tan preparation being a highly skilled task; the same bark being used over again until its strength was spent and it was sold off.(16)

The cleaned hides would be suspended in the weakest solution first, then pass through progrssively stronger 'oozes', until after 3 months they would be half-tanned, the complete process lasting from 1-2 years depending on size, nature, thickness and purpose for which the hide was to be used. Near the end of the process the 'butts' would be laid flat with neat bark powder between them as the final stage. The constant movement and carriage of the hides from pit to pit, necessitated the use of large numbers of 'tan-poles'. Levi Winchester of Dallington paid 6d (2½p) per 100 for these from the Ashburnham estate in 1881.(17)

Ever eager to capitalise an asset, the tanners - as well as selling surplus bark, hides and fresh tan home and abroad, sold the spent liquor, noted by John Evelyn the diarist as keeping -

> "deer conies and hares ... from plantations ... by sprinkling tanner's liquor ... which cattle most abhor"

The disposal of wastes was always a problem, and tanners were frequently blamed for pollution of downstream water supplies, by their flushing out tan and lime pits.(18)

The weight lost during tanning by the hides - up to 50%, meant leather was easy to transport, and gave more flexibility to the location of the next stage, the currier's craft. As this process restored weight to the leather, curriers were located near to leather users rather than producers. After tanning the leather could go a variety of ways, English leather though almost wholly intended for the home market, was highly prized abroad; for export and smuggling. In 1624, 20 armed men at Pevensey, were alleged to have fought off an attempt to prevent them loading wool, leather and cloth on to a waiting ship.

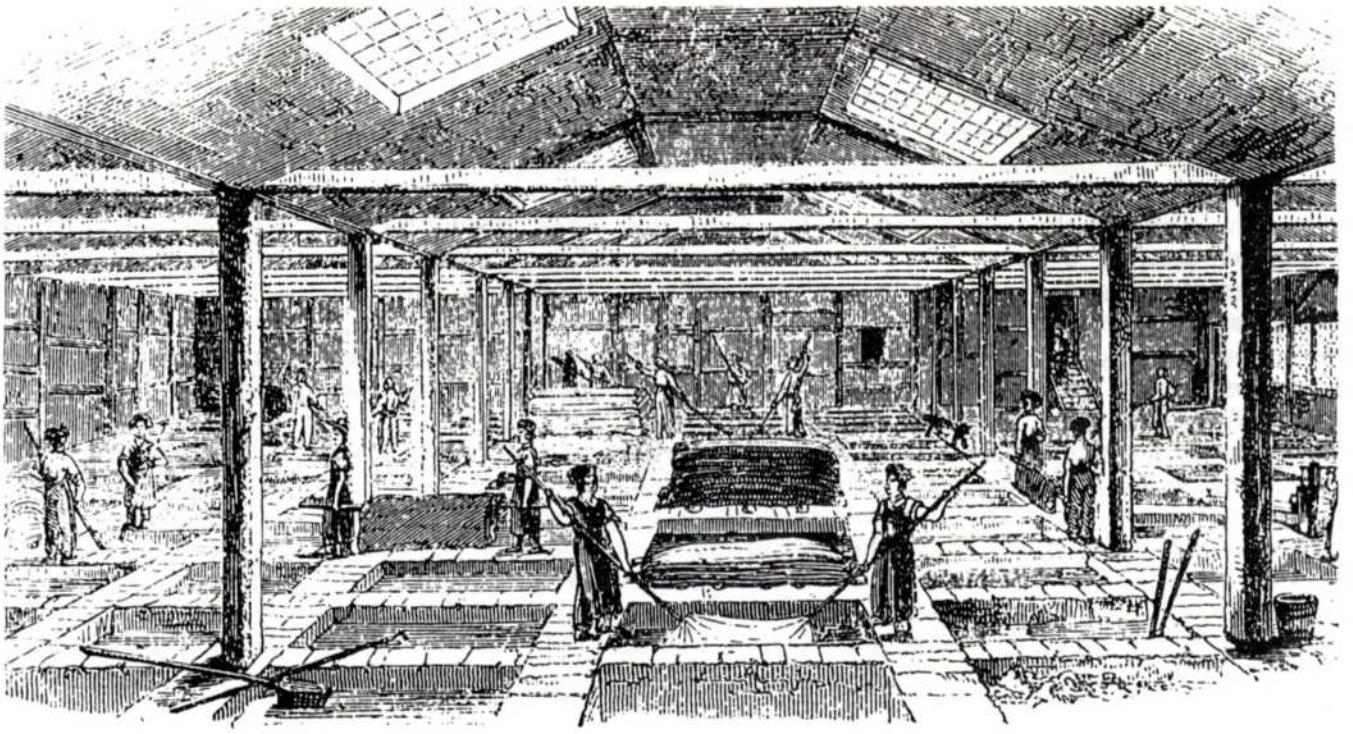

Fig.4 Nineteenth-century print of a tanyard with pits.

Internally, middlemen or leathersellers operated between tanners and curriers, though many shoemakers in particular, found curriers too adept at covering up flaws in the leather, and bought their own material direct from tanners. Curriers took the 'crust' leather, scoured and scraped it, stretching, rolling and oiling to achieve the thickness required by the customer.(19)

Tanning and currying both dealt with heavy leathers, cattle and ox hides, but an important trade was conducted in un-tanned light leathers, sheep, goat and calf skins: this was fellmongering. As no tanning was involved, less was involved in the way of fixed capital equipment, and less money was tied up in products; the operations therefore tended towards smaller, family businesses, less constrained in site location. Many of these businesses combined 'community-functions', not only fellmongering, but also buying and selling skins, pelts and furs, slaughtering and butchering meat animals, as well as making up products from skins. George Eede of Wivelsfield -

> "tanned sheepskins and manufactured there-from leggings, hedging gloves ... the masterpieces of his craft were bootligs, which were long leggings reaching nearly to the top of the leg"(20)

Fellmongers generally bought sheepskins on long contracts at specific times of the year, as the cost varied with the wool length on the pelt; Young noted that from shearing to Michaelmas, they were 1/- (5p) each, to Shrovetide 2/- (10p) and from Shrove to shearing 3/- (15p). Bones, hoofs and horn were sold for button and handle making, or as fertilizer, waste scraps being used in iron working areas in the cementation process of steel making, to introduce a high carbon content when mixed with molten metal. Pig bristles and oxtails went to brush makers, but the toughest bristle was used by saddlers for needles.(21)

After washing and fleshing, pelts were hung in a smoke house to loosen the wool, this was then fulled by hand - the actual job of 'felling' - and was used to stuff saddles, horse collars or sold to carpet-makers. Felled pelts were then 'tawed' - treated with a mixture of alum, salt and egg-yolk, hens being kept specifically for this egg using process. A variety of skins were processed, horse-hide appropriately(!) for harness and whips; mule hide especially, was favoured for machinery drive belts; deer and seal were used for fancy work and clothing, even eel skin was used as the swivel on flails; rabbit and moleskins were sent to London for clothing trimmings - Dan Scott of Nutley on Ashdown Forest, gave as his occupation in 1851 - 'pedlar in rabbit skins'. Even the humble hedgehog was

hunted down; horse trainers in foxhunting Leicester, fixed the skins to training jumps when exercising young jumpers!(22)

The final link in the chain from working beast to work-bench, were the various craftsmen turning the processed hides into consumer products; this was a 'market-orientated' sector, divided into heavy trades - saddlers, collar and harness makers, and light-shoemakers and clothiers; a division between those not suitable for 'a putting-out' system, and those which were. Shoemakers and cordwainers, by the nineteenth century synonymous terms, were 'low-investment' trades, capable of being carried on at the single man level, with little capital or fixed costs involved, often combined with other occupations, especially in small Downland parishes such as Pyecombe or Edburton, where the shoemaker-grocer was often the only tradesman; or at Plumpton Green where shoemaking was carried on in a room of the Fountain Inn. Larger centres of population, Battle and Lewes, operated 'putting-out' on a larger scale of grouped workers in proto-factories. At the bottom of the hierarchy came humble repairers and menders with 'translators' who made up recycled shoes from cast-offs; there was at one time an export trade from affluent England to France of old footwear. The poor state of roads meant a heavy toll on the toughest footwear and in the area of worst roads, the High Weald, the making of wood and leather clogs and pattens lasted long into the nineteenth century at such places as Uckfield, Burwash and Salehurst.(23)

All but the smallest parishes supported a shoemaker: Adams gives a threshold population of 300:1 but the 1851 census for 142 Sussex parishes shows a strong tendency for 100:1 to be more realistic for east and mid Sussex. Almost alone among the great production industries of the nineteenth century, shoemaking remained a cottage industry until the later years. The concentrations of craftsmen under a few hands as at Battle suffered greatly when the great flood of factory made wares came 'on stream' from 1860 onwards, out of the East Midlands and London.(24)

Towns on good communication routes had long taken out-work from the overflow of the Bermondsey yards, in the form of tanning, but the railway's arrival brought cheap ready-made materials into former production areas, Horsham was badly affected this way, but areas further from London survived; Battle by its proximity to Hastings, and Chichester by its services to the surrounding agricultural region. The railway stimulated transport in many forms, and saddlers and harness-makers prosperred until the arrival this century of motorised transport, originally supplying the equipment for haulage and farm tackle, they often combined allied trades, in particular ropemaking for harness; the rope works at Hailsham were founded by Thomas Burfield in 1780, then a journey-man saddler and collar maker. Large Sussex country houses with extensive lawns were an unlikely market for saddlers, but a couple of accounts mention the ponies who pulled the lawn mowers and rollers, were shod in leather 'horse boots' to prevent damage to the lawns!(25)

A large part of the saddlers' work involved the repair of existing tackle, and every spring apprentices set out to a round of farms loaded down with materials and tools, to clean and service harness for the coming year's work. During the 1860s saddlery apprentices doing a 63 hour week, started at 1/- (5p) which rose to 12/- (60p) after 7 years and doubled to 24/- (£1.20) on becoming a journeyman. Summer was spent building up a store of harness sets for the boom-time of Michaelmas, which with its round of farm sales and moves, was a peak sales period. As it was also one of the few traditional days off for farm labourers, they would flock to town with their harvest money to buy boots, gloves and leggings, for themselves and their families for the winter.(26)

A major Wealden occupation was gloving, supplying tough workmens' mitts and gauntlets, as well as lighter gloves for town sales. The latter was predominantly a female occupation, the lightness of skins and finished product making it suitable as a mode of outworking. Distribution and collection was done by urban-based travelling salesmen. At Henfield, William Morley carried on the joint occupation of batmaker and glover, no doubt linked to the town's cricket interests. Urban areas in the Weald

manufactured other light leather goods - trunks at East Grinstead, bellows at Lewes; and thin 'skived' leather would be used in the coastal resorts for hat linings, book-binding, bags, purses and trunk covers.(27)

The leather industry in Sussex during the nineteenth century, changed from a thriving local trade, with London and overseas connections, to an industry fully incorporated into the national economy, and suffering thereby from the more efficient modernised competition. From the seventeenth century at least, documents show a growing link between national and local economy, especially between the enormous tanning business of South London and the hides and bark from the Weald. A tanyard at Cliffe, Lewes, was owned by - "Abrahams Adams of St. Mary Bermondsey, fellmonger" in April 1681. The South Mill, Midhurst was leased in 1826 to a leather dresser of New Kent Road, Bermondsey and by 1861 a large family group from that parish had settled in Waldron carrying on a gloving-fellmonger business. The 1851 census shows a large number of workers and their families in the Sussex leather trades were born in and around Bermondsey, an area containing an eighth of the nation's tanyards.(28)

The movement of stock 'on-hoof', hides, bark and finished goods, promoted strong centuries-old, inter-regional links which lasted in many cases into the twentieth century, to be broken eventually by a combination of socio-economic and technological factors. The railways allowed mass-produced factory goods, mainly footwear, to be freely available throughout the region; the First World War severely depleted stocks of leather and a faster chemical-based tanning process was introduced, to eliminate the time-consuming oak-bark tanning; World War Two placed constraints on availability of imported hides and tanning compounds, promoting adoption of man-made fibres and materials. Finally the disappearance of horse transport took away saddlery and harness markets, home and abroad, especially military contracts for huge harness orders for the Indian Army cavalry.(29)

Unable to restructure to forms of new process and manufacture, the Sussex leather industry shrank rapidly: the Lewes tannery closed before 1907, Horsham in 1912, Battle by 1939 and finally, the Chichester yard at Westgate in 1955.(30)

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R. M. PALMER & A. E. BAXTER

Water-wheel Driven Beam Pump at Bignor Park

Introduction

It was a tantalisingly brief mention of Bignor Park in the SIH article on the Petworth Water Supply (1) that set the first-named author on what proved to be a long and at times exhausting trail of discovery and detection. Armed with the statement that a beam pump similar to that at Coultershaw existed in Bignor Park, he set out with the, almost voluntary, aid of some SIAS colleagues to track it down. This article relates their endeavours to piece together the design and operation of the pump installation.

The article starts by tracing the history of Bignor Park and includes some comments on water supply to country houses. This is followed by a description of the excavation and recording carried out on site. The results are then set out, leading to a theoretical reconstruction of the layout and operation of the pump. Finally, the archival evidence available on the history of the pump is considered and some attempt made to date its origin.

Bignor Park is in West Sussex, situated just to the north of the Downs near Petworth (fig.1) and lies in the Gault Clay strip between the Upper and Lower Greensands. Through the Park (fig.2) runs a stream fed by springs which gush out from the foot of the Downs above Bignor Mill. By this stream was built the beam pump (GR 993153) to supply water to Bignor House.

Historical Background

The Park has a long history going back at least to the thirteenth century when it became an appendage of Arundel Castle as one of ten enclosed parks in the area used for the fattening of deer. In 1584 it was sold by the Arundel family to Richard Pellatt, by which time it had acquired a lodge and garden with 350 acres of land. A new house was built in 1632, the commemoration stone of which is still retained in the exterior of the present house. The estate remained in the Pellatt family until 1712, when it passed to the Turner family and thence via a Mrs Dorset to John Hawkins in 1806. Hawkins spent a considerable amount of money and effort improving the estate including building the present house, designed by Henry Harrison in the Grecian style, and begun in 1826.

By the end of World War I Bignor Park, like many other large estates throughout the country, was in some disrepair and nearly bankrupt. It was put up for auction in late 1924 and most of it was bought by Charles Bigham, later to become the 2nd Viscount Mersey. His grandson, the 4th Viscount Mersey, now owns Bignor Park and we are extremely grateful to him for allowing us access to the pump and for the invaluable services of his estate manager Mr Robert Robertson.

The supply of water for the large country houses has always posed something of a problem, principally because they tended to be built on high ground for the view. Apart from rainwater cisterns, water was provided from deep wells, springs and streams using a variety of mechanical contrivances. Dr T.P. Hudson, in his article on Muntham Well, Findon (2) describes some of the ingenious arrangements employed. Certainly water raised from wells by human or animal power must have been among the earliest ways but were slow and demanded the full-time presence of a human. Later horse gins, windmills and steam engines were used to power well pumps until the advent of oil engines and electric motors. Where, however, the country houses were sited near a stream or river, the solution was to harness the water power so abundantly and cheaply available. But this

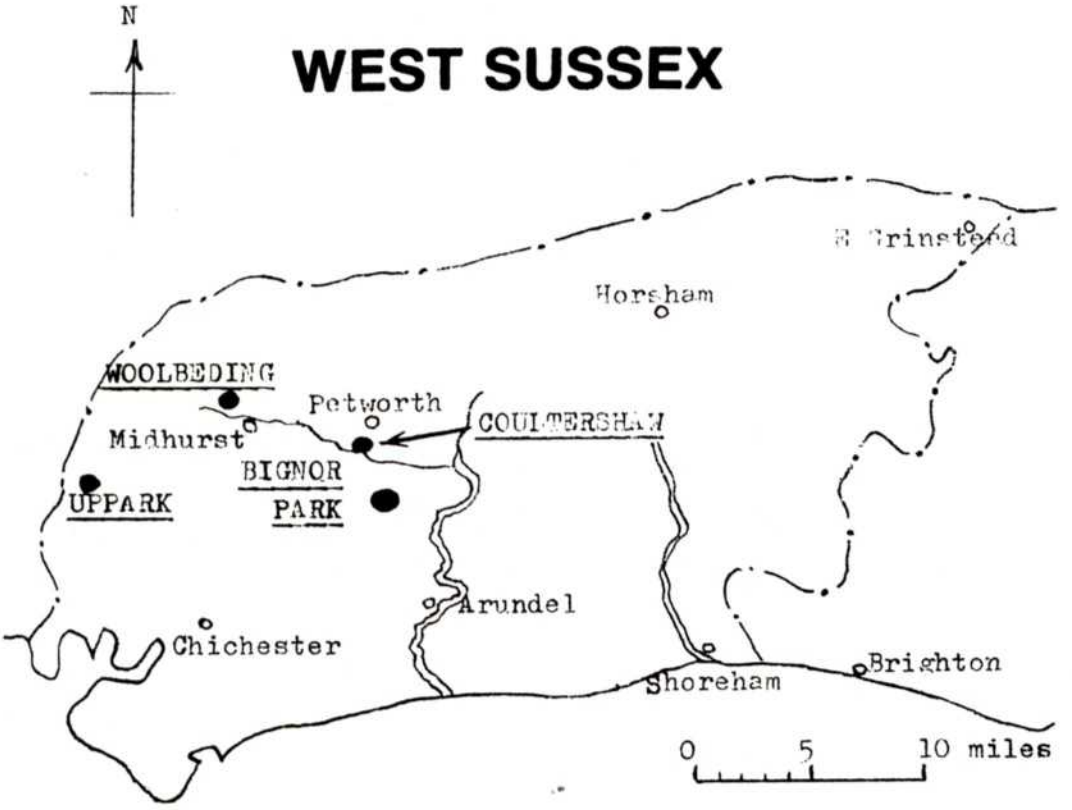


Fig.1 Locations of Bignor Park, Coultershaw, Uppark and Woolbeding.

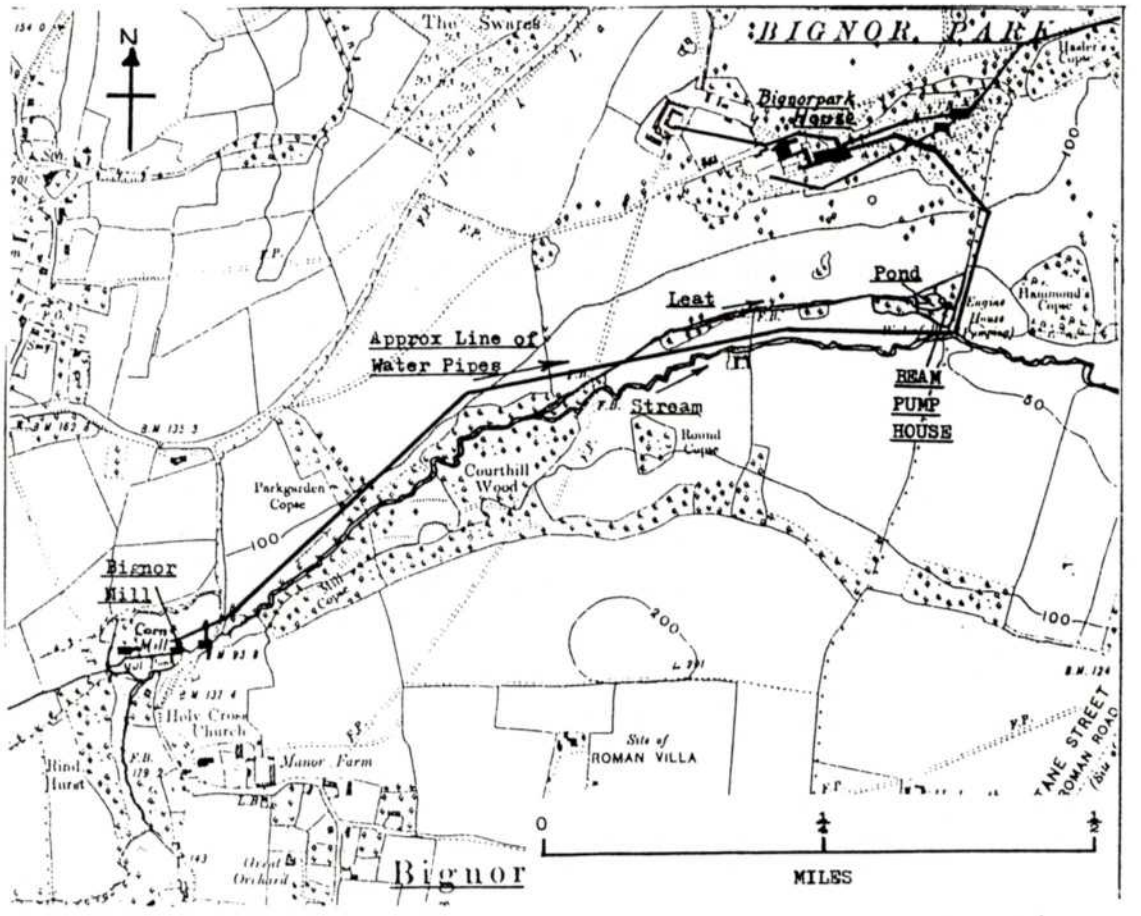


Fig.2 Bignor Park Pump House, Bignor Mill and Delivery Pipe System c1910.

was not a practical proposition until a satisfactory pump together with means of operating it by a waterwheel had been devised. It seems that this was achieved as early as the end of the sixteenth century in London where a waterwheel installed at London Bridge drove two vertical pumps through a simple crank and rocking wheel mechanism.(3) From documentary evidence of a crank driven pump designed for Woolbeding House, near Midhurst, in 1799 it is possible to suggest that this sort of basic arrangement was employed for early country house water supply in various places in Sussex, including Uppark House.(4)

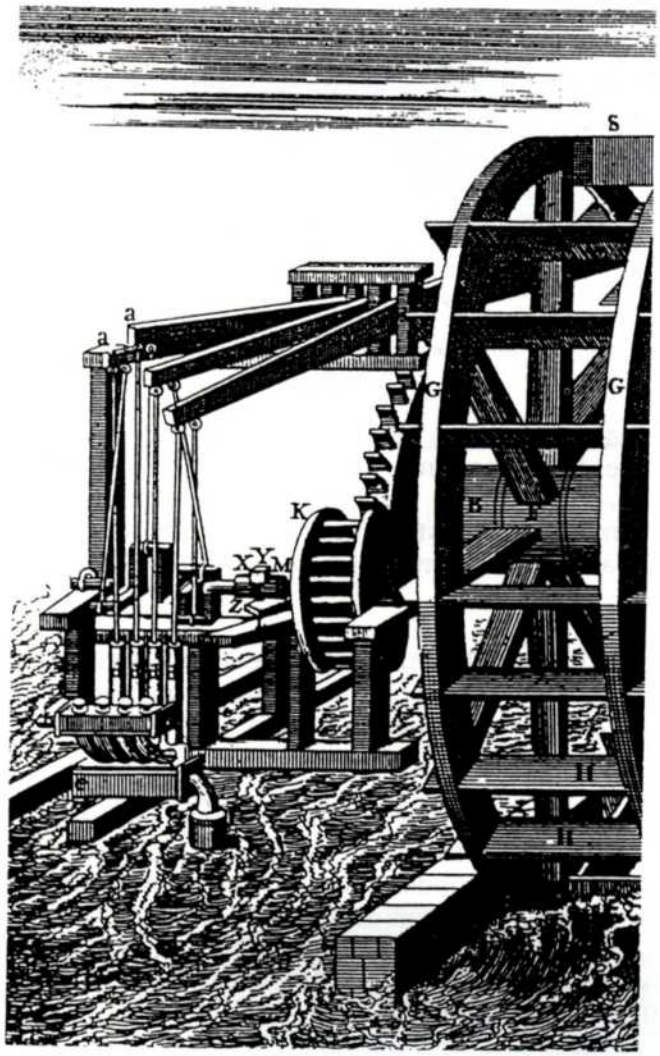


Fig.3 Sorocold's 1702 pump (part only) at London Bridge.

In 1702 George Sorocold, with a country-wide reputation for water pumping installations, erected a large water wheel at London Bridge driving sixteen vertical pumping cylinders through two geared four-throw crank and beam mechanisms (fig.3). Its success would have prompted the introduction of pumps of similar design in other parts of the country including Sussex during the eighteenth century. Certainly one was built at Coultershaw by the 3rd Earl of Egremont in 1784,(5) and it is likely that earlier examples operated elsewhere in the county. The Coultershaw pump ran until about 1960 and has since been restored by the SIAS. Such pumps continued to be installed well into the nineteenth century, for example at Woolbeding in the 1840s.(6) In all, a total of 21 water driven pumps are known to have existed in Sussex (See Appendix p.20). Except for the three already mentioned and one at Buckhurst Park,(7) little information has been published about their design or condition.

This brief survey of the history of water supply to country houses would not be complete without reference to the ram pump. The hydraulic ram, commercially developed in the mid-nineteenth century, with its great advantage of fully automatic operation, largely supplanted other water driven pumps and indeed allowed much smaller water supplies, like springs, to be exploited. A considerable number were installed throughout Sussex and some are still working.

Practical Investigation

The practical investigation of the site, involving photography, excavation and measurement, extended from October 1985 to October 1986, during which time seven visits were made with working parties ranging from one to five people. Those involved were A.E. Baxter, J.M.H. Bevan, L.J. Martin, R. Palmer (non-member) and R.M. Palmer. Much help, both informative and practical, was given by Mr R. Robertson.

Fig.4 Bignor Park Pumphouse as found 1985.

It should be mentioned at this stage that it was not until the investigation had been under way for more than six months that the team became aware that the site had been visited and recorded photographically by F.W. Gregory in November 1971, at which time the building, waterwheel and pump mechanism were almost complete. Initially, therefore, the team had no idea what they might find, barring the limited information available from the map survey (fig.2).

On arrival the site was found to be very overgrown, having been disused for over seventy years. The leat was dry but recognisable; the pond was silted up and covered with self-sown trees, and the pump house was a ruin, the roof and some of the walls having collapsed. The general state is shown in fig.4.

The rotting remains of the oak wheelshaft and of the launder clearly indicated that the external wheel had been overshot, and the bottom third of the broken cast iron wheel and spokes could just be seen protruding from the muddy silt in the wheel-pit. The interior of the pump-house was filled with fallen timbers and tiles from the roof. As these were cleared other non-structural timber beams were discovered, which were recognised as the beams, pivot support frame and guide frame of a three-cylinder beam pump, of the same general type as the Coultershaw pump (fig.5).

Once the pump-house had been cleared by the removal of several tons of rubble it became obvious that the installation had been systematically broken up to remove almost all the metalwork. Besides the lower part of the wheel, the only metal parts remaining were the broken suction and delivery pipes protruding through the walls, the dog-tooth coupling on the wheelshaft, the inner wheelshaft bearing pedestal and the crankshaft bearing pedestals (fig.7). Fortunately the base of the beam pivot frame was still in situ and the frame members could be identified. Thus with the measurements of the pump beams it became possible to reconstruct the layout with some confidence; this was subsequently confirmed by F.W. Gregory's 1971 photographs.

The remains of the wheel were partially excavated, sufficient to obtain dimensions of the wheel rim and spokes and to confirm the existence of sheet metal buckets. It had been hoped to excavate and recover the whole remainder of the wheel, with the possibility of finding a maker's name, but the extremely wet and muddy conditions and the dangerous state of the upstream launder wall dictated otherwise.

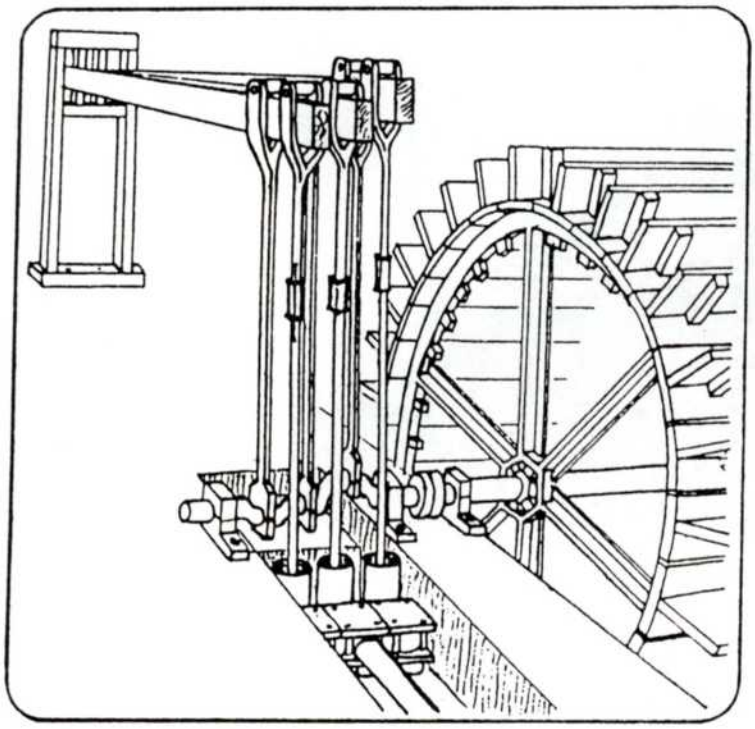


Fig.5 Coultershaw beam pump.

Fig.6

Bignor Park pump beams and rods 1971. (F.W. Gregory)

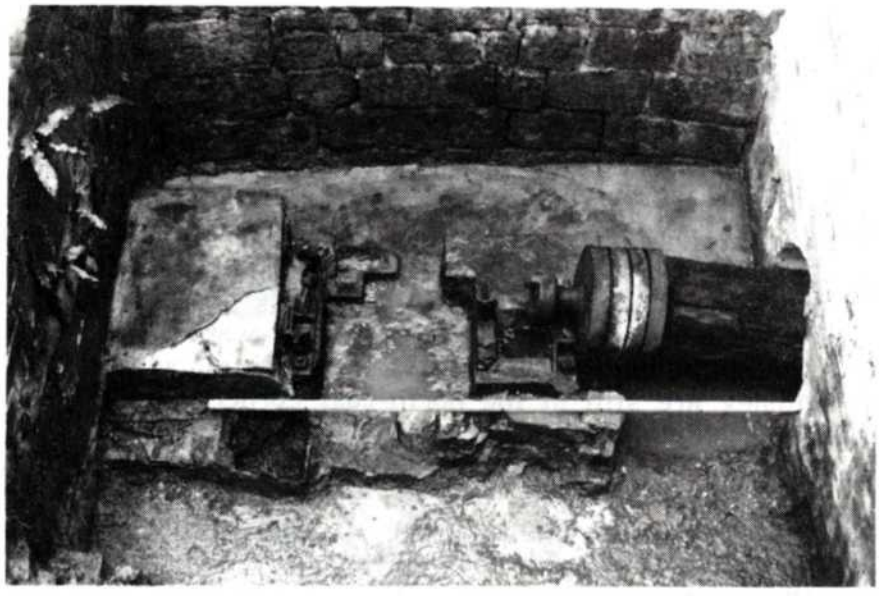


Fig.7 Bignor Park pump wheelshaft and crankshaft area 1986

Fig.8 Bignor Park wheel 1971 (F.W. Gregory)

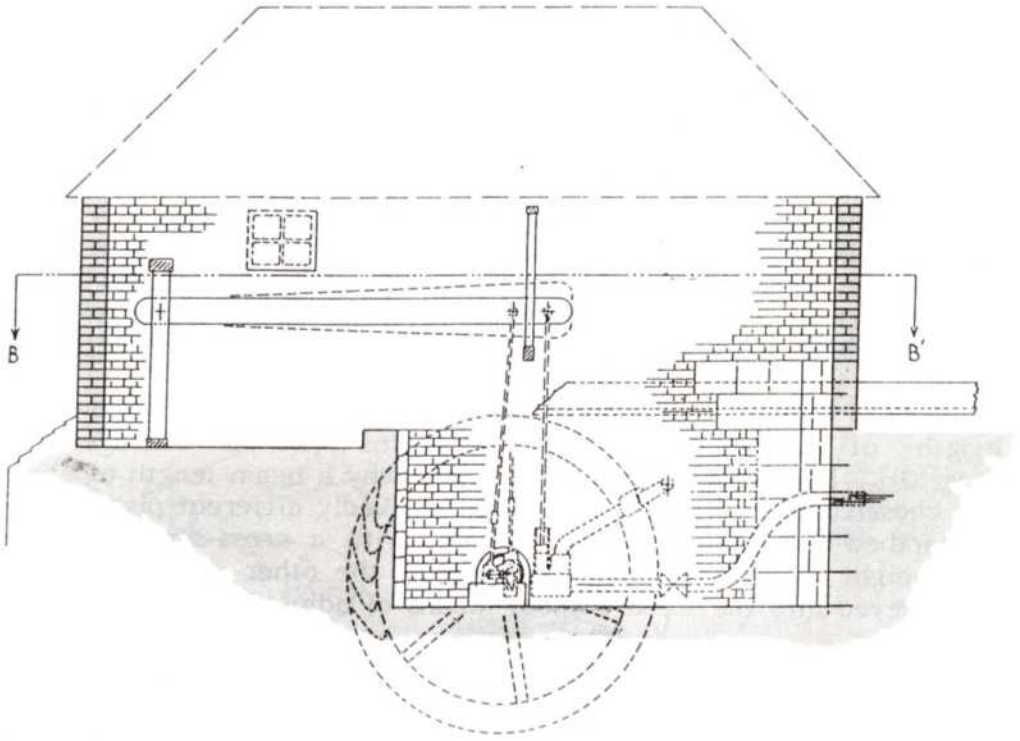
Results and Theoretical Reconstruction

From the investigations carried out, the general arrangement of the pump system in its final operational state is clear. Although the precise dimensions of the pump itself are not known, a reasonable estimate of its size can be deduced from the beam layout and from F.W. Gregory's photographs (figs. 6,8) which show that in 1971 the pump body and cylinders and one piston had already been removed.

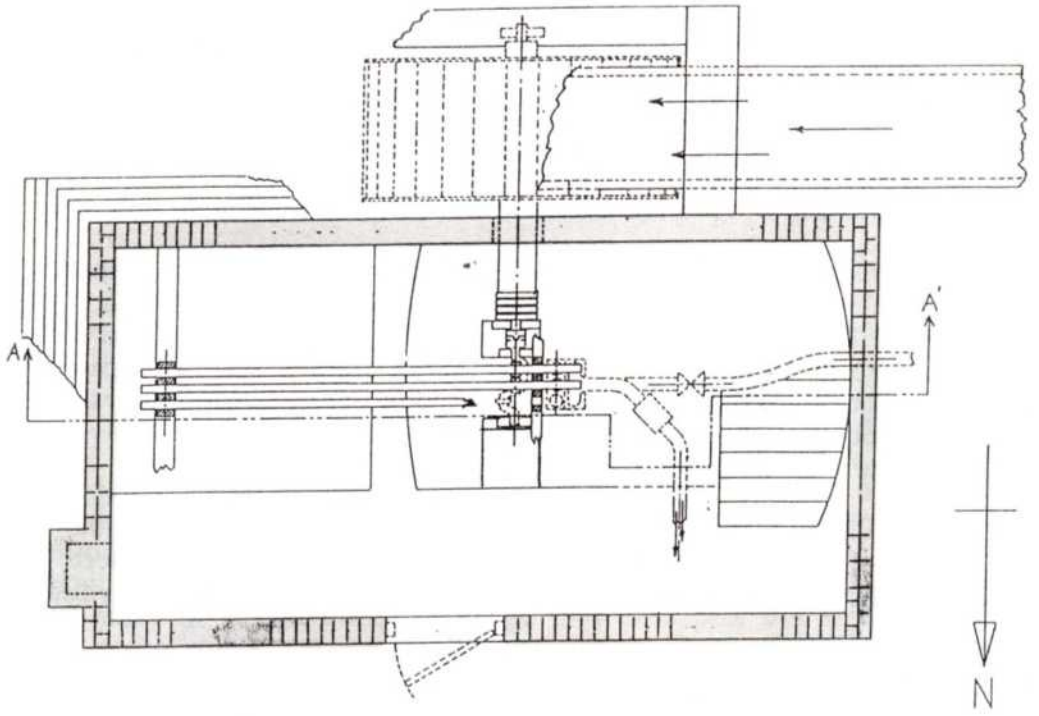
The pump drew fresh water from a spring-fed cistern of reinforced concrete with a capacity of about 8,000 gallons, built within the pond (fig.10), and delivered it up to cisterns both in and near the house against a head of 70 to 80 feet and over a distance of approximately $\frac{1}{4}$ mile. Late in the nineteenth century the water was also fed to the fountains in the gardens to the east of the house. The pump was driven by an overshot waterwheel, external to the pump house, fed from the storage pond which in turn was filled from the stream through the leat some 600 yards long. The pond has a stone dam wall to the east and south. Water entered the pond at the south-west corner over a spillway. There are two further spillways (main and subsidiary) sited immediately down stream (fig.10). The flow and thus the water level in the pond was controlled by boards located in side slots of both these spillways.

The pump house shows evidence of various phases of construction. The pit containing the wheelshaft, crankshaft and pump - about 12ft long, 8ft wide and 5ft deep - is largely constructed of ashlar, presumably local stone, each end being slightly curved as an arch dam. The wall on the wheel side and the superstructure are of brick and carried a hipped roof with clay pegged tiles. The building is 21ft long and 11ft wide internally, with 9" brickwork. The brickwork on the south, or wheel, side is irregular and patchy. There had been a door opposite the wheel and two small windows. A fireplace and the remains of a chimney are still in the north-east corner, which perhaps implies that the pump-house had other uses. The wooden launder lined with sheet metal was 3ft wide and 10ins deep. The penstock, presumably of cast iron, was entirely missing.

The cast iron wheel, 9ft diameter and 4ft wide, had a square hub with six integral spokes. The cast iron rims were in three circumferential sections bolted to the spokes, and carried 30 sheet metal buckets. Evidence for this is from one of F.W. Gregory's



SECTIONAL ELEVATION on AA'



SECTIONAL PLAN on BB'

Scale 0 4 8 12 16 20 Feet

All full lines are measured

Fig.9 Bignor Park Beam Pump.

photographs in 1971 (fig.8) and from partial excavation in 1986 of the lower third of the wheel. All indications are that the installation had always had an overshot wheel, though it is open to question whether the iron wheel is the original one or a subsequent replacement, as was the case at Coultershaw, where the original wooden wheel was replaced in the mid-nineteenth century with an iron wheel by Robert Chorley of Cocking Foundry. The oak shaft was 11ins square carried in $3\frac{1}{4}$in diameter bearings with the usual half brasses. The drive to the three-throw pump crankshaft was through a four-tooth face coupling. The cranks and therefore the pump cylinders were spaced $5\frac{1}{2}$ins apart (deduced from measurement of the beam guides).

The beams were 11ft 5ins long (pivot to pump rods). These compare to the average 12ft length of other similar pump beams [London Bridge(8), Coultershaw(9), Woolbeding(10)]. It is interesting to speculate why a beam length of about 12 feet should have been chosen for all four pumps despite markedly different piston strokes. The design of the unearthed beams was crudely simple, with a cross-section of 9ins deep by 3ins thick, lightweight by comparison with those of the other pumps. All the bearings were solid bushes keyed into the wood without means of adjustment.

As mentioned earlier, the pump body was already missing when the site was visited by F.W. Gregory, but inspection of his photographs indicates that the design must have been very similar to that of the Coultershaw pump (fig.5) with open-ended cylinders in which the cup-leathered pistons operated. The arrangement and style of the crankshaft, bearing journals, connecting rods and pump rods were also strikingly similar, except that the clasp joints to facilitate withdrawal of the pump pistons were on the connecting rods, not the pump rods.

Based on the known cylinder spacing of $5\frac{1}{2}$in and on inspection of the photographs, the cylinder bore is estimated with some confidence to have been 4in. Estimation of the piston stroke is however less reliable; again, inspection of the photograph of the crankshaft suggests a crank throw of about $4\frac{1}{2}$in. On this basis, the known dimensions of the pump beams give a piston stroke of some 10in. Assuming a wheel speed of 8 revolutions per minute, the pump capacity would approach 600 gallons per hour or 14,000 gallons per day. With a fresh water supply cistern holding about 8,000 gallons, it is clear that the pump was unlikely to have been in operation all day. The necessity for a pond in which to store the water to drive the wheel reinforces this point.

The pump suction and delivery pipes were of cast iron, both of 3in bore and 4in outer diameter. It is apparent that a stop valve was fitted in the suction pipe. The pump delivery did not incorporate an air vessel, but what appears to be a non-return valve was included. Generally speaking, a 3-cylinder pump gives a very uniform delivery, so that an air vessel is not essential to smooth out flow variations; nevertheless, it is normal practice to fit one so as to protect the pump from shock in the event of failure of the non-return valves in the long delivery pipe.

Having thus been able to reconstruct with tolerable certainty the general design and method of operation of the pump, as it was in its latter years, there is little more that can be done except to examine what limited historical evidence is available.

History of the Pump

Direct evidence of the installation date is totally lacking. At best it is a matter of conjecture based on some indirect pointers. The known dates of the other beam pumps in Sussex give little help. The Coultershaw pump was originally built in 1784 and that at Woolbeding seems to have been rebuilt as a beam version in the 1840s.

A study of the available maps is no more helpful. The earliest map is by Yeakell and Gardner of 1778(11) which shows some signs of a small building and what might be a pool in the general area of the present pump and pond, but both in the wrong positions.

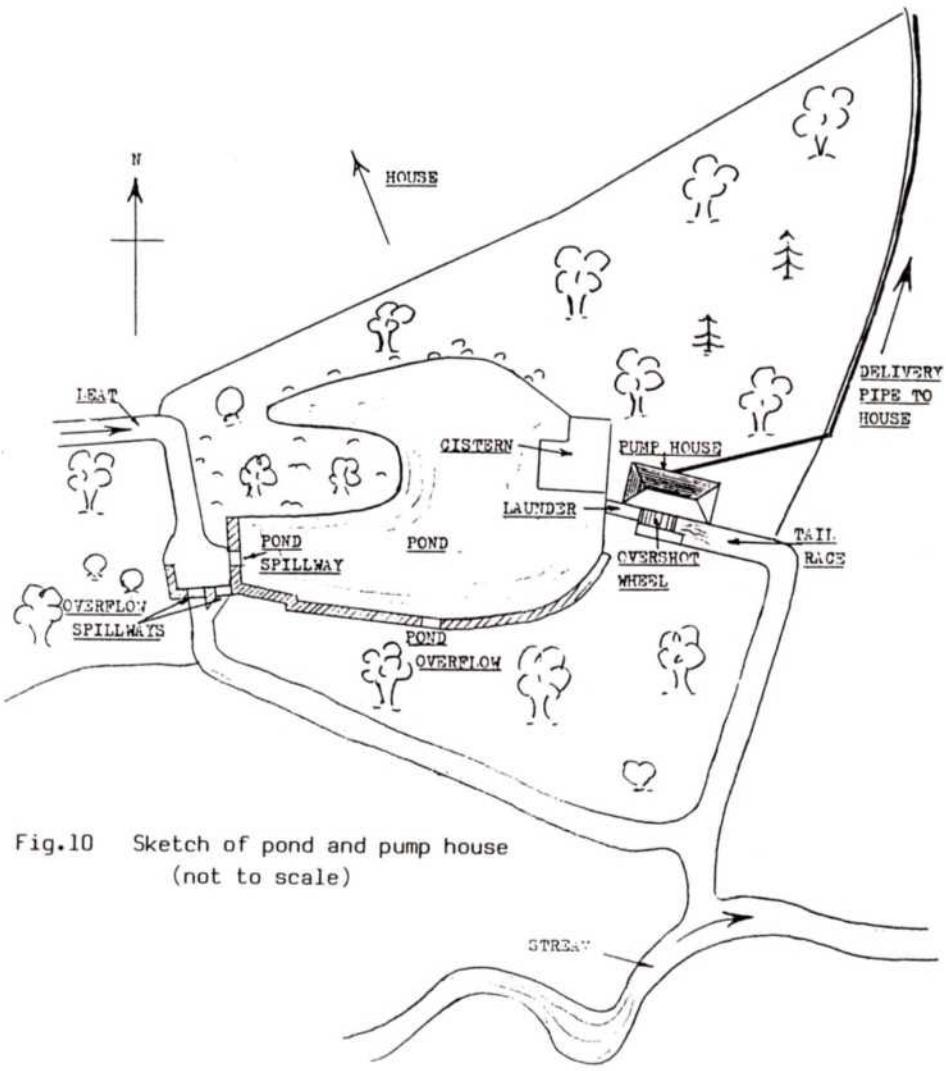


Fig.10 Sketch of pond and pump house
(not to scale)

There is also a line running along the approximate course of the leat, but it seems more likely to have been the existing boundary hedge. So it is reasonable to suppose that the pump, as we know it, was not in existence when the survey for the map was carried out, probably in the late 1770s.

The next map is a tithe map of 1843(12). This clearly depicts the pump and pond in their present positions, together with the leat and, what is significant, an adjacent field called "Engine Meadow". This gives a positive latest date but still a wide bracket of about 60 years. One final piece of evidence does however help to narrow the gap. The "John Hawkins Collection"(13) contains "John Hawkins Notes"(14) which are a compilation of information about Bignor Park assembled by him shortly after he bought the Park in 1806. There is a mass of detail about drainage and cess pits but frustratingly nothing about water supply or the pump. One brief comment however gives an all important clue: "The Engine Field has been grazing ground for 20 years". Bearing in mind that the appellation "Engine" in all subsequent maps and documents is confined to the fields and woods adjacent to the pump house, it is reasonable to assume that the pump was in existence in 1806, but how soon before 1806 is another matter. The figure of 20 years plainly has no connection with the age of the pump. On the other hand Mrs Dorset, the owner before John Hawkins, is unlikely to have invested in a pump shortly before selling the estate; but it would be dangerous to take this sort of conjecture any further. Thus a date between 1780 and 1805 would seem acceptable; and it would perhaps be best to leave it at that were it not for the fact of the marked resemblance to the Coultershaw pump

built in 1784. It therefore seems worth considering whether there might be a chronological connection between the two. The similarity of fundamental design, despite subsequent renovations, could imply that the same millwright was responsible for both, particularly as they are barely 3 miles apart as the crow flies. Moreover, with Petworth House being only about 4½ miles away there could have been an element of keeping up with the Jones's. Yet in the end this does no more than suggest that the two pumps could have been originally built within a few years of each other, though the question of which came first must for the moment remain unanswered.

The reason for the precise location of the pump and pond is worth mentioning. The tithe map shows the eastern boundary of the estate, which is also the parish boundary, running north to south at the end of the tail race. In other words the pump was positioned as far down-stream as it could be, presumably in order to achieve the maximum head of water for the wheel.

Nothing further is recorded of the pump's history until the twentieth century, and that merely its assumed demise following the installation of two ram pumps upstream near Bignor Mill by Messrs Green and Carter in about 1910.(15) No doubt during the previous 100 years changes and improvements were made, and there is evidence from the brickwork of the pump house of significant building alterations. There is also evidence of a possible change of concept at some point. In its final state the pump, though driven by stream water from the pond, pumped fresh water from the cistern which drew its supply from a spring somewhere upstream. This cistern is shown on the 1912 25 in OS map, but not on the 1876 issue. Nevertheless it is uncertain whether the building of the cistern necessarily heralded a change from pumping stream water to pumping fresh, or merely an improvement in the means of supplying the fresh water. Unquestionably when the ram pumps took over they pumped only fresh water and utilised the existing delivery pipe system (fig.2) through a new pipe laid from the rams at Bignor Mill and connected in at the pump house, thus irrevocably cutting the wheel pump delivery.

Once the ram pumps began to operate, the old pump fell into disuse and remained decaying and forgotten until F.W. Gregory discovered it and photographed what were still the substantial remains. Had he not done so, it would have been most difficult to reconstruct with much accuracy the pump's complete design. Already by 1975, when a further sighting was made by A.G. Allnutt, the metal parts had gone and everything was in ruins.

Conclusion

From what has been said it is apparent that many different solutions were employed over the years to solve the problem of supplying water from streams and springs to country houses and their estates. The system used at Bignor Park, with its application of the long beam to produce near-linear motion, displays an elegant simplicity. The longevity of this pump type is noteworthy, with more that 100 years of service at Bignor Park and over 170 years at Coultershaw; in all there are at least 250 years of known history from Sorocold in 1702 to the closure of Coultershaw in 1960. What more fitting testimony could there be to the success and endurance of the water wheel driven beam pump?

APPENDIX

SUSSEX WATER WHEEL DRIVEN PUMPS

(Based on information supplied by F.W. Gregory)

	LOCATION	MAP REF	BRIEF DETAILS	CONDITION
1	Ashburnham	686144	Cast iron wheel	
2	Ashfold Crossways, Warren Wood	239292		

3	Bignor Park	993153	3-Cylinder beam pump direct driven by iron overshot wheel	Demolished early 1970s
4	Birchen Bridge Mill	194292		
5	Buckhurst, Withyham	498353	3-Cylinder vertical pump gear driven from iron overshot wheel: see SIH 8	
6	Bungehurst, Heathfield	5924		
7	Bury, Mill Farm	0014/0015	Home-made wheel	
8	Coultershaw	972194	3-Cylinder beam pump with iron breast-shot wheel: see SIH 9	Restored by SIAS. Operational
9	Duncton Mill	965165	Corn mill with iron overshot wheel. Auxiliary drive to pump	
10	Knepp Castle	156211		Wheel exists but two pumps gone
11	Lealands, Hellingly	577132		
12	Ninfield	713116		
13	Rotherbridge	968202?	Iron wheel crank and rod drive	
14	Rowner	072270	Pump driven from corn mill	Mill demolished by Southern Water Authority
15	Sutton Place nr Newick	438186		Remains of wheel now at Chalk Pits Museum, Amberley
16	Uppark	784191	See SIH 15	Pump house remains
17	Warnham Mill	168323	Single cylinder horizontal pump gear driven from mill wheel	Existing but derelict
18	Westbourne Mill	Not Known	Pump driven from mill-wheel	
19	West Grinstead Park	167217	3-Cylinder horizontal pump	
20	Hurst Mill, West Harting	765210		
21	Woolbeding House	874227	3-Cylinder beam pump gear driven from iron undershot wheel	Existing but derelict

References

1. J.E. Taylor, P.A. Jerome & A.G. Allnutt, "Petworth Water Supply" SIH 9 (1979) 15-22
2. T.P. Hudson, "Muntham Well, Findon" SIH 8 (1978) 2-4
3. John Eyre & Alan Allnutt, "The Water Supply to Uppark" SIH 15 (1986) 25-31
4. Ibid; WSRO Misc Document No 13423, Plan of Woolbeding House water wheel 1799
5. Taylor, Jerome & Allnutt op. cit. Appendix II 21-22
6. WSRO Mis Document No 13425, Plan of Woolbeding water wheel engine house 1842
7. "A Water-driven Estate Water Pumping Plant at Buckhurst Park, Withyham", SIH 8 (1978) 10-12
8. "Water Supply of Greater London" H.W. Dickinson, 1954
9. Taylor, Jerome & Allnutt op. cit. Appendix II 22
10. Correspondence with T.E. Evans, August 1987
11. WSRO Map Section, Yeakell and Gardner 2 in : 1 mile map 1778
12. WSRO Map Section, Tithe Map of Bignor Parish, 1843
13. "The Hawkins Collection" published by WSRO Vol.24, 27 November 1985
14. WSRO MP678, Notebook of John Hawkins
15. Original Green and Carter correspondence and sketches about Bignor hydraulic rams in possession of Lord Mersey

P. J. JAMES

Lowfield Heath Windmill

It is indeed remarkable that only two months before the worst storm in the last 200 years, Lowfield Heath Windmill was dismantled and thus saved from certain destruction. This marked the first phase in the restoration to full working order by the 'Lowfield Heath Windmill Trust', which together with a small team of volunteers have made this formidable task possible.

Lowfield Heath is of the type known as a post mill, in which the whole body of the mill is suspended on a single post (see diagram). The mill body, or buck, can then be revolved about this post by levering against the tailpole, until the sails face the wind. It is interesting to note that this basic design of mill dates back to the twelfth century, and continued to be built in this fashion right up to 1868, almost to the end of the windmill era.

The sails were mounted upon a great cast iron windshaft and drove, via a wooden brake wheel of 9 ft in diameter and a cast iron tail wheel of 8 ft, and through cast iron stone nuts and quants, two sets of millstones. One was a peak stone for grinding animal feeds, the other being a French burr stone for flour grinding. Each set of millstones had its own flyball governor and associated tentering mechanisms for automatically regulating the gap between the stones and hence the quality of the flour.

A sack hoist was mounted in the ridge of the roof and driven by a wooden pulley mounted on the front face of the tail wheel. A wire dressing machine for grading the flour, was mounted across the tail of the mill on the stone floor and was driven, via flat belting, from a pinion engaging with the brake wheel, as at Reigate Heath and Outwood post mills.

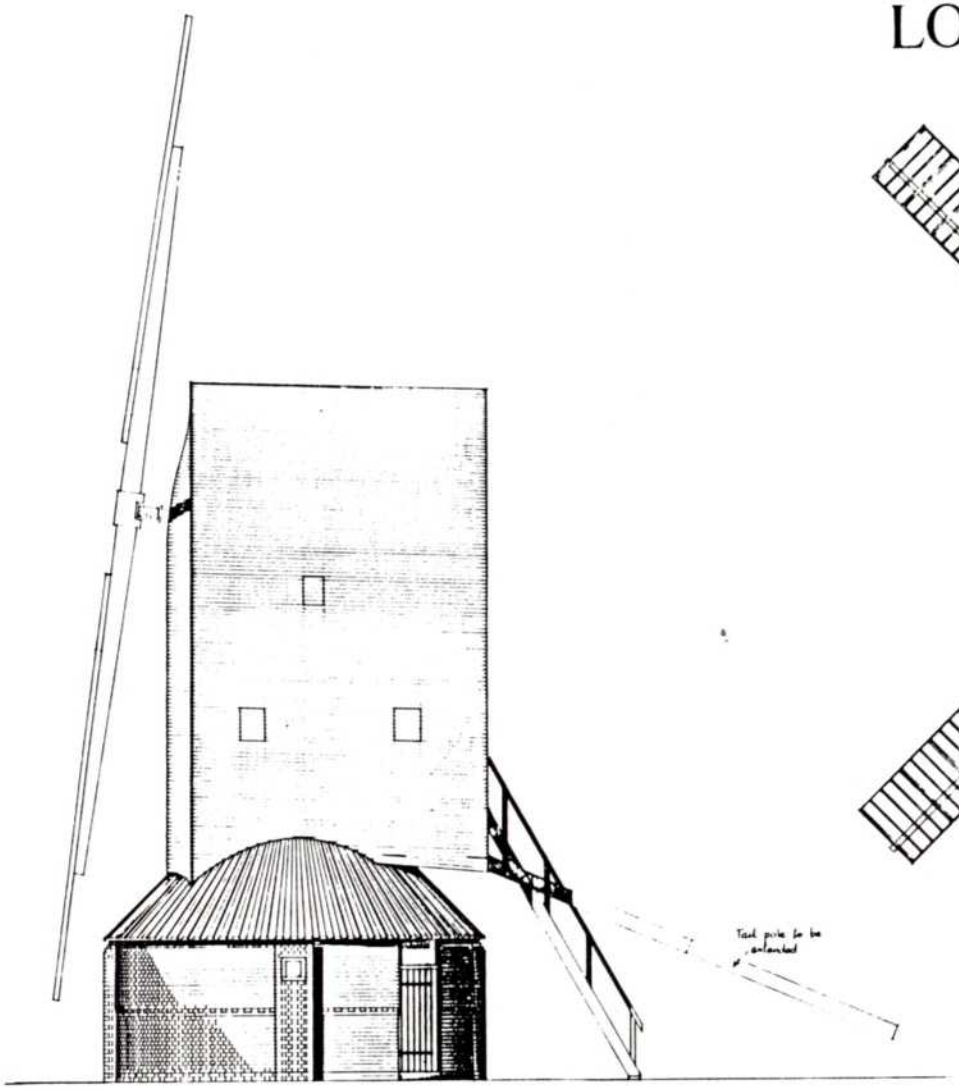
The double shuttered patent sails were operated by a continuous chain mounted on a pulley at the back of the mill. By pulling on this chain, the wheel would revolve and through a rack and pinion arrangement, move the striking rod in and out. This force was finally transmitted through a 'spider' linkage on the front of the windshaft, to all the shutters on all four sails.

The framework of the mill is similar to many post mills, basically being built about the huge crowntree mounted on top of the post - this crowntree measures two feet square in section. Much sagging in the timbers has taken place over the years but the many wrought iron tie bars have prevented any structural failure.

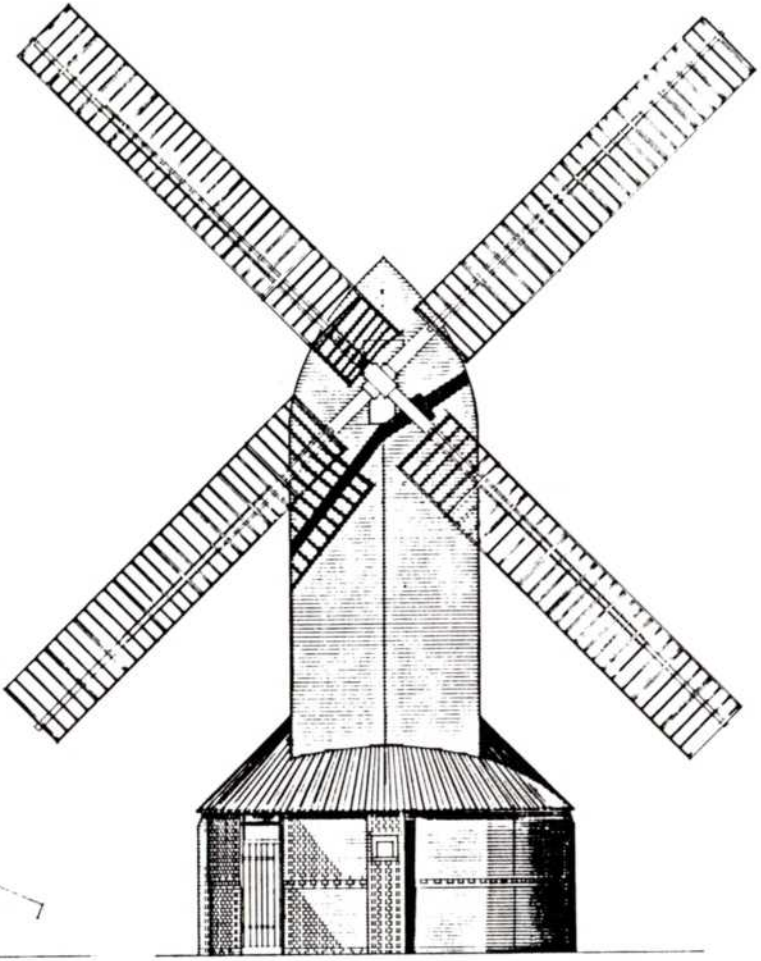
Having been interested in windmills for many years now I was particularly pleased to get involved in a local windmill project, although at first I was under the impression that not a lot was left which could be restored. This impression was reached after reading several books, in which the mill was described as 'remains'. However this impression was quickly dispelled. The truth is that a lot of the machinery does still exist, the 'remains' being the windshaft, brake and tail wheels, brake, stone nuts and quants, bedstones, one governor with linkage, both stone spindles with bridge trees and brayers, striking wheel, rack and striking rod, intermediate drive pulley for the wire dresser, wire dresser spindle, even a quantity of shutter brackets from the sails, together with the wrought iron tie bar for the tailpole (fig.2). All this, together with an extensive photographic record has turned, what at first was apparently an empty mill, into an exciting project with which to enrich the local community.

As with many mills, the exact building date is not known. It is first shown on Rocque's map of 1762, but local rumour has it that it was brought from nearby Hookwood to replace an earlier mill in that same year. However, it has not been possible to

LOWFIELD HEATH WINDMILL

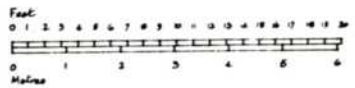


Side Elevation

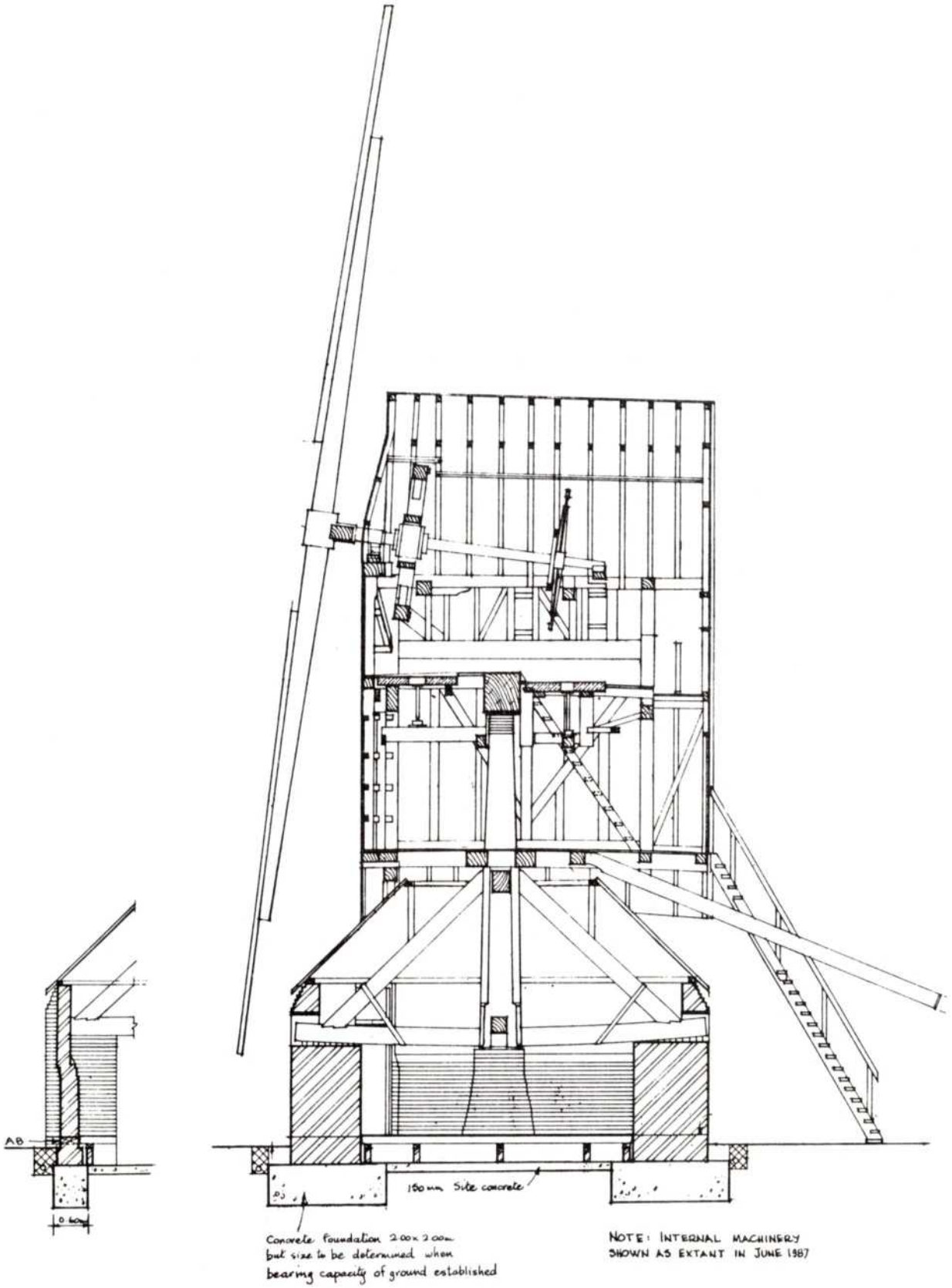


Front Elevation

NOTE: SAILS AND STOCKS
SHOWN DIAGRAMMATICALLY

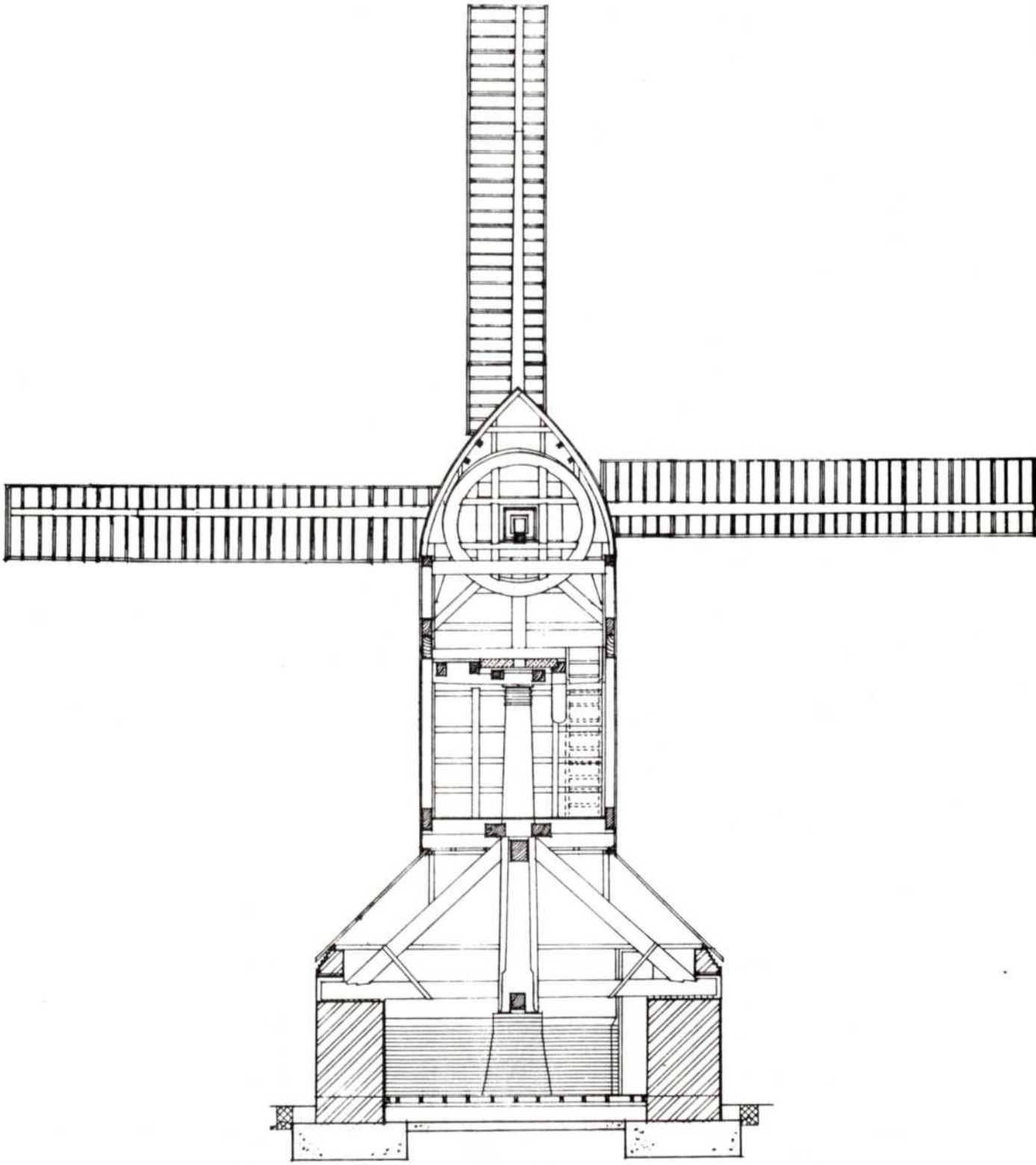


SCALE



SECTION THROUGH ROUNDHOUSE WALL

SECTION A-A

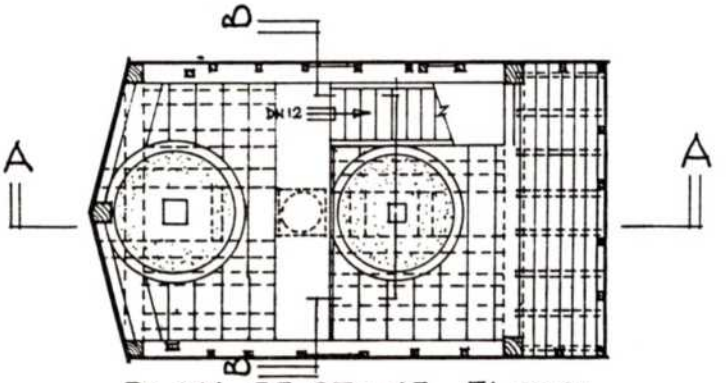


NOTE: INTERNAL MACHINERY
SHOWN AS EXTANT IN JUNE 1987

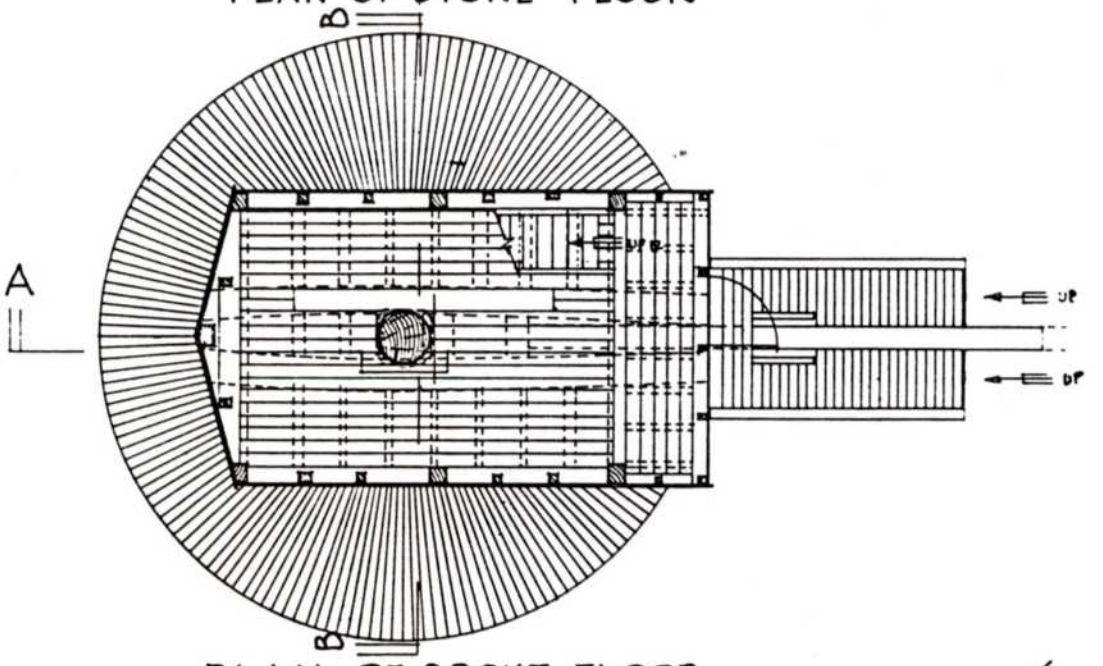
SECTION B-B

LOWFIELD HEATH

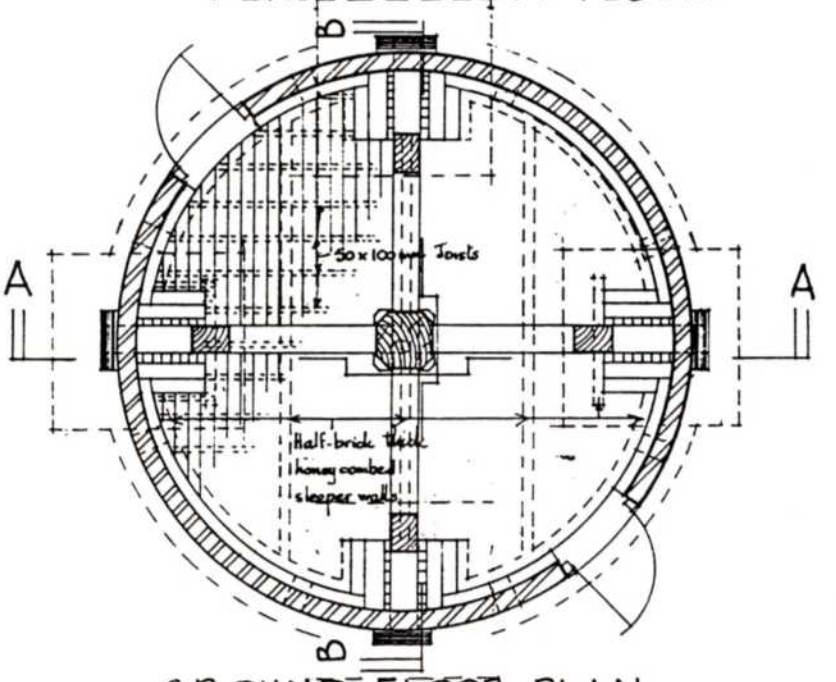
WINDMILL



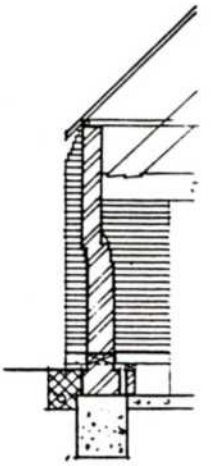
PLAN OF STONE FLOOR



PLAN OF SPOUT FLOOR



GROUND FLOOR PLAN
(through top of Roundhouse wall)



SECTION
(through Roundhouse wall)

establish that a mill stood at Hookwood before 1820 or, that an earlier mill had stood at Lowfield Heath or Lovel Heath as it was then known. Bearing in mind the time that was probably spent in compiling a map at that time, I think we can assume that the mill was built by the 1750s.

Fig.1 With all four original sails circa 1885. Note the damaged top sail.

In the early years a James Constable held the mill. A tenant miller named Parker worked the mill in the 1820s and it is particularly interesting to note here, an inscription found in the mill, bearing the initials 'C.P.' with the date '1801". Could this be Parker?

It must have been around this time that one pair of the original 'common' or cloth sails were lost and subsequently replaced by patent sails with shutters. In order to fit the striking mechanism for this type of sail, a hole needed to be drilled through the windshaft. For this task a millwright named Joe Morley was engaged. Using the motion of the sails it took a fortnight to accomplish!

J. and H. Robinson took over the mill from 1831. The last miller John Ansell, was at the mill for 32 years. The cessation occurred in 1880 though work was extended until 1895 by the use of a portable steam engine. This presumably drove a set of stones, mounted on a hurst frame, within the roundhouse. No evidence exists of another drive to the windmill stones. At about this time the Robinsons had the runner stones removed for use as garden ornaments in their garden at Iford near Lewes. Hopefully these can be traced and brought back for the restoration.

Shortly after 1881 the uppermost sweep or sail was damaged (fig.1) and removed; two other sails quickly following (probably sold to another mill). Fortunately the last sail remained intact long enough to appear in several postcards, showing excellent details of the sail construction, which will prove invaluable in the restoration.

By about 1910 this last sail had disappeared, leaving only the remnant of the last stock. The photograph of 1923 (fig.5) shows only the stumps of the stocks left in place, although the body still seems in reasonable condition. It remained in this condition through most of the 1930s, although several boards vanished from the roof and the

Fig.2 Circa 1900. Note the striking chain weight sitting on a small platform below the chain.

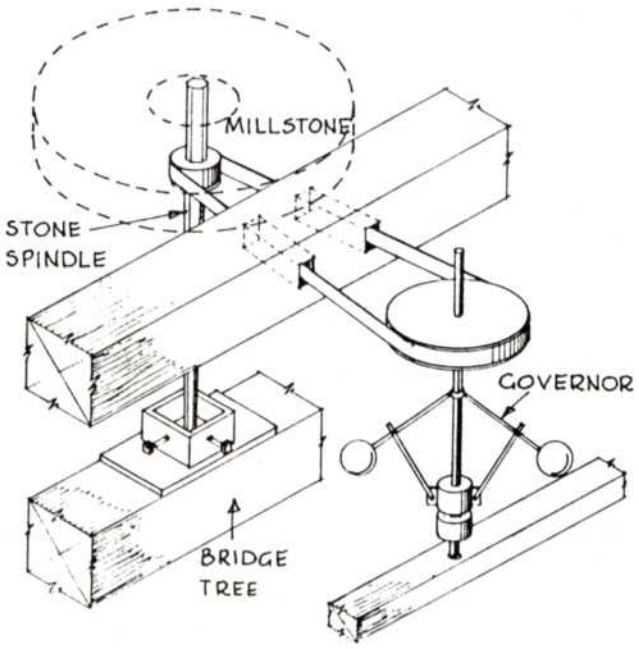


Fig.3 The curious drive to the governor carved through a floor joist that happened to be in the way!

roundhouse had a considerable growth of ivy on one side, starting the rot in the trestle at that point. At the time of dismantling this joint was non-existent.

In 1938 the then landowner, a Mr Lowe, had the body patched up and new short sails erected. The outbreak of war seemed to put pay to any continued maintenance and by 1950 the mill was again in a sorry state. Most of the roof boarding on the mill and half that on the roundhouse was missing. In 1957 a severe storm wrecked the mill, removing most of the roof and bin floor - leaving it in a very sorry state as our photograph (fig.8) shows.

It remained in this condition, open to the elements, until 1963, when E. Hole & Sons under the direction of the SPAB restored the body of the mill to the condition in which it last stood. It is remarkable that a wreck like this should have been repaired, when at that time many other mills were being demolished.

When in 1982 the adjacent mill house (built in the 1930s to replace the original mill house) was demolished, concern for the mill increased. Many discussions were held with the landowners in order to obtain a public access agreement, but unfortunately the value of the land, as it was, next to an airport, was such that they were unable to agree. With no access agreement it was impossible to raise the substantial sums necessary to restore the mill, furthermore Crawley Council were unable, due to insufficient funds, for compulsory purchase of the mill under the terms of the listed building act.

Fig.4 Circa 1910, showing the original miller's cottage in the background.

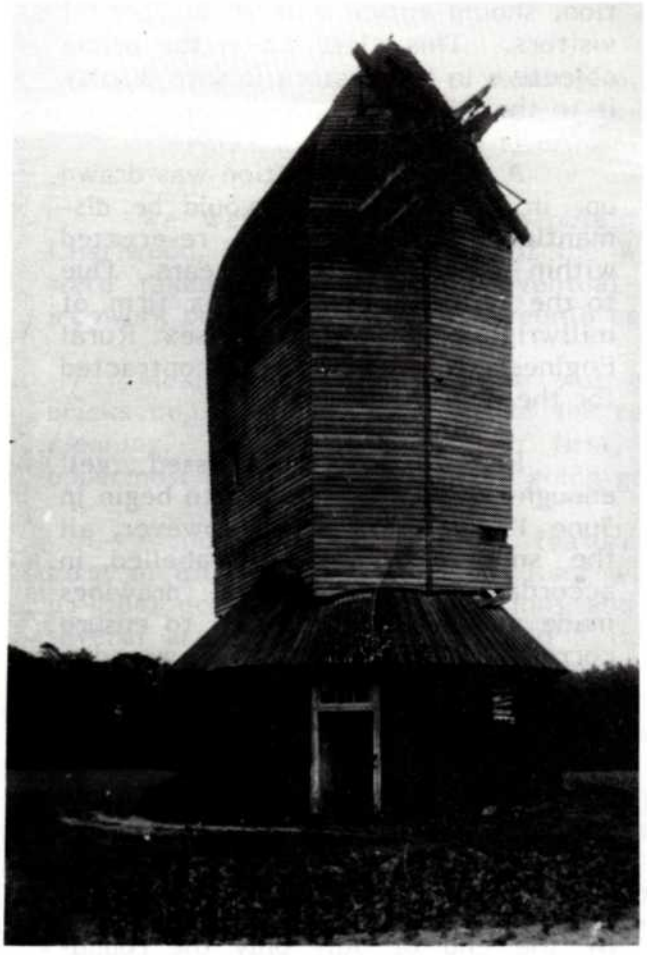


Fig.5 Circa 1923, note the corbelling in the roundhouse brickwork.

Fig.6 After the new sails had been fitted in 1938. It is a shame that the ivy wasn't removed as well.

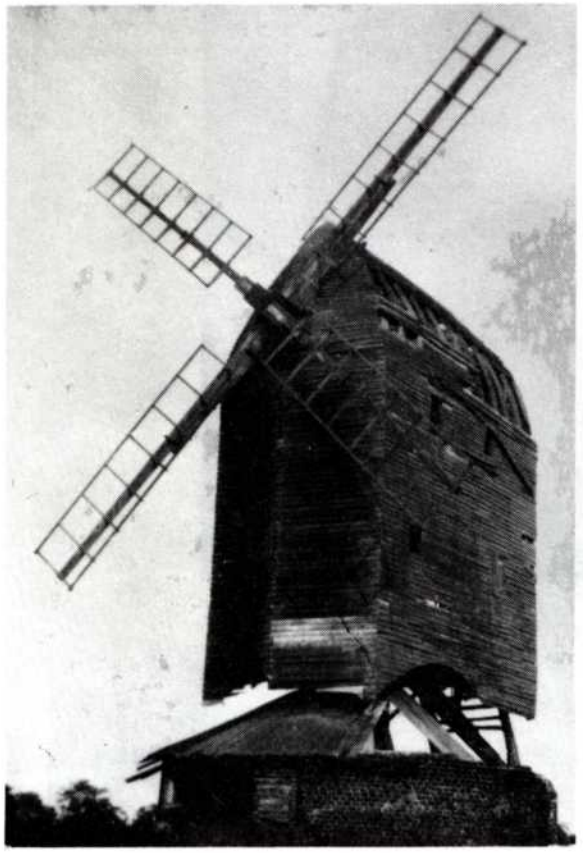


Fig.7 Circa 1950 with the roof obviously starting to rot.

Fig.8 1958 - a sorry state indeed!

By the time the 'Lowfield Heath Windmill Trust' was formed in 1986, the trestle was in such a bad condition that we took the unprecedented step of deciding to move the mill. Everyone concerned agreed that this was the only way of preserving the mill, though great sadness was felt in that the original site would be lost.

After much discussion and advertisement in the local press, a site in Charlwood was offered to us, adjacent to the Gatwick Zoo and Avaries. Furthermore, the land was offered on a long lease at a peppercorn rent. Incidentally, this will mean a return to Surrey after an absence of 14 years, for the 1974 boundary change moved Lowfield Heath into Sussex. Although the new location is not ther most windy site for a windmill, it does have the advantages of being only three miles from the old site in the same parish, and also being adjacent to an existing tourist attraction, should entice a large number of visitors. This after all is the prime objective in the restoration, to display it to the public.

A plan of restoration was drawn up, in which the mill would be dismantled, restored and re-erected within a period of three years. Due to the nature of the job, a firm of millwrights, the West Sussex Rural Engineering Co. Ltd., was contracted for the bulk of the work.

Fund raising progressed well enough for the dismantling to begin in June 1987. Before this, however, all the smaller parts were labelled in accordance with detailed drawings made at the time, in order to ensure correct assembly. The mill was dismantled in a number of sections, in the following order:- roof, windshaft assembly, breast section (front of mill), tail section, upper and lower side panels, crowntree, shear tree assembly (the lower beams running fore and aft next to the post) and finally the trestle. The operation went so smoothly that by the end of July only the roundhouse remained.

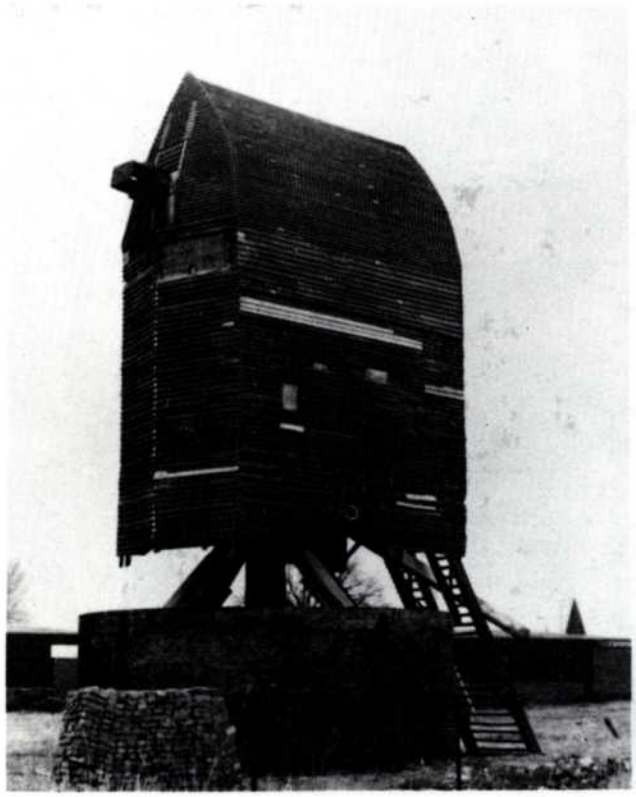


Fig.9 The mill just prior to dismantling, the pile of bricks being salvaged from under the concrete floor.

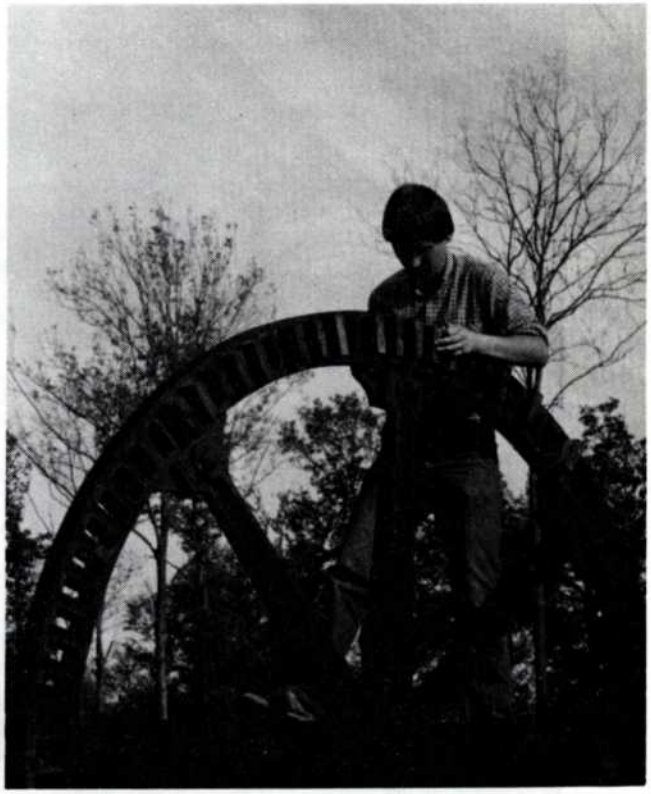


Fig.10 The writer removing the old cogs from the tail wheel, note the sawn off striking rod in the windshaft.

We were lucky enough to obtain the use of a large industrial building, sited at Charlwood, by kind permission of the Woodland Trust. Here the larger parts of the mill were taken for storage and eventual restoration; the smaller parts and most of the ironwork being taken to two sixteenth century barns, also nearby.

Meanwhile the roundhouse was carefully demolished by our volunteer force, the bricks being salvaged for use in the reconstruction and transported to the new site for cleaning. This proved easy at first, as the lime mortar was very weathered in the uppermost courses, however, the going got tougher as we progressed downwards.

A number of interesting features were found during the roundhouse demolition. First of all, when the concrete floor was taken up (this replaced the original wooden one in 1964) details of the foundations and underfloor ventilation were found, together with several artifacts. These included a mill bill (used for dressing the stones) and a small earthenware pot found in the footings and obviously dating back to when the roundhouse was built. The evidence suggested that it was highly probable that the mill started life on four brick piers and that the roundhouse was added at a later date.

The last discovery, just as the footings were reached, was a drainage culvert, leading from the roundhouse, radially out for a distance of fifteen feet. Once the grating was cleared it proved still watertight. The channel was made up of bricks cast in 'U' sections, one above the other, thus forming a box section, the joints being sealed with tar. The site was finally cleared on 13 September.

Since this date landscaping has started at the new site, brick cleaning is also well under way. Volunteer work has been concentrating mainly on the restoration of the

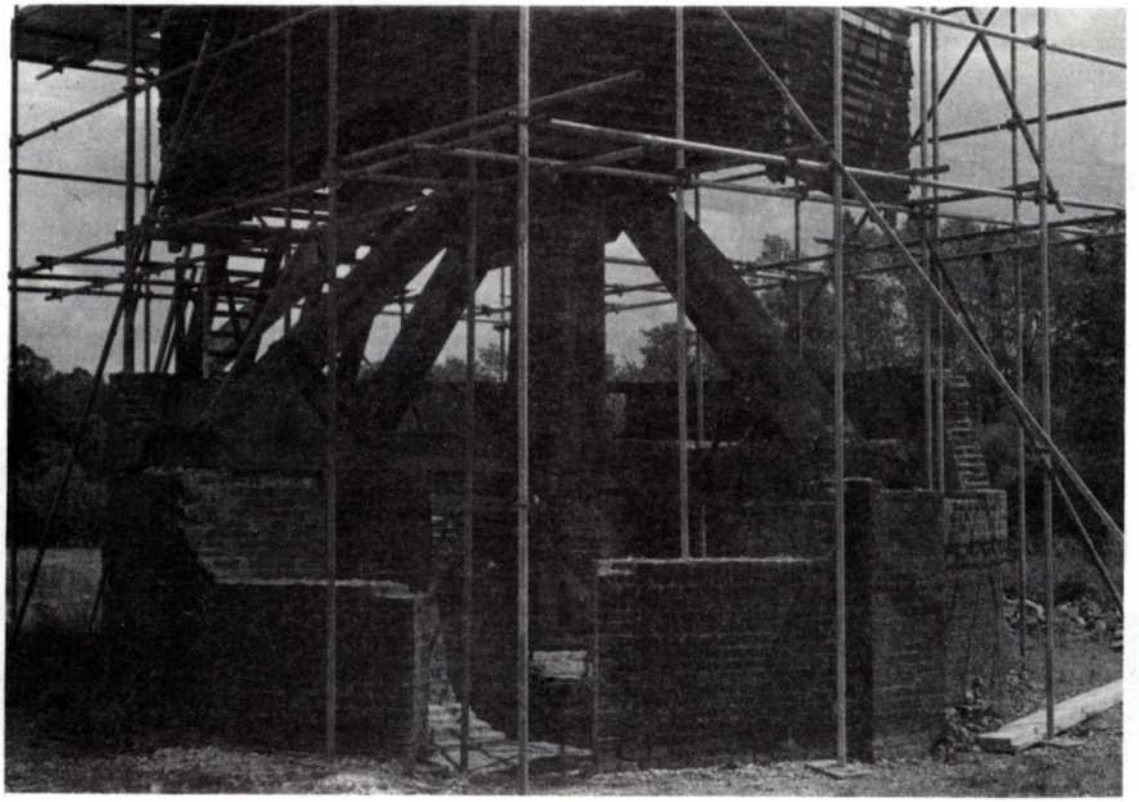


Fig.11 An unusual view of a post mill showing the huge trestle timbers with their decay. Subsequent to this photo a supporting framework was built under the mill in order to take the weight from the trestle during dismantling.

Fig.12 Volunteers hard at work demolishing the roundhouse.

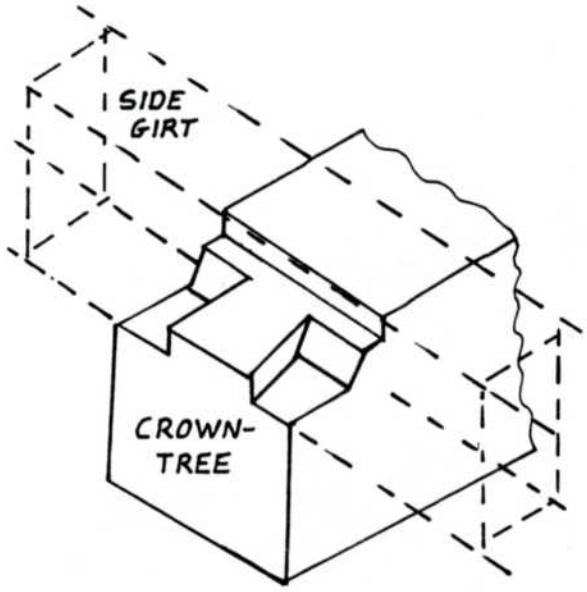


Fig.13 A joint not usually seen, that of the junction between the crowntree and side girt - a rather elaborate dovetail!

machinery, cleaning, painting and renewing. Remarkably many seemingly rusted nuts have come apart without the use of penetrating oil, and once removed the threads are shown to be still as bright as the day they were cut - this says a lot for the durability of wrought iron. The second phase, that of restoring the main timbers is just about to start, once exact details of the work has been agreed.

A substantial amount of the final bill has already been raised but we still need over £20,000 to complete the project - offers of assistance, financial or otherwise, to the Hon. Secretary at 15 Sandringham Road, Broadfield, Crawley, West Sussex RH11 9NF.

References

The historical information for this article was compiled from the notes of H.E.S. Simmons, in the Science Museum as well as from Farries & Mason's 'Windmills in Surrey & Inner London' 1966.

For several of the photographs, I would like to thank P. Allen and A. Brunt of the Wealden Postcard Club, F. Gregory and J. London.

MICHAEL WORTHINGTON-WILLIAMS

The BMR Gearless Car

Brighton, along with other seaside towns like Bournemouth and Eastbourne, had more than its fair share of motor manufacturers and home-grown makes over the years.

Just recently David Hurley, showed me some fascinating photos of the Gearless car built by BMR Ltd, (Brighton Motor Repair) at Portslade in 1919. They were provided by Mr F.G. Watts of Sutton, who was employed as a boy by BMR and whose father (previously with coachbuilders Thomas Harrington of Hove) was their coachsmith. Mr Watts' employment as a fitter and turner lasted only from June 1919 until January 1920, and during that period at least twelve Gearless cars were laid down.

One of the photos shows four half-completed cars in course of erection, one chassis on trestles and another five frames standing upright along one wall. Another shows an incomplete chassis and one running chassis fitted with a test body in the blacksmith's shop. This latter car was taken out by the General Manager, son of a Mr Bannister, the proprietor of BMR.

Engines were by Coventry-Simplex, and the "gearless" transmission was a form of

Fig.1 The assembly shop of the BMR Co Ltd, showing Gearless cars being erected. The date is 1919.

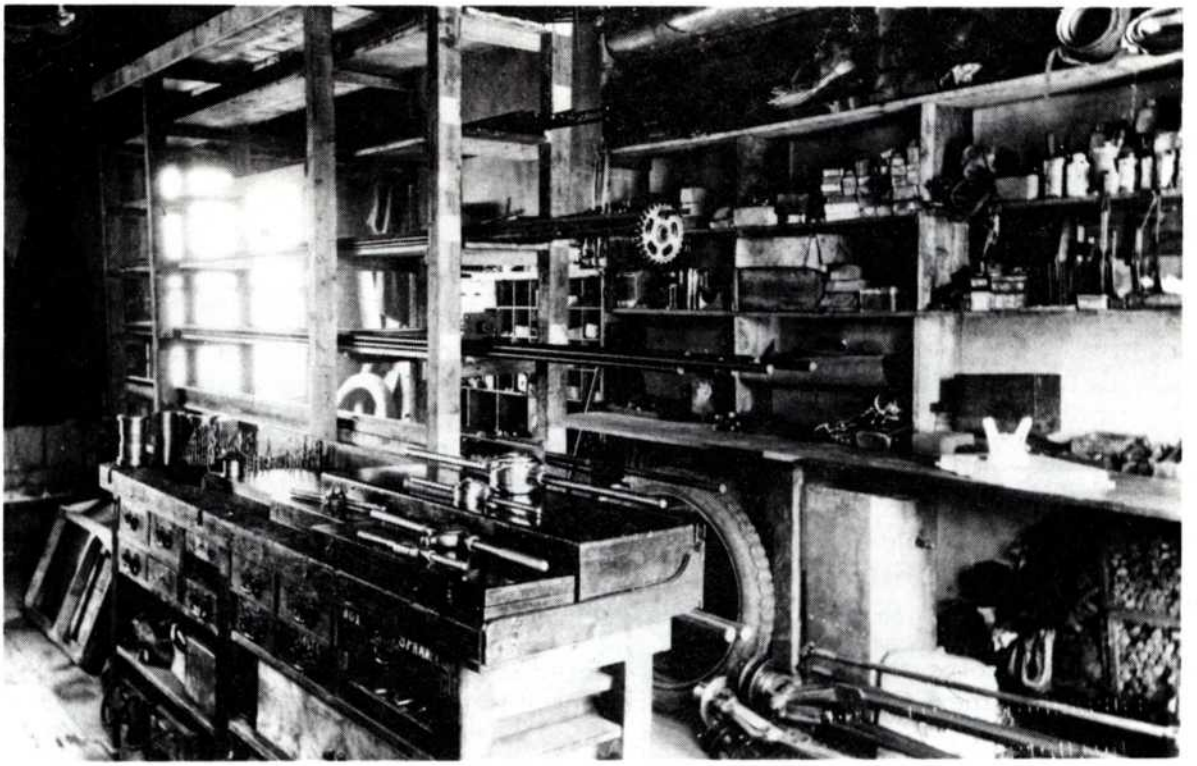


Fig.2 The Stores BMR Co Ltd.

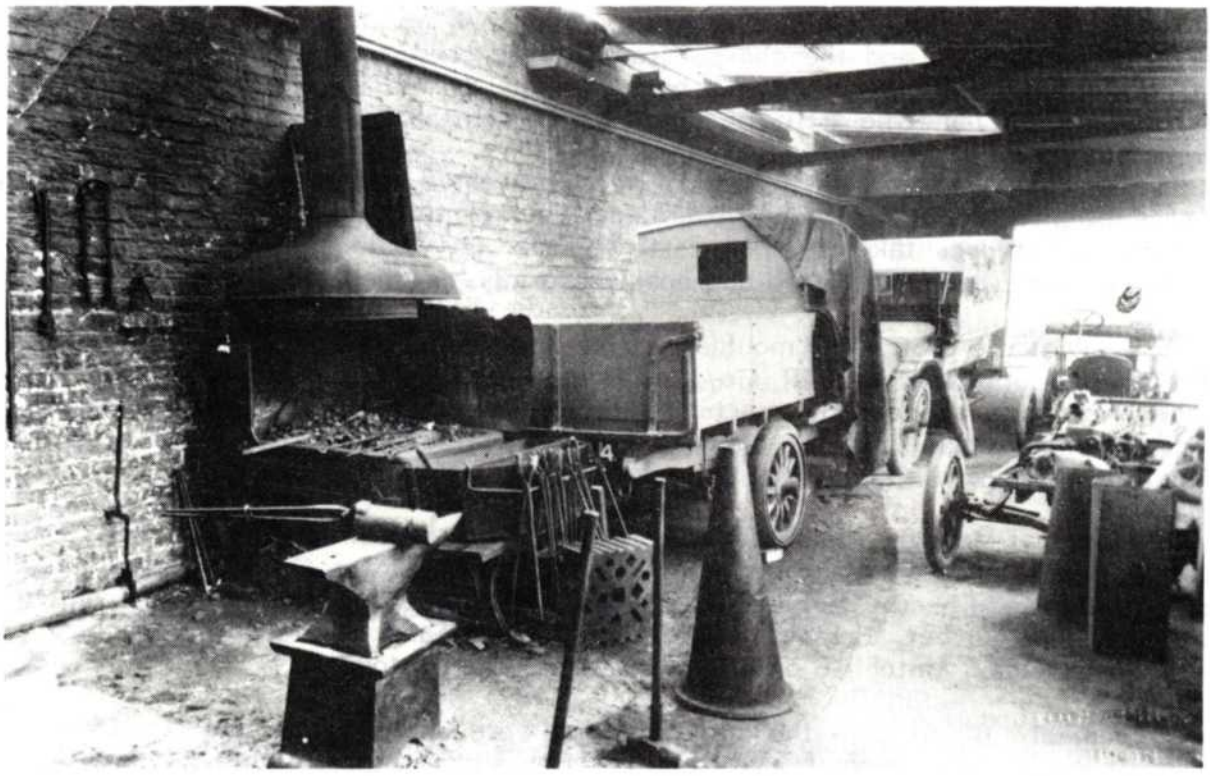


Fig.3 BMR's blacksmith's shop. The truck is a Pierce-Arrow - the van belongs to Ronuk Polish

Fig.4 The Staff of BMR Co Ltd.

friction drive. Radiators were a distinctive Rolls-Royce type not dis-similar to the Battersea-built Stafford and the chassis frames were presumably bought-in like the other major components. Springing was by half elliptics at the front but with three-quarter elliptics at the rear, and the artillery wheels came from Sankey.

The assembly shop would appear to be a converted stable block, and no attempt at mass-production could obviously be made under such primitive conditions. Apart from the one chassis which was taken out on test, however, it would not appear that any other Gearless cars were ever completed and none, certainly, reached the public.

It was not the protracted moulders strike or the slump which hit the industry at the end of 1920 which forced BMR Co Ltd to shut its doors, however, or even a direct shortage of finance. Instead the machine shop was run on overhead line shafting and belts from a single gas engine running on town gas. A coal strike caused delivery problems to the local gasworks, and without gas the machine shop couldn't operate.

The general Manager, Bannister Jnr, decided that there was no future with BMR and persuaded young Fred Watts to join him at the Surrey Motor Co in St. Nicholas Road, Sutton where he had been offered the post of Works Manager. Other premises which BMR operated in Ship Street, Brighton were closed down, and some of the machinery was transferred to Sutton Motor Co on an ex-WD Pierce-Arrow lorry.

Presumably the rest of the staff of BMR were dismissed, or the firm reverted to pure repair work and abandoned car manufacture. What became of the uncompleted cars, however, is not recorded, and no information has so far come to light concerning their fate.

Reproduced from Classic and Sportscar July 1982 with permission

M. BESWICK

Bricks for the Martello Towers - Further Details.

Since the publication in Sussex Industrial History No17 of the article 'Bricks for the Martello Towers in Sussex', further information has come to light on the exact location of some of the brickfields. This is contained in a military map entitled 'Sketch of the Coast from Eastbourne to Hastings' - scale 1 mile to an inch.(1) It was enclosed with a letter of 2 June 1805 from Brig-Gen. Twiss, the Commanding Engineer of the Southern Division who was then in Hastings, to R.H. Crow of the Board of Ordnance in London. (2) On the map are marked the sites of the Martello towers then under construction and the location of 60 twenty-four pounder guns in position at that date. Also marked, by letters, are the sites of five of the brickfields which were supplying materials for the building of the towers. These are listed in a key as follows:

A	Mann's brickground to furnish 1 Million
B	Ordnance Brickground to furnish 3 Millions
C D E	Dallaway's Brickgrounds to furnish each 2 Millions
	Total 10 Millions

From this it is clear that the brickfield opposite Anthony Hill (Nat. grid ref. TQ 631 051), marked 'B' on the military map, was the most important and was under the

direct control of the Board of Ordnance. This site was correctly located on the map on page 22 of Sussex Industrial History No.17 (referred to henceforth as 'the SIH map').

The contractor Dallaway had three brickfields under his control on the stretch of coast covered by the military map. Of these, the one marked 'C' was at Pevensey Bay (TQ 657 041) on the north side of the coast road, east of the Castle Inn. This site was not included on the SIH map. Site 'D' was at Normans Bay (TQ 690 059) a little to the west of the position assigned to it on the SIH map. Site 'E' at Bulverhythe (TQ 767 081) was on the north side of the coast road opposite the Bull Inn, approximately as suggested on the SIH map.

The other contractor was John Mann of Eastbourne, whose brickfield, marked 'A' on the military map (TQ 620 990), was on the north side of the road from Seahouses to Anthony Hill. This was not included on the SIH map but the site is the same as the one occupied by Mann's brickyard in 1816 and confirms his involvement in the supply of bricks for the redoubt.(3)

As the military map does not extend either eastwards to Winchelsea or westwards to Seaford, no further light is thrown on the brickmaking operations in those areas.

References

1. P(ublic) R(ecord) O(ffice) MFQ 307/16B. This was discovered by John Goodwin, the author of The Military Defence of West Sussex (Midhurst 1985), who kindly showed it to the writer.
2. PRO WO 55/733. I am grateful to Brian Phillips of the PRO staff who was able to place the map in context. Twiss's letter confirms that the price of bricks in London had nearly trebled within a year to between 100s. and 120s. per 1,000, whereas it was hoped to make them on the coast for 40s. or 50s. per 1,000.
3. Sussex Industrial History 17 25-6 and 27 note 22.

R. MARTIN

The Old Forge, Wadhurst

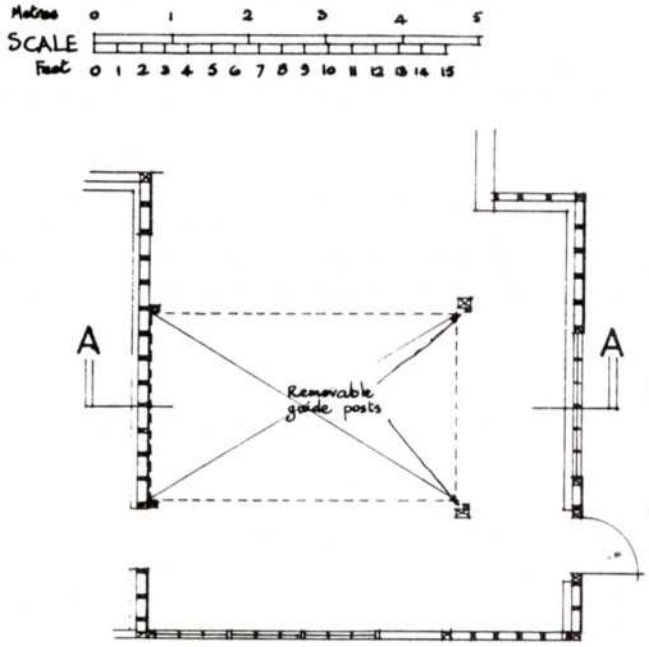
James Bassett started his business as a general smith in the 1880s and moved in about 1900 to the present site in Mayfield Lane, Durgates in the Parish of Wadhurst, map reference TQ 630322. Business had by then increased and was expanded to include carriage building and the buildings which still exist were then erected.

These comprise a single storey range containing two forges set back from the road and a two storied block to the north at right angles to the road with its front edge on the road line. Construction generally is of softwood studded walls covered with painted weather-boarding externally with continuous ranges of windows and with corrugated sheet steel roofs. The rear wall of the forges is in 215 mm thick brickwork. A later single storey extension to the rear contains remains of under-floor line shafting by which power from an electric motor was transferred to woodworking machinery. A brick-built cottage adjacent to the forge to the south was built in 1906 and is still occupied by the grandson of the founder.

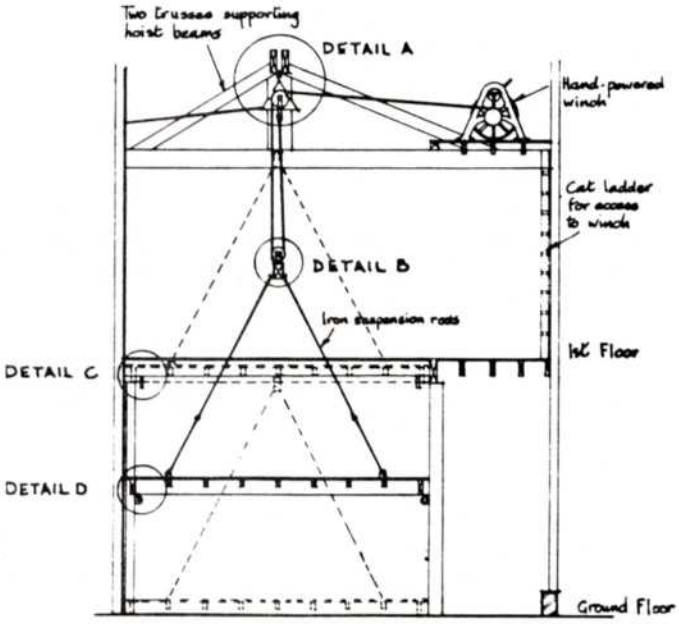
The ground storey of the two storied block was used for carriage building, the paint

WADHURST FORGE

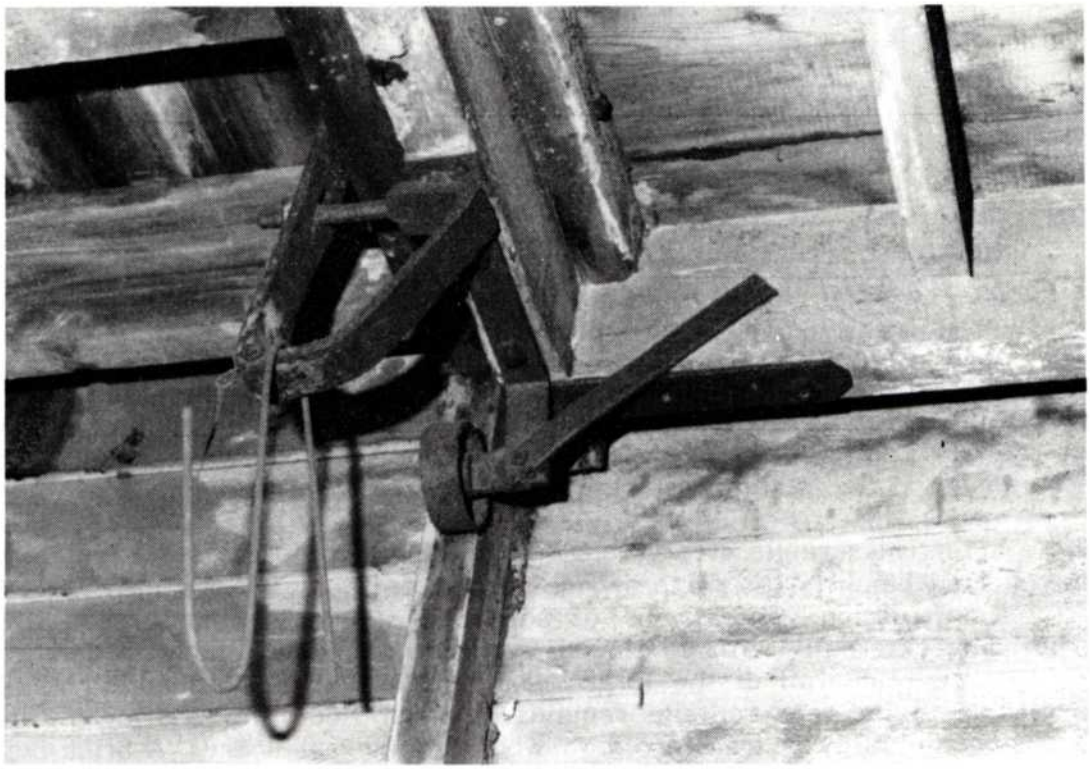
CARRIAGE HOIST



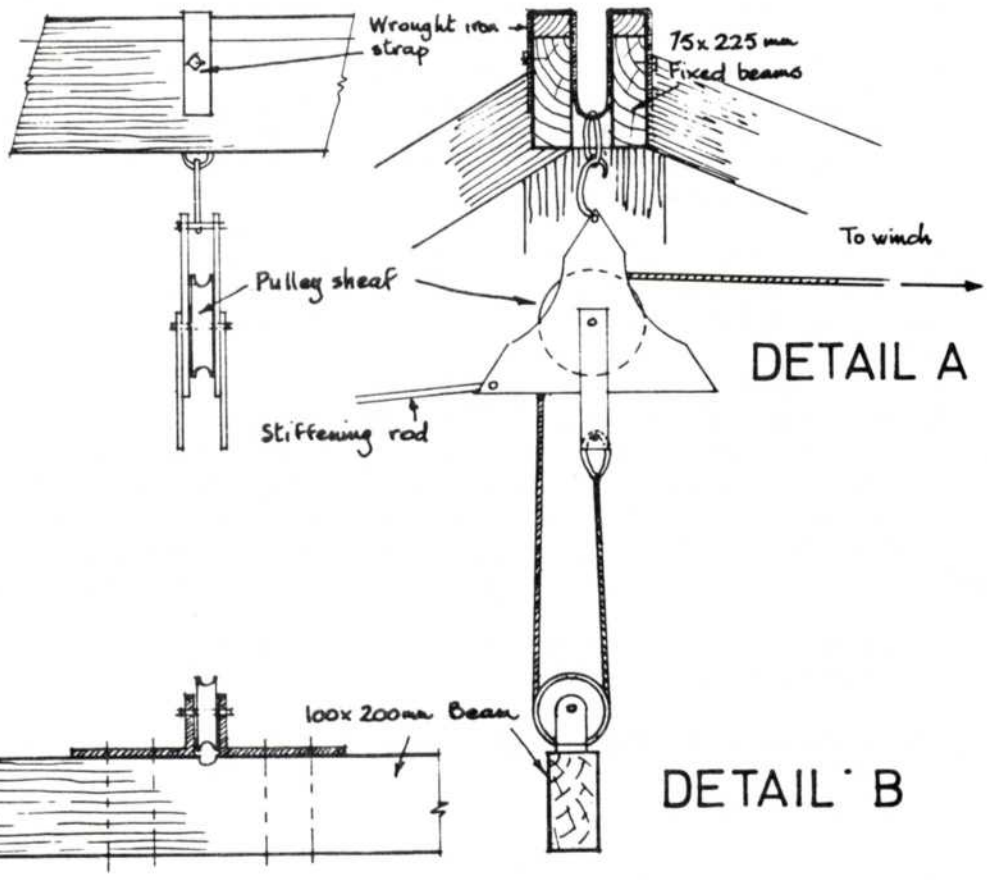
GROUND FLOOR PLAN



SECTION A–A

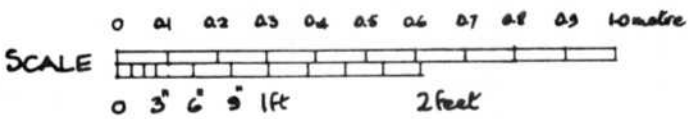


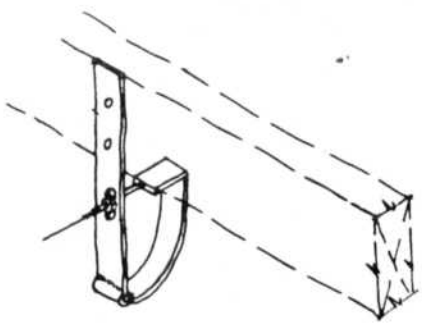
View of underneath of platform showing hinged stop & pulley guide

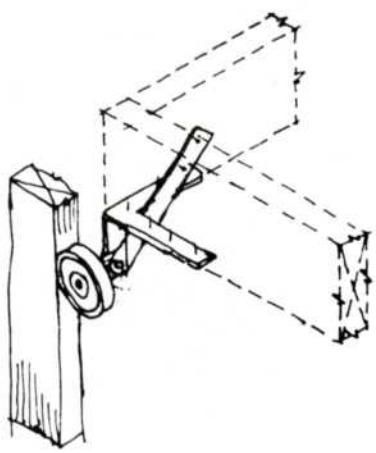


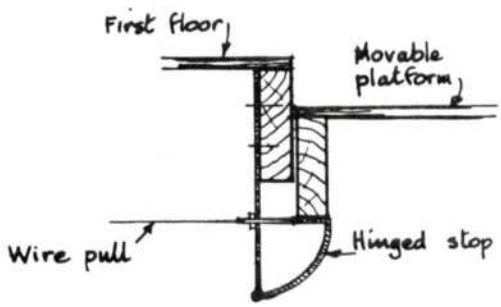
DETAIL A

DETAIL B

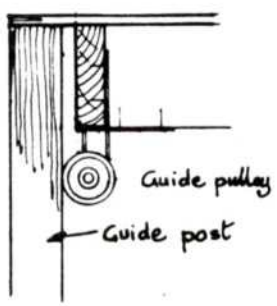








DETAIL C
HINGED STOP



DETAIL D
GUIDE PULLEY

and varnish shops being on the first floor. Access to the latter for carriages requiring painting was obtained by a hoist which is still extant although not used for many years. This consists of a platform 3.96 x 2.51 m on plan with 50 x 100 mm joists and a 63 x 200 mm edging member suspended from a single 100 x 200 mm oak beam by four 25 mm diameter iron rods. The beam is in turn suspended by a rope through a double pulley system and connected to a cast iron hand-operated winch with a mechanical advantage of 10. Three similar winches are still to be seen on Brighton beach and were used for hauling fishing boats up the beach.

When the platform is in the "up" position there are four wrought iron hinged brackets which lock under the outer edge of the platform, one at each corner, which may be disengaged by pulling on wires. Pulleys at each corner also locate the platform against vertical guide posts.

The firm survived until March 1988 when Rodney John Bassett, grandson of the founder finally decided at the age of 80 that he had to give up the forge. He started work in the family business at the age of 14 and completed his apprenticeship as a farrier at the age of 19, and in the course of his long working life had many strange and comical tasks including that of shoeing a Shetland pony from a circus accompanied by an elephant. His father did not believe in holidays and he was only allowed three weeks off in 44 years.

A billhead of the firm shows the range of vehicles which were then being built before the First World War.

I am indebted to Mr Rodney Bassett for the help and information he has given me.

Previous numbers of Sussex Industrial History are still available:

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No 16	(1986)	Identical to John King, Gatwick: The Evolution of an Airport (see below)
No 17	(1987)	Bognor Gas, Light & Coke Company; Glynde Aerial Railway; Bricks for the Martello Towers; Jesse Pumphery, Millwright
No 18	(1988)	The Windmills and Millers of Brighton

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Also available:

Sussex Industrial Archaeology: A Field Guide (1985)	£3.95 post free
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