

**THE IRON INDUSTRY IN THE WEALD  
IN THE PERIOD OF  
THE SEVEN YEARS' WAR  
1750-1770**

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## ABBREVIATIONS

BLI	British Library, Oriental & India Office Collections
BRL	Brighton Reference Library
EcHR	<i>Economic History Review</i>
ESRO	East Sussex Record Office
GL	Guildhall Library
GMR	Guildford Muniment Room
Hants RO	Hampshire Record Office
IJNA	<i>International Journal of Nautical Archaeology and Underwater Exploration</i>
KAO	Kent Archives Office
PMA	<i>Post-Medieval Archaeology</i>
PRO	Public Record Office
SkRO	Suffolk Record Office
SLSL	Southwark Local Studies Library
SyAC	<i>Surrey Archaeological Collections</i>
SyRO	Surrey Record Office
SxAC	<i>Sussex Archaeological Collections</i>
TNS	<i>Transactions of the Newcomen Society</i>
WI	<i>Wealden Iron</i>

## INTRODUCTION

**The English Iron Industry**

At the onset of the second half of the eighteenth century, the iron industry in Great Britain was embarking on a period of considerable change. Up to this time, it had been distinctly regional in character, with almost separate areas of activity; the Weald, Dean, south Yorkshire and Shropshire are examples. However, the coalescence of the iron producing regions in the west of England, together with the efforts to unite opinion for or against imported iron, suggest that the industry was beginning to take on a more national character. Since the end of the Civil War, the growth of the industry in the West Midlands had been considerable, with the integration of high quality pig iron from furnaces in the Forest of Dean, and lower qualities from those in Worcestershire and Shropshire, carried to the Stour Valley for forging, slitting and rolling for the wire and nail industries there (Johnson 1951: 167-74). Pig iron from the west Midlands penetrated the east of England but land carriage costs reduced its competitiveness in the face of imported pig from Sweden, Russia and colonial America.<sup>1</sup> The cheapness and high quality of imported iron displaced the bar iron made in the Weald which had supplied eastern England through the London market.

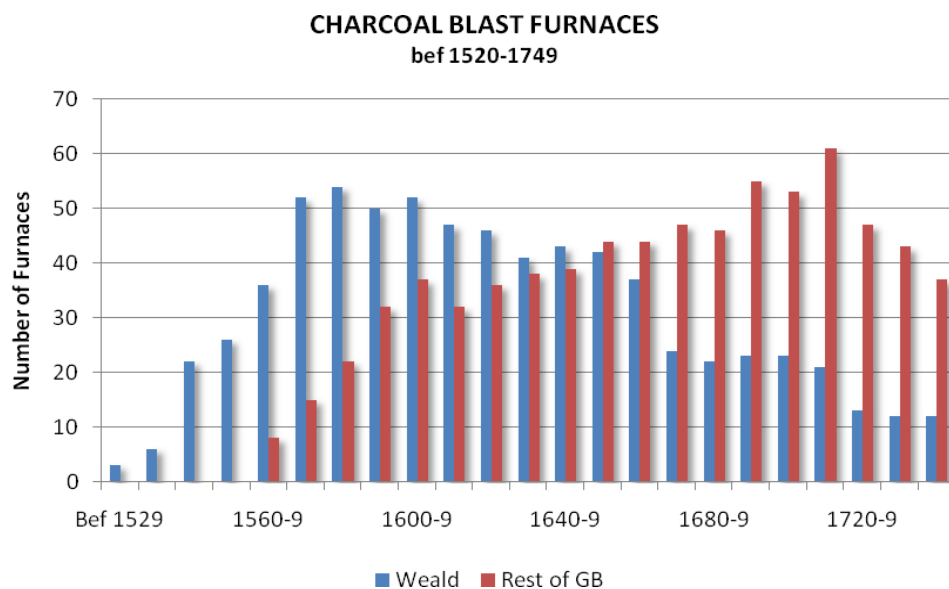


Fig. 1

(Hammersley 1973: 595 Table 1)

The Weald had dominated the English iron industry in the sixteenth and early-seventeenth centuries but the scale of its original investment - furnaces and forges of low output by later standards - made it less able to meet the increasing demands for iron that a swelling population and a more urbanised society were making in the 1660s and after. Lists of Wealden ironworks in 1653 and 1664 show a decline of 22 furnaces and 24 forges in the intervening period, although a subsequent, and associated, list dated 1667, shows some had been revived and equipped for the ordnance trade with the incentive of business

generated by the Dutch Wars (Crossley 1975b). It is likely that the reduction in the number of forges may have been exaggerated to give support to efforts to seek government protection for the bar iron trade, but the origin of the lists, and their authorship, is not known. The list which John Fuller obtained in 1717 shows a further reduction in forges (Cleere & Crossley 1985: 187-8). The Fuller list, of which there is more than one version, shows vividly the scale of the Wealden furnaces compared to those in other parts of England and Wales. An average output of 179 tons a year for the ten furnaces in the Weald for which figures are given, is compared with the 364 tons a year for the forty five furnaces elsewhere in the country, drawing attention to a combination of small furnaces and short campaigns which placed the Weald in an inferior position nationally (Hulme 1929: 21-2).<sup>2</sup>

Over-attention to the Wealden evidence, a lack of accurate output figures for the growing number of ironworks elsewhere in England and Wales, the establishment of furnaces in geographically more remote areas, such as Wales and Scotland, and evidence of the importation of Swedish iron led Ashton (1963: 13-22) to conclude that the British iron industry in the first half of the eighteenth century was in a state of decline, brought about by a shortage of charcoal fuel. This long-held view influenced many other writers.<sup>3</sup> Eventually it was challenged by Flinn (1958) and Hammersley (1973), who showed that careful examination of the early-eighteenth century lists of ironworks, together with a more precise knowledge of the ironworks of the period and of their output, revealed at most stagnation, but more probably slow growth, with old, small furnaces being replaced by new, larger ones. The spread of the industry into areas such as Wales and Scotland, rather than being evidence that the supply of charcoal in the traditional areas of iron smelting and forging was being used up, showed a concern for the conservation of wood resources for the industry in those traditional areas, and that ample wood continued to be available.

If the availability of charcoal was not a source of concern to ironmasters, its cost was. Efforts to lower the cost of production by reducing expenditure on raw materials became concentrated, in the areas where mineral coal was available, on the search for a means of smelting iron with coal. The pioneering work by Darby at Coalbrookdale, and others, is well documented, and a small number of furnaces were operating, using coke, in the Shropshire area during the 1730s (Raistrick 1953). However, Hyde has suggested that it was not until the 1750s that the economic conditions existed whereby coke-smelted iron could be produced more cheaply than traditional charcoal iron. From then on, the numbers of coke furnaces increased and charcoal ones decreased. Furthermore, improvements in furnace design, together with the greater burden-bearing quality of coke, allowed furnaces of greater capacity to be built (Hyde 1977: 57-67). With no known supplies of coal, and with its uncompetitive bar iron production denied more than a local market by imported iron, the Weald was cut off from the mainstream of technological development.

Wealden iron production in the first half of the eighteenth century is characterised by the sale of iron sows to a number of local forges for conversion into bar iron, and by the modest production of ordnance by a small number of founders, for in one branch of the industry alone did the Weald retain its dominance. From the 1540s, the Weald had a number of furnaces which specialised in the exacting art of gunfounding. This

number had always been small, rising to a peak in the 1570s but declining to no more than ten at the time of the Armada (Teesdale 1991: 40). From then on, the number of furnaces so employed fluctuated according to the political situation at the time, with the generally unsettled conditions in the second half of the seventeenth century stimulating the production of guns in the Weald, attracting the involvement of London merchants like Thomas Western and Peter Gott, and encouraging the building of three new furnaces. With the demand for guns restricted by a lengthy period of peace, from 1713 until 1739, gunfounding was unprofitable for all but a few until the War of the Austrian Succession caused a revival in its fortunes, and the location and traditional skills of the Weald attracted renewed interest. Cowden furnace was revived as a result of the demand created by the conflict, and the Harrison-Legas partnership forged to meet the demand more effectively. The uneasy peace which was ushered in at Aix-la-Chapelle in 1748 brought about a decrease in the demand for ordnance from the Government, but with sufficient prospect of a renewal of hostilities for the majority of ironmasters who had cast guns during the war, to stay in business and concentrate on the merchant trade, stimulated by the increased traffic with Britain's growing number of overseas trading interests.

### **The Economy of the Weald**

From a possible labour force of 6500 at the industry's peak in the 1570s, the decline to just over 1000 in the first half of the eighteenth century had caused a vacuum in employment, especially for the smallholders and common dwellers of the High Weald.<sup>4</sup> The economic conditions which were the background to the iron industry in the Weald had altered relatively little in 150 years. The population attracted to the Weald by the iron and cloth industries in the sixteenth and early-seventeenth centuries had begun to increase again after a period of stagnation after 1650, leading to an increase in squatting on the Wealden wastes. Hardship was caused by higher grain prices during the period of the Seven Years' War, although the popular riots which these shortages engendered in the textile areas of the South West, and in the metal working districts of the west Midlands, were not mirrored to the same extent in the Weald, for the South East was the main wheat growing area, and also because industrial workers in the region were essentially agricultural workers who laboured for the iron industry during slack periods in the farming year (Rude 1981: 37).<sup>5</sup> Much of the work in the Weald was seasonal; woodland industries, such as besom and hurdle making, were the resort of many, and poaching and smuggling were accepted at several levels of the social scale. An intensification of stock rearing for the London market added few employment opportunities (Brandon & Short 1990: 214-33). To the majority of its population the Weald's was an economy wherein there were few surpluses. Landed estates accounted for a substantial proportion of its area but little investment had taken place and woodland predominated, much of it formerly maintained to support the iron industry. Attitudes varied among proprietors; the Ashburnhams were generally concerned to improve, while the Fullers were more interested in the income their estate generated (Short 1984: 298). The widespread practice of annual tenancies militated against investment by landowners, which was directed more towards improving roads and rivers (Lowerson 1976: 21).

## The Seven Years' War and Colonial Expansion

The roots of the Seven Years' War lay in the shortcomings of the Peace which concluded the War of the Austrian Succession in 1748. The return to the status quo of nine years earlier, with little resolution of the problem of colonial boundaries, stimulated international tension. As the main contribution to the war effort, by the iron industry in the Weald, lay in the supply of cast iron ordnance, which was the principal armament of naval vessels, only those aspects of the conduct of the war which affected the navy need outlining. War was waged in four main theatres; in continental Europe, where Frederick the Great, of Prussia, engaged the armies of France, Austria and Russia; in North America and the Caribbean, where there was competition for territory by British and French colonists; in India, where there was competition for influence among the native rulers by French and British trading companies; and at sea, where control of the shipping routes would secure unhindered access to colonial wealth. The campaigns in India and the Americas ensured that the war was fought over a wider geographical area than any war hitherto. The implications for naval armaments were that, in addition to naval warships, the hostilities demanded that a large number of merchant vessels be armed. Warships were needed for convoy protection, whether trans-oceanic or for coastal traffic, and in an offensive role, for the coastal blockade and for fleet actions, such as the victories at Cape Lagos and Quiberon Bay. In the early part of the war, a number of, ultimately fruitless, offensive military attacks on the French mainland, described at the time as "breaking windows with golden guineas", required naval support (Langford 1989: 338). In 1755 alone, before the declaration of war, ninety five additional ships were commissioned, and in the period 1755 to 1758, seventeen new warships were commissioned by the Government (West 1991: 31-2). Ordnance was also required when it became necessary to replace lost or damaged guns, as in the case of the ships of Admiral Holburne's squadron, in 1757, which had to jettison their guns during heavy seas.<sup>6</sup>

As seen by the growth in shipping at the beginning of, and immediately preceding hostilities, demand for armaments was highest in the first three years. Purchases of guns by the Board of Ordnance show a peak in 1760, although this peak reflects contracts placed in 1757-8, offset by the Board's delay in payment. Demand subsided in the second half of the war, the major naval actions and expeditions having reached their culmination in the *annus mirabilis* of 1759.



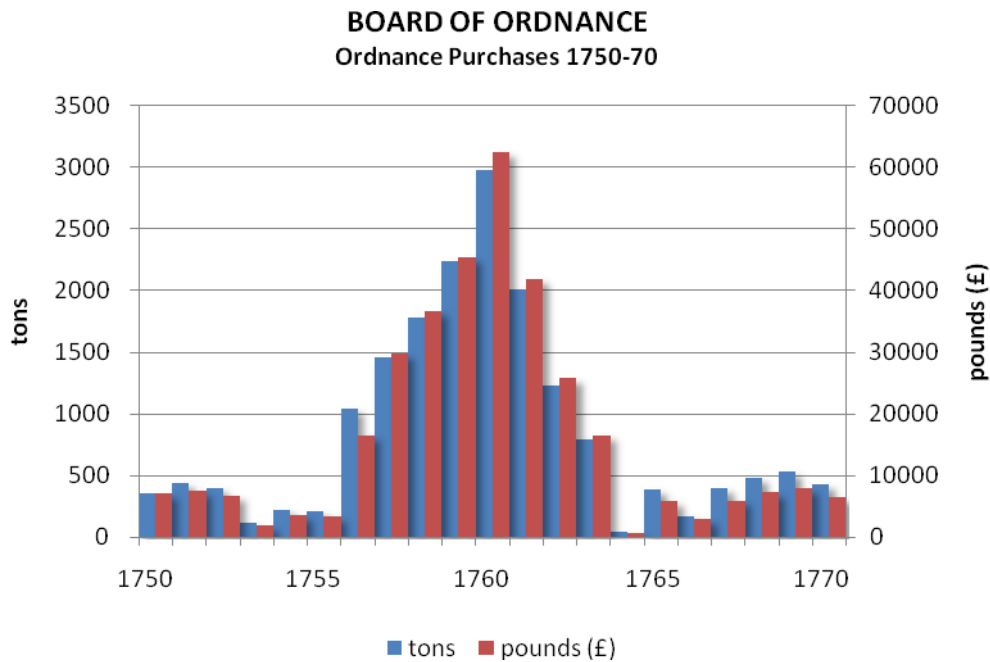


Fig. 2

(PRO WO51 173-246)

No increase in demand is observable with the entry of Spain into the war in 1762; indeed the Board of Ordnance began to decline tenders from its regular suppliers as early as 1760, because of the intensive build up of military and naval stores in the late-1750s.<sup>7</sup> Once peace had been declared in September 1763, and Britain's supremacy in Canada and India established, the demand switched from large naval guns to smaller protective weaponry on merchant vessels, such as East Indiamen, with the India trade benefiting from the enlargement of British influence through the achievement of the commercial administration of Bengal in 1765. The American trade affected the iron industry in the Weald to a lesser extent, as the principal ports in England which served this trade were Bristol and Liverpool. The iron producing regions in the west of England were able to supply these ports more easily, especially after the war, during which a number of gunfounding furnaces had been brought into operation; the furnaces at Carmarthen, and Bersham in Flintshire, were supplying merchants during the war years.<sup>8</sup>

## Historiography and Sources

Study of the iron industry in Great Britain owes much to the local and regional nature of the industry. The regional distribution of centres of production and their markets, insulated from other regions by the cost and inconvenience of transport, have lent themselves to regional studies. Similarly the units of production, the furnaces and forges, which, because of the capital-intensive nature of the industry, were well-defined local entities, continue to be the subject of local study. It is on these regional and local studies that subsequent national surveys have been forced to rely. Inevitably, the strength of such national studies is proportionate to the regional and local evidence available. Thus Flinn's reassessment of the theory propounded by Ashton and others, that the English iron industry was in decline during the first

part of the eighteenth century, was based in part on the inaccuracy of the contemporary information available to earlier writers. His claim, that new evidence of ironworks challenged the established view, was supported by a list which he included in his paper (Flinn 1958 146). Flinn's argument has gained in force. For instance, in his list of furnaces constructed between 1660 and 1760, highlighting elements of growth in an iron industry hitherto thought to be stagnating, Lamberhurst was the only Wealden example. Subsequent research has added three more to his list, if revivals after long periods of inactivity are included; Heathfield 1693, Pippingford 1696 and Warren 1758/9.<sup>9</sup> Although documentary sources do not suggest the likelihood of any greater number than this, the uncertainty about the late occupation of Burningfold furnace, together with the complete absence of information about a small number of other Wealden furnace sites, does not completely exclude the possibility of additions to the list. Records of the iron industry in the Weald in this period are far from complete. Information on the ownership, tenancy and working life of furnaces and forges has to be gleaned from a disparate array of sources, with a full picture rarely attainable.

The first historian to draw attention to, and attempt to chronicle, the iron industry in the Weald was Mark Antony Lower, in a series of papers published by the Sussex Archaeological Society. Writing in the 1840s, a mere twenty years after the closing of the last forge, at Ashburnham, Lower concentrated on earlier eras, notably the Roman and Tudor periods. His observations on the industry in the eighteenth century, still within living memory for a few, were confined to a topographical section (Lower 1849). Lower's studies generated interest among a number of historians and antiquaries. Subsequent general studies of the iron industry in the Weald, which included works by Delany, Richards and Jenkins, built on the work begun by Lower, but were overshadowed by Ernest Straker's monograph, *Wealden Iron*, which was to be the standard work on the subject for more than fifty years. Its strength lay in its topographical section which differed from Lower's in that it was the result of painstaking fieldwork and documentary research (Straker 1931). Straker's work stimulated further studies but, apart from the Fuller papers, little attention was given to sources relating to the industry in the eighteenth century. Henry Cleere and David Crossley's *The Iron Industry of the Weald*, published in 1985, is altogether more thorough in its treatment of the economic and technical development of the industry, making much greater use, than was hitherto possible, of local sources, as well as the increased body of material about the iron industry nationally. The section dealing with the eighteenth century makes use of sources from the Ashburnham estate papers and the material relating to the administration of the will of William Harrison, in addition to the Fuller archive.

The Fuller family papers are the largest primary source for the iron industry in the Weald in this period. They are deposited at the East Sussex Record Office, in Lewes, and comprise an extensive archive of the family's involvement, not only in the iron industry for over 100 years, but also in the management of their own and others' estates in Sussex and in Jamaica, and in the politics of their times. The material concerned with ironfounding comprises accounts of furnace campaigns (the period of months during which a furnace was in blast), which include purchases of raw materials, and the

names of suppliers, the costs of transport and of labour. There also exists a body of correspondence, not all of it included in the recently published letter book, much of it concerned with the day-to-day management of the ironworks.<sup>10</sup> Some of the material, including records of their furnace and forge in the later eighteenth century, has yet to be catalogued.

Attention to the Fuller archive was first drawn by a collection of extracts edited by Herbert Blackman (1926). Little commentary accompanied the extracts, but use was made of them in two subsequent works. Firstly, Hulme incorporated the 1717 list of ironworks transcribed by John Fuller, which Blackman published, in his statistical survey of the national iron industry in the first half of the eighteenth century (Hulme 1929). Secondly, considerable use was made of Blackman's material by Straker (1931). Further use of the Fuller papers was made by Mary Salt (1966; 1968; 1969) who, from them, compiled a detailed history of the family, together with some lengthy description of their ironmaking activities. Salt's three articles are, however, largely narrative, and do not offer any commentary on the Fullers in the context of estate management or iron founding either in Sussex or nationally. Howard Tomlinson (1976) took the family's gunfounding business as a case study of the Wealden industry during its decline. He drew attention to the lack of technical progress which the Fullers' methods demonstrated and, while conceding that there was insufficient comparative material from the Weald to determine the extent to which the Fullers' experience should be regarded as typical, he was of the opinion that the little evidence of other founders that he was able to examine supported his selection of the Fullers. The most recent interest in the Fullers has been shown by Richard Saville (1982; 1983), who has examined, successively, the output of their ironworks and the management of their landed estate. The culmination of his interest has been the editing, in collaboration with David Crossley, of the 1729-55 letter book (Crossley & Saville 1991). It is perhaps unfortunate that studies of the Wealden iron industry have been so indebted to the huge volume of documentary material available from the archives of the Fuller family. Although they have bequeathed an unparalleled view of the industry in the first half of the eighteenth century, the view is, in some respects, misleading, for the Fullers were unique in their role as country landowner-ironmasters, and their approach to the industry was inevitably coloured by the interaction of iron founding with their other interests; interests that they were unlikely to have shared with their contemporaries in the iron industry. As will be described in more detail below, most ironmasters operating in the Weald in the mid-eighteenth century held their ironworks on relatively short-term leases, so their involvement in the management of iron founding as an element in the economy of the Weald was considerably less than the Fullers'.

The only other set of accounts for the running of a furnace in the period are those for Ashburnham furnace, from 1756. Although generally more legible than the contemporary Fuller accounts, and organised in accounting periods by campaign, the accounts only deal with expenditure.<sup>11</sup> Reference to this material is made, particularly in Chapter 4, in assessing the costs of the various elements involved in iron production. Nevertheless, they have hitherto not been subjected to more than passing examination. Such is also the case with the Harrison papers.<sup>12</sup> William Harrison died in 1745 and his will named John Legas and Samuel Remnant as executors, and as trustees until his sons, Andrews and John, came of age.<sup>13</sup>

The papers cover the five year period of the trust, mainly outside the limits of this study, and include details of the supply of raw materials, and of production at their furnaces. Some of the material relates to the period 1741-5, during which Harrison was in partnership with Legas. A collection of letters, mainly from Legas to Remnant, parallels those written to Remnant by John Fuller in the same period. Tomlinson (1976: 400) made use of a small amount of the material as a comparison with the Fullers, but these papers await detailed analysis. There are, in addition, two small groups of correspondence which are relevant to this period, and to which reference is made below. The first are the letters written to the steward of the Glynde estate, concerning the re-letting of Hawksden forge in 1765-6.<sup>14</sup> The second is the correspondence between John Churchill and others, and the Battle Abbey estate, in 1753-4, over the letting of Robertsbridge furnace and forge. The latter form part of the Battle Abbey archive at the Henry Huntington Library in Pasadena, California (Whittick 1992).

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An important primary source for the student of the iron industry in the Weald are the records of the Board of Ordnance. The Board was a department of state with wide ranging responsibilities. It was charged with arming all ships and forts, and it came to control other defensive works, barracks, stores and factories, both at home and overseas. At its head was the Master General., who was a senior political and military figure. Beneath him was the Lieutenant General, also with senior military rank, and four civilian members of the Board: the Clerk of the Ordnance, who was responsible for purchases, the Surveyor General, who oversaw quality, the Storekeeper, who was in charge of storage, and the Clerk of the Deliveries, responsible for issuing (Skentelbery 1975). The decisions of the Board were set down in the Minutes of the Surveyor General, and include the issuing of warrants for the supply of guns and other materials, the records of proofs, and general correspondence with suppliers, among them gunfounders. A considerable amount of incidental information about the gun trade can be gleaned from these papers, particularly in relation to problems of transport, and extensive use is made of this source, particularly in Chapter 3.<sup>15</sup> Records of the warrants issued, the natures of the guns and other items supplied, and the payments made to suppliers are found in the series of Bill Books.<sup>16</sup> These also record quarterly payments to personnel. As a source of statistical material on the production of guns by Wealden and other founders, only limited use has been made of this archive up till now. Tomlinson listed the tonnage and value of guns purchased by the Board in the period 1700-70 but, as the period and consistency of production for each gunfounder varied, and the founders named sometimes included more than one generation in the same firm or family, his list is of limited value (Tomlinson 1976: 398). In this study the Bill Books have been analysed to provide statistical information about the Board's purchases of guns during this period, and also about production for the Board by individual founders.

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Records of the purchase of guns by the East India Company provide an additional source, although the Cash Journals of the Accountant General lack the detail of the Ordnance Bill Books.<sup>17</sup> Some statistical information has been compiled from this source and is referred to below. The purchases recorded in these volumes appear to relate to ordnance and other items required for export and use in India, rather than for the arming of East Indiamen. Some of these purchases can be traced to guns transported

to London from the Weald by the coastal trade. Because of a prohibition of the unlicensed export and coastal traffic of warlike materials, by the Privy Council from 1755 until 1763, records of the issue of such licences form a limited source of information about such movements. These are to be found in the Registers of the Privy Council.<sup>18</sup>

Of the published works of a specialised nature, the lists of ironworks in the Weald in the second half of the seventeenth century, since lost, which Lower had obtained, and which were republished by J. L. Parsons, are germane to the period which followed as they provide a useful indication of the state of the industry in the region at the time when the specialisation in castings, and particularly in ordnance and shot, was taking over from the bar iron trade (Lower 1866; Parsons 1882). D. W. Crossley has edited these, identifying inconsistencies, and annotating the texts (Crossley 1975b). The first published work specifically concerning the industry in the Weald in the eighteenth century were extracts from the accounts kept by Robert Knight, an East Grinstead carrier, whose teams transported guns from the Warren and Gravetye furnaces to Woolwich in the 1760s (Breach 1903). A complete transcription of the accounts relating to ironworking has been prepared by the present author (Hodgkinson 1978). Howard Tomlinson's paper, analysing the demise of the Wealden gunfounding industry, was the first attempt since Straker to examine this specialised branch of the industry in the Weald (Tomlinson 1976). In it he traced the growth of gunfounding in the region, identifying the Seven Years' War as the turning point in its fortunes, when gunfounders outside the Weald gained government contracts and, following which, the Carron Company undercut Wealden prices; and citing the Board of Ordnance's decision, in 1775, to accept only guns bored from the solid, as the terminal point. His case study of the Fullers has already been referred to above. In his conclusion he drew attention to the resilience of gunfounding in the Weald, through the continued patronage of the Board of Ordnance, but also to technological failure, and an inability of Wealden ironmasters to adapt.

Williams's paper on Robert Morgan, the Carmarthen gunfounder, during the Seven Years' War is of value as it offers, in some respects, a more valid comparison with some of the gunfounders in the Weald than the Fuller papers do. Also, Morgan had connections with the Weald, both with his skilled personnel and in sub-contracting (Williams 1959). Flinn's study of the Crowley family is also useful although he seriously underestimates their interest in gunfounding and therefore barely mentions their activities in the Weald (Flinn 1962).

## Notes and References

1. In 1755, imports of pig iron from Sweden amounted to 17,762 tons, from Russia, 9,949 tons, and from America 3,441 tons (Scrivenor 1841: 339-40). Sweden's alliance with Britain's opponents in the Seven Years' War, coupled with tensions over the inequality of its trade, caused the relaxation of restrictions on American pig iron, the importation of which had been allowed since 1750 (Ashton 1963: 116-21).

2. For a more detailed discussion of this and other lists, *see also* Riden (1977).
3. For example, Williams (1962), 113.
4. For a discussion of the criteria by which these figures have been arrived at, *see* Chapter 4 pp. 96-7.
5. Although not strictly in the Weald, there was a potential riot in Lewes in 1757 (Vaisey 1985: 82).
6. PRO WO47 50 f.311.
7. ESRO SAS RF16/V/47. PRO WO47 57 f.21.
8. PRO PC2 105-8.
9. *See* Appendix 1.
10. *See* Saville 1981 for a detailed conspectus.
11. ESRO ASH 1815.
12. GL Ms. 3736; 6482; 6482A; 6483; 6483A.
13. *See* Appendix I.
14. ESRO GLY 2770, 2771, 3088.
15. PRO WO47.
16. PRO WO51.
17. BLI L/A/G/1/5/.
18. PRO PC2 105-109; I am most grateful to Dr J. West for drawing my attention to this source.

## CHAPTER TWO

### OWNERSHIP, ORGANISATION AND RISK

During the sixteenth century, it was possible to recognise two distinct categories of ironmaster in the Weald; owner-occupiers and tenants. By and large, the former were responsible for the fixed capital assets of a site, the buildings and machinery, while the latter provided the stock and raw materials, the working capital. In a number of cases, tenants provided both, with fixed assets ultimately forming part of the leased property, and an accommodation being made in the rent. Partnerships became increasingly common towards the end of the sixteenth century, some formalised by a legal agreement, allowing a greater chance for the vertical integration of raw materials and manufacturing processes. Also, the great majority of Wealden ironmasters at that time were local, having their main dwelling close to their works (Goring 1978: 205-11).

By the second half of the eighteenth century, the owner-occupier category had greatly diminished, and the majority of those who occupied the furnaces and forges were short-term leaseholders. The few owner-occupiers can not be simply categorised, for they are represented by a variety of personalities. William Harrison, a London merchant, had purchased the Manors of Birchden and Orznash, in Rotherfield and Withyham, which included Hamsell furnace. Harrison died in 1745 and the property, heavily mortgaged, was left to his sons, Andrews and John.<sup>1</sup> The Harrisons occupied, as tenants, several other ironworks but Hamsell seems to have been the only one they owned outright. William Bowen probably began his career in London, but his entry into Wealden ironfounding was marked by his purchase, in 1741, of the freehold of Woolcombs Farm, Cowden, of which Cowden furnace was a part.<sup>2</sup> It is not known whether his tenure of Barden furnace was freehold or under a lease. When Bowen died in 1771, he was residing in Tonbridge. The best known of the owner-occupiers is the Fuller family, who owned Heathfield furnace and Burwash forge. Their ownership of these sites is characterised by their sustained use over a century and, while the Fullers have probably attracted greater attention than any of the other Wealden ironmasters of this period, their status as owner-occupiers is far from typical.

The inherent fragility of the gun trade must have been an influential factor in the decision as to whether to buy or lease. Owner-occupation had the advantages of greater control over the supply of raw materials if it included resources of coppiced woodland or iron ore. The Fullers ensured that all ore and timber was reserved to them when formalising agreements with tenants (Saville 1983: 136). A tenant labour force might also be available. There was no annual payment as with a rent, although the initial outlay was greater, but sub-letting of parts of a property, which could generate an income, could be considered. By the mid-eighteenth century, it is unlikely that any potential occupiers of furnaces or forges would have been prepared to consider a virgin site. The Fullers' purchase of the site of Heathfield furnace in the 1690s was at a time when there was a growing market for Wealden guns, so the considerable expense of construction could be placed in the context of a long-term business venture, and with



the support of an agricultural estate. By the period from 1750-70, the Fullers' ironworks contributed a significant element in the family's income; an income which only temporarily suffered when they were undercut by the Carron Company in the mid-1760s, because of the increasing profitability of their Jamaican estates, and other sources of income.

Page 20

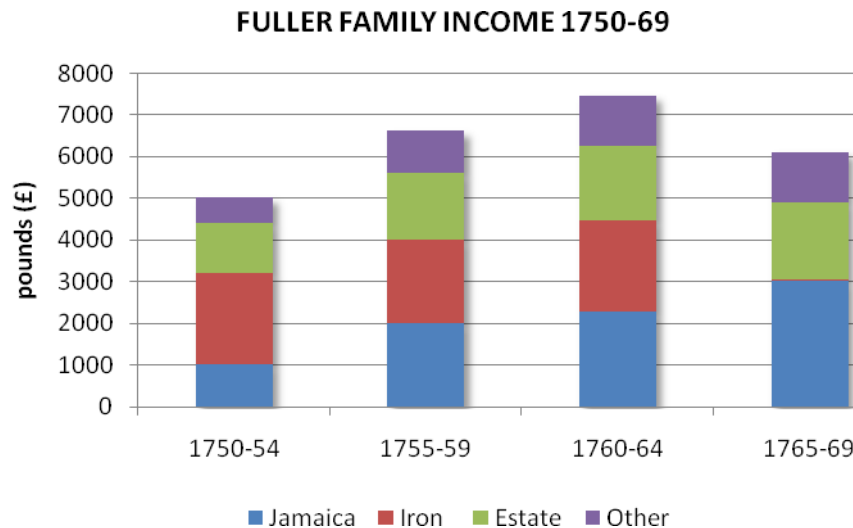


Fig. 3

(Saville 1983: 143 Table 5)

Both Harrison's and Bowen's purchases, while probably for different motives, would have taken into consideration the state of existing buildings and water systems at the time of purchase. Leasing ironworks carried less responsibility and liability; most were concerned with landlords' rights to timber or fish, but lessees' responsibilities in respect of the condition of the works at the end of the term seem to have caused some problems. Negotiations had to be carried out between Sir Whistler Webster and George Jukes before John Churchill was satisfied with the condition of Robertsbridge forge prior to taking a lease of the site in 1754 (Whittick 1992: 56-62). Premature termination of a lease was also a cause for concern; the condition of Hawksden forge, following the bankruptcy of Richard Tapsell in 1765, led to difficulties for the Bishop of Durham's estate in trying to secure a tenant.<sup>3</sup> Ultimately leasing was a short-term means by which ironmasters could acquire works. Even so, Legas's lease of the Gloucester furnace at Lamberhurst, continued by Tapsell, was to last for over forty years. In a number of instances, the landlords of ironworks were themselves descendants of ironmasters; the Gotts, Pelhams and Ashburnhams had all, in the past, been directly involved in the production of iron. Even the Websters, who purchased the Battle Abbey estate in 1725, worked Beech furnace until about 1737, so they had limited direct experience of the industry (Whittick 1992: 34-5, 54).

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The majority of the ironmasters were leaseholders and they can be divided into a number of overlapping groups according to the characteristics of their involvement both in the industry and in the region. Of all the leaseholders, up to the mid-eighteenth century, the Crowley family's involvement in Ashburnham furnace was, contrary to the view expressed by Flinn (1962: 101), the longest of any. Its antecedents dated back to the Browne and Foley families' use of the site a century before and, through the Foleys to the interest of Ambrose Crowley and John Hanbury in the early 1700s (Johnson 1951: 171-2;



Cleere & Crossley 1985: 195-6). The link was strengthened in 1756 with the marriage of Elizabeth Crowley, co-heiress of the Crowley fortune, to John, 2nd Earl of Ashburnham. The Crowley family's business remained in the hands of Elizabeth's mother, Theodosia, who had taken over the year before, after her sons, Ambrose and John, had died (Flinn 1962: 87-8). The Crowleys may have been influential in the involvement of Edward Raby in the Weald, Raby's father having been apprenticed to Sir Ambrose Crowley in the early years of the century, and both Crowley and Raby junior, albeit at different times, being associated with the Drapers' Company in London. Edward Raby had been apprenticed to Alexander Master, himself an apprentice of Crowley, and father of Raby's erstwhile partner.<sup>4</sup>

Page 22 Raby was one of a distinct group of ironmasters in the Weald, whose business origins were in London. Others include the Harrisons, the Jukes brothers, William Bowen and Joseph Wright. This group variously described themselves as merchants or ironmongers, having addresses or yards in Southwark, although Raby and Master started in Smithfield, and William Harrison had a house in the City. Despite moving into ordnance manufacture in the Weald sooner or later, all retained their Southwark yards and presumably, in the cases of Bowen and Wright, their brassworks. The Jukes brothers retired from gunfounding after they gave up the lease of Robertsbridge furnace, and concentrated on a merchant role. They continued to do business with founders in the Weald, as well as elsewhere.<sup>5</sup> The Harrison brothers inherited their father's estate when they came of age in 1750, after a period during which John Legas and Samuel Remnant acted as trustees. The partnership with Legas, which was to continue under their father's will, included Gloucester and Beckley furnaces, Westfield forge and a boring mill at Horsmonden. All were leased from the Gott family. In addition, the partnership had subsequently leased Waldron and Brede furnaces, as well as the forges at Hawksden, Bivelham and Brightling. The precise arrangements whereby the sites were leased are obscure, and the documentary evidence has not survived in every case. From the Land Tax returns, it would appear that Tapsell was the nominated holder of the partnership's property in Sussex, but they appear to have acted largely in concert when contracting to cast for the Board of Ordnance, Tapsell's name being omitted from time to time from 1756-8, although not subsequently. Whether this is an omission of the clerk of the Board, or a reflection of the source of the ordnance referred to, is not clear.<sup>6</sup> In addition to Tapsell and the Harrisons, an important figure who, on William Harrison's testamentary recommendation, joined the partnership, was Robert Bagshaw. Formerly Harrison's clerk, Bagshaw may have been the most commercially active partner.

Page 23 Tapsell, together with his uncle, John Legas, although in partnership with London merchants, were members of a smaller group of leaseholding ironmasters who had Wealden origins; the others were John Butler, and William Clutton. Resident in Wadhurst, Legas's involvement in the Weald started in the 1720s and was strengthened, after fifteen years, by his partnership with William Harrison. Legas died in 1752 and, like Harrison, was of an older generation, but their partnership had a profound effect on the iron industry in the Weald, particularly into the 1750-70 period, under Tapsell and Harrison's two sons. John Butler's family history in the Bramshott area is well documented but his career as an ironmaster is shadowy

(Cochrane 1967: 46-7). Apparently in business by the late 1730s, his occupancy of Northpark furnace is only confirmed when it ended in 1769.<sup>7</sup> His name is not one of those supplying the Board of Ordnance, and a passing reference to a partnership with a Mr Eade suggests that Butler may have been one of the suppliers for Eade & Wilton's wide ranging merchant organisation (Butler & Butler 1845: 10). William Clutton's foray into Wealden gunfounding was brief and seemingly impetuous. His two year career is better documented than the thirty years of John Butler, with whom he had in common an absence from the list of Ordnance Board suppliers, and a sub-contract with Eade & Wilton. Clutton was a young man and his spell as an ironmaster, and his consequent bankruptcy, was to have little apparent effect on his later life (Hodgkinson 1989: 27-33).

Page 24 John Churchill and his son do not fit into the groups already mentioned, for their business origin lay in the Midlands. Churchill senior was an established ironmaster in Staffordshire, where he retained a residence, and his interest in the Robertsbridge works came at a time when enquiries were being made by others from outside the Weald/London area; a Mr Cotton, who may be associated with the family of the same name who had ironworks in the north Midlands, and Thomas Braxtone from Titchfield, near Fareham, where a forge had long been established. Churchill's informant was a John Botton of Derbyshire, and clearly knowledge of the state of the Wealden iron sites was available to those who sought it. Churchill's successor at Robertsbridge, at the very end of this period, James Bourne, was a kinsman who had presumably moved to Sussex from Staffordshire with Churchill, for he was initially employed as his clerk. Churchill appears to have worked Darwell furnace, although there is no direct evidence for this. In 1757 he doubled the quantity of iron he proposed to cast for the Board, above the capacity of Robertsbridge furnace. The Crowleys had operated Darwell in the 1730s and 40s, so it was in working order, and James Bourne was subsequently recorded as occupying it (Hodgkinson 1979: 13).<sup>8</sup> Surviving evidence of the marking on the trunnions of cannon corroborates this assumption (Brown 1989: 326). Although apparently the only Midlands ironmaster to move directly into the Weald, Churchill's origins were shared by Raby and possibly by the Jukes brothers, both of whose families came from the Stour valley area of Worcestershire.<sup>9</sup>

## Partnerships

Partnerships figure in many of the ironfounding operations in the Weald. Harrison and Legas's was formalised and was equal in the financial commitment of each party. Alexander Master and Edward Raby were bankrupted together, although it appears likely that Raby was in charge of the blast furnace operation, leaving Master at the partnership's ironmongery works in London.<sup>10</sup> But not all partnerships appear to have been equal. John Norden escaped the bankruptcy that affected his partner, William Clutton, possibly because the latter had financial responsibility, leaving practical matters to Norden. Joseph Wright may have taken Thomas Prickett into partnership when they moved out of London, again perhaps for his technical ability. It is possible that some of these associations fell short of actual partnership. In some instances, family ties gave rise to

partnerships, such as William and George Jukes. When William died, George joined with his other brothers, Thomas and James, in the merchant trade. Churchill's son, John, is unlikely to have been an equal partner as, despite inheriting the ironworks in Staffordshire and Sussex, he did not continue to operate them after his father's death. A partnership of particular interest is that of Jonathan Eade and William Wilton. Based at Wapping, their interests included general victualling and, in another partnership, Eade & Bridges, the manufacture of gunpowder (West 1991: 144). There is no evidence which suggests that Eade & Wilton operated their own blast furnace, but the regularity of their supply of new guns cast out of ore for the Board of Ordnance, both during and after the Seven Years' War, suggests a regular sub-contract with one or more gunfounders. Clutton, at Gravetye, was certainly one, but for only a short period, and the output of Northpark furnace, for which evidence of its disposal elsewhere is lacking, seems a candidate for another.

## Merchants

As merchants, Eade & Wilton purchased guns for the fitting out of vessels involved in overseas trade, privateering, and coastal traffic. A number of sources existed for this; guns transferred from ships going out of service, prizes from captured foreign vessels (although these often proved problematical, needing different sized shot), guns cast specially for the merchant trade by gunfounders in the Weald and elsewhere, and at air furnaces in London, and guns rejected by the Board because of minor flaws in their casting. Although some derided the trade, its existence was essential to gunfounders, both as an alternative to the Board of Ordnance during periods of peace, and also to enable them to cover the losses caused by failure.<sup>11</sup> A 12 pounder cast for the Board in 1757 might fetch £20 a ton, but as scrap it would only be worth £5 a ton; a price of £9 a ton sold to a merchant vessel, including commission, would diminish the loss to the founder. Several Wealden ironmasters involved themselves in the merchant trade, either as direct manufacturers or as dealers offering a service to other founders. The Churchills and Crowleys both set aside a proportion of their production specifically for merchant vessels, the former assuming the merchant role personally when, for example, he sold refused shot to shipowners in Rye, and in Gainsborough in Lincolnshire.<sup>12</sup> Robert Bagshaw, Eade & Wilton and the Jukes brothers acted for, among others, the Fullers in finding markets for surplus or sub-standard Wealden ordnance.<sup>13</sup> Other merchants confined their activities to buying and selling. The Privy Council registers record several individuals who sought to traffic in guns during the war years, such as Richard Green, who did business with Isaac Wilkinson as well as in the Weald, and Joseph Wright, who later was to move into iron founding in the region.<sup>14</sup>

## Agents

The Crowleys' agent was their manager, Roger Hanmer, whose responsibilities embraced the whole of the family's ironworking activities. A London agent was essential for those who were based in the Weald, most notably the Fullers, but less so for

those ironmasters who were based in the city, where the principal civilian market for ordnance was to be found. It was common practice for country gentry business interests to be handled by agents, to avoid the necessity of frequent and often difficult travel to conduct business personally. The Fullers employed an agent for their Jamaican business, and Stephen Fuller, who was later to act as agent for the Jamaican Assembly in England, managed the ironworking part of the Fuller estate for his brother, Rose (Crossley & Saville 1991: xxiv-xxvii). The role of the agent was similar, in many ways, to that of a merchant except that, whereas the merchant was free to ply for trade with anybody, an agent was expected to act in the interests of his employer, and it is clear that John Fuller felt that the two roles were becoming blurred when he dispensed with the services of Samuel Remnant as his agent in 1750 (Crossley & Saville 1991: 260). Subsequently the Fullers enjoyed the services of Jefferson Miles and, later, James Cooper, both civil servants at the Tower of London. Samuel Remnant exerted considerable influence over the Wealden iron industry, even after his death in 1752. Apart from his long connection with the Fullers, he acted as agent for John Legas, with whom he was executor of William Harrison's will, and trustee of the partnership for five years. He had been a neighbour of Harrison and made a small bequest to Andrews and John, Harrison's sons, in his will. William Bowen is also mentioned as a "friend" in the will, suggesting some influence in his career.<sup>15</sup> Bowen later bequeathed property to Remnant's son, Stephen.<sup>16</sup> As part-owner of two East Indiamen, as well as having a productive foundry at Woolwich, Remnant was ideally placed to derive the maximum advantage in business dealings with both the Board and the merchant trade.

### **Sub-contracting**

The Fuller letters suggest that sub-contracting between gunfounders in the Weald was common in the 1730s and 40s. Board of Ordnance warrants did not always suit the gunfounders in the blend of gun types that were required. Most preferred to cast the smallest guns first, gradually increasing the size as the hearth itself grew larger. Thus a founder casting small guns might help another who was contracted to supply the same but who was already committed to casting larger calibres. The Fullers had informal arrangements from time to time with Bowen, Harrison and the Jukes brothers, although the Jukes's fraudulent casting of John Fuller's monogram on the guns they were making for him brought theirs to an end (Crossley & Saville 1991: 250-1). The period of greatest sub-contracting activity involving the Fullers generally ceases in 1750 with their abandonment of Samuel Remnant as agent, and it seems very probable that his unique contact with this group of iron masters enabled him to arrange sub-contracts to everybody's advantage. Other examples of this practice occur throughout the war period, and not only within the Weald itself. During the previous hostilities the Fullers had agreed to supply some guns for the Sones at Sowley furnace, in Hampshire (Crossley & Saville 1991: 216-23). Later, after the outbreak of the Seven Years' War, Thomas Pryce, who had a furnace at Neath, in South Wales, offered to cast guns for the Fullers in 1757. In the following year he tendered for a contract with the Board of Ordnance.<sup>17</sup> There is no evidence

that the offer to Fuller was taken up, and Pryce's guns subsequently failed the Board's proof so badly that he never cast guns for them again.<sup>18</sup> Edward Raby sub-contracted to an unknown founder in the Bristol area for round shot in 1759 within the first year of his gun and shot warrants for the Board.<sup>19</sup> It is clear that Raby's decision to sub-contract was made prior to his proposing to cast for the Board. His intention to cast the shot, as well as the guns, out of ore precludes the use of any air furnaces he and Alexander Master might have had at their works in Smithfield, and to offer to cast 400 tons of iron at a Sussex furnace was unrealistic.<sup>20</sup> Different motives drove Robert Morgan, of Carmarthen, to sub-contract to John Churchill for guns. Uncertainty about the availability of a suitably skilled gunfounder, together with Morgan's own pessimistic assessment of the risk involved in selling guns to the Board, persuaded him to come to an agreement with the ironmaster at Robertsbridge to pay Morgan £1 a ton for guns cast for him in 1762 (Williams 1959: 42-3). Churchill, who was a gunfounder with a good proof record, had lost his contract with the Board in 1761.<sup>21</sup> Where Eade & Wilton differed was that they do not appear to have had any casting facility. To attempt to purchase from other gunfounders to service the Board's warrants would have entailed too great a risk, so they must have relied on sub-contractors to service their warrants for the Board. The accounts of the carrier at Gravetye furnace show William Clutton to have been one such contractor; evidence suggests that John Butler, at Northpark furnace, may have been another (Hodgkinson 1978: 16-8).<sup>22</sup> The bankruptcy of William Clutton in 1762 may have caused some problems for Eade & Wilton despite being able to carry away a substantial quantity of the bankrupt's stock (Hodgkinson 1978: 28-9).

## Finance and Bankruptcy

Of the ironmasters working in the Weald in this period, bankruptcy afflicted five: William Clutton in October 1762, Edward Raby and Alexander Master in November 1764, Richard Tapsell in January 1765, and John Churchill in July 1767.<sup>23</sup> The iron industry was more prone to financial failure than most because of the dependency on government contracts during wartime and the possibility of their sudden withdrawal at the onset of peace. Ironmasters had only limited control over their business environment. Many were not based near their works, and they manufactured goods for purchasers who were often at a great distance. Also many of those who were casting guns in the Weald were relatively new to the venture. Cash flow was a problem; the Board of Ordnance and the East India Company were notoriously slow at paying, and therefore the ironmasters' requirement for credit would have been considerable. During wartime, the demand for money, particularly by the government, raised interest rates, making it difficult to obtain funds except at high cost (Hoppit 1987: 96-110, 1239, 177-8). As late as 1773, Rose Fuller complained that "...the delay of payment sometimes for years without interest is unprecedented in any other Trade and ... one great cause of the ruin of most of the Gunfounders during the last War".<sup>24</sup> The evidence suggests that Fuller was overstating his case, although his cause may have been just. As Clutton did not supply the Board directly, his failure cannot be laid at their door. Raby's ruin was only temporary, and Churchill's occurred four years after hostilities ceased. Even

Tapsell's bankruptcy, with which Fuller may have been most acquainted, did not occur until the beginning of 1765. Of the rest, all continued to cast in the reduced circumstances that peacetime afforded. What remains unknown is the extent to which the gunfounders, both those that failed and those that survived, were weakened financially, even terminally, by the Board payment system, especially after 1763.

To reach firm conclusions on the individual causes of bankruptcy among the Wealden ironmasters is not possible from the available evidence. Bankruptcy records only reveal the minimum of information. What is known is that to have been declared bankrupt an individual trader had debts in excess of £100 to one creditor, or more to a greater number. Assignees, to administer the bankrupt's property, were appointed by a meeting of the creditors so it is likely that they were of their number, and probably of some importance (Hoppit 1987: 36-8). William Clutton's assignees included his elder brother, who was the petitioning creditor, and his father-in-law. Given that he was back in business before receiving a Certificate of Conformity, his bankruptcy may have been arranged for his own good (Hodgkinson 1989: 31). The stigma of untrustworthiness does not seem to have attached itself to Clutton, nor to Edward Raby. Master and Raby's petitioning creditor was Robert Macky, a fellow ironmonger, and both were seen to be cooperating with their creditors, a Certificate being granted within eighteen months.<sup>25</sup> After which, Raby, this time alone, was back casting guns at Warren furnace and with sufficient funds to purchase the remainder of the lease to Clutton's furnace at Gravetye. The bankruptcy of Richard Tapsell seems to have ended somewhat differently. Lower (1849: 213) refers to his imprudence and to his decline into indigence, and in his subsequent career there was no noticeable return to ironfounding. The petitioning creditor was Robert Bagshaw, his business associate, and Lower's description suggests that Tapsell may have been endangering the stability of what had once been a powerful and profitable partnership. From the date of his bankruptcy, the existence of Harrison & Co., as a major force in the Weald, came to an end, and one must assume that, as it was precipitated by Bagshaw, it was a deliberate act. Harrisons' continued to exist as merchants and as suppliers to the Board of Ordnance, but sub-contracted, notably to Wilkinson & Co. (Brown 1988: 106-8). Little is known of the bankruptcy of John Churchill. Its effect is concealed by his death a month or two after. The operation of his works was not affected, for a partnership headed by Churchill's kinsman, James Bourne, leased the furnace and forge at Robertsbridge in the following year (Whittick 1992: 48-9).

The economic climate which was the background to these bankruptcies suggests that, in general, they were brought about less by national factors than by individual circumstances. The period from mid-1759 until mid-1766 was one of relative economic prosperity, with bankruptcy levels below average (Hoppit 1987: 107, 123). Crises occurred in 1761 and in 1763 and there would have been a general demand for cash, particularly in the latter year when private finances were more affected (Hoppit 1986: 44-50). The entry of Spain into the war in 1762 caused a fall in exports and increased interest rates, giving rise to the possibility of credit strain between the metropolis and the provinces (John 1955: 342). Borrowing money



became very expensive in the early 1760s because there had been a fall in the number of deposits and interest rates had risen (Joslin 1960: 170). William Clutton's failure may have been precipitated by pressure on his creditors. The end of the war and its consequent downturn in business would have particularly affected gunfounders; Raby & Masters might well have suffered for this reason, as they had entered the gunfounding business three years into the war period and, given the great delay in payment by the Board, could easily have found themselves in difficulties. The same excuse cannot be made for Tapsell, who had been in the business on his own account since John Legas's death in 1752. The viability of John Churchill's Staffordshire iron works may have contributed to his bankruptcy during a period of relative national economic stability.

The Fullers used Child & Backwell, in London, to hold money for them, and to pay out when requested. They also had substantial deposits in the Bank of England (Crossley & Saville 1991: 244, 279-80, xxix). A passing reference to the Churchills issuing instructions to Henton, Brown & Co., who were based in Lombard Street, London, to pay for some cord wood, is the only other record of the banking arrangements of the Wealden ironmasters.<sup>26</sup> Less difficult to assess are the sources of finance for the ironworks in the Weald. In the case of the Fullers, their landed estates, both in England and in Jamaica, together with their long involvement in the ordnance trade, provide the answer. Similarly, the Crowleys' substantial ironmongering business located on Tyneside and at Greenwich, together with a large personal fortune, enabled them to sustain a casting branch in the Weald. Whereas the Wealden ironmasters of the sixteenth century often had an agrarian background, those who worked in the region in the period around the Seven Years' War had a largely mercantile background. The Harrison brothers and Richard Tapsell built on the profits and reputation of the Harrison-Legas partnership. William Bowen had a foundry in Southwark for nearly twenty years before purchasing Cowden furnace in 1741; while Raby had married, to great advantage, the daughter of his employer, and had succeeded to a foundry and ironmonger's shop in Smithfield.<sup>27</sup> Churchill had an established iron smelting and forging business in Staffordshire. John Butler may have had agrarian roots but had probably been in the iron business for long enough to have a firm manufacturing base by the onset of war in 1756. Only Clutton's source of finance is a complete mystery, and the very brevity of his ironmaking career calls into question the secure basis upon which it was founded. For those who operated forges, a capital outlay was less important. Charcoal and pig iron requirements were small, and the cash flow much more immediate.

## Notes and References

1. PRO PROB11 737 f.15.
2. See Appendix I. KAO U1280 T.2.
3. ESRO GLY 2770, 2771.
4. Drapers' Company records; ex. inf. G. E. Buttriss.
5. PRO PC2 105, 108. ESRO SAS RF16/V/10-11.

6. PRO WO51 ff.196-229.
7. WSRO Cowdray 1443, 1444.
8. SkRO HAI/GD/2/3.
9. ex inf. G. E. Buttriss.
10. PRO B4 17 p.166.
11. In his letter to Charles Frederick (23 October 1749), John Fuller likened the risk in casting great guns to that in gambling at cards; he dismissed the merchant trade's foundries as "Tinkers Shops" (Crossley & Saville 1991: 254).
12. PRO PC2 109 f.20.
13. Crossley & Saville 1991: 228 & 278. ESRO SAS RF/16/V/10 & 11.
14. PRO PC2 105-9; 106, f.446.
15. PRO PROB11 794.
16. PRO PROB11 973.
17. ESRO SAS RF16/V/13. PRO WO47 51 f.98.
18. PRO WO47 53 f.582: 54 f.39.
19. PRO WO47 54 f.507.
21. PRO WO47 52 f.216.
22. ESRO SAS RF16/V/47.
22. *see* Appendix I.
23. PRO B4 16 p.238; 17 p.166; 17 p.185; 18 index.
24. ESRO RAF/F/6/1.
25. PRO B6 3 p.132.
26. KAO U1776 E19A.
27. *Gentleman's Magazine*, 9th July 1746; Miss Mary Master brought £15,000 to her marriage with Edward Raby.



## CHAPTER THREE

### PRODUCTS AND MARKETS

From the second half of the seventeenth century the output of the Wealden iron industry had changed from being concentrated on the production of bar iron, through the close integration of furnaces and forges, to a specialisation in the manufacture of castings and, in particular, ordnance (Cleere & Crossley 1985: 187). This trend, which is reflected in the changing proportion of forges to furnaces, is demonstrated in the succession of lists which appeared during the hundred years from 1650. In them the reduction in output of the forges is very evident, and the petitions and pamphlets which often accompanied such lists point to the increasing dominance of Swedish iron in the eastern half of England; the market earlier served, in part, by the Wealden forges.<sup>1</sup> Not only was the iron, that was imported from the Baltic, of a higher grade than the Wealden product but, despite export and import taxes and a long sea journey, was cheaper as well. The Crowleys, themselves manufacturers of ordnance in the Weald, were the largest importers of Swedish iron, at their extensive works on Tyneside (Flinn 1962: 107). Thus the Wealden forges were deprived of a wider market by cheaper, imported iron, and reduced to working up the limited surplus iron from furnaces, the production of which was geared to casting guns.

### Production at Forges

Of the twelve forges which had survived in the Weald into the 1750s, most were associated with one or more furnaces, and worked up the iron that was surplus to the castings that were the mainstay of their campaigns. Iron was surplus in several forms. Firstly there was pig iron, which was the output of the furnaces in the first weeks of a blast, before the iron flowed in sufficient quality for castings to be made. Secondly, there were the gunheads which were an essential part of each cast piece of ordnance, and which provided a volume of iron in the highest part of each casting for gas bubbles and slag to accumulate. The 'heads' were sawn off the guns before boring, and carried to the forge. Thirdly, there were failed castings. Although a founder would strive to minimise the occurrence of these, the accidental movement of the nowel bar during pouring, or a weakness in the mould causing a breakout, would necessitate the complete rejection of a casting. So long as a forge received most of its cast iron in the form of rejects, in one form or another, from the furnace, the quality of wrought iron produced would inevitably be poor. Furthermore, the time taken to convert poor quality cast iron into reasonably saleable bar would lower the output of the forge, so the average output of a Wealden forge at 40-60 tons a year, compared with 115 tons nationally, can be accounted for as much by the poor quality of the iron worked as by the small size of Wealden forges generally (Hyde 1977: 10). During periods when orders for castings were insufficient, ironmasters could increase production of pig iron, this time of probably better quality, for sale to forges.

From the distribution of forges and the pattern of their ownership, it appears to have been regarded as essential for gunfounders to have access to one or more forges for the profitable disposal of their surplus cast iron. The number of forges seems closely related to the number of furnaces, so Harrisons', who operated up to five furnaces, had four forges, while the Fullers had one of each. Only the Crowleys appear to have managed without a forge. They had an extensive ironmongery business elsewhere and any surplus cast iron could be used to supplement imported Swedish iron.

Of the few forges that were not directly associated with particular furnaces, and only Maresfield, Abinger and Thursley can be so described at the beginning of this period, little is known of the last two. Maresfield, however, purchased both pig iron and gunheads from Heathfield furnace so, from the point of view of the quality of the iron it converted, it cannot be said to have been any better off than those forges which were more closely linked to furnaces. In the case of Abinger and Thursley, it is not known from where they obtained their iron, but it is conceivable that Warren or Northpark were the source, as Thursley lies at too great a distance from any other furnace but Northpark, and Abinger was to be associated with both furnaces in later periods. Of all the Wealden forges, Maresfield seems to have been operated on commercial lines to a greater extent than any other. There is evidence that it was directly associated with a retail outlet in Lewes. Benjamin Molineux, who occupied the forge in the later 1760s supplied a shop, run by other members of his family, with bar iron and edged tools. The shop had been in the hands of the Molineux family for some years and may have purchased iron from previous occupiers of the forge.<sup>2</sup> Both Mr Tidy and Daniel Beard, who successively worked the forge until 1761, are referred to as 'of Lewes' which hints at a similar commercial link.<sup>3</sup> Abinger may also have been commercially orientated from 1756 when James Goodyer began to occupy the works.<sup>4</sup> His family had an ironmongery business in Guildford which he presumably supplied from the forge. Apart from Maresfield and Abinger, the only forges for which there is evidence of retail outlets for their products, the market for Wealden bar iron lay mainly in the country smiths, as it had done since the decline in the London market at the end of the seventeenth century (Cleere & Crossley 1985: 192-3). The Fullers operated a wholesale outlet to forgemasters and blacksmiths from their Iron House at Brightling, which seems to have been a clearing house for the products of Heathfield furnace.<sup>5</sup> The purchase of the lease of the forge and furnace at Robertsbridge in 1768, by James Bourne, William Polhill and David Guy, the last two being ironmongers, suggests that an attempt was being made to focus production at the works on a wholesale outlet, perhaps in Rye (Whittick 1992: 48-9).

Tomlinson (1976: 393) has suggested that the concentration on gunfounding was at the expense of the home market, with local, domestic purchasers of bar iron neglected in favour of lucrative government contracts. However, it could equally be argued that the growth in gunfounding in the Weald was a response to the declining market for bar iron because of foreign imports. Paradoxically the increase in the production of ordnance generated by the demands of the Seven Years' War stimulated the work of the Wealden forges, and it seems that the market for Wealden bar iron expanded in this period, despite the fact that Swedish iron imports were well established and American bar iron had been allowed into England since 1750. What may be regarded as a speculative venture, to take advantage of the increased output during the war, was the revival, in about 1756, of Howbourne Forge,

Buxted, which had been idle since the mid-seventeenth century (Combes 1987: 16-9). Although initially not associated with any particular furnace, it worked up iron purchased from Heathfield furnace, and was occupied later by William Clutton and subsequently by Edward Raby, both of whom occupied Gravetye furnace. Its apparent continuance after the demand for ordnance had subsided highlights a continuing local demand for bar iron, perhaps stimulated by increased mechanisation of agricultural methods in the Weald in the second half of the eighteenth century. This continuing demand is also illustrated by the fate of the forges occupied by Harrisons'. The bankruptcy of Richard Tapsell in 1765 liberated the tenancy of four forges (Bivelham, Hawksden, Westfield and Glazier's). The correspondence which survives from the attempts of the Glynde estate to relet Hawksden forge offers indicators of the problems facing the landlords of the others.<sup>6</sup> The prospective tenant, Samuel Baker, showed considerable concern for the viability of the forge both from the point of view of the markets for the iron, in view of growing American competition, and of the cost of wood. Apart from inquiring at Ashburnham furnace about supplies of pig iron, he had also written to an American ironmaster about the same. Of the three other forges, only with Westfield is there any uncertainty that it might not have been let; the others being sustained during the post-war years by Heathfield furnace, and probably by the other furnaces which continued in work.<sup>7</sup>

Details of production at Wealden forges in this period are very scarce. In correspondence prior to the leasing of Robertsbridge forge in 1754, its output was said to be about seventeen hundredweights of bar iron a week, although no hint is given of the market for it (Whittick 1992: 58-9). The only accounts available are those for Burwash forge which show an average annual profit over the twelve year period, 1757-69, of £122, although the average becomes a deficit of £12 if the aberrant periods of 1763-6 and 1764-? are omitted.<sup>8</sup> No output figures are available for the same period. What does seem evident is that the Fullers, who owned Burwash, did not expect to do any more than cover their costs and were regularly prepared to subsidise the running of the forge from the rest of their estate because of the benefit that the estate and its tenants would derive from it. So Burwash forge cannot be regarded as commercial in the sense that Maresfield can.

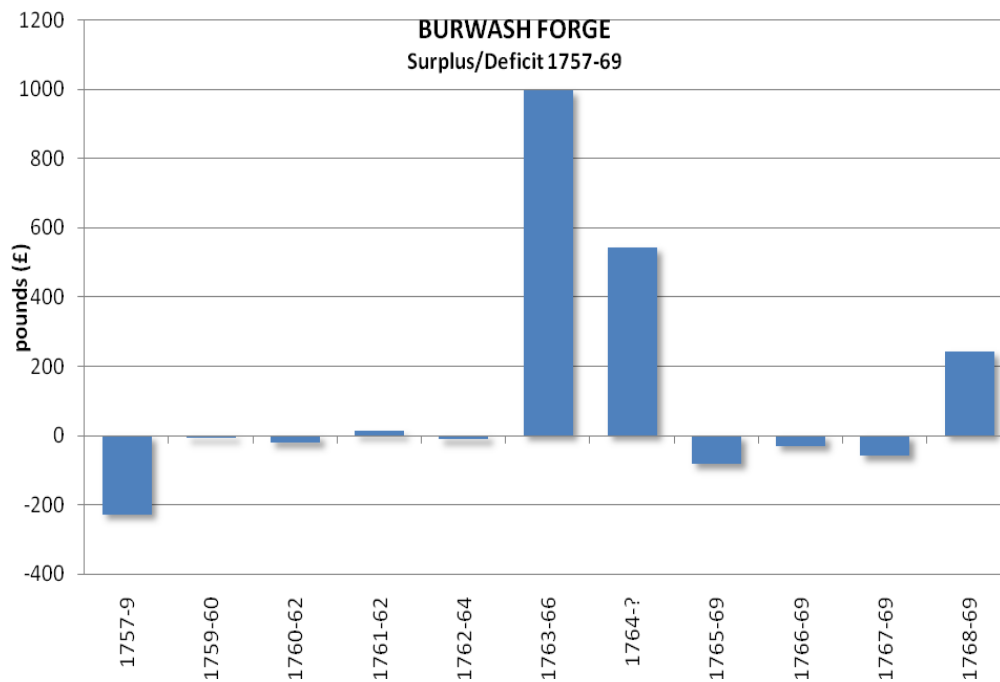


Fig. 4

ESRO Uncatalogued ledgers

Gunfounding had brought considerable income to the Fullers, and by the end of the Seven Years' War, when contracts were no longer available, their Jamaica estates had recovered from the management problems they suffered in the 1720s and 30s. Thus, money from sugar was able to make a greater contribution to the family's income just at the time when iron was ceasing to do so. The Fullers, however, remained hopeful that government contracts would come their way again, so Heathfield furnace was kept working intermittently, and Burwash forge was therefore kept in work.

## The Ordnance Trade

During the war years as many as fourteen furnaces were in blast in the Weald, probably all of them producing ordnance (only in the case of Northpark is specific evidence lacking). Ordnance cast in the Weald was produced for two main markets: the Board of Ordnance at their arsenal at Woolwich, and the merchant and privateer trade. A small number of guns were cast for foreign states early in the period, but they did not constitute a significant alternative market. An important purchaser in the private sector, which received some official assistance in the form of gun proving, was the East India Company.

Over the period 1750-70, the Weald supplied about 80%, by weight, of the guns purchased by the Board of Ordnance (see Fig. 5; also Appendix III). The Board was responsible for the provision and equipping of the army and navy, and of the various forts, shore installations and vessels from which they operated. It was the most lucrative market for the gunfounder, offering prices which were consistently above those paid by merchants, for a high standard of workmanship, but at the disadvantage that the Board was bureaucratic and

inflexible. Payment by the Board was slow, and the penalty system which was introduced to discourage late delivery paid scant regard to the practical difficulties which faced gunfounders, especially during wartime. From the Wealden ironmasters the Board of Ordnance purchased iron guns in a wide variety of sizes, from half-pounder swivel guns to 42 pounders. They also purchased iron round shot, and shells for howitzers and mortars. Trucks, the cast iron wheels for gun carriages, were also manufactured by a small number of founders. The requirement by the Board, that all the guns it purchased should be cast directly out of ore, favoured the Weald and other regional gunfounders. The same stricture did not apply to shot and shells, although a sizable quantity was supplied by Eade & Wilton, William

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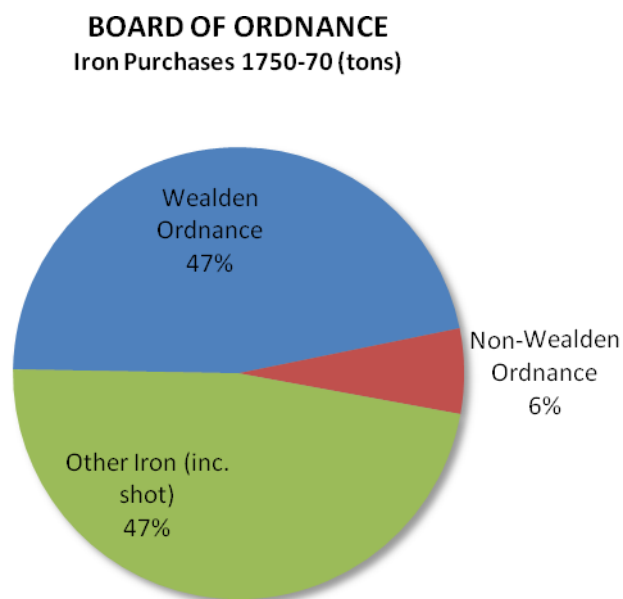


Fig. 5

PRO WO51 173-246

Ford at Bonawe, and Thomas Pryce at Neath. With the possible exception of Eade & Wilton, no Wealden founder made shot in quantities of any significance. Of more importance was the ability of all the Wealden ironmasters to cast what John Fuller referred to as “great guns” (Crossley & Saville 1991: 254). When Fuller wrote of them in 1749, he stated that only Brede, Beckley, Lamberhurst, Robertsbridge, Ashburnham and Heathfield were capable of casting 32 and 24 pounders. To that list must be added at least one of Bowen’s furnaces and one of Raby’s, before or during the war period. Only Harrisons’ cast 42 pounders during the war, although Rose Fuller considered doing so, the Board declining the £4 a ton advanced payment he required.<sup>9</sup> Later the Carron Company cast in that size also.

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The link between the Board and the Weald went back to the sixteenth century and owed its resilience to the proximity of the region to London, and to the depth of skill in its personnel. Ashton (1963 ed.: 14) suggested that the Board favoured the Weald, and that the Board’s conservatism was to the disadvantage of other regions. It must be said that evidence to support this is wanting. Tomlinson’s comment (1976: 386) that “for more than 50 years of the eighteenth century the Wealden gunfounder had only

to fear competition from his neighbouring tradesmen", suggests that the Board actively pursued a policy which discriminated in favour of the Weald, and mistakenly equates the mercantile background of the ironmasters concerned with the geographical location of the Wealden ironworks. The picture he paints of a gunfounding industry which is distinctly regional in management as well as geography is challenged by the industrial origins of many of the manufacturers concerned, as the previous chapter has shown. Furthermore, what monopoly the Weald might have enjoyed with the Board in earlier periods, was broken by the second half of the seventeenth century, and a major supplier in the early 1750s was the non-Wealden firm of Philip Sone & Son, at Sowley, near Lymington, Hampshire. In addition, a growing number of urban-based foundries cast guns in reverberatory furnaces for the merchant trade. A rare example of conservatism by the Board in this period was when they declined to grant a contract to Richard Tapsell, shortly after he had succeeded John Legas in 1752, because his prices were not significantly different from those of William Bowen, an established supplier, who had been willing to accommodate the Board by adjusting his price downwards.<sup>10</sup> The Board were strict but fair in their policy of awarding contracts. Even John Fuller fell foul of them when he tried to undercut all the other gunfounders in 1750 by five shillings below their lowest bid price. He was, instead, asked to submit a tender for the quantity he was prepared to cast, at the price he would make them for, like his fellow founders.<sup>11</sup> When war loomed and the Board's requirement for guns increased, they showed no signs of discouragement towards non-Wealden gunfounders. Some they contracted with, such as Abel Walter, who succeeded the Sones at Sowley, and Thomas Pryce, of Neath, Glamorgan, were notably unsuccessful. Such was the demand for ordnance in 1758, that the Board, far from only looking to the Weald to satisfy its needs, vainly requested Wilkinson & Co., at Bersham in Flintshire, to supply guns and shot.<sup>12</sup> If the Board appeared to have a loyalty to the gunfoundries in the Weald it is much more likely that it was because its products were reliable. Only money deflected the Board, once the Seven Years' War was over, and even then, Bowen, the only Wealden founder initially to accept the reduced tender that the Carron Company submitted in 1764, retained his contract.<sup>13</sup>

The Board of Ordnance drew its supplies from a variety of manufacturers, some of whom were under the control of the Board, such as the Royal Brass Foundry, and others, like the Wealden gunfounders, who were independent private contractors. Contracts for the supply of guns were placed on the basis of tenders submitted by founders or their agents, either at the request of the Board or unsolicited. Warrants were issued for a number of guns of specific natures (the weight of shot fired) and lengths; often a variety of types.<sup>14</sup> Before hostilities began in 1756, the operation of a time limit for warrants was not practised. As payment for each warrant was not authorised until all the guns it applied to had been received (that is delivered and passed proof), and ironmasters found it unsatisfactory to cast different natures of guns in a batch, preferring to cast all their output of a particular nature in one go, the time taken to complete

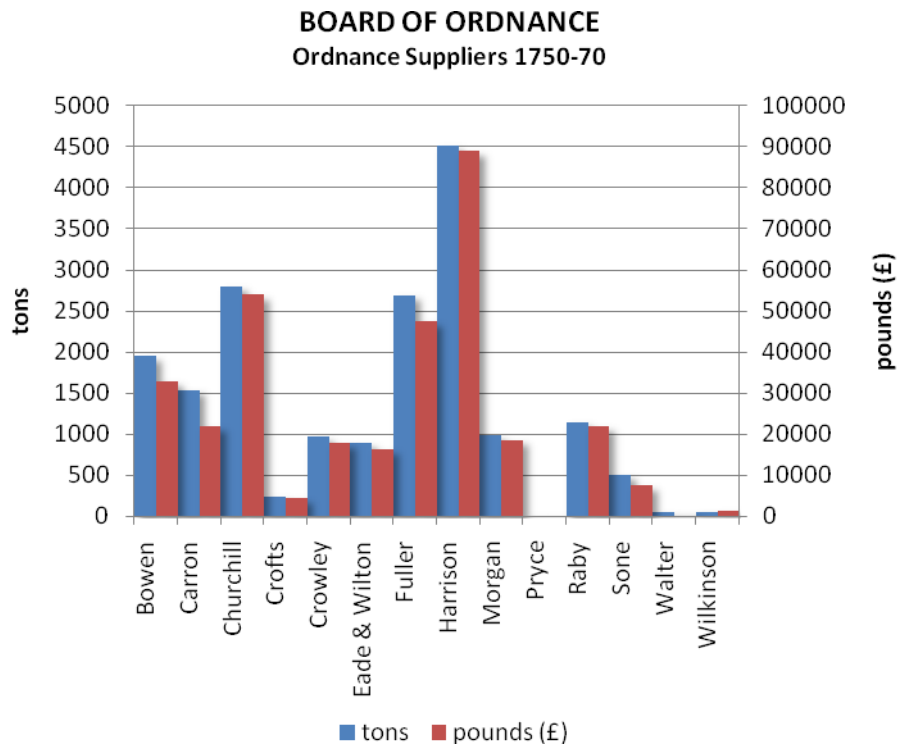


Fig. 6

(PRO WO51 173-246)

individual warrants was often counted in years. Payment was therefore frequently delayed for a similar length of time. Various methods were employed by ironmasters to overcome this delay as cash flow problems could seriously jeopardise the viability of an ironworks. They would apply for the cancellation of a warrant, and the issue of a warrant of justification for those guns already received; then ask for a new warrant to cover the uncompleted part of the original one. The Crowleys attempted a more underhand method in 1750. They asked for warrants for small numbers of guns, having failed to complete earlier warrants for larger numbers. They then claimed that the guns subsequently delivered were to complete the later warrants, thus ensuring earlier payment. This “most barefac’d fraud” was unmasked when their warrants were called in and discrepancies of more than a year were discovered.<sup>15</sup> During the Seven Years’ War, such was the Board’s demand for ordnance, several gunfounders were able to ask successfully for cash payment rather than the debentures the Board usually made payment with. In 1759, the Board received a petition from Fuller, Harrison’s and Churchill asking for six-monthly payments to maintain the gunfounders’ cash flow, or, failing that, interest on their outstanding payments of 4%. The Board offered some unspecified relief.<sup>16</sup> After the war, the Board allowed William Bowen several imprests in part payment prior to the completion of orders.<sup>17</sup> The Carron Company, heavily committed financially because of the scale of its orders, was able to benefit from a similar arrangement.<sup>18</sup>

To speed up the delivery of guns when demand for them was at its height during the war period, the Board began to place time limits on the warrants they issued. Warrants completed within the specified period would be paid for at the contract price. Thereafter the warrants would be void and any guns delivered might not be received, or paid for at a lower price if demand had slackened in the



meantime. The customary expiry date was the 31st December, which was not a particularly convenient one for the Wealden gunfounders, it generally being a couple of months into their winter campaign and at a time of year when overland transport was difficult because of the impassability of many of the roads, and poor weather was liable to delay coastwise shipping. The rush to complete warrants was often fraught with last minute difficulties, and the Minutes of the Surveyor General of the Ordnance, who had responsibility for quality, note many letters from gunfounders appealing, usually in vain, for exemption from the time penalty because of circumstances, which they often claimed were beyond their control, such as contrary winds, distemper among the horses, the lack of a convoy, press gangs, or in an extreme instance, the Churchills' furnace blowing up.<sup>19</sup>

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The fluctuation in prices paid for guns by the Board of Ordnance between 1750 and 1770 reflects the changing international situation. As has been noted above, peacetime posed the greatest threat to the financial buoyancy of the gunfounder, for prices paid by the Board were at their lowest and greater reliance had to be placed on sales on the merchant market. In 1750, the Board accepted tenders by Fuller and Bowen on a sliding scale according to gun size. The largest guns, 32 and 24 pounders, were £15 a ton; 18 and 12 pounders, £14 10s. a ton; and the smaller calibres, thirteen guineas, except for half pounders which, because of the proportionately higher labour input into the manufacture of their moulds, were seventeen guineas a ton.<sup>20</sup> At the outbreak of hostilities in 1756, the Board offered an increase in price of between 25 and 30%. Guns which were 12 pounders and upwards fetched £20 a ton; the lower calibres, £18, except half pounders which were £24 a ton.<sup>21</sup> Almost immediately the war ended, the price paid by the Board for ordnance went down from £18, for medium calibre, to £15 10s; smaller calibres to £14 a ton. In late 1764, however, Messrs. Roebuck, Garbett and Cadell, who had formed the Carron Company, near Falkirk in Scotland, proposed to the Board that they should cast guns of all natures at £14 a ton.<sup>22</sup> In this instance, technological not political change had allowed Carron to bid for the Board's contract, though Roebuck & Co. gambled on the boldness of the bid winning the company sufficient orders, the price undercutting their own conservative estimate of £16 a ton (Campbell 1961: 83). Rose Fuller declined to match the price, observing that only with coked pit coal, which, seemingly unknown to him, Carron was using, might it be possible to cast guns at that price.<sup>23</sup> Evidence of the ability of the other charcoal gunfounders to match the Carron price is confused by the fact that both John Churchill & Son and Theodosia Crowley & Co., whom Campbell believed had continued to cast at the new price, only accepted £14 a ton for guns which were received late for their warrants (Campbell 1961: 83). Of the charcoal gunfounders, initially only Bowen continued to undertake orders for guns for the Board at the new price. Later, Eade & Wilton, whose source of guns is a matter for some speculation, also offered to cast guns, as did Edward Raby, who had re-established himself after his bankruptcy. Thus the only gunfounders to continue to supply the Board, and offer competition to the Carron Company, were all based in the Weald.

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The East India Company enjoyed semi-official status, and the increasing involvement of the British army against the French in India allowed the Company to use the Board of Ordnance for the proving of the guns it purchased, although at the gunfounders' expense. It



was not, however, constrained by the necessity of only purchasing guns cast out of ore, and advantage was taken of the supply of less expensive guns cast at the air furnaces of Richard Gilpin, Stephen Remnant and others. Partly as a consequence of this, Wealden guns accounted for only 16% of the Company's purchases of ordnance in the period 1750-70, although it is likely that a considerable additional number were purchased by the Company from merchants, those having been cast surplus to other orders or having marginally failed the Board's own rigorous proof (see Appendix IV). The majority of the guns purchased directly by the Company from Wealden founders were for the arming of its forts and forces (Brown 1990: 18). However, requests to the Board for the proof of guns destined for the Company, from Harrison's, are likely to have been related to the arming of East Indiamen, as no business with Harrison's is recorded in the cash journals of the Company's Accountant General. Prices paid were considerably lower than those paid by the Board. For example, Crowleys were paid £14 for a twelve pounder in 1758, when they had been paid £22 by the Board.<sup>24</sup>

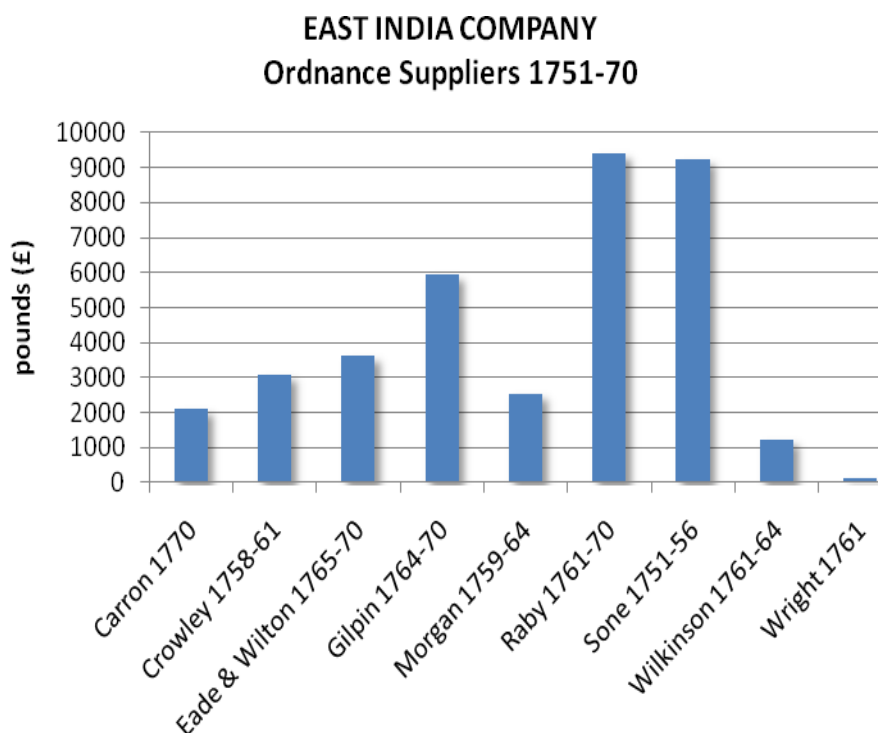
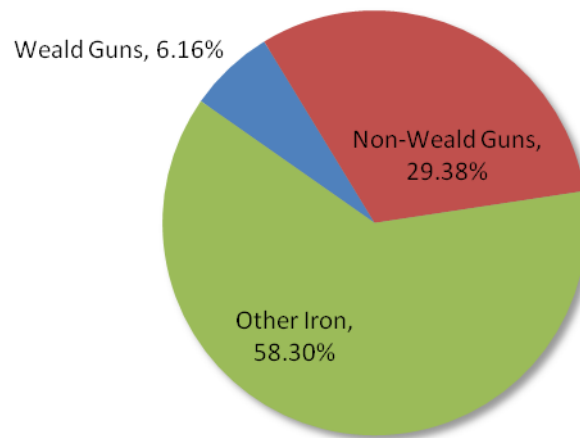


Fig. 7

(BLI L/A/G/1/5/15-19)

**EAST INDIA COMPANY**  
**Iron Purchases 1750-70 (see Appendix IV)**



**Page 51** If the purchases of ordnance by the Board peaked during the war years of 1756-63, purchases by the East India Company, while showing a lesser peak during the same period, began to rise considerably towards the end of the 1760s because of the Company's greatly increased activity in India following the establishment of control over Bengal in 1765. Edward Raby and Eade & Wilton were responsible for 100% of the ordnance supplied to the Company in 1769 and almost 50% the year after. There may also have been an illicit trade between the Weald and India. Correspondence between the Company's head office in London, and their office at Fort William, Calcutta, in the 1760s reported that, on a number of occasions, outgoing vessels bound for India were shadowed by ships as they left England. Making a rendezvous near one or other of the Atlantic islands, guns would be transhipped to be subsequently off-loaded and sold to native rulers before the East Indiamen docked at Bombay, Madras or Calcutta (Srinivasachari 1962: 142 etc.). There is no direct evidence that Wealden ironmasters were involved in this activity although John Legas was allegedly fined for illicit trading.<sup>25</sup> There is also the mysterious instance of ships carrying guns from Rye for Harrisons' in 1757, slipping away from their convoy and not all of them returning.<sup>26</sup> The third market for Wealden ordnance were the merchants who sold guns to commercial shipping and, during the war, to privateers. Because of the often informal nature of this trade, details are only sketchy. A list of ordnance proved for merchants by the Board between 1750 and 1753 notes the frequent involvement of most, if not all, of the Wealden founders of the time; Fuller, Bowen, Harrisons' and Crowley, as well as the Sones from Hampshire.<sup>27</sup> The Fullers certainly made use of the market for disposing of surplus or sub-standard guns. Robert Bagshaw, as well as being a partner of the Harrison brothers, seems to have acted on his own as a merchant, or at least an agent.

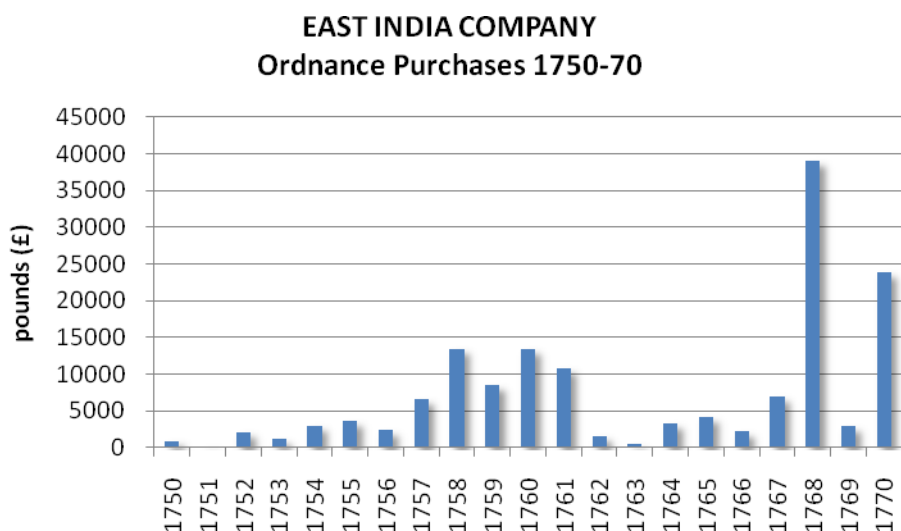


Fig. 8

(BLI L/A/G/1/5/15-19)

Some other ironmasters of Wealden furnaces appear to have carried on a business with merchants, mainly in London. During the war years the coastal traffic in “warlike materials” (gunpowder, saltpetre, arms and ammunition) was banned, except under licence from the Privy Council. Some gunfounders like John Churchill sold guns directly to specific buyers. The Crowleys annually shipped guns out of Hastings, invariably of small calibre, and often for the East India Company.<sup>28</sup> Sometimes the names of other merchants or agents are mentioned. Some, like Roger Hanmer, were directly linked to individual founders. Others were merchants whose deals with founders included shipping the goods from the furnaces. The Jukes family, who had been tenants at Robertsbridge until 1754, later turned their attention to buying and selling ordnance, purchasing guns from Sowley furnace as well as from one of the works in eastern Sussex. Eade & Wilton, who contracted for the casting of guns for the Board of Ordnance, also dealt widely in the merchant trade, supplying ordnance for fitting out coastal and overseas shipping, or buying and selling captured guns. Gunfounders in the Weald were, by no means, the only suppliers for merchant shipping. Robert Morgan, at Carmarthen, and the Wilkinson family at Bersham, and later at Willey, sold guns to merchants in Bristol and Liverpool for the Africa and West Indies markets. Towards the end of the war, Roebuck & Co. at the Carron works entered the trade. As much of the ordnance which found its way into private hands may have been rejected by the Board at Woolwich, and therefore would not have been subject to the Privy Council orders, the extent of Wealden involvement in the merchant trade is not possible to measure. Clearly, there were a few who cast specifically for this market. Output at Ashburnham continued to include guns for at least two campaigns after they had ceased to supply either the Board or the East India Company.<sup>29</sup> With others, like Fuller and the Harrisons, their involvement was largely incidental to their main business of casting for the Board. In 1757, Harrisons’ were requested, by the Board, to supply some half pounder guns they had cast for the merchant fleet. Harrisons’ were concerned that the guns would not withstand the Board’s proof; an indication of the higher standard of casting which the gunfounders lavished on the more highly priced work they did for the Board. The wartime control of coastal shipping was lifted in 1763, after which movements of ordnance for the merchant trade are harder to trace.

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A small trade existed in supplying foreign governments with ordnance. The Fullers had a good reputation and did business with Sardinia, and with the Kingdom of Naples, in the early 1750s. An earlier deal with Austria was not finalised because they were to be of French bore, of which there was no English equivalent, and any rejects would be difficult to dispose of other than as scrap (Crossley & Saville 1991: 271). Harrisons' sold rejected guns to Genoa in 1755, and Eade & Wilton sold to the Kingdom of Sardinia and to Russia in the late 1760s; the latter also purchasing from Crowleys'.<sup>30</sup>

### Other castings

It has been estimated that casting specific items accounted for about 20% of the output of the iron industry nationally in about 1750 and that, apart from the Weald, centres of the trade were at Coalbrookdale, Rotherham, the Wilkinsons' works at Bersham and Willey, and at Backbarrow in Furness (Hyde 1977: 219). This percentage was increasing as casting techniques improved (Schubert 1957: 268-9). Very little information is available about specific casting methods used in the Weald in the third quarter of the eighteenth century, so it is not possible to do more than speculate as to the extent to which the Wealden ironmasters adopted methods which were being developed elsewhere in Britain. Apart from guns, products cast at the Wealden furnaces can be divided into two main categories; military materials in the form of shot, shells and trucks, and decorative, domestic and agricultural ironwork.

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As in the case of guns being sold to the merchant trade, there was no requirement, even from the Board of Ordnance, that shot or shells had to be cast out of ore. This opened up the market to the London foundries, notably those of Richard Gilpin and Stephen Remnant. However, because it was relatively easy to cast and could be transported by sea conveniently, shot could be cast at furnaces which did not have available to them the skilled workforce necessary for casting guns. Abel Walter, of Sowley, and Thomas Pryce, of Neath, both failed gunfounders, cast shot in considerable volume for the Board.

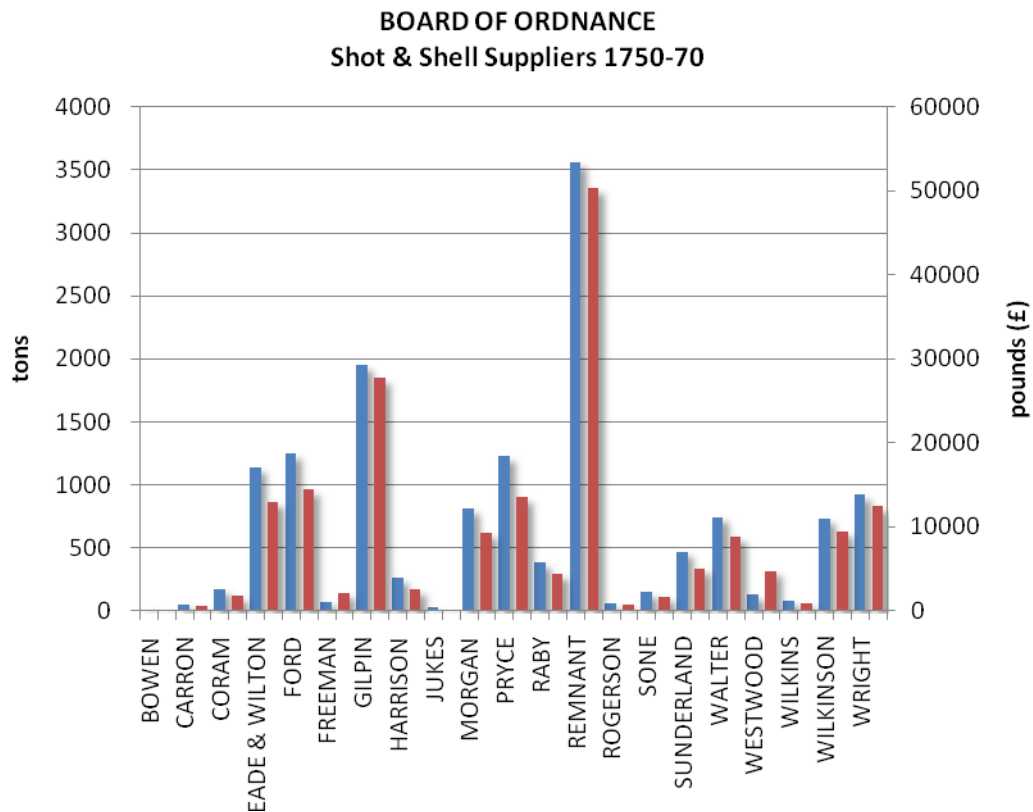


Fig. 10

(PRO WO51 173-246)

Other prominent shot founders who operated out of blast furnaces, rather than air furnaces, included Robert Morgan and William Ford. Wealden furnaces, concentrating on ordnance, do not figure greatly among the suppliers of shot or shells. Eade & Wilton supplied over 1000 tons to the Board during this period, but it is unclear what their source was. Neither the Fullers nor the Crowleys supplied the Board at all, although shot moulds were made at Ashburnham. Harrisons' only cast just over 250 tons, despite the exclusive use that John Legas had made of Waldron furnace for casting shot in the late 1740s.<sup>31</sup> Some of their output, somewhat experimentally, was in shells for mortars and howitzers, as was some of Edward Raby's. Shells were more specialized, being cast hollow, and attracted a significantly higher price (£15/ton, as against about £11/ton for round shot).<sup>32</sup> Harrisons' experienced some problems in casting shells, theirs being singled out as over-repaired, with voids in the iron needing filling.<sup>33</sup> Trucks, the wheels of gun carriages, were produced by both blast furnaces and air furnaces and were, like shot and shells, cast in greatest numbers in the London foundries. Again, only Harrisons' and Raby cast trucks in the Weald, indicating, perhaps, a particular expertise in box casting.

The manufacture of castings not associated with either the government or merchant gun markets, nor with the supply of pig iron to forges, was largely subordinate to them until peace came in 1763. Records of specific furnace output are only available for Heathfield and Ashburnham. At the former, output was concentrated on ordnance until 1764 so the peacetime years from 1750-56 are not distinguished by the extensive manufacture of domestic and agricultural castings. However, throughout the war period, it was to Heathfield that forge hammermen turned when hammers, anvils and other forge tackle needed

replacing.<sup>34</sup> The Crowleys purchased several boring bars from the Fullers' forge at Burwash, having converted the forge at Ashburnham to a boring mill. At Ashburnham, records survive only from 1756 but, again, despite the wartime demand for guns, the furnace was able to retain some of its output for civilian purposes. Mill cases, used for holding the lower mill stone in a corn mill, required boring, as did garden rollers. This operation of the boring mill, which would have been specifically built for gunfounding, was an effective use of resources which could be underemployed at certain times during a campaign. Other domestic castings included stoves, plates (firebacks), pans and grates.<sup>35</sup> Ornamental work included some "cockles" for Sir Whistler Webster, suggesting that Robertsbridge furnace, of which Webster was the owner, was not able to manufacture such items. The sow iron and gunheads from Ashburnham could not be refined into wrought iron on site and, instead of selling them to other forges as the Fullers did, they were exported from Hastings, presumably to the Crowleys' forges elsewhere. Correspondingly, wire and bar iron for use at the furnace was brought by sea, probably from the firm's warehouse at Greenwich. As to the output of the other Wealden furnaces, there is little evidence available, although some specialised decorative castings appear to have been made at Lamberhurst in the late 1760s (Phillips 1896: 214-5).

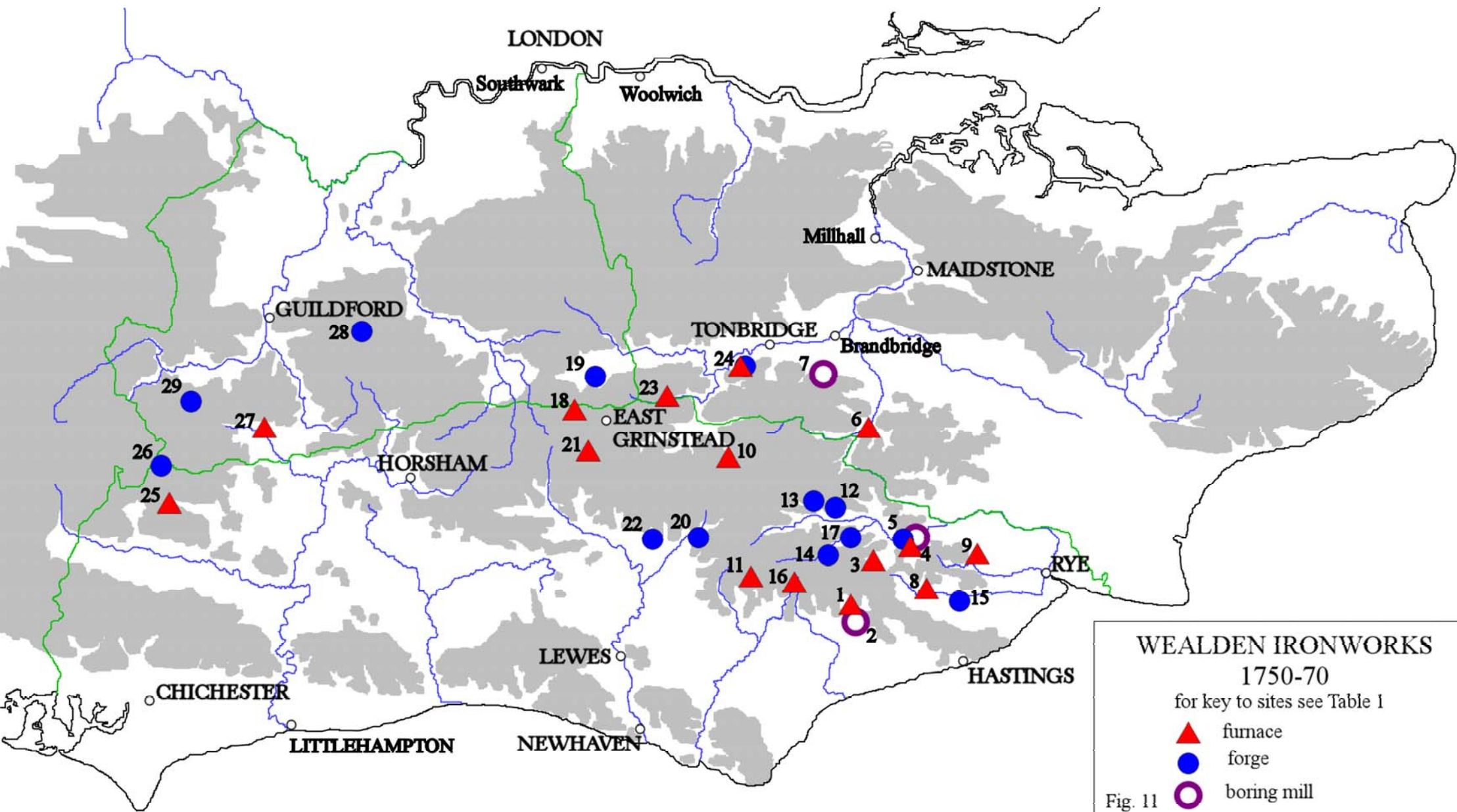
Wealden gunfounders had been attracted to casting in "brass" at least since John Browne had a brassworks probably at his furnace at Horsmonden (Cleere & Crossley 1985: 179).<sup>36</sup> In the period 1750-70, William Bowen manufactured brass ordnance, presumably at his foundry in Southwark, and Harrison & Co. offered to cast brass cannon in 1755, although no indication is given as to where they intended carrying this out.<sup>37</sup> At the end of the period, Edward Raby offered to cast brass mortars for the Board, claiming some success with the East India Company.<sup>38</sup> His evident facility for boring and turning using water power suggests use of one of his Wealden furnaces.

## Notes and References

1. See Hulme 1928-9, Parsons 1882. Riden 1977, and Cleere & Crossley 1985: 187-91.
2. BRL *Sussex Weekly Advertiser* 6th January 1772. 21st June 1762.
3. ESRO SAS RF/15/30.
4. SyRO PI/6/1-.
5. See ESRO RAF/F uncatalogued ledgers 1758-60 (the Fifth Ledger) and 1765-71 (the Sixth Ledger).
6. ESRO GLY 2770-1.
7. See KAOU274 T54; Westfield was later in the occupation of John Standen, then of Henry Bourne, both probably scions of ironworking families, and suggesting a later association with Robertsbridge furnace.
8. ESRO RAF uncatalogued ledgers 1758-60 & 1765-71 (the Fifth & Sixth Ledgers; see Saville 1982: 53-4).

9. PRO WO47 53 f.218.
10. PRO WO47 40 f.40.
11. PRO WO47 35 f.195.
12. PRO WO47 47 f.676.
13. PRO WO47 64 f.197; 65 f.27.
14. Guns were identified by the weight of shot they fired; their “nature”. The following were standard: ½, 3, 4, 6, 9, 12, 18, 24, 32 and 42 pounders. There were also length variations with ½, 6, 9, 12, 18 and 24 pounders.
15. PRO WO47 36 ff.383–5.
16. PRO WO47 53 f.560.
17. PRO WO47 65 f.129.
18. PRO WO47 69 f.215.
19. PRO WO47 63 f.112.
20. PRO WO47 35 f.260.
21. PRO WO47 47 f.188.
22. PRO WO47 64 f.197.
23. PRO WO47 65 f.56.
24. BLI L/A/G/1/5/17 March 31st 1758. PRO WO51 200 f.131.
25. ESRO PAR498/7/10.
26. PRO WO47 49 f.294.
27. PRO WO47 42 f.27; probably for East India Company shipping.
28. PRO PC2 105 ff.359 & 657; 106 ff.149, 246 & 469; 108 f.206.
29. ESRO ASH 1815 Campaigns AM & AN.
30. PRO WO47 46 f.526; 73 f.313; 76 f.17.
31. Guildhall Library Ms.6482.
32. PRO WO51 172-246.
33. PRO WO47 54 f.496.
34. *See particularly* ESRO AMS 5622/5.
35. ESRO ASH 1815.
36. Brass is used here in its archaic sense, i.e. bronze, in the proportions of 10% tin and 90% copper.
37. PRO WO47 46 f.197.
38. PRO WO47 76 f.187.







## LOCATION, RAW MATERIALS, TRANSPORT AND LABOUR

### The Location of Ironworks

The location of the furnaces and forges in the mid-eighteenth century Weald was, in every instance, the result of a sometimes lengthy historical development. Even the works which came into operation during the period did so on sites which had previously been occupied for the same purpose; Warren Furnace had been in blast in the late sixteenth century, and Howbourn Forge had been at work until the 1650s at least (Cleere & Crossley 1985: 364, 338). When there had been a spate of furnace construction at the close of the previous century, two of the three known new works had been constructed on existing ironworking sites.<sup>1</sup> The rationale behind this is obvious for, although the occupation of such sites would have necessitated the probable reconstruction of the furnace, or the complete reassembly of the forge machinery, the cost of either would have been insignificant compared with the expense involved in laying out a water management system consisting of bays, ponds and sluices not only for the storage of water but also for the passage of water over the waterwheels and, in the case of gunfounding furnaces, for boring mills as well; costs that would have undoubtedly included considerable legal fees in settling with other landowners or occupiers whose rights to the water would be affected. Some doubt has been expressed as to whether Gravetye Furnace, at West Hoathly, was a completely new works in 1761, or whether it was a case of an earlier site reoccupied (Cleere & Crossley 1985: 333). In the light of the probable financial commitment outlined above, together with the apparent inexperience of the ironmaster, William Clutton, and the location, which cannot be said to have had the easiest access to Woolwich, it seems highly improbable that it was a virgin site.

The 1750s and 60s were a period when, in other parts of the country, furnaces and forges were being established in new locations. However, many of the Wealden gills were already occupied by ironworking sites of earlier periods, over 180 furnaces and forges having been established in the region since the end of the fifteenth century. The fact that both Edward Raby and probably William Clutton had to restore long-abandoned sites suggests that there were no working furnaces readily available, or that if there were, their leaseholders were not prepared to let them go. So it should not necessarily be seen as an indication that the Wealden iron industry lacked industrial vitality when, with those exceptions mentioned above, all the sites of the period had been established and working for most of the preceding century, and many, such as the works at Robertsbridge, Burwash and Ashburnham, with a long history of continuous production.

The determining factors in the survival of Wealden ironworks into the 1750s seem often to have been coincidental; owing as much to family inheritance as to the advantages of location, and the maintenance of waterways and buildings that continued use

bestowed on a number of sites. The Gott family, for instance, personally involved in the iron trade in the late-seventeenth century, continued to own the freehold of several ironworks a century later; and the Ashburnhams, while generally landlords rather than directly concerned, retained interest in their estate's works through periodic intervention, such as when they were unable to find a lessee for them. Given that the establishment of a furnace depended largely on a suitable flow of water, with reliable sources of ore and charcoal within a radius of little more than five miles, and that by the 1750s, only twenty-five ironworks, at most, were at work in the Weald, the location of several of the works concerned left much to be desired in relation to the transport options available to them, and to the markets for which their products were destined. Even Heathfield furnace, probably the first on its site, and built as late as 1693, was poorly situated, requiring expensive overland transport, either to the Medway or to Newhaven. Because of the state of the roads, carriage of guns was virtually abandoned in the winter months because of both the practical difficulties and the consequent expense.

With the principal market for Wealden iron dictated by the ordnance trade, access to the Medway, or to one of the Channel ports, either directly or via the Ouse, Brede or Eastern Rother, caused the principal concentration of furnaces to be in the north-eastern quarter of Sussex. Northpark, far to the west, may either have sent its products via the Wey at Godalming or along the Western Rother/Arun to Littlehampton. Robertsbridge and Beckley were the most advantageously situated of the furnaces, with access to navigable water throughout the year, although in wartime there were hazards in advantage, as shall be seen below. Perhaps the most surprising locations for works re-established during the war period were of the Warren and Gravetye furnaces; both remote from navigable waterways and from the sea, their location on the northern edge of the High Weald put them within reach of Woolwich by an overland route which apparently remained passable during the winter.

The location of forges was less dependent on their markets than on the location of the furnaces which provided them with cast iron. A forge was often let with its associated furnace, as in the case of Woodcock and Warren, Pophole and Northpark, or the Robertsbridge works. In the case of Westfield Forge, its ownership by the Gott family, together with the furnaces at Horsmonden, Lamberhurst and Beckley, had ensured its continued association with those works when let to Harrison and Legas in the 1740s. Other forges, such as Maresfield and Abinger, served local markets which were sufficient to sustain them in work even though they had long ceased to be associated with particular furnaces. Bivelham and Glazier's Forges had a long association with Waldron Furnace when they were worked by the Pelham family, and therefore had an established local market as well as being maintained in working order (Cleere & Crossley 1985: 193). Hawksden Forge operated independently in the same district, with iron being purchased from Waldron in the early years of the eighteenth century (Cleere & Crossley 1985: 335). All four were brought under the control of the Harrison/Legas partnership.

A particular advantage in taking over ironworks in working order was the likelihood of specialist staff being available in the district, who were familiar with the furnace and the sources of raw materials. Where the Weald was able to retain its paramountcy

over other regions in the ordnance trade was in the skill of its workforce. Within the close tolerances of gunfounding, considerable losses in rejected guns could be avoided by employing a competent moulder or founder. An ironmaster, such as John Churchill, who purchased the lease of a working furnace and forge, could expect to be able to employ the skilled personnel already working at the site, although the enquiries he made prior to taking the lease of Robertsbridge did not mention the labour force. For the few who resurrected a defunct furnace or forge, there was the problem of finding suitable skilled men, and the risk of financial disaster if they did not. The skilled workers had to be enticed from other works or from among the small number of founders, moulders and hammermen who had become unemployed by the closure of works elsewhere. The problems John Fuller had in 1751 with poorly cast guns being repaired with lead, serve to emphasize the need for a skilled workforce (Crossley & Saville 1991: 266).

The nearness to London and the prospect of being able to buy the lease of an ironworks in operation or, failing that, one which required restoration, rather than having to bear the expense of establishing works on a virgin site, must have acted as a considerable inducement for an ironmaster wishing to enter the ordnance trade, as must have been the reservoir of skill which the region had to offer. It is significant that, of the twenty-one gunfounding furnaces operating in Great Britain in the period, more than half of them were in the Weald and as many as six of those had been run by concerns from outside the Weald.

## Transport

Transport was a major element in the cost of Wealden iron and, as has been seen above, it was an important factor in the location of ironworks. Both land and water transport were liable to cause problems where a heavy commodity such as iron was concerned.

Overland transport was expensive but, when conditions were right, relatively quick. It was expensive because the weight of the iron prevented more than a limited amount being carried on any one wagon and therefore the number of wagons and the number of journeys involved were necessarily great. Robert Knight was carrying guns to Woolwich from Warren furnace every three days in 1762, and in the Ashburnham campaign of 1760-1. at least seventy-one turnpike charges were incurred by the carriers taking guns to Maidstone (Hodgkinson 1978: 14-5).<sup>2</sup> Wartime placed pressure on gunfounders to send guns to Woolwich overland because of the danger to coastal shipping from French privateers. Presumably to balance the cost against the danger, Crowleys were sending half their output overland, and half by sea from Hastings. Ironworks probably had at least one wagon team to carry out the various transport tasks necessary through the year, but other teams were hired from neighbouring farms, such as Stephen Goodsall's team at Udiam Farm which carried guns from Robertsbridge furnace to Maidstone, or along the short distance to Udiam Bridge where they were offloaded on to barges bound for Rye.<sup>3</sup> The state of the roads was a further disincentive to overland transport though clearly this varied from area to area. John Fuller's oft-quoted comment, about his nine pounders tearing up the roads

to universal annoyance, has been used to illustrate the poor condition of Wealden roads.<sup>4</sup> However the volume of traffic from the Sussex furnaces which converged on the navigable River Medway by road, let alone from other destinations, suggests that road transport, while remaining expensive, was not always as difficult as it has been portrayed.

The growth of the turnpike system in south-east England contributed to the improvement in the state of roads although the ironworks were seen as a major cause of their decay and, until 1767, ironmasters had an obligation to contribute cinder for road repair. In that year, the use of the road for the carriage of goods to and from the forges at Thursley and Pophole was put forward as an argument for the alteration of the position of the tollgate on the Guildford-Godalming Turnpike, in Surrey.<sup>5</sup> Forge goods from both works avoided payment of tolls by transferring to barges on the Wey instead of passing through the tollgates. Harrisons' encountered a different problem when attempting to move guns from Lamberhurst in 1756. Their use of a sixwheeled 'machine' to carry one gun conflicted with the terms of the turnpike Act, insofar as it had narrow wheels but required more than the permitted four horses. Compromises involving broad-wheeled wagons, which presumably incurred a higher charge, or the Board of Ordnance interceding on the Harrisons' behalf, did not apparently resolve the matter although the Board Minutes do not record the outcomes

Where the state of the Wealden roads exercised its greatest effect was in the winter months. Carriage of both iron and raw materials cost more at the very time when furnaces and forges were at their busiest. In a letter to the Board in 1762, Rose Fuller stated the impossibility of delivering guns to Woolwich before June of the next year because of the condition of the highways.<sup>7</sup> Winter carriage was surcharged by 100% at Ashburnham whereas Fuller seemed to pay only 50% over the summer rate. Wartime did not appear to have an effect on carriage costs for, at Ashburnham at least, there was no alteration in the rate between 1757 and 1770. Where the state of the roads had an effect on ironmasters, such as the Fullers, who were loath to spend the extra to move their products in winter, was in the delay in delivery which resulted. As has already been seen, the payment system of the Board of Ordnance was such that gunfounders were only granted a debenture on completion of warrants, which depended on the delivery of guns before the expiry date set by the Board. When peace was declared in 1763, the price of ordnance dropped and many gunfounders found that late arrivals were paid for at deflated, post-war prices.

More often it was coastal transport which gave rise to excuses for late delivery. Carriage by water was considerably cheaper than overland though somewhat slower. Stephen Fuller asked successfully for up to six shillings and six pence per ton more for guns sent overland to Maidstone, rather than out of Newhaven, because the Board were in urgent need of them.<sup>8</sup> Judging from the time taken to carry guns overland from the Warren to Woolwich, the round trip from Ashburnham or Heathfield to Maidstone cannot have been more than three days, and from Lamberhurst furnace or Horsmonden boring house, half that time. The promotion of the Upper Medway navigation owed much to those in the Weald who had heavy materials, such as timber or iron, to move. In 1760, 30% of cargoes on the upper Medway were guns. Bowen, Tapsell and Fuller, the only three clients who

used the navigation, had 1208 tons of ordnance freighted in that year. By 1770, only 11.8 tons were carried (Hood 1979: 223-4). Carriage to the Medway, whether to Maidstone itself, or to Branbridges on the Medway Navigation, had the advantage during wartime of greater security for there was less chance of a Maidstone hoy, from Millhall or Newhithe, being captured in the Thames estuary than of a vessel travelling round the Forelands from Rye, Hastings or even Newhaven. For this reason, the ordnance storeships either travelled in convoy or awaited escort by a passing naval vessel. The Board requested a convoy for a ship carrying guns for Harrisons' from Newhaven in 1756 but refused a similar request from Churchill the next year, denying their earlier action.<sup>9</sup> Further requests from Harrisons' the same year, and the next, were acceded to. Movements for the Board of Ordnance were exempt from the Act prohibiting coastal traffic in warlike materials.<sup>10</sup> It is likely that Churchills' were refused because the guns they were exporting were not for the King's service, Churchills' having requested the Board to intercede with the Customs to allow them leave to export. Ironfounders outside the Weald experienced greater problems with enemy threats to the coastal traffic. William Ford, at the Lorn Furnace in Argyllshire, and John Sunderland, at Low Wood in Furness, both shot founders, had considerable distances to send their products, and delays were frequent. The lack of a convoy had prevented shot cast for Edward Raby, by a sub-contractor in the Bristol area, from reaching Woolwich by the end of 1759.<sup>11</sup> Sometimes the fault lay with the suppliers. In the same year, a naval vessel sent to escort ships laden with guns from Rye for Harrisons', had to depart without them because they were not ready to leave.<sup>12</sup>

Bad weather was a further restraint. The convoy carrying Raby's shot was also delayed by contrary winds. Because of delays 'of convoy and wind,' Thomas Pryce's shipment of round shot from Neath took from November to February to reach Woolwich in 1761-2.<sup>13</sup> The warrants had expired, and the shipment was prevented from landing until the Board's permission had been sought. Pryce had to bear the cost of keeping the crew at sea in the meantime. A similar fate befell guns shipped for Harrisons', Churchills' and Robert Morgan, from Rye in 1763.<sup>14</sup> The delay consequent on contrary winds and then ice in the Thames led to the cancellation of the uncompleted part of their warrants because of the Board's reduced requirements, peace having been declared since the orders were placed.

In wartime in particular, impressment threatened to deprive ships, transporting guns or shot, of their crews. The Board were rarely sympathetic unless their needs suited them to be so. Vessels were also in short supply from time to time during the war period, either because of impressment or because of increased coastal traffic. Eade and Wilton's letter of January 1761, whereby they were unable to deliver guns 'for want of shipping,' typifies the problem.<sup>15</sup> The time limits imposed on warrants by the Board, resulted in financial loss even when out of the founder's control, and the prevailing attitude of the Board, whereby they were generally unsympathetic to most of the founders' excuses, may well have deterred many appeals for mitigation. Robert Morgan, of Carmarthen, was fortunate in the Board's favourable response to his memorial concerning a cargo of guns and shot which, while en route to Woolwich in 1759, had been forced in to Ostend and

detained. Duly released at the cessation of hostilities, it arrived at its destination four years late<sup>16</sup>

## RawMaterials

Contrary to the view of Ashton (1963 ed.: 15), the records of Wealden ironworks which survived into the mid-eighteenth century show that sources of wood for charcoal, and of ore, remained within a convenient radius of the works, and there is no evidence to support his assertion that the Weald's specialization in castings was mainly caused by a shortage of charcoal, thus inhibiting the operation of forges. An important determining factor in the location of ironworks was the supply of charcoal which, because of its friability, could not be transported intact from much further than a five mile radius of its destination. This imposed a limit on the area which could be exploited by an ironworks, but it also protected the ironmaster from the competition of major charcoal users further away. The onset of a war in which demands for charcoal, particularly for gunpowder, might be stretched to an unprecedented extent could place pressure on existing consumers in a vulnerable area like the south east. A number of factors inhibited this tendency with regard to the iron industry in the Weald.

Most Wealden ironworks were leased by the owners of substantial estates. Thus it was in the interests of landowners, seeking a market for their timber and underwood, to ensure that the ironworks they leased were an integral, viable part of that marketing process. Many of those estates had been founded, in part at least, on the profits of ironworking in earlier centuries, so the estate infrastructure had been geared to servicing the needs of the iron industry. The continuous operation, over more than a century, of many of the ironworks which survived into the 1750s attests to the effectiveness of woodland management on the estates which supplied them. Sir Whistler Webster's steward referred to some 3000 acres of the Battle Abbey estate woods which had always been used for charcoal for the furnace, implying that they could continue to be so used (Whittick 1992: 57). This figure compares comfortably with Hammersley's estimate of 7000 acres for a furnace casting 530 tons, taking into account the additional consumption of Robertsbridge forge and the fact that production at both sites, which were small in comparison to those in other parts of the country, was restricted to between seven and nine months in the year (Hammersley 1973: 606). At Ashburnham, both wood and ore were available during the period from within a similar radius. Nor were Harrisons' apparently experiencing any difficulty in obtaining raw materials. Cattell has shown that Hawksden forge was supplied by the regular rotation of nearby woods, and the lists of locations supplying Gloucester furnace with both wood and ore in the late 1740s reveal a similar hinterland (Cattell 1973: 143-5).<sup>17</sup> Correspondence relating to the attempts to find a lessee for Hawksden forge, following Tapsell's bankruptcy in 1765, concentrates on the problems faced by estates in finding markets for wood when ironworks close.<sup>18</sup> Roger Challice, the incumbent at Mayfield, reported to the Bishop of Durham's steward that, without a tenant at the forge, he saw no better way of disposing of woodland, that was overdue for felling, than to sell to the other tenants of the manor, suggesting that, far from there being competition for the woods, landowners who wanted



an income from their property depended on the demand the iron industry created. This state of affairs corresponds well with the experience of the ironworks in the East Midlands during the same period, and lends support to Hammersley's view that the price of wood was largely artificial and local in nature (Riden 1991: 76; Hammersley 1973: 608-10). It also calls into some doubt the claim expressed in 1755, in letters to the Board of Ordnance from Stephen Fuller, Sone and Stephens, and Robert Bagshaw on behalf of the Harrison brothers and Richard Tapsell. They claimed the scarcity of fuel and the increased price of carriage and labour as justification for their appeal for a higher price for ordnance from the Board. Acting in concert may have been an indication of strongly held opinions, but may also have been a combined effort to boost prices during a period of peace.<sup>19</sup> There is no evidence that any attempt was made to import coke into the region, but the use of coal as a fuel has been suggested on two sites. Straker refers to its alleged use by Churchill at Robertsbridge, and quantities of it were taken to Warren and Gravetye furnaces (Straker 1931: 316 & 216). The operation of an air furnace, or the drying of cannon moulds remain as likely explanations.

Undoubtedly the landlord-tenant relationship was important in determining to what extent ironmasters had to compete for wood with other potential purchasers. It was common practice for some rights to be established in the leases for works. Churchill's lease of Robertsbridge furnace in 1754, which virtually reiterated the terms by which the Jukes brothers had it seven years earlier, obliged the landlord to sell all sixteen year underwood grown within fourteen miles to the lessee for seven shillings a cord uncut. If none was to be available the landlord was to give adequate notice for the lessee to make alternative arrangements (Whittick 1992: 45-7). Such may have been the case in March 1763 when James Bourne, on behalf of John Churchill, paid Thomas Hussey for 195 cords of coppice wood.<sup>24</sup> Prices fixed in the lease were protected from inflation. Ironmasters who had to negotiate with landowners for supplies of wood for charcoal were necessarily more conscious of the value of the commodity. From an ironmaster's point of view, the ability to sell off wood which was surplus to his needs was an important bonus. Churchill was able to sell as hop poles wood which was too small for coaling. Likewise, Samuel Baker, subsequently tenant at Hawksden, recognised the financial advantage of paying by the acre, and would have had a purchaser for the spray wood if he had been able to buy in that way, rather than paying for just the cord wood, with the timber of other sizes sold elsewhere.<sup>21</sup> Thus the interests of local woodreeves, wishing to market woodland to the best advantage for their landlords, inevitably conflicted with those of ironmasters, hoping to bargain for rights over a sufficient acreage of woodland to guarantee supply, and to allow for some additional income.

The cost of wood was a major element in the economics of iron manufacture. At Ashburnham, wood supply consumed 30% of the expenditure of campaigns between 1756 and 1770. In assessing the consumption of wood for a blast in the Weald in this period, the evidence varies according to location.



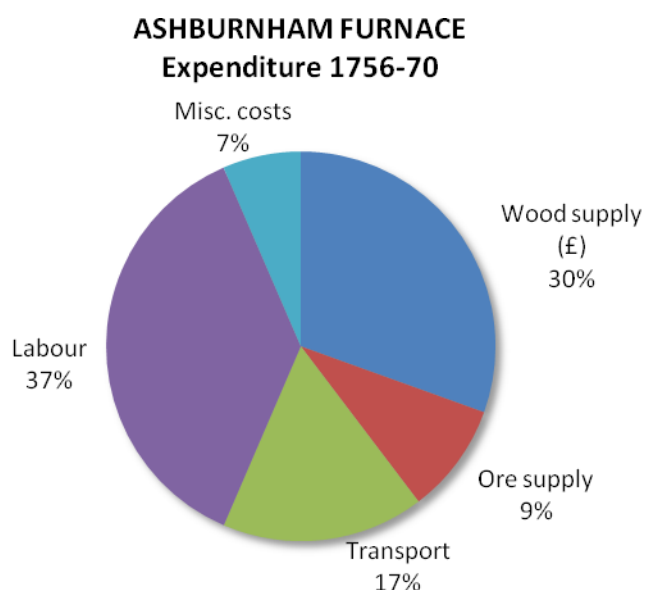


Fig. 12

(ESRO ASH 1815)

At Robertsbridge, the only figures given are those supplied in letters to prospective lessees, in which the estimate was between 1000 and 2000 loads of charcoal to achieve between seven and eleven tons of iron a week at the furnace, with a further seventeen hundredweight of bar iron at the forge. At Ashburnham the expenditure accounts are more detailed and a quantity for each campaign can be calculated. Wood was purchased in a variety of ways and the prices reflecting that diversity require some analysis for comparisons to be made. At Ashburnham there seemed to be little variation between costs during and after the war period. Wood was sold by the cord, cut or uncut, the variation lying in the quality of the wood; topwood, sprays, runts, coppicewood, spillwood. Over this was the cost of cutting, cording, teaming, and the many individual costs incurred by the colliers; cleaving, stacking, coaling, filling sacks. Prices at Robertsbridge and Ashburnham compare closely, those at the former not changing between 1747 and 1768. On top of these costs were those of carriage, 'trespass' over neighbouring land, and the occasional establishment of lodges to house the colliers. Carriage was the determining factor as in it lay the greatest variation; distance.

Expenditure on iron ore was affected by the cost of carriage in the same way as expenditure on wood was, and again the payments made were broken down into a number of separate elements; the rent for the land, the labour of digging or 'drawing' the mine, and the carriage to the furnace. Prices varied with the distance carried and with the quality. The three grades, fine mine or 'veins,' coarse 'greys,' and 'pitty' (or marlpit) were priced at rates which, like the price of wood, did not materially alter throughout the war period and after. Fuller was paying the same price, 1s.6d. a load in the ground, twenty years earlier (Crossley & Saville 1991: 264). Unlike wood, which was a renewable resource, iron ore supplies would inevitably run out, so it is a testament to the richness of the Wealden beds that Ashburnham and Robertsbridge, both working since the mid-sixteenth century, could still draw upon sources which were close at hand. For instance, Foxearth Wood, from which

ore was brought to Ashburnham in 1762-3, lay less than a kilometre away from the furnace.<sup>22</sup> The apparent abundance of ore within a short distance may have been the reason for the continued importance of some sites. Certainly, it was not always the case. William Clutton was having ore carried to Gravetye from Boyles Farm, south of East Grinstead, at least five kilometres distant (Hodgkinson 1978: 16). Similarly, in 1767 the anonymous enquiry about ore to Clutton, by then steward of Broadhurst Manor, Horsted Keynes, which probably also relates to Gravetye furnace, would have entailed a journey of six or seven kilometres (Hodgkinson 1987: 35-7). Local land sales throughout the period advertised the presence of beds of ore, and ironmasters who could not benefit from advantageous terms in their lease had to treat with local landowners for the necessary rights, though it is not clear to what extent formal agreements were entered into.

## Technology

Tomlinson (1976: 397) has said that the Wealden ironmasters were unable to adapt to new technology, which was geared to coke and to large scale operation. To some extent this must be open to question as within it lies the assumption that Wealden ironmasters were a different type from their contemporaries elsewhere in the Midlands, Wales or Scotland. It has been established, above, that in many cases the firms which operated ironworks in the Weald originated in the very areas where the innovation was taking place. It was the gunfounding industry, and the specific regional advantages that the Weald offered in that business, which attracted those firms. However, it also can be said that the inflexible specialization of the Weald was a major contributor to its demise as a potent industrial area. What was absent from the Wealden iron industry were the developing manufacturing processes which were bringing prosperity to the other iron producing areas of the country; coke smelting, crucible steel, slitting and rolling mills. Because of specialisation in casting, and ordnance in particular, none of these processes was necessary in the Weald, but when they began to influence the ordnance trade itself, the fate of the Weald as an iron producing region of significance was effectively sealed.

Where technological advances could affect production of the Weald's specialism, they were utilised. The reverberatory, or air, furnace, wherein pig and scrap iron, and flawed castings, could be remelted and cast without the decarburization of the forging process, was developed during the seventeenth century, particularly in the use of non-ferrous metals. Its advantages lay in that it did not require a forced blast, thus obviating the need for streams, bays and ponds, nor did it require a nearby ore source, with the attendant problem of the disposal of large quantities of slag. It has not been appreciated how many of these air furnaces there probably were in the Weald. John Churchill's correspondence with Sir Whistler Webster discloses that the Jukes brothers had converted the second finery hearth at Robertsbridge forge into one (Whittick 1992: 37). Straker (1931: 316) ascribed this to Churchill himself. The executors of William Harrison installed one at Hamsell furnace in the late 1740s, which was apparently still in use as late as 1758,<sup>23</sup> and Edward Raby undoubtedly had an air furnace, very probably at Warren furnace, to melt bronze when he widened his production to this metal in about

1769 (Hodgkinson 1978: 12). Other Wealden founders had air furnaces at works or yards they had in Southwark. William Bowen cast shot from old metal which he received in part payment from the Board of Ordnance, as did Joseph Wright, though whether the latter was in Southwark or at Pophole forge is not known. Linked with their use of surplus iron from Ashburnham, Crowleys would have probably had an air furnace either at Greenwich, or on Tyneside. John Fuller had to decline the Board's offer of part payment in old metal because he had no air furnace, declaring that he 'must lie at the Mercy of those that have, to give what Price they please' (Crossley & Saville 1991: 257). Some shot founders, such as Richard Gilpin and Stephen Remnant, both based in London, worked exclusively with air furnaces. The requirement of the Board of Ordnance that the iron guns they purchased should be cast from ore prevented the expansion of a London-based guncasting trade using air furnaces, which Bowen and Gilpin were already using to cast in bronze, and which Remnant was using at Woolwich to cast for the merchant trade.

A technological development which had been under way in other regions for more than a century was in the size of furnaces. The capacity and output of Wealden blast furnaces was, in most cases, a legacy of the past, and affected the ability of the region's gunfounders to expand their production to meet the demands of wartime. Estimating output from furnace hearth size relies on archaeological evidence for which there is little in this period. The remains of Northpark furnace were surveyed and, although the hearth had not survived, the overall ground plan of the furnace measured 5.5 metres square, which is comparable to the plan of Batsford or Chingley furnaces, both of which had been abandoned by the third decade of the seventeenth century; Northpark was put up for sale as a working furnace as late as 1777.<sup>24</sup> No excavation work has been carried out at any other Wealden furnaces from the Seven Years' War period, so the only estimate as to size can be made from the available output figures. Churchill's initial proposal to the Board was for 200 tons of ordnance in 1757 which, over an assumed average campaign of thirty three weeks, is not unreasonable compared with the output level of seven to eleven tons a week quoted by the estate three years earlier (Whittick 1992: 59).<sup>25</sup> Churchill doubled his proposed output for 1759, and it is presumed that he was able to make this offer by running Darwell furnace as well as Robertsbridge.<sup>25</sup> In 1757 William Bowen offered to cast 300 tons of ordnance at his furnaces, presumably Cowden and Barden, which is a low figure suggesting small hearth capacity.<sup>27</sup> Heathfield was one of three furnaces erected during the 1690s, and it might reasonably be supposed that they were of similar size. Furthermore, it is known that the other two, Lamberhurst and Pippingford, were both larger than the norm for the Weald, as suggested by archaeological evidence; the former being 28 feet (8.5m) high and probably of comparable dimensions around the base, the latter being known to be 8m square at the base. The size of the hearth at Lamberhurst was reported to have been 8¾ sq.ft. (0.8m<sup>2</sup>) although this figure alone cannot be directly equated with a quantity of iron (Straker 1931: 78). Cleere and Crossley (1985: 212-3) have shown that production at Waldron and Lamberhurst was similar at about 1.4 tons a day in the 1740s, and that Heathfield was achieving slightly more a decade earlier. The warrants issued to Harrison, Bagshaw and Tapsell at the end of 1756 were for almost 1500 tons of ordnance which, at an average output per furnace of 250 tons, would have required the combined production of five furnaces.<sup>28</sup> Stephen Fuller was unable to guarantee to supply more than 270 tons for the Board in 1759, although he said he

would try to deliver 300 tons. More than any other, Fuller's furnace seems to have been devoted to the production of ordnance at this time, so these figures may be a better guide.<sup>29</sup> Output figures are available for Ashburnham but they are distorted in that the weight of iron often relates only to ordnance and does not consistently include other castings. Nevertheless figures of 341 tons for 1759/60 and 307 tons for 1760/1, the latter in a campaign apparently lasting only 35 weeks, suggest a capacity substantially similar to the furnaces mentioned above.<sup>30</sup>

If Wealden furnace capacity was modest in this period, the ordnance production of furnaces outside the Weald was very similar. Robert Morgan, at Carmarthen, offered the Board of Ordnance 100 tons a year in 1758 and 1759, which appears very low in comparison with Wealden furnaces, but which cannot represent Morgan's maximum output as he was expecting to cast 650 tons in 1760 (Williams 1959: 35). Some Wealden gunfounders, notably the Crowleys and, later, Edward Raby, as well as other non-Wealden gunfounders, such as the Sones, of Sowley in Hampshire, Robert Morgan, and John Wilkinson, of Willey in Shropshire, combined production for the Board of Ordnance with orders for the East India Company, so orders for the Board cannot be taken as an accurate guide to furnace output.

Other technological innovations which began to appear elsewhere in the iron industry included alternative methods of blowing air into the furnaces. The traditional Wealden method, two pairs of leather and oak bellows, allowed little room for improvement. The Ashburnham and Heathfield accounts contain regular payments for hides and oil for their maintenance, without which furnace efficiency would be impaired and water supplies exhausted sooner. There is no reference to the introduction of alternative blowing methods, such as the cylinders that Smeaton made for the Carron Company. Although the Fullers had an engine made to raise water in the 1730s, it does not seem to have been a success, and no other evidence exists of attempts to provide more reliable means of maintaining the water supply to furnaces and forges. The unusually dry years of the mid 1740s had passed, although Edward Raby reported to the Board that dry weather had prevented him from boring his guns to complete his 1759 warrants, and in 1757 Stephen Fuller's clerk, William Gregson, came to an agreement with the miller upstream of Heathfield to allow his water to be used, for a daily charge, to avoid his workers having to tread the water wheel in the absence of water!<sup>31</sup>

Forges played a role of diminishing significance in the Wealden iron industry during the 1750-70 period. There is no evidence in the Weald of any of the developments which affected forges elsewhere in England, and especially in the West Midlands. Although a wire mill was established at Woodcock Hammer by 1787, the use of rolling or slitting mills is not recorded in the Weald during the Seven Years' War period. The Jukes brothers' conversion of the second finery at Robertsbridge forge into a reverberatory furnace can be related more to the casting of shot, but it is of some interest that John Churchill wished the second finery to be reinstated. In one instance at least, an ironfounder did without a forge altogether. The Crowleys employed their forge site at Ashburnham as a boring mill. Ample boring capacity seems to have been a necessity at the larger furnaces. The Fullers had built a second boring

house in 1742, and there were two at Robertsbridge forge (Crossley & Saville 1991: 161-2; Whittick 1992: 48). A second boring mill was constructed at Ashburnham in 1766, possible with an eye to future demand for ordnance, although the casting of mill cases and garden rollers required boring as well.<sup>32</sup> The innovation which perhaps had the most profound effect on the Wealden gunfounding industry, Wilkinson's boring machine, did not appear until the 1770s, after the end of this period.

The relative unimportance of forges may have led to their neglect. In the 1765 correspondence about Hawksden forge, the state of the works, the structure, machinery and waterways, was described as in need of repair, some urgently. It may be that the neglect was, in part, due to the difficulties which had beset Richard Tapsell, the former tenant, prior to his bankruptcy. It also seems likely that tenants of forges had to take pains to ensure that, when they entered into a lease, a full set of tackle was included. Churchill made it clear that he expected Robertsbridge forge to be in a good state of repair when he took it over (Whittick 1992; 60).

## Labour

The permanent labour force of the iron industry in the mid-eighteenth century Weald was small. At Ashburnham, the accounts record payments to a clerk, founder, borer, moulder and labourer, in addition to a wide range of other individuals employed for specific purposes at piece rates. With a minimum of ten furnaces at work at any time between 1750 and 1770, the total permanent personnel at work in them would have been about fifty. In addition were the forges in the region, which again numbered about ten at any one time. Assuming a permanent staff of three at each of these, finer, hammerman and labourer, thirty can be added to the overall total making eighty permanent ironworkers in the Weald at any one time. It is impossible to count accurately the total number of persons engaged in working at, or around, the furnace, for there is no way of knowing how many others were paid for out of the individual expenditure items. For the 1758/9 campaign at Ashburnham furnace, about sixty people can be identified as being paid for one or more jobs, whether it was regular work such as coppicing, coaling, or transporting iron, or for periodic tasks such as repairing a boring bar, making baskets or currying hides, and that number does not include those whose work can be regarded as permanent. Therefore, assuming that half as many again can be added to the sixty already counted, the number of non-permanent personnel may have been as many as ninety at a typical furnace; a total of nearly a thousand permanent and casual workers for a minimum of ten furnaces. Forges required no ore, their output was considerably less than the furnaces (Robertsbridge had an average output of 40 tons a year) and their products were generally distributed in a smaller area. The casual labour force of a forge would therefore have been considerably less than a furnace; perhaps a quarter of the number. For an average of ten forges, we can expect that a little over 300 permanent and casual workers may have been employed, making a grand total of about 1300 for the whole industry in the Weald. In the period 1756-70, labour

charges at Ashburnham, excluding any part of the cost of transport, consumed 37% of the total expenditure. A comparison between the labour costs at the beginning and the end of the period is less easy to assess as rates are not always given. Where they are, however, no change can be discerned over fourteen years.<sup>33</sup> There is some evidence that ironmasters made some provision for the accommodation of their workforce, particularly in areas where there may have been insufficient housing in the surrounding agricultural community. A map of the lands of Sir Kenrick Clayton in 1761 shows a number of small closes with cottages, adjacent to the Warren furnace, let to Mr Masters, one of the partnership operating the works.<sup>34</sup> At Northpark furnace, memories of a 'shanty town' survive locally (Barnes 1991: 28).

In an industry where the number of skilled personnel was so small, it is inevitable that individuals became widely known, and that there was a distinct market for such artisans. The Diamond family, who in successive generations were moulders at Ashburnham, and of whom John Fuller thought highly, were called upon for advice at other furnaces than their own. William Bowen, whose career in the Weald began with his purchase of Cowden furnace in 1741, appears to have had a practical training in ironfounding, for in 1744 John Fuller described him as "the best Molder among us" (Crossley & Saville 1991: 194). Bowen may have worked for Samuel Remnant early in his career. John Butler, however, experienced some difficulty attracting specialist workers to his furnace near Fernhurst, outside the main area of Wealden gunfoundries. His response was to employ workmen from the north, though it is not known from where, until local men had acquired the necessary skills (Butler & Butler 1845: 11).

With the gunfounding industry spreading outside the region, the specialized skills of the Wealden workers were in demand elsewhere. Following the death of George Tyler, his founder, Robert Morgan had considerable difficulty attracting a replacement in 1759. A suitable candidate from the Weald could not be engaged. Desperation nearly drove him to employ "Drunken Bets," whose poor workmanship had caused such a disastrous proof for Abel Walter at Sowley, that the latter had given up trying to cast guns for the Board (Williams 1959: 34-5). Coincidentally perhaps, the moulder at Ashburnham in the 1760s was a John Betts. The Carron Company employed moulders from Sussex, but in inadequate numbers for the output they were contemplating, and the use of unskilled labour led to a lower standard than the company were aiming for (Campbell 1961: 82).

## Notes and References

1. Heathfield furnace was built in 1693, Lamberhurst adjacent to the site of Hoadly forge, in 1695, and Pippingford, on or adjacent to the site of Steel Forge, in 1696; Cleere & Crossley 1985: 194-5, 350.
2. ESRO ASH 1815.
3. ESRO ALF 9/9.

4. John Fuller to Samuel Remnant 26th February 1742/3.

5 GMRLM1064.

6 PRO WO47 48 ff.545, 566, 582 & 593.

7 PRO WO47 60 f.366.

8. PRO WO47 47 f.618.

9. PRO WO47 47 f.652; 49 f.11.

10. PRO PC2 105.

11. PRO WO47 54 f.507.

12. PRO WO47 54 f.22.

13. PRO WO47 57 f.87.

14. PRO WO47 61 f.50.

15. PRO WO47 57 f.31.

16. PRO WO47 61 f.433.

17. GL Ms.3736/4.

18. ESRO GLY 2770.

19. PRO WO47 45 f.396.

20. KAO U1776.E19A.

21. ESRO GLY 2771.

22. ESRO ASH 1815.

23. PRO WO47 51 f.405.

24. Magilton 1990: 32; Bedwin 1980: 98; Crossley 1975: 31.

25. The average length of campaign at Ashburnham from 1757-70 was 232 days; ESRO ASH 1815.

26. PRO WO47 49 f.314.

27. PRO WO47 49 f.577.

28. PRO WO47 48 f.602.

29. PRO WO47 50 f.409.

30. ESRO ASH 1815.

31. PRO WO47 54 f.507. ESRO SAS RF 16/V/9.

32. ESRO ASH 1815.

33. ESRO ASH 1815.

34. SyRO 61/3/2.



## CONCLUSIONS

Whereas the term, Wealden, may be accurately used to describe geographical locations in the Weald, or to recognise a distinctness of the region, its use can be misleading. Its frequent application in connection with the iron industry has come to imply a regional character where such is often inappropriate; indeed Wealden, in this context, has almost become an epithet for outdated practice. Tomlinson (1976: 386) draws a distinction between Wealden and “alien” gunfounders, suggesting a cohesion among those working in the Weald for which there is no evidence. Apart from the location of their works, there is little about most of them which is distinctly Wealden. From the late-seventeenth century there had been increasing involvement in the region by merchants and entrepreneurs from London. The Westerns and the Gotts, whose families were linked, and who occupied works in the Weald for long periods, were in this category, as were Hooper and Diggs, who built Pippingford furnace (Cleere & Crossley 1985: 194-5). The Gotts later settled in Sussex, but only after their fortune, based on iron founding, had been made. Of their successors, the Fullers and John Legas were Wealden in the true sense, but William Harrison was based in London, and exploited the Weald because of what it had to offer; skilled, specialist labour, appropriately equipped furnaces, and relative ease of access to the main ordnance markets. So the subsequent attraction to the Weald of the Jukes brothers. William Bowen, John Churchill, and Edward Raby, all based outside, serves to dispel the myth of the “Wealden” gunfounder in the eighteenth century. Others also showed interest; Thomas Braxtone, of Fareham, and a Mr Cotton, possibly a member of the family of ironfounders from the north-west Midlands, both received replies to inquiries about the Robertsbridge works in the early 1750s although nothing is known about their motives (Whittick 1992: 57-8).

Links with London brought elements of integration into the organisation of the ironworks in the Weald. This integration was most apparent during the 1740s, when Samuel Remnant acted as agent for both the Fullers and for the Legas-Harrison partnership. His agency, together with his friendship with William Bowen, would have enabled Remnant to draw together their separate manufacturing units for mutual benefit, notably in the arrangement of sub-contracts. Remnant would have been able to retain, if not strengthen, his influence following the death of William Harrison, for Harrison’s sons were still young and John Legas, the co-trustee of Harrison’s estate, was based in the Weald, and therefore in need of an agent close to the markets.<sup>1</sup> However, Fuller’s decision to reject Remnant would have undermined the latter’s influence, and although it cannot be determined whether Fuller, or Remnant, benefited or suffered as a result of this hiatus, an element in the integration of the Wealden ironworks was lost (Crossley & Saville 1991: 260). Remnant’s death, two years later, weakened it further.

During the Seven Years' War, the demand for ordnance sustained the viability of the partnership between Harrison's sons and Richard Tapsell, who had succeeded Legas, maintaining the integration of their furnaces and forges. The influence of Robert Bagshaw, who retained an independent role as a merchant, as well as joining the partnership, may have been significant in this period, his acknowledged business acuity compensating for the inexperience of the Harrisons and the apparent imprudence of Tapsell. For whatever reason, the marked decline in the partnership's business after 1763 (see Fig.19) must have been a factor in the bankruptcy of Tapsell, in which Bagshaw was the prime mover. More than any other event, apart from the resumption of peace, Tapsell's bankruptcy contributed to the decline of the iron industry in the Weald in that, at a stroke, as many as ten furnaces and forges went out of production, at least temporarily, and a cohesive manufacturing entity was broken up and its place taken by a number of small, independent operators. Only one of the former partnership's furnaces, the Gloucester furnace at Lamberhurst, remained in use, although all their forges, hitherto an adjunct to their ordnance business, were to continue to serve a declining local market.

The integration of furnaces and forges, albeit limited to a small number of units, had been an established practice in the Weald since the sixteenth century. Bowen, Churchill and Raby operated two furnaces each for some of the time, but, more importantly, with the exception of Fuller, Butler and Clutton, the ironfounders in the Weald all operated ironworks in other areas, usually London but, in the cases of Churchill and the Crowley family, elsewhere. The extent to which integration had financial as well as manufacturing implications is impossible to assess. As far as the Crowleys were concerned, it is unlikely that their casting operations at Ashburnham constituted a major part of their annual turnover. The bankruptcies of Raby and Churchill suggest that the integration of their own varied industrial interests was far from successful, although Raby demonstrated that financial precariousness was not a certain threat to continued prosperity. His ability to continue to cast for the Board of Ordnance, after the dramatic lowering of prices forced by the Carron Company, is evidence in itself. Similar resilience is shown by William Bowen, the most consistent of the founders in the Weald.

The end of the Seven Years' War saw a sharp decline in the government market for guns, and although there was a rise in the demand for guns for the merchant trade, the high cost of guns cast out of ore made Wealden ordnance less competitive. Although a small number of air furnaces seem to have been built in the Weald, their location was disadvantaged by the distances to the markets. The existence of a number of foundries close to the River Thames ensured that their products would reach the merchant market unimpeded. Edward Raby is an exception, in that he cast a substantial share of the East India Company's purchases at the end of the 1760s. Lacking innovative enterprise, iron manufacture in the Weald suffered from its early pre-eminence. Furnace output was markedly below the average for the rest of the country. In 1717, the average annual output of the Wealden furnaces was 180 tons, furnaces in the west of England averaged 450 tons (Hammersley 1973: 601). Even Gloucester furnace, said to have been the tallest in England when it was built in 1695, produced only 200 tons in that period. Although Sir Ambrose Crowley considered Sussex and Kent bar iron to be of "tough" quality, comparable with Swedish iron, it is more likely that

low yields, in addition to small hearth size and short campaign length, had an important effect on output figures (Flinn 1962: 35-8). The relatively high cost of operating small furnaces could only be offset by high-profit production of ordnance for government contracts (Cleere & Crossley 1985: 215).

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In some technological aspects the Wealden furnaces and forges did not benefit from the improvements made in the iron industry in other parts of the country. Box bellows had been introduced into the Black Country early in the eighteenth century, but there is no evidence of their adoption in the Weald (Schubert 1957: 208). The Carron Company made use of blowing cylinders designed for them by Smeaton. However, developments in cannon boring affected none of the gunfounding furnaces in Great Britain during the 1750s and 60s. Carron were employing the same method as was used in the Weald (Campbell 1961: 88-9). Wilkinson's innovative boring machine was not introduced until the next decade. It is difficult to assess the extent to which casting techniques in the Weald reflected improvements elsewhere. The small number of founders who attempted the casting of shells or trucks suggests that they were specialised skills possessed by only a few. In forging, output was low, and it is not clear to what extent, if any, the use of mineral coal in the chafery hearth had reached the Weald. Being far from the coalfields, it was an expensive substitute for charcoal, but carriage of coal to Woodcock forge may suggest such a use (Hodgkinson 1978: 19). Lack of development and innovation in the Weald was seemingly recognised nationally, even internationally, for when a visit was paid to Britain in 1764 by the distinguished French engineer, Gabriel Jars, his itinerary omitted the Weald, despite its proximity to France, and concentrated on ironmaking at Carron, in Scotland, and at Clifton in Cumberland, as well as on other extractive industries (Chevalier 1949).

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As far as transport and accessibility were concerned, from only two furnaces, Robertsbridge and Beckley, was it said to be possible to move guns in winter, because of their nearness to navigable water, although it is clear that overland journeys were regularly made from some locations. Nevertheless, the Wealden clays were a considerable hindrance. In the supply of charcoal, there seems to have been little discernible shortage around some sites, although competition for coppicewood, through the increasing demand for hop-poles, which required a shorter growing period, affected others, notably those which were not part of the larger estates. Estate wood prices do not seem to have reflected the general rise in charcoal costs to which earlier authors had attributed the decline of the industry in the region. Similarly, ore remained plentiful in the areas traditionally most associated with ironworking. In the more marginal areas, away from the Wadhurst Clay, the most reliable source, distances over which ore had to be carried were greater. Traditional ironworking skills in its labour force were probably the Weald's greatest asset. Board of Ordnance proofs of guns reveal that, throughout the period, ordnance cast in the Weald had a higher success rate than its competitors.<sup>2</sup> Thus gunfounders in other parts of the country sought to attract moulders and founders from Sussex, ultimately perhaps to the Weald's detriment.

If the transient nature of the gun trade was ultimately doomed to extinction in the Weald, the small local bar iron trade remained unexpectedly resilient. Possibly because of the same

geological intractability that restricted the movement of guns, the forges were able to compete successfully for a market in local blacksmiths, estates and inland towns. Their low output could be serviced by the diminishing number of furnaces, and the livelihoods of their personnel sustained by part-time agriculture.

The commercial security of the iron industry in the Weald in the third quarter of the eighteenth century rested in the continued demand, by the Board of Ordnance, for guns cast out of ore. Once that demand diminished, the region was neither equipped nor located to compete for markets which would make do with guns cast in air furnaces, nor was it able ultimately to compete with furnaces which, because of larger capacity, longer campaigns or coke fuel, were able to cast an equivalent product at a cheaper price. There is no evidence that the Board favoured the Weald, so when demand exceeded the Weald's ability to supply, the Board accepted, even invited, tenders from elsewhere.

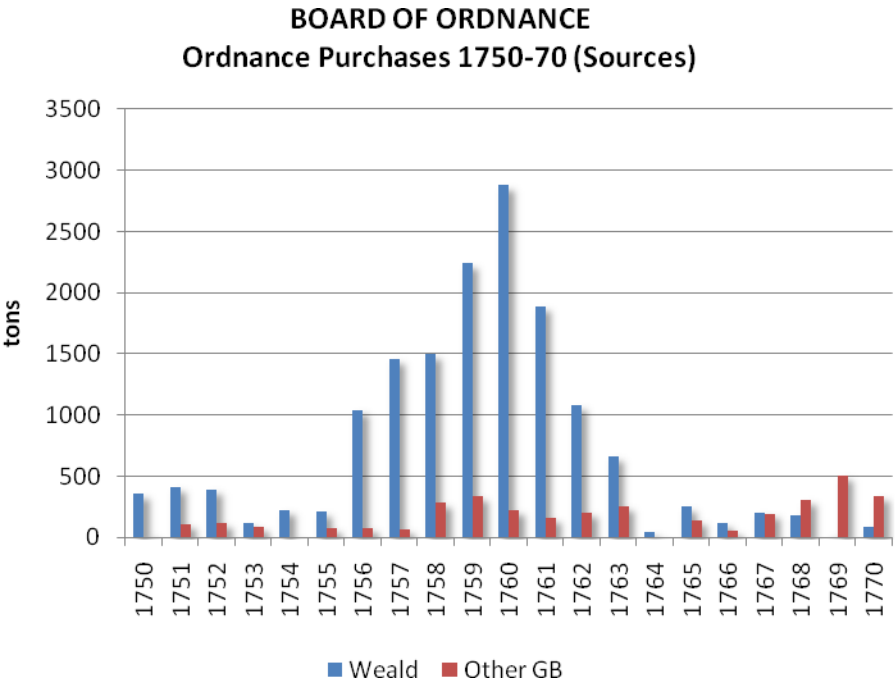


Fig. 13 (PRO WO51 172-246)

The decline in the Weald's share of the government's contracts for ordnance closely followed the end of the Seven Years' War. The disintegration of the Country Partnership, and the fate of individuals, such as William Bowen and Edward Raby who both died in 1771, meant that gunfounding furnaces and, to a lesser extent, forges became unexpectedly vacant at a time when there was little in the markets to attract new tenants. Gunfounding in the Weald was to be revived again early in the 1770s, when the Carron Company's products failed dramatically, but it was short-lived. The period of the Seven Years' War had seen the final demonstration of the strength of a regional industry to prolong the viability of its specialist production.

## Notes and References

1. GL Ms.6482.
2. Between 1750-70, 79.5% of the 10,860 guns cast in the Weald passed the Ordnance Board proof, whereas only 70.7% of the 3,130 cast elsewhere (guns cast by Eade & Wilton have been assumed to have been cast in the Weald). It is believed that the records of the proofs of guns, recorded in the Surveyor General's Minutes, are not complete and that some proofs took place without their results being included in the Minutes: PRO WO47 38-76.

WEALDEN IRONMASTERS AND THEIR SITES 1750 - 1770

ASHBURNHAM & CROWLEY FAMILIES

Guns were cast at Ashburnham, with two boring mills, one at Ashburnham Forge. In the late 1730s and 40s the Crowleys had two furnaces in blast in the Weald, at Ashburnham and Darwell.<sup>1</sup> Contrary to the view expressed by Flinn (1962: 101), they retained an interest in the smelting branch of the iron industry, for they were supplying the Board of Ordnance with guns from Ashburnham in the early 1750s and again in the late 50s and 60s.<sup>2</sup> Confident of ordnance markets, one of the boring mills was rebuilt in 1766. The lack of a forge necessitated importing wire, bar iron etc. for use at the furnace, presumably from the Crowleys’ warehouse at Greenwich, or purchasing it from the Fullers’ forge at Burwash. Correspondingly, gunheads were carried to Hastings, presumably for export to the Crowleys’ other works where they would be melted down. They also purchased condemned and refused guns from the Fullers.<sup>3</sup> In 1756, John, 2nd Earl of Ashburnham, married Elizabeth, daughter of Theodosia Crowley, and for a while, the ironworks continued under Crowley management (the Ashburnham family gained possession of half the Crowley estate after Theodosia’s death in 1788). During the late 1750s, Roger Hanmer, agent for Theodosia and another of her daughters, of the same name, shipped guns for merchantmen and privateers out of Hastings and Maidstone.<sup>4</sup> William Summers, a furnaceman at Ashburnham in the 1750s, was later imprisoned as an insolvent debtor at Horsham.<sup>5</sup> Domestic ironwork and

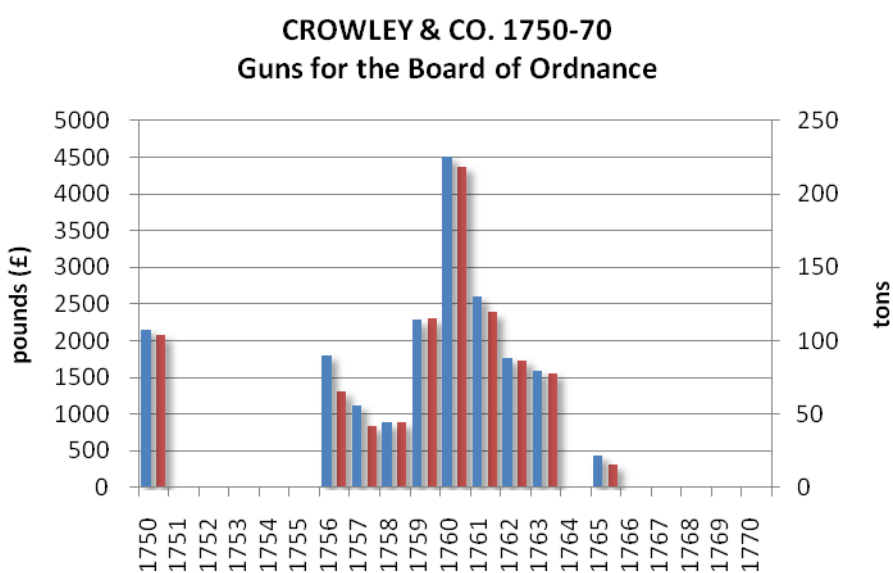


Fig. 14

(PRO WO51 174-230)

pig continued to be produced intermittently until 1813 (Beswick *et al* 1984: 226). The forge worked until c.1827.

## SAMUEL BAKER

Leased Hawksden Forge from the Trevors of Glynde in 1766 after a year's correspondence.<sup>7</sup> He purchased pig iron from the Fullers, and sold iron ore to them.<sup>8</sup>

## DANIEL BEARD

Occupied Maresfield Forge from 1751-61.<sup>9</sup> Purchased pig iron and forge tackle from the Fullers.<sup>10</sup> Probably had an ironmonger's shop in Lewes.

## JAMES BOURNE & CO.

Bourne, of Salehurst, leased Robertsbridge furnace and forge from 1768-79, in partnership with William Polhill, of Hastings, and David Guy, of Rye (Whittick 1992: 48-9). He also ran Darwell Furnace (Straker 1931: p.309). He supplied the Board in 1773-4, and took a lease of Glaziers Forge, Brightling, in 1785,<sup>11</sup> on condition that he worked sows from Ashburnham, but does not appear to have operated at the works. His son, Henry, gave evidence of the work he did for his father in working teams bringing ore from Silverhill to Robertsbridge.<sup>12</sup> Bourne acted as clerk at Robertsbridge to John Churchill sen., to whom he was kinsman, and later executor.<sup>13</sup> In 1748 a James Bourne had been lessee of Rushall Furnace in Staffordshire, which John Churchill was later to lease (Riden 1987: 19).

Trunnion Mark: ?IB

## WILLIAM BOWEN

Bowen supplied the Board until 1770. He purchased the freehold of Cowden furnace in 1741, and was casting at Barden furnace (Bidborough) c.1761.<sup>14</sup> Reference to his furnaces in 1757 suggests that both were in blast by then, but it is likely that only Cowden was still working in 1768.<sup>15</sup> From 1729, Bowen, at Barden, was one of those to whose forge the Fullers were selling pig iron, gunheads and failed guns.<sup>16</sup> The forge also appears in the list of those working in 1736, but it is not known whether it was still in operation after 1750.<sup>17</sup> Fuller reckoned Bowen the best moulder in the business. He sub-contracted to the Fullers in 1748 and bought refused 18 pounders from them in 1751 (Crossley & Saville 1991: p.194, 246, 265). He took old iron guns in part payment for guns and shot he supplied to the Board of Ordnance, confirming that he



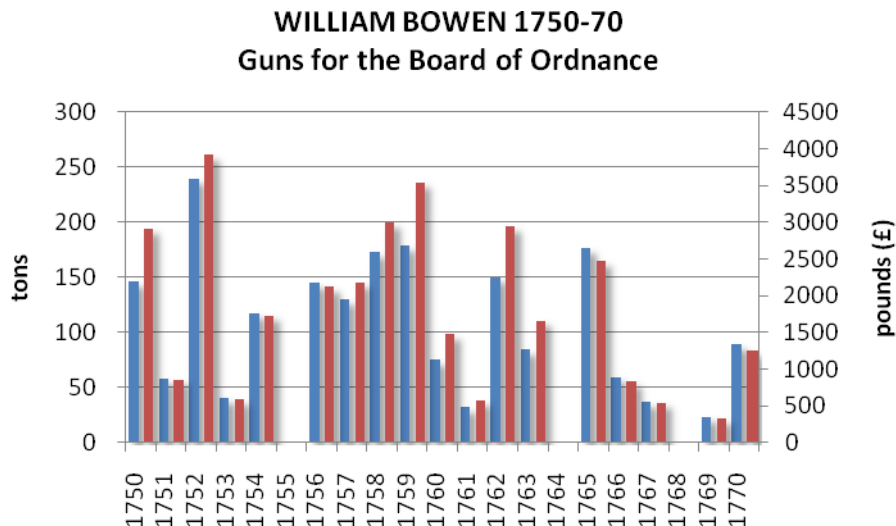


Fig. 15

(PRO WO51 176-246)

had an air furnace, probably at his foundry at Marigold Stairs, Upper Ground, in Christchurch parish, Southwark, which he leased from the Edward Edwardes Charity in 1722, renewing the lease for 31 years in 1748.<sup>18</sup> Bowen continued to contract for orders after the general lowering of prices to £14 per ton, instigated by the Carron Co. in late 1764. He also cast in bronze, probably at Southwark. Bowen was a friend of Samuel Remnant and was mentioned as such in the latter's will.<sup>19</sup> Bowen, who was described as of Tonbridge, died in 1771.<sup>20</sup>

Trunnion Mark: W B

## FAWLKNER BRISTOW

Occupied Howbourn Forge (Buxted) in 1765, following the bankruptcy of William Clutton.<sup>21</sup> He purchased iron from the Fullers' iron house at Brightling.<sup>22</sup>

## JOHN BUTLER

Butler, of Bramshott, sought to have guns made for him by the Fullers in 1738, and ran Northpark furnace (Linchmere), in partnership with Eade, probably of Eade & Wilton (though possibly Jas. Eade, later of Abinger Ham.), prior to Wright & Prickett taking over the furnace in 1769 (Butler & Butler 1845: 10-11).<sup>23</sup> The furnace was probably that hinted at as working in the west of Sussex in 1752 (Crossley & Saville 1991: p.273). In the copy of the 1788 list of furnaces closed since 1750, in the Boulton & Watt papers, Butler is given as the occupier of "Burhamfold." This is presumably a mis-spelling of Burningfold, although no corroborative evidence has been found.<sup>24</sup> Butler died in 1775.<sup>25</sup>

## JOHN CHURCHILL & SON

Churchill, of Hints, Staffordshire, had leases of Rushall Furnace, Hints Forge and Bromwich Forge, in the same county; an earlier lessee at Rushall was a James Bourne (Riden 1987: 19). After initial correspondence with Sir Whistler Webster, he took a lease of Robertsbridge Furnace and Forge (Salehurst) in 1754 (Whittick 1992: 56-62), where he reinstated the second finery hearth at the forge, and in 1755, together with his son, John, he offered to cast guns for the Board from 1756. Initially offering to cast 200 tons, he increased to 400 tons the following year, suggesting he had greater furnace capacity, perhaps through operating Darwell Furnace (Mountfield).<sup>26</sup> He also cast for the merchant trade,<sup>27</sup> but was bankrupt in August 1767.<sup>28</sup> He subcontracted for Robert Morgan, gunfounder at Carmarthen, in 1761, having lost the Board's contracts himself that year (Williams 1959: 42).<sup>29</sup> In early 1764 he reported to the Board that his works had blown up.<sup>30</sup> Although he had accepted £14 per ton for guns delivered late, Churchill did not continue to offer to cast for the Board after the general lowering of prices to that level, instigated by the Carron Co. in late 1764. He died between August and October of 1767 and his business, both in Staffordshire and Sussex, was inherited by his son, who sold, or did not renew their respective leases in 1768.<sup>31</sup>

Trunnion Mark: IC, IC/R, IC/D

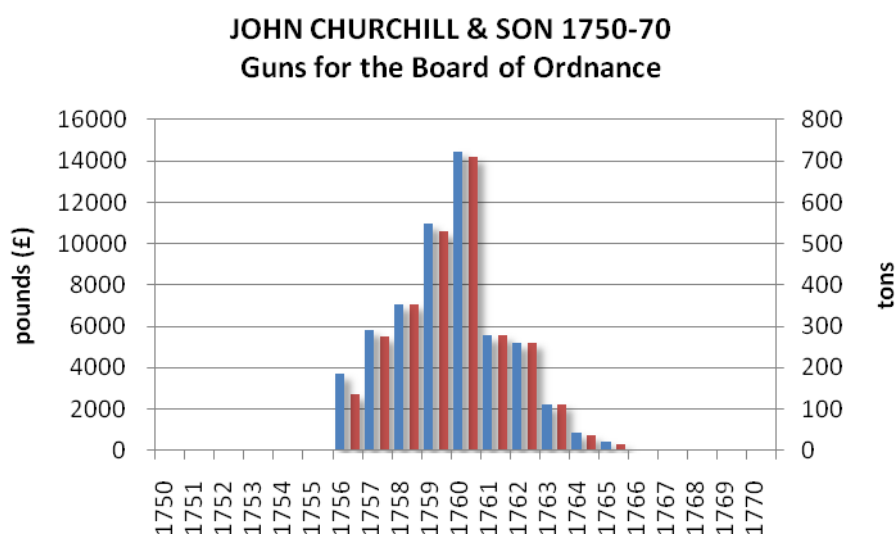


Fig. 16

(PRO WO51 196-228)

## CLUTTON & CO.

William Clutton, of Horsted Keynes, cast guns at Gravetye (West Hoathly) from 1761 until bankruptcy in August 1762. He also had Howbourn Forge (Buxted) and Maresfield Forge. He did not sell directly to the Board but seems to have subcontracted for Eade & Wilton, who had guns, presumably cast for them, carried to Woolwich by Robert Knight, after the bankruptcy. Thereafter, Clutton's

assignees, his brother Ralph Clutton and Samuel Durrant, took possession of the furnace to clear the stock. Clutton's partner was John Norden, who may have worked for Harrison and Legas as a draughtsman for cannon moulds (Hodgkinson 1989).

## DAVID COLLINS

Took over Bivelham Forge c.1766, following the bankruptcy of Richard Tapsell.<sup>32</sup> A William Collins later rented Gloucester Furnace (Lamberhurst).<sup>33</sup>

## CHRISTOPHER CRIPPS

Occupied Howbourne Forge (Buxted) from 1756-60.<sup>34</sup> He bought forge tackle from the Fullers in 1758.<sup>35</sup>

## EADE & WILTON

Jonathan Eade supplied guns for East India Co. ships from 1753 and, with William Wilton, supplied the Board with guns and shot from 1756-68. Though it is not known if they operated any works themselves, they must have had a firm arrangement with at least one gunfounder to ensure that orders and prices could be met. They also dealt in guns for the merchant trade.<sup>36</sup> Described as ships' chandlers, their office and warehouses were near to King Edward's Stairs, in Wapping.<sup>37</sup> In late 1762 they paid Robert Knight to carry guns from Gravetye when Clutton went

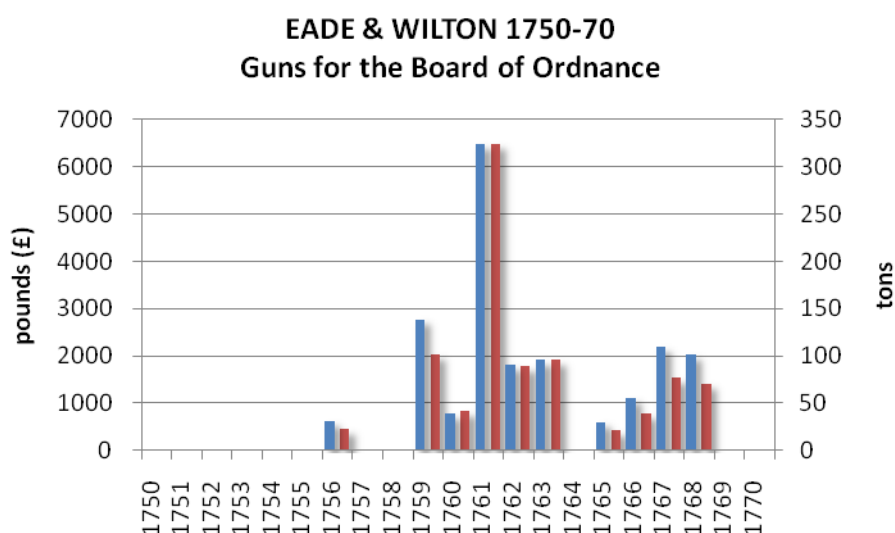


Fig. 17

(PRO WO51 199-240)

bankrupt, presumably to fulfil orders (Hodgkinson 1978: 18). In 1753, they purchased over 200 small calibre pieces from Fuller, as well as sub-standard guns

for the merchant trade.<sup>38</sup> Eade may have worked with John Butler, suggesting that, after Clutton's bankruptcy, Northpark Furnace was Eade & Wilton's chief source of ordnance.<sup>39</sup> In one source Eade is described as a founder (Coote 1763). Eade also manufactured gunpowder, traded with Africa, and was a director of an insurance firm (West 1991: 144).

## JAMES EADE

Had Abinger Hammer 1781-2.<sup>40</sup> Possibly the Mr Eade who partnered John Butler.

## FULLER FAMILY

John Fuller began casting at Heathfield furnace in 1693, and it was continued, during this period, by his grandsons, John (1745-55), Stephen (1755-57) and Rose

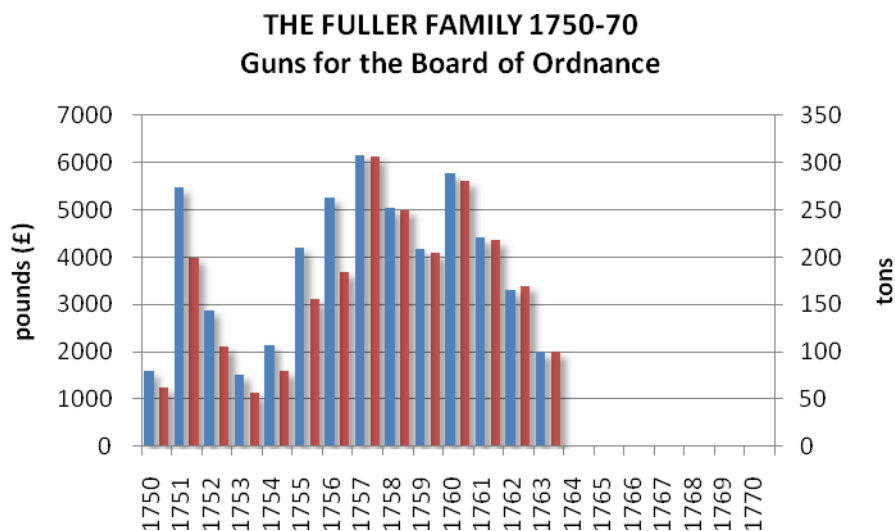


Fig. 18

(PRO WO51 175-232)

(1757-77), although Stephen retained overall control of the ironworks after Rose's return from Jamaica in 1757. They sub-contracted work to Harrison's and the Jukes brothers on occasions, offered to assist Rev Sone & son (Sowley Furnace, Hants.) with contracts, were invited to cast guns for John Butler in 1738, and sold rejected ones to William Bowen in 1751 and to Eade & Wilton in 1754. They also ran Burwash Forge until 1803, and it is reported that there was an air furnace at Goodsoal Farm, Burwash Weald, though the Fuller papers make no mention of one (Lower 1849: 207). They supplied the Board with guns until 1765, also the Kingdom of Sardinia in 1753, and the Kingdom of Naples and the Two Sicilies in 1755 (the latter order containing guns of French bore, and thus harder to dispose of, or replace, if they failed the proof). Another contract, with Austria in 1752, was not completed. They continued to cast intermittently until 1793 or 4. The forge ceased to work in 1803 (Crossley & Saville 1991).

## JAMES GOODYER

A Guildford ironmonger, he occupied Abinger Hammer from 1756 (possibly from 1751).<sup>41</sup> In 1774 he took a lease of Northpark Furnace and Pophole Hammer, until bankruptcy in 1777.<sup>42</sup>

## HARRISON &amp; CO.

William Harrison, of New Broad Street, and of Stone Wharf (Gun Wharf), Morgan Lane, Southwark, entered into the Country Partnership with John Legas in 1741, formalised in 1743, for a term of sixteen years.<sup>43</sup> Harrison died in 1745 and the business descended to Legas (d.1752) and, in trust, to Harrison's sons, Andrews and John. Robert Bagshaw, Harrison's clerk, joined the partnership, on his former employer's advice, after 1750. The trustees were Legas and Samuel Remnant. Richard Tapsell, Legas's successor, operated with them from time to time. The partnership jointly leased Gloucester (Lamberhurst), Conster (Beckley) and Waldron furnaces, as well as a boring house at Horsmonden, and forges at Westfield and Hawksden (Mayfield). They rented Glaziers forge (Brightling) and Bivelham forge (Mayfield). In addition, Harrison separately had the lease of Brede furnace, and the freehold of Hamsell furnace, which he left to his son, John.<sup>44</sup> They cast guns for the Board, for the East India Co., and for other purchasers (e.g. Sardinia and Ireland). Brede furnace ceased working in 1766 (Lower 1849: 207). An air furnace had been built at Hamsell in 1745, and their offer to cast shot out of "melting iron" as well as ore in 1758 suggests a working life at least until then; land tax was paid until 1764.<sup>45</sup> In 1755, Harrison & Bagshaw offered to cast bronze guns for the Board, though there is no record of any orders being placed, nor of where such castings were to be made.<sup>46</sup> Waldron, although used primarily for shot casting in the late 1740s, seems to have been casting cannon as late as 1758, for Harrisons' were shipping guns out of Newhaven in 1756, a gun marked 'W' was proved for them in October 1757, and Tapsell was buying loam for the furnace from the Fullers in 1758.<sup>47</sup> A plan of Gloucester furnace in 1795 shows the site of a boring mill despite the partnership's use of Horsmonden for gun boring, although this may relate to later use.<sup>48</sup> From 1734-45, Harrison had a joint lease of Robertsbridge furnace with William and George Jukes. Harrisons' were the only Wealden founders to cast 42 pounder guns for the Board (the Carron Co. were later able to, and Wilkinson also offered). The partnership had warehouses at Tonbridge and Maidstone.<sup>49</sup> Robert Bagshaw also appears to have been in business as a merchant on his own account, at an address in New Broad Street, London (Kent 1754; Rivington 1765).

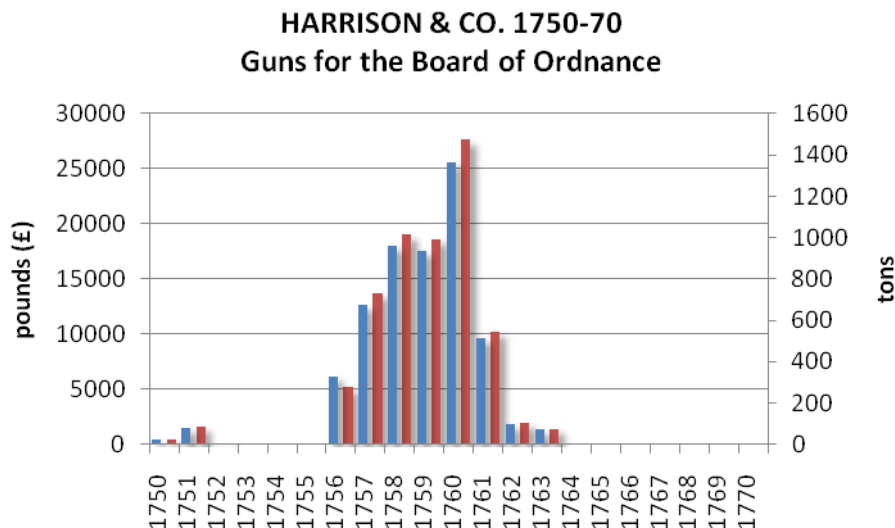


Fig. 19

(PRO WO51 196-229)

## JUKES BROTHERS

William and George Jukes (or Jewkes) had Robertsbridge Furnace, firstly in partnership with William Harrison (from 1734), and then separately (from 1747). From 1737, they were sole lessees of the forge, where they constructed an air furnace. Both leases terminated in 1754 (Whittick 1992: 45-7, 52-5). They cast for the Board and as subcontractors for John Fuller. The latter arrangement broke down in acrimony in 1749 (Crossley & Saville 1991: 250-1). They ceased to cast guns for the Board in 1748, although they continued to supply shot until 1750, by which time William Jukes was dead. They were also tenants of Burningfold Furnace and Forge (Dunsfold) for which there is evidence of gun and shot casting. Burningfold had been sold by the executors of John Tanner, who d.1751, to Viscount Montague c.1756 (Kenyon 1952, p.239 n.7). In the Militia returns for Dunsfold in 1758, William Gardiner is referred to as a "furnaceman".<sup>50</sup> Burningfold Furnace is not shown on Rocque's map of Surrey (1762) so probably had ceased working by then. George, Thomas and James Jukes, who were based at 10, Alhallows Lane, close to the Steelyard, off Thames Street in London, shipped ordnance out of Sowley Furnace, Hants, in 1756, and out of Rye in 1757, as agents or merchants rather than as founders.<sup>51</sup> They bought refused guns from the Fullers the same year.<sup>52</sup> In the 1720s William Jukes & Co. of London had purchased pots and kettles from Coalbrookdale (Raistrick 1953: 55). In 1754-5 Jukes and Co. of Southwark sold pig iron to south Yorkshire furnaces, and a year earlier had purchased iron from Carburton Forge, Notts. (Hopkinson 1961: 145-6).

Trunnion Mark: (?) R

## OWEN KNIGHT & CO.

Paid Land Tax for Thursley Hammer and Ponds in 1769.<sup>53</sup> The Thursley forge is marked on Rocque's map of Surrey (1762), and was noted as working in 1767

during the campaign for the repositioning of the tollgate on the Guildford- Liphook Turnpike, when the iron used was brought by water to Godalming and from thence by road.<sup>54</sup>

#### JOHN LEGAS & RICHARD TAPSELL (see Fig. 19)

Legas, together with Thomas Hussey, leased Gloucester furnace (Lamberhurst) in the early 1720s, from Maximilian Gott (Melling 1961: 95), leasing Hawksden forge in 1727 and Chingley a year earlier (Crossley 1975: 5).<sup>55</sup> Legas ran the first two, together with Beckley Furnace and Westfield Forge (both of which the Gott family also owned), and five other ironworks in partnership with William Harrison, from 1741 until Harrison's death in 1745 (see above). Legas's correspondence with Samuel Remnant indicates that he concentrated production at Waldron on shot until 1747.<sup>56</sup> Legas died on 22nd May 1752, aged 62, after handing over his business to Richard Tapsell, his nephew-in-law, who had worked with him since c.1737. According to Rev. Samuel Bush, Vicar of Wadhurst (1743-83), with whom both Legas and Tapsell had an acrimonious acquaintance, Legas was fined £2000 for illegally exporting guns, thus ending his contracts with the government.<sup>57</sup> Tapsell continued the partnership with the Harrisons, and with Robert Bagshaw, until his bankruptcy in 1765, for which the petitioner was Bagshaw.<sup>58</sup> Tapsell's bankruptcy caused the temporary closure of all the works tenanted by the Harrison-Legas partnership. Tapsell continued to be rated for stock at Waldron Furnace until 1768. The body of Judith, wife of John Legas, who died in 1747, lies buried beneath an iron memorial plate in Wadhurst Church. Tapsell died c.1777.

Trunnion Mark: G. W

#### BENJAMIN MOLINEUX

Occupied Maresfield Forge from 1767. He purchased gunheads, sows and forge tackle from the Fullers.<sup>59</sup> He sold bar iron from the forge, and from an ironmongers' shop in Lewes run by Joseph, and later, Ann Molineux.<sup>60</sup>

#### RABY & CO.

Edward Raby and his brother-in-law, Alexander Master, had an ironmongery business at Smithfield before 1750, and were already supplying the Board with forgings before 1759 when they first cast ordnance at the Warren Furnace, Worth. Masters, or his father, may also have run Maresfield Forge in the 1740s,



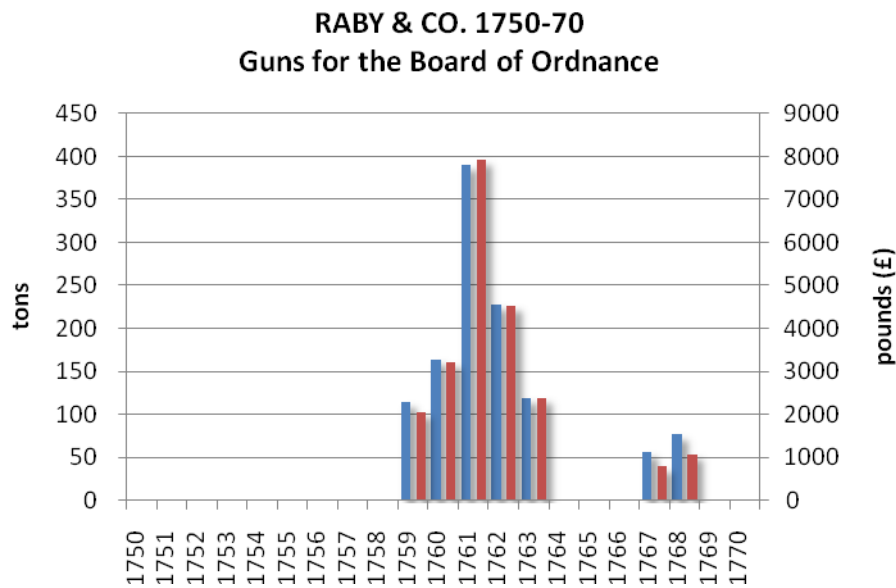


Fig. 20

(PRO WO51 195-240)

with Tidy (see below) (Straker 1931: 402). The Raby-Master partnership was bankrupt in November 1764 but had been granted a Certificate of Conformity by May 1766, by which time Raby alone, by then of Southwark, had presumably purchased the lease of Gravetye Furnace, West Hoathly, for he contracted for orders of 4-500 tons from the Board in 1766.<sup>61</sup> He cast guns at both places, for the Board and for the East India Company, boring only at the Warren, until his death in 1771. He was associated with a Mr Rogers. In 1770 he also ventured, somewhat unsuccessfully, into bronze casting. He was succeeded briefly by his son, Alexander (Hodgkinson 1978: 11-2). Edward Raby also ran Woodcock Hammer, Godstone, and, in 1767, Howbourn Forge, Buxted; two forges to cope, presumably, with the surplus from two furnaces. He was a member of the Drapers' Company.<sup>62</sup>

Trunnion Mark: MR. EF

## SAMUEL REMNANT

Until 1750, Samuel was agent for John Fuller, father and son, having also been agent for William Harrison. In the early 1750s he operated a furnace in Sussex, possibly Beckley.<sup>63</sup> This was almost certainly in connection with his role as co-executor, with John Legas, of William Harrison's estate. After Samuel's death in 1752, his son, Stephen, with whom he had been in partnership, supplied shot and shells to the East India Company (1757->1772) and, in large quantities, to the Board of Ordnance, from works at Woolwich. Samuel and Stephen Remnant were friends of William Bowen and Stephen was a beneficiary of Bowen's will.<sup>64</sup> Samuel Remnant, a member of the Glovers' Company, died a very wealth man.<sup>65</sup>

## GEORGE RUMENS

Occupied Gloucester Furnace (Lamberhurst) after Tapsell's bankruptcy, and before Wright & Prickett.<sup>66</sup> An Edward Rumens was founder at Heathfield in 1787, and a William Rummens was founder at Ashburnham in the 1810s.<sup>67</sup>

## ROBERT SAXBY

Owned Howbourn Forge (Buxted) from c.1767. He was jointly rated for the property with Edward Raby in 1767 and with a Mr Pengree in 1768, though from 1769 on his own, which may indicate that the forge was no longer working.<sup>68</sup>

## MR TIDY

Occupied Maresfield Forge in 1750. He probably had an ironmonger's shop in Lewes. The Fullers had sold iron to Masters & Tidy in the 1740s. Masters may have been the Alexander Master who later partnered Edward Raby, or more likely Master's father, also Alexander.

## THOMAS WILLIS

Occupied Glazier's Forge (Brightling) from 1768, following the bankruptcy of Richard Tapsell.<sup>69</sup> He purchased pig iron and forge tackle from the Fullers.<sup>70</sup>

## MR WHITE

Occupied Maresfield Forge from 1764-66, following the bankruptcy of William Clutton.

## WRIGHT & PRICKETT

Joseph Wright and Thomas Prickett, of Southwark, already occupied Pophole Hammer when they leased it and Northpark Furnace, Linchmere, for 21 years, in 1769.<sup>71</sup> Pophole Hammer was noted as working in 1767 during the campaign for the repositioning of the tollgate on the Guildford-Lip hook Turnpike, when the iron used was brought by water to Godalming and from thence by road.<sup>72</sup> Wright cast shot for the Board, from 1760, firstly at Wapping, and later, with Prickett, at Falcon Stairs, Southwark, and guns from 1771-5.<sup>73</sup> Later he also cast in bronze, though probably not at Northpark, and was involved in supplying ironwork for the Faversham Powder Mills.<sup>74</sup> Wright & Prickett had Gloucester Furnace (Lamberhurst) for a period from about 1769, and Prickett subsequently occupied Hoadly Farm, nearby.<sup>75</sup> In the early 1770s, Wright & Prickett occupied

one of Raby's furnaces, perhaps to utilise the bronze foundry there.<sup>76</sup> Thomas Prickett's brother, Richard, may have been he who occupied Maresfield forge later in that decade.<sup>77</sup>

## Notes and References

1. SkRO HAI/GD/2/3.
2. ESRO ASH 1815.
3. ESRO RAF uncatalogued ledger 1758-60
4. PRO PC2, 105-108.
5. *Sussex Weekly Advertiser* July 11th 1774.
6. See Brown 1989.
7. ESRO GLY 2770 & 2771.
8. ESRO RAF uncatalogued ledgers 1765-71 & 1758-60.
9. ESRO ELT Maresfield.
10. ESRO SAS RF/15/31.
11. ESRO ASH A.192.
12. ESRO ALF 9/9.
13. KAO U1776 E19A. PRO PROB 11 231 302.
14. KAO U1280 T2. *Sussex Weekly Advertiser*, March 9 1761 & September 10 1764.
15. PRO WO47 49 f.577; 72 f.235.
16. ESRO SAS RF/15/26.
17. Birmingham Central Library Boulton & Watt Muirhead II/5/10.
18. SLSL8287.
19. PRO PROB 11 794 f.104.
20. PRO PROB 11 973 f.469.
21. ESRO ELT Buxted.
22. ESRO RAF uncatalogued ledger 1758-60.
23. A copy of this rare volume is in the possession of the Bramshott & Liphook Preservation Society; I am most grateful to Mr Laurence Giles for making available to me copies of the relevant pages. WSRO Cowdray 1443 & 1444.
24. Birmingham City Library, Boulton & Watt Muirhead II. In the copy of this list in the Weale Mss., in the Science Museum Library, the furnace is written as "Burnham" (Hodgkinson 1979: 13-4).
25. Hants RO 10M50/195. WSRO Cowdray Mss 297.
26. PRO WO4746 f.6; 49 f.314.
27. PRO PC2 106-109.
28. PRO B4 18.
29. ESRO SAS RF/16/V/47.
30. PRO WO4763 f.112.
31. PRO PROB 11 231 f.302.
32. ESRO ELT Mayfield.

33. KAO U120 C67.
34. ESRO ELT Buxted.
35. ESRO RAF uncatalogued ledger 1758-60.
36. PRO PC2 105-109.
37. See Longman 1752; Kent 1754; Hitch 1760; Rivington 1765; Baldwin 1768; 1770.
38. ESRO SAS RF/15/31.
39. see Butler & Butler 1845: 10.
40. SyRO Abinger Land Tax.
41. SyRO PI/6/1-.
42. WSRO Cowdray 1445. PRO B4 21 1st October 1777.
43. Sotheby & Co. Sale Catalogue, 6th June 1966. I am grateful to Mr Leslie Weller for providing me with a note of this.
44. PRO PROB11 737 f.15
45. PRO WO47 46 f.285; WO47 51 f.405; ESRO ELT Rotherfield.
- 46 PRO WO47 46 f.197.
47. PRO WO47 47 f.652; ESRO SAS RF 16/V/19; ESRO uncatalogued ledger 1758-60.
48. KAO U120 P15.
49. Guildhall Library 3736/2.
50. *Victoria County History of Surrey* Vol. 3 (1911), p.92 citing a Loseley ms.
51. *Op. cit.* note 31 above. PRO PC2 105-106.
52. ESRO SAS RF 16/V/10 & 11.
53. SyRO P46/1/1.
54. GMR LM1064.
55. ESRO GLY 1234.
56. Guildhall Library Ms 6482.
57. ESRO PAR498/7/10. I am grateful to Mr Brian Harwood for informing me of this reference.
58. PRO B4 17 f.185.
59. ESRO AMS 5622/5.
60. BRL *Sussex Weekly Advertiser*, June 21st 1762, January 6th 1772 & April 26th 1773.
61. PRO B4 17 f.166; B6 3 f.137; WO47 68 f.196.
62. ex.inf. Mr G.E.Buttriss.
63. PRO WO47 35 f.310.
64. PRO PROB 11 973 f.469
65. PRO PROB 11 794 f.104; 973 f.469.
66. KAO U274 T54.
67. ESRO R.A.F uncatalogued ledger 1771-91; *Sussex Archaeological Collections* XXXVI (1893).
68. ESRO SAS/E 51a; ELT Buxted.
69. ESRO ELT Brightling.
70. ESRO AMS 5622/5.
71. WSRO Cowdray 1443, 1444.

72. GMR LM1064.

73. See Coote 1763: Rivington 1765; Baldwin 1768; 1770. SLSL Southwark Poor Rate book 1766-8.

74. PRO WO47 67 f.343.

75. KAO U274 T54. Phillips 1896: 214-5.

76. PRO WO47 81 f.99.

77. ESRO ELT Maresfield.

**Table 1. WEALDEN IRON WORKING SITES AND THEIR TENANTS 1750-70 (see Fig. 11)**

	FURNACE / Forge		1750	1751	1752	1753	1754	1755	1756	1757	1758	1759	1760	1761	1762	1763	1764	1765	1766	1767	1768	1769	1770
Map No.	Boring Mill																						
1	ASHBURNHAM	Crowley	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
2	Ashburnham	Crowley	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
3	DARWELL	Crowley?												Churchill?	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	Bourne?	- - - - -	>
4	ROBERTSBRIDGE	Jukes	- - - - -	- - - - -	- - - - ]	Churchill	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	Bourne	- - - - -	>
5	Robertsbridge	Jukes	- - - - -	- - - - -	- - - - ]	Churchill	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	Bourne	- - - - -	>
6	GLOUCESTER	Legas	- - - >	Tapsell	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	?Rumens	- - - - -	- - - - ]	?Wright	>
7	Horsmonden	Legas	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
8	BREDE	Harrisons	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
9	CONSTER	Legas	- - - >	Tapsell	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
10	HAMSELL	Harrison	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - >	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
11	WALDRON	Legas	- - - >	Tapsell	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
12	Bivelham	Legas	- - - >	Tapsell	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	Collins	- - - - -	- - - - -	>
13	Hawksden	Legas	- - - >	Tapsell	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	Baker	- - - - -	- - - - -	>
14	Glazier's	Legas	- - - >	Tapsell	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)		Willis	- - - - -	>
15	Westfield	Legas	- - - >	Tapsell	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)			- - - - -	>
16	HEATHFIELD	Fuller	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
17	Burwash	Fuller	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	>
18	WARREN										Raby	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	Raby	- - - - -	- - - - -	- - - - -	>
19	Woodcock										Raby	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	- - - - -	(bankrupt)	Raby	- - - - -	- - - - -	- - - - -	>

## APPENDIX II

## BOARD OF ORDNANCE and EAST INDIA COMPANY

## SUPPLIERS OF IRON (INCLUDING SHOT &amp; ORDNANCE) 1750-70

MESSRS BODDY & HULME	BD
WILLIAM BOWEN	BO
THE CARRON COMPANY (MESSRS ROEBUCK, GARBETT & CADELL)	CA
JOHN CHURCHILL & SON	CH
ALLEN, CORAM, VAUGHAN & CROFTS	CO
CROWLEY & CO. (JOHN, AMBROSE & THEODOSIA)	CR
ZEPHANIAH FADE & ROBERT BOLTON	EB
JONATHAN EADE & WILLIAM WILTON	EW
WILLIAM FORD	FO
SAMUEL FREEMAN	FR
FULLER FAMILY (JOHN, STEPHEN & ROSE)	FU
RICHARD GILPIN	GI
HARRISON & CO. (ANDREWS & JOHN HARRISON, ROBERT BAGSHAW, RICHARD TAPSELL & SAMUEL REMNANT)	HA
RICHARD HEDDON	HE
ROBERT MORGAN	MO
THOMAS PRYCE	PR
RABY & CO. (MASTERS & RABY, EDWARD RABY, ALEXANDER RABY)	RA
REMNANT FAMILY (SAMUEL, STEPHEN)	RE
ROGER ROGERSON, SAMUEL JOHNSON & CO.	RO
SMITH BROTHERS (JOSEPH & ROBERT NORRIS SMITH)	SM
SONE & CO. (PHILIP SONE & SON, SONE & STEPHENS)	SO
JOHN SUNDERLAND (SUNDERLAND & HOUSEMAN)	SU
ABEL WALTER	WA
SAMUEL WESTWOOD & CO.	WE
JOHN WILKINS & JOHN MAYBURY	WM
JOHN WILKINSON & CO.	WI
JOSEPH WRIGHT & CO.	WR

[sources: PRO WO51 170-246. BLI L/A/G/1/5/15-19.]



## APPENDIX III

## BOARD OF ORDNANCE Ordnance Purchases 1750-1770 (tons)

[PRO WO51 170-246]

	1750	1751	1752	1753	1754	1755	1756	1757	1758	1759	1760	1761	1762	1763	1764	1765	1766	1767	1768	1769	1770	TOTAL
Weald																						
Bowen	146	58	240	41	118	0	145	130	173	179	75	32	150	84	0	177	59	37	0	23	89	<b>1955</b>
Churchill	0	0	0	0	0	0	184	290	354	548	721	277	259	110	42	20	0	0	0	0	0	<b>2807</b>
Crowley	108	0	0	0	0	0	90	56	44	114	226	130	88	79	0	22	0	0	0	0	0	<b>959</b>
Eade & Wilton	0	0	0	0	0	0	31	0	0	139	39	325	91	96	0	30	56	109	101	0	0	<b>1016</b>
Fuller	80	273	144	76	107	210	263	309	252	209	288	221	166	100	0	0	0	0	0	0	0	<b>2698</b>
Harrison	24	82	8	0	0	0	330	676	676	938	1366	517	99	74	0	0	0	0	0	0	0	<b>4789</b>
Raby	0	0	0	0	0	0	0	0	0	114	164	391	228	119	0	0	0	56	76	0	0	<b>1148</b>
Weald	358	413	392	116	225	210	1044	1461	1499	2241	2879	1892	1081	663	42	249	115	202	178	23	89	15373
Other GB																						
Carron	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139	54	196	307	507	341	<b>1543</b>
Crofts	0	0	0	0	0	0	0	0	0	0	14	98	54	76	0	0	0	0	0	0	0	<b>242</b>
Morgan	0	0	0	0	0	0	0	69	236	337	122	46	54	121	1	0	0	0	0	0	0	<b>986</b>
Pryce	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	<b>3</b>
Sone	23	113	119	86	11	77	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<b>507</b>
Walter	0	0	0	0	0	0	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	<b>47</b>
Wilkinson	0	0	0	0	0	0	0	0	0	0	89	20	99	60	0	0	0	0	0	0	0	<b>268</b>
Other GB	23	113	119	86	11	77	78	69	283	339	226	164	207	256	1	139	54	196	307	507	341	3595
<b>TOTAL</b>	<b>381</b>	<b>526</b>	<b>511</b>	<b>203</b>	<b>236</b>	<b>287</b>	<b>1122</b>	<b>1530</b>	<b>1782</b>	<b>2580</b>	<b>3105</b>	<b>2056</b>	<b>1288</b>	<b>919</b>	<b>43</b>	<b>388</b>	<b>169</b>	<b>398</b>	<b>484</b>	<b>531</b>	<b>430</b>	<b>18968</b>

## APPENDIX IV

## EASTINDIA COMPANY: Iron Purchases 1750-70 (tons)

	Weald Ordnance	Total Ordnance	Total Iron
1750	751	937	1937
1751	0	149	15018
1752	0	2115	10015
1753	0	1182	10254
1754	0	3000	26302
1755	0	3613	11044
1756	0	2346	7243
1757	0	6633	12261
1758	152	13493	25922
1759	326	8529	17959
1760	459	13480	21395
1761	3391	10797	20265
1762	185	1617	12927
1763	0	441	8257
1764	631	3314	21945
1765	746	4196	22867
1766	199	2169	18703
1767	1974	6975	33523
1768	1232	39085	62205
1769	2904	2904	19989
1770	11847	23872	42095
	<b>4796</b>	<b>150849</b>	<b>422126</b>

(BLI L/A/G/1/5/15-19)

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Ashburnham Archives (ASH)

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Miscellaneous Deeds (SAS/E)

Glynde Manuscripts (GLY)

Battle Abbey Estate Archives (BAT)

Parish Records (PAR)

Raper & Fovargue Papers (SAS/RF & RAF/F)

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