

CHAPTER ONE

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.¹ 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.

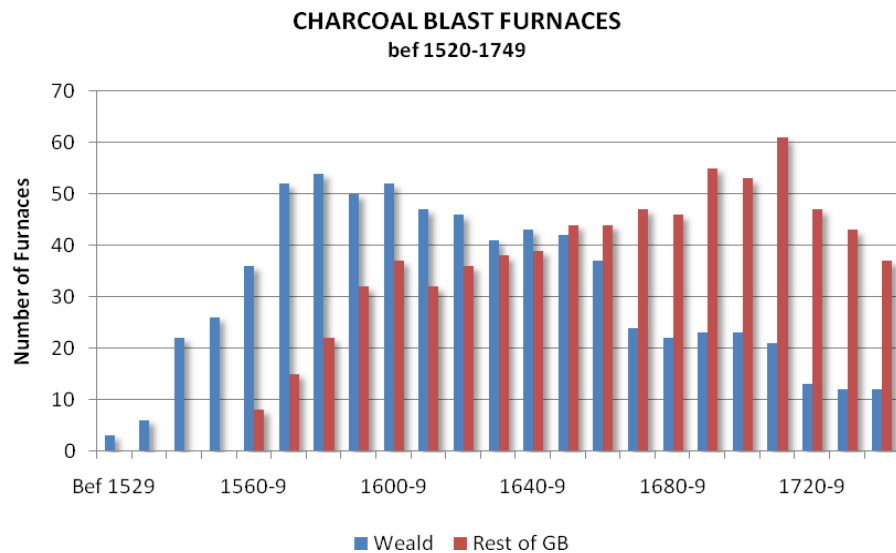


Fig. 1

(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

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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).²

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.³ 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.

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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

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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

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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.⁴ 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).⁵ 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

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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.⁶

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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.

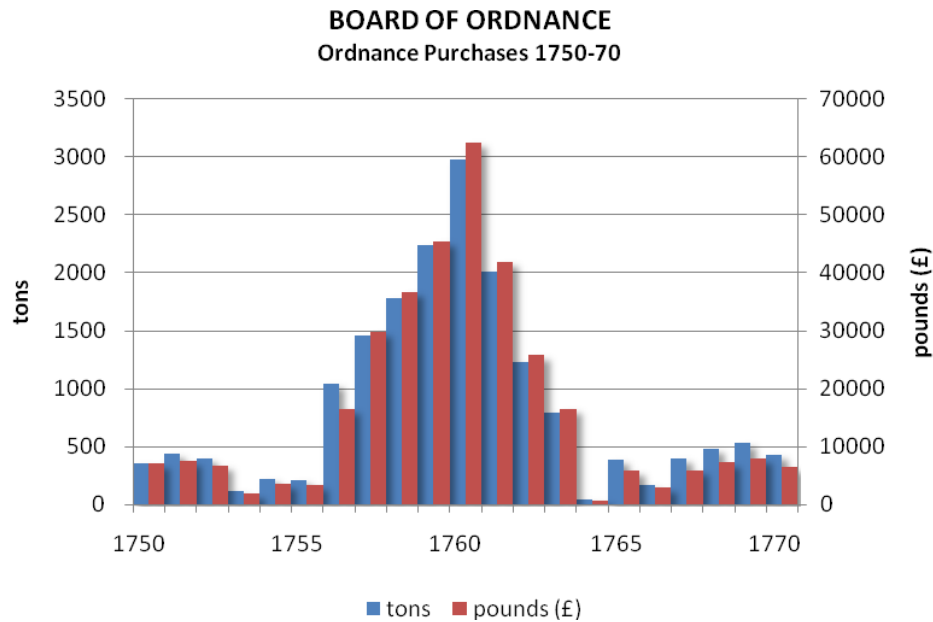


Fig. 2

(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.⁷ 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.⁸

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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

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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 1758/9.⁹ 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.

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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.¹⁰ Some of the material, including records of their furnace and forge in the later eighteenth century, has yet to be catalogued.

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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'.

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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.¹¹ 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.¹² 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.¹³

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 1765-6.¹⁴ 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 (Skenkelbery 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 3.¹⁵ 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.¹⁶ 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.¹⁷ 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.¹⁸

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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).

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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.