

## THE DEVELOPMENT OF THE IRON INDUSTRY IN SOUTH STAFFORDSHIRE IN THE 17TH CENTURY: HISTORY AND MYTH

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A gap has been left in studies of the charcoal iron industry in the west Midlands between the first use of the indirect process in the Elizabethan period and the mature industry of the late 17th and 18th centuries. Under Elizabeth the industry was in the hands of great magnates, such as the Pagets with ironworks on Cannock Chase and the Willoughbys of Wollaton (Notts.),<sup>1</sup> whose object was to turn unsaleable wood into saleable iron: usually in their accounts no cost was attributed to the fuel, except that of cutting, cording, and coaling it, so that their profits appeared to be enormous. In the later period, when the industry was run by professional ironmasters who bought standing wood by the cord from magnates' coppices, the industry could still be profitable but only if the prices negotiated for supplies were not excessive.<sup>2</sup>

Most of the detailed published descriptions of the industry concern ironworks for which accounts or other internal records survive. This applies both to the Pagets and Willoughbys in the Elizabethan period and to the Foleys and the Knights in the late 17th century and beyond.<sup>3</sup> For the period in between there are virtually no surviving accounts and for the most part it is not possible to do much more than set out the ownership and extent of operations of the various firms. Even this, however, reveals that the firms were much fewer in number and that they operated on a larger scale much earlier than has hitherto been suspected.<sup>4</sup> The outline presented here is the result of piecing together scraps of information from a large number of sources, chiefly those which result from the affairs of particular firms having been considered by the court of Chancery. Most of these Chancery proceedings are newly-identified; at least one has long been known but never before adequately discussed because its stained and faded condition deterred researchers.<sup>5</sup>

### I

The former South Staffordshire iron district comprised the Black Country and Cannock Chase coalfields. In the era before the Industrial Revolution when iron was made with charcoal, it stretched also beyond the edge of the coalfields into adjacent areas where there was more water (for power) and further charcoal supplies for forges to exploit. It was generally easier to bring pig iron to charcoal than vice versa. Except in earlier periods or where it could be carried by river or sea, iron ore was usually not carried far and most furnaces were accordingly within the coalfield. The district thus extended beyond the old boundaries of Staffordshire into adjacent parts of Worcestershire and Warwickshire, and included Halesowen, then a detached part of Shropshire.

It is first necessary on the one hand to distinguish the production of iron by ironmasters in blast furnaces and forges using water-power and on the other its manufacture into finished iron wares, such as nails, mainly by ironmongers who put out the iron they had bought from ironmasters to

- 1 For the Pagets see G. R. Morton, 'The reconstruction of an industry: the Paget ironworks, Cannock Chase 1561', *Transactions of the South Staffordshire Archaeological and Historical Society*, vi (1966), 21ff; *Victoria County History* [hereafter *V.C.H.*] of *Staffordshire*, ii. 110-11. For Willoughby see R. S. Smith, 'Sir Francis Willoughby's ironworks 1570-1610', *Renaissance and Modern Studies*, xi (1967), 90-140.
- 2 A cord is a stack of wood, generally consisting of sticks cut four foot long made into a stack eight foot long and four foot high: G. Hammersley, 'The charcoal iron industry and its fuel 1540-1750', *Economic History Review* [hereafter *Econ. H. R.*], 2nd ser. xxvi (1973), 603-5, citing N. D. G. Jones, *The forester's companion* (Oxford, 1955), 206.
- 3 For the Foleys see B. L. C. Johnson, 'The Foley partnerships: The iron industry at the end of the charcoal era', *Econ. H. R.*, 2nd ser. iv (1952), 322-40; *idem*, 'The iron industry of Cheshire and north Staffordshire 1688-1712', *Transactions of the North Staffordshire Field Club*, lxxxviii (1953-4), 32-55; M. B. Rowlands, *Masters and men in the West Midlands metalware trades before the industrial revolution* (Manchester, 1975), 54-8; R. G. Schafer, 'Genesis and structure of the Foley "Ironworks In Partnership" of 1692', *Business History*, xiii(1) (1971), 19-38. As to the Knight family see M. B. Rowlands, *Masters and Men*, 58-9; L. Ince, *The Knight family and the British iron industry* (1991).
- 4 The only attempt at a general survey of this period is by B. L. C. Johnson in *V.C.H. Staffs.* ii. 108-120. There are histories of several individual works: *ibid.* v. 20, 63, 161; J. Gould and G. R. Morton, 'Little Aston Forge 1574-1798', *Journal of the Iron and Steel Institute* [hereafter *J.I.S.I.*], ccvi (1967), 237ff (also repr. *Bulletin of Historical Metallurgy Group* i(1-6) (1963-66: 1982 repr.), 23-9); D. Dilworth, *The Tame mills of Staffordshire* (Chichester, 1976); but these provide no general synthesis.
- 5 Public Record Office, London [hereafter P.R.O.], C 3/403/93 and C 3/403/94. The latter, which contains much important detail, is very faded, dirty, torn, and not wholly legible even with the aid of ultra-violet light; it was cited in *V.C.H. Staffs.* ii. 113 n. 84 by B. L. C. Johnson, who described it as 'poorly preserved.' Similar information is however contained in P.R.O., C 2/Chas. 1/M76/52 and C 2/Chas. 1/M57/66 to which C 3/403/93 and C 3/403/94 are a counterclaim.



nailers and other workmen, working at home. The ironmasters' principal raw materials were wood and 'mine', that is iron ore, which in South Staffordshire was argillaceous ironstone from the coal measures. Elizabethan statutes prohibited the use of timber (defined as the trunks of trees that would square to one foot at the butt) for making iron, and timber was anyway generally too dear for such use. What ironmasters used was cordwood, the result of cropping coppices about every 14 years, as well as the tops and lops from timber trees that were unsuitable for other purposes. Until the mid 16th century iron had been made by direct reduction of the ore (without being melted) in 'bloomeries', known popularly as bloomsmithies or just smithies, the resultant 'bloom' (a spongy mass of iron with slag) being hammered out into a bar under water-powered hammers.<sup>6</sup> Such a 'smithy' was built at James Bridge near Walsall in 1543,<sup>7</sup> and about 1577 Sir Francis Willoughby built (or considered building) one on the Black Brook, possibly at Hints Forge, to use his wood from Middleton (Warws.).<sup>8</sup>

This process was gradually replaced, from the 1560s in the Midlands, by a two-stage (that is, an indirect) process using a blast furnace and a forge. A blast furnace was a substantial building with a tapering vertical shaft into the top of which the raw materials of iron ore and charcoal were charged. The charge gradually rose in temperature as it descended until in a narrow section at its base (the hearth) it was hot enough to produce molten iron and slag. Air was blown into the side of the hearth from bellows, perhaps ten foot long and operated by a waterwheel. Molten iron tapped from the furnace was cast in channels made in the casting house floor into sow (or pig) iron, so called because the channels were thought to resemble a sow suckling her little pigs. The product was then taken to a separate works known as a forge, where it was remelted using more charcoal in a 'finery' hearth, in order to oxidise the 4–5% of carbon dissolved in the pig iron and so produce a 'bloom'. The bloom was then drawn out into a bar using the forge hammer, weighing about a quarter of a ton, being reheated as necessary in a 'chafery' hearth. The fineries and the chafery in the forge were blown by bellows operated by water-power, and another waterwheel lifted the hammer. This technology is well understood, and there is a published description of it as used at Cannock in 1590, from an original report in the Coke MSS., now in the British Library.<sup>9</sup>

One of the first such ironworks in the Midlands was built by William, 1st Lord Paget, on Cannock Chase about 1560; a few years later he had two furnaces and two forges there, with a further furnace at Teddesley Hay (on the west side of the Chase) and forge at Abbots Bromley (some six miles to the north-east). Following his son's attainder in 1583, the works were run by Crown employees. In 1590 they were let to Fulke Greville of Beauchamps Court, Warwickshire, whose lease was confirmed by William, 5th Lord Paget, when the family estates were restored in 1597, but limiting Greville to one furnace and two forges.<sup>10</sup> Greville continued the works until the lease expired in 1610, and according to surviving accounts 120 tons of iron were made in six months in the spring and summer of 1608. Ironworks established by John Leveson of Wolverhampton at Cheslyn Hay in (or before) 1563 were contemporary with Lord Paget's.<sup>11</sup>

There was little scope for expanding the production of bar iron by the direct (bloomery) process save by the erection of more and more bloomeries. Only a single bloom could be produced at a time and its size was limited with the result that a bloomsmithy could not produce more than 20 or 30 tons of iron a year. In contrast, charcoal blast furnaces could produce 500 tons of pig iron or more per year, though probably somewhat less in the period with which this article is mainly concerned. A forge with a single finery could then convert 130 tons of pig iron into 100 tons of bar iron each year, so that the indirect process provided considerable economies of scale. The indirect process as described here continued in use until the late 18th century. Though some pig iron was produced using coke as fuel from the early 18th century, that was almost exclusively used in foundries for making cooking pots and other cast iron goods. Coke pig iron only began to be converted into bar iron on a significant scale after the erection of Horsehay and Lightmoor Furnaces in Shropshire in

6 H. R. Schubert, *History of the British iron and steel industry from c. 450 B.C. to A.D. 1775* (1957), 133–41.

7 Staffordshire Record Office [hereafter S.R.O.], D. 1810, f. 49.

8 R. S. Smith, 'Willoughby's ironworks', 91–7.

9 A. C. Jones and C. J. Harrison (eds.), 'The Cannock Chase ironworks report, 1590', *English Historical Review*, xciii (1978), 795–810; also see H. R. Schubert, *History*, 230–45, 272–91, and W. K. V. Gale, *The Black Country iron industry: a technical history* (1966), 10–22.

10 *V.C.H. Staffs.* v. 161.

11 British Library, Add. MS. 69895, f. 13v; for Leveson see *Calendar of Patent Rolls, Elizabeth, 1560–3*, 478.

the 1750s. In the subsequent period new means of making pig iron into bar iron were devised, of which ultimately the most successful was puddling, the invention of Henry Cort, who additionally found that blooms could be drawn out into bars using a rolling mill rather than a hammer. But these developments belong to a period long after that being considered here.<sup>12</sup>

## II

Two names widely associated with the iron industry in the early 17th century are those of Dud Dudley and Richard or 'Fiddler' Foley; each will be examined in turn. Dud Dudley's fame rests on a book that he wrote as an old man, *Metallum Martis or iron made with pitcoale, seacoale, etc.* (1665), in which he alleged that he had many years before made iron using pitcoal (i.e. mineral coal), when every one else used charcoal. As such, he has been seen as an originator of a process that was successfully used only later.<sup>13</sup> Dud Dudley's putative father Edward, Lord Dudley, had succeeded to the family estates around Dudley in 1587, a property which then included 'smithies' (bloomery forges).<sup>14</sup> His activities are not well-documented but passing references can be found to furnaces on his estates at Conigree Park (Dudley), Cradley, Himley, Gornalwood, and possibly Ettingshall; he also had a forge at Cradley on his own land. With his brother John Dudley, Lord Dudley rented other forges at Bromford Forge (probably in Erdington, Warws.) and Greens Forge (at Chasepool in Wombourne).<sup>15</sup> The latter was built about 1599 and adjoined the land of Greens Lodge, which Lord Dudley leased to Thomas Green, who together with Geoffrey Mason, also of Wombourne, built a furnace adjacent to Compton Park in Kinver in 1605.<sup>16</sup>

In 1618 Lord Dudley acquired a licence to use the 1613 patent of John Rovenson (or Robinson) for making iron with pitcoal and in February 1621/2 he obtained his own patent, as a result of experiments that had started before obtaining the 1618 licence. This chronology does not entirely accord with that of Dud Dudley's book as Dud was still a student at Oxford in the early 1620s, but perhaps he was involved with experiments when at home. His father placed him in charge of the Cradley Works, on Pensnett Chase, but they were destroyed by a flood on May Day 1623, perhaps the result of a dam bursting. The works were rebuilt, but Dud was 'afterwards outed of his works' and he moved to the furnace at Himley. In the absence of a forge there he had to sell pig iron to charcoal ironmasters, who 'did him much prejudice, not only detaining his stock, but disparaging his iron'. In other words, they said his pigs made bad iron and refused to pay for them. Their complaint may well have been valid as the presence of even a small amount of sulphur as an impurity in iron renders it 'redshort' (liable to shear at redheat), meaning that it could not be worked in a forge and was therefore useless.<sup>17</sup> In 1625 Lord Dudley let Himley Furnace to Richard Foley, who had taken a lease of Greens Forge the previous year.<sup>18</sup> Dudley next built (or more probably rebuilt) a furnace at 'Hasco' (Askew Bridge, Gornalwood), where he managed to make seven tons of pitcoal iron per week, a record for pitcoal iron, but presumably because he failed to trade profitably he let his furnace and mines to an agent of Richard Foley in 1627. Lord Dudley took possession in 1631 and a spate of

12 H. R. Schubert, *History*, *passim*; W. K. V. Gale, *The Black Country iron industry*, 10–12, 23–36; N. Cox, 'Imagination and innovation of an industrial pioneer: the first Abraham Darby', *Industrial Archaeology Review*, xii(2) (1990), 127–44; B. Trinder, *The industrial revolution in Shropshire* (Chichester, 1973), 33–45; R. A. Mott (ed. P. Singer), *Henry Cort: The great finer: creator of puddled iron* (1983), 27–39.

13 E.g. S. Smiles, *Industrial biography: iron-workers and tool-makers* (1876), 46–59.

14 Dudley Archives, D/DE/II, abstract of deed.

15 H. R. Schubert, *History*, 372–77; for Bromford see Dudley archives, D/DE/II, 1601; for Cradley see D. Dudley, *Metallum Martis* (1858 repr.), 61; there was however another Bromford Mill in Oldbury with a 'Smythie leasow' nearby: D. Dilworth, *Tame Mills*, 173–6; for Ettingshall see *V.C.H. Staffs.* ii. 113, based on occupations in *Sedgley Parish Register* (Staffordshire Parish Register Society, 1940–1), but note that those called 'hammerman' were probably nailers or other smiths: in Ambrose Crowley's workforce near Newcastle-upon-Tyne, much of it recruited in the Midlands, a hammerman was a journeyman nailer: M. W. Flinn, *Men of iron: The Crowleys in the early iron industry* (Edinburgh, 1962), 205).

16 For Greens Forge see P.R.O., E 112/244/11; Herefordshire Record Office [hereafter H.R.O.], E12/S, Wombourne, deed of 19 June 1602; *V.C.H. Staffs.* ii. 113. For Greens Lodge see Dudley Archives, D/DE/IV/3, leases, Wombourne. Greens Lodge may have preceded Lodge Farm, Chasepool, but its land included the site of the present Bank Farm, Greensforge. Compton Furnace occurs only in H.R.O., E12/VI/KY/1. I am most grateful to Mr A. T. Foley of Stoke Edith for permission to examine his family archives deposited in Herefordshire Record Office.

17 D. Dudley, *Metallum Martis* (1858 edn.), 61–3; H. R. Schubert, 'The truth about Dud Dudley', *J.I.S.I.*, clxvi (1950), 184; Dudley Archives, D/DE/V/1, agreement of 25 May 1619; P. W. King, 'Dud Dudley and pit-coal iron', *The Blackcountryman*, xxix(3) (1996), 23–4. In *Metallum Martis* Dud Dudley did not explain why he was 'outed of his works,' merely stating it was 'overlong to relate.'

18 For Himley Furnace see Dudley Archives, D/DE/IV/3, leases Himley, 1628 (*sic*); for Greens Forge see P.R.O., E 112/244/11.



litigation followed, in the course of which a certain William Coxe denied that Dud Dudley had ever made iron with pitcoal.<sup>19</sup>

'But this defendant believeth it to be true that the complainant [Dud Dudley] ... hath spent much labour and coste and travell in the invention to make the said iron but denieth that the said complainant hath bin at great or any charge in the building or setting up of any furnace or houses for the making or ordering in thereof to the knowledge of this defendant or that he made the said iron with seacoles or pittcoles as ... alleged but believeth that [he] after great trouble and charge therein brought the said worke to reasonable good perfection ...'

Nineteenth-century writers believed Dud Dudley,<sup>20</sup> but doubt has since been thrown on his claims.<sup>21</sup> Like that of Thomas Procter, an earlier patentee, at Shipley near Bradford (Yorks.),<sup>22</sup> Dud's iron was probably so redshort that it hardly deserved the name of iron.

### III

Richard Foley's traditional fame, on the other hand, results from a folk-tale, the earliest version of which to name him (as Rhys Jenkins and W. K. V. Gale pointed out)<sup>23</sup> was that published by William Playfair in 1809, some generations after the alleged events but based possibly on a family source:<sup>24</sup>

'Richard Foley for some time monopolised the slit iron business, and brought the invention from Holland. The tradition respecting him is curious and not improbable, as all knew that small nail rods came from Holland, and they cost more than bar iron. One day Richard Foley, a nailor, ... [finding his] cow ... seized for the rent ... swore that he should never be so told again, and away he went, and was not seen again for three years, when he returned from Holland with the invention of the slitting mill. He had worked his passage out there, and maintained himself by begging, and playing the flute. In this manner he went at intervals, in the habit of a mendicant, and with the counterfeited appearance of an idiot, to the slitting mill, where no strangers were allowed to enter ... After two years, ... returning at intervals, always longer and longer, he was let in, and saw the nature of the machine, which was indeed all he needed to see, in order to get it made. When he returned to England, he soon found monied people to support him ... Before he died he built and endowed a hospital, still maintained, on a great scale for an individual. The tradition goes farther, and says, when the mill was first made it soon broke into pieces, when Foley was conscious he had forgot something, and went back to Holland, playing on his flute. As he had been long absent at intervals formerly he got admittance as usual; but the thing he had forgot was the small stream of water that runs constantly on the slitters to keep them cool. The instant he saw this his countenance changed, and if he had not got off very speedily would have been taken; for the Dutch had heard that their secret had made its way over to England, and they suspected the counterfeit idiot, whose face very naturally betrayed him at that moment, when he saw the only thing he really wanted to know.'

The tale exists in several different versions in 19th century sources, the best known being that of the poet Samuel Coleridge, as repeated by Samuel Smiles, which makes him a fiddler rather than a flautist and takes him to Sweden (but other versions say Russia or Germany). Some versions name his financial backer as 'Mr Knight',<sup>25</sup> and most agree that Foley's mill was Hyde Mill at Kinver.

Similar stories are told of the introduction of wire-making to Wortley (Yorks.) by John Cockshutt and of brass-making to the Bristol area by John Champion,<sup>26</sup> but those stories do not stand up to serious criticism: wiremaking began at Wortley long before Cockshutt's arrival.<sup>27</sup> If anything, Playfair's account of Foley the flautist is the most credible in that the slitting mill was indeed

19 H. R. Schubert, 'The truth'; P.R.O., C 2/Chas. I/D49/33.

20 D. Mushet, *Papers on iron and steel* (1840), 40-3; J. Percy, *Metallurgy: Iron and steel* (1864), 883-5; S. Smiles, *Industrial Biography*, 46-59.

21 A. A. Rollason, 'The seamy side of Dud Dudley and his father' (reprinted from *The Dudley Herald*, 1921); R. A. Mott, 'Dud Dudley and the early coal-iron industry', *Transactions of the Newcomen Society*, xv (1934-5), 17-37; H. R. Schubert, 'The truth'; G. R. Morton and M. D. G. Wanklyn, 'Dud Dudley: a new appraisal', *Journal of West Midlands Studies*, i (1967), 48-65.

22 C. Collinson, 'Enterprise and experiment in the Elizabethan iron industry: the career of Thomas Procter', *Yorkshire Archaeological Journal*, lxxviii (1996), 191-208.

23 R. Jenkins, 'Links in the history of technology: iii the slitting mill', *The Engineer*, cxxv (1918), 445 (repr. *The collected papers of Rhys Jenkins* (1936), 9-23); W. K. V. Gale, 'Richard Foley and the iron slitting mill', *The Blackcountryman*, xxi(3) (1988), 10.

24 W. Playfair, *British family antiquities* (1809), i, 218n.

25 S. T. Coleridge, 'Additional Table Talk', in *The Tabletalk and Omniana of S. T. Coleridge ...* (1888), 332-3 (whence *Dictionary of National Biography*, s.v. 'Thomas Foley 1617-1677' and S. Smiles, *Self help* (1958 edn.), 212-14); for a different (longer) version see S. Griffiths, *Griffiths' Guide to the iron trade* (1873), 138-43.

26 For Cockshutt see C. R. Andrews, *The story of Wortley ironworks* (Nottingham, 1956), 66-7, quoting (sceptically) Rev. J. F. Prince, *Silkstone: the history and topography of the parish of Silkstone* (Penistone, Yorks., 1922), 187-8; for Champion see Rev. H. T. Ellacombe, *History of the parish of Bitton* (Exeter, 1881), 229.

27 Nottinghamshire Record Office, DD.SR.1/17/83; R. A. Mott, 'The early history of Wortley Forges', *Bulletin of the Historical Metallurgy Group*, v (1971), 63 (where the lease mentioned of 1684/5 actually relates to a corn mill).

probably invented in Belgium or Westphalia,<sup>28</sup> whence rod iron would have been imported by way of Holland.<sup>29</sup> The additional material in later versions of the Foley legend is largely the result of anachronism. Large quantities of iron (though bar iron rather than rod iron) were indeed imported from Sweden from the mid 17th century and from Russia from c.1725, the imports in the 18th century exceeding British production, but in the early 17th century Russian industry was technologically backward, being based entirely on bloomeries until the 1630s,<sup>30</sup> and although the slitting mill had reached Sweden in the early 1590s,<sup>31</sup> that is unlikely to have affected British nail-makers, since hardly any iron was imported direct from Sweden until the 1630s. Sweden and Russia, being the largest exporters of iron,<sup>32</sup> were the perceived competitors of the British iron industry in the period before the story was written down, by which date Holland and Germany had become very minor trading partners in iron, Holland's importance mainly being as a source of 'bushel iron', that is scrap.<sup>33</sup> The appearance of 'Mr Knight' probably resulted from the control that successive members of that family were reputed to have in the late 18th century over the price of iron as the largest firm participating in the Stourbridge ironmasters' quarterly meetings.<sup>34</sup> However, the first of that family to reach prominence was Richard Knight, who bought Bringewood Furnace and Forge (Herefs.) on the bankruptcy of Job Walker in 1695,<sup>35</sup> long after Richard Foley's supposed adventures.

The mention of a Mr Brindley in some versions of the legend is probably not an anachronism, for successive members of that family owned Hyde Mill from 1647 until the bankruptcy of John Brindley in 1730.<sup>36</sup> Indeed, the earliest version of the story, published in 1801 by Stebbing Shaw, from Dr. Richard Wilkes' manuscript history of Staffordshire written in the early 1750s, concerned a Brindley rather than a Foley.<sup>37</sup>

'About a mile above [Kinver] is a place called the Hide ... Here was the first mill for rolling and slitting iron that was erected in England. One Brindley, whose posterity enjoyed it till about 20 years ago, went into Germany, there he acted the fool, and from thence brought back this excellent machine which has been so serviceable and has brought so much money into this country.'

This plain, unadorned version of the story is thoroughly credible, as it fits with provable historical fact. With the substitution of 'Brindley' for 'Foley' and of 'Germany' for 'Holland', Playfair's version becomes credible; and if Coleridge's version is altered so that Foley sponsored Brindley, instead of Knight sponsoring Foley, even its worst difficulties disappear, for it was Richard Foley who leased Hyde Mill in 1627 and employed his brother-in-law, George Brynley (or Brindley), to manage it for him until 1647. Nevertheless, according to the antiquary H. E. Palfrey, Paul Foley (died 1928) claimed to have evidence that his ancestor Richard Foley did visit Uppsala in Sweden. By 1647 when George's son, Richard Brindley, bought the Hyde, both mill and farm,<sup>38</sup> slitting had become a routine

28 H. R. Schubert, *History*, 304–5.

29 Cf. references to 'Lukes iron', from Luik, i.e. Liège in *Port and trade of early Elizabethan London*, ed. Brian Dietz (London Record Society, viii, 1972). This shows imports from Antwerp, but trade with the Rhine valley was subsequently diverted to Holland as a result of the Dutch blockade of Antwerp during their war of independence: C. R. Boxer, *The Dutch Seaborne Empire 1600–1800* (1990), 20–23.

30 I intend to deal with this at length in a book, *Iron in the North* (in preparation).

31 Carl Sahlin, *Valsverk inom den Svenska metallurgiska industrien ... [Rolling mills in Swedish metallurgical history ...]* (Stockholm, 1934), 345: I thank Mrs. M. Fornander for this reference.

32 K.-G. Hildebrand, 'Foreign markets for Swedish iron in the eighteenth century', *Scandinavian Economic History Review*, vi (1958), 3–52; S.-E. Åström, 'English navigation laws and the Baltic trade', *ibid.*, viii (1960), 3–18; *idem*, *From Cloth to iron: the Anglo-Baltic trade in the late seventeenth century* (Societas Scientiarum Fennica: Commentationes Humanarum Litterarum, xxxiii(1) and xxxvii(3), Helsinki 1963).

33 Gordon Jackson, *Hull in the 18th century* (Oxford, 1972), 35; *The Fuller Letters, 1728–1755: guns, slaves and finance*, ed. D. Crossley and R. Saville (Sussex Record Society lxxvii, 1991), no. 182; Bradford Archives, accounts of Kirkstall Forge, Sp.St. 5/5/3/4, 1709–10 and 1710–11.

34 Robert Morgan's letterbook (National Library of Wales [hereafter N.L.W.], G. E. and D. A. Owen MS. 162), 2 Nov. 1761 and 18 Jun. 1762; P.R.O., BT 6/112, f. 227 (dated 1786). For the Knight family generally see L. Ince, *Knight family*.

35 R. Page, 'Richard and Edward Knight: ironmasters of Bringewood and Wolverley', *Transactions of the Woolhope Naturalists Field Club*, xliii (1979), 12; N.L.W., Cilybebyll 416; cf. N.L.W., Powis Castle 17883; the exact date is shown by H.R.O., Foley ironworks accounts, E12/VI/DEf/4, ff. 2, 29 and E12/VI/DEf/5, f. 28, sub 'Bringewood' and 'Richard Knight'.

36 M. V. Cooksley, 'Hyde Mill', *West Midland Studies*, xiv (1981), 48.

37 Stebbing Shaw, *History and Antiquities of Staffordshire*, ii(1) (1801), 265. For a transcript of Wilkes' history see T. Fernihough, 'Original collection for the history of Staffordshire by Richard Wilkes M.D.' William Salt Library [hereafter W.S.L.], Salt MSS. 467–68; cf. M. W. Greenslade, *The Staffordshire Historians* (Staffordshire Historical Collections [hereafter S.H.C.], 4th ser., xi), 90–91.

38 M. V. Cooksley, 'Hyde Mill', 48; H. E. Palfrey, 'Foleys of Stourbridge', *Transactions of Worcestershire Archaeological Society*, n.s. xxi (1944), 3.

industrial process and any unusual profits that may have come from cost savings as a result of the introduction of the slitting process had probably disappeared, due to a realignment of prices within the trade, as will be discussed later.

Richard Foley's father (another Richard) had been a nailer, who had died in 1600 leaving a net estate of under £6 apart from his house, but Richard ('Fiddler') Foley was no poor nailer when he leased Hyde Mill in 1627, nor could he have just spent years abroad, for he had become an ironmaster with a number of ironworks by 1625. His works (see fig. 1) consisted of the group belonging earlier to the Parkes family (described in the next section) and of Lord Dudley's ironworks in the south-west part of the Black Country, including Himley Furnace and Greens Forge and Cradley Furnace and Forge, all built by Lord Dudley in the late 16th century and some of them previously managed by Dud Dudley. The origins of his (Trescott) Grange Furnace and Heath Forge (Wombourne) remain obscure, but it is possible they also belonged to Richard Parkes, since he was using wood cut (probably for charcoal) near that furnace at Perton in 1606.<sup>39</sup>

#### IV

Much of the west Midlands iron industry was by the 1620s already concentrated in relatively few hands, principally those of Foley's immediate predecessors and of Thomas Chetwynd, who had ironworks on Cannock Chase and elsewhere. A significant group of ironworks, assembled in the late 16th century, belonged to William Whorwood of Sandwell Hall and Thomas Parkes of Wednesbury, and is best known from a series of incidents in the autumn of 1596 when the owners were prosecuted for riotously expelling each other from half-shares of Perry Barr Furnace and Forge, Wednesbury Forge, and West Bromwich Forge.<sup>40</sup> The rupture presumably ended the partnership and certainly Whorwood's involvement in the industry, but Thomas Parkes evidently remained a successful ironmaster for the rest of his life, as did his son Richard. The Parkes family at first lived at Wednesbury, possibly at the Delves, but later their home was at Willingsworth on the east side of Sedgley parish, where Richard's son Thomas bought the manor for £2,500 from a hard-up Lord Dudley in 1617. Thomas Parkes's daughter Anne married William Ward and their grandson inherited the Dudley estates on succeeding as 6th Lord Ward. As a result, the Parkes's estates lost their separate identity and the family have been largely forgotten.<sup>41</sup>

In 1618 Thomas Parkes, as his father's executor, sold the family ironworks to Middleton, Nye and Company.<sup>42</sup> Except for those held jointly with William Whorwood up to 1596, it is not known when and how the Parkes family acquired their works. Richard Parkes, however, bought Stone Furnace and Chebsey Forge (probably at Moddershall and Norton Bridge respectively) in 1611,<sup>43</sup> and there was trouble over the way he was cutting wood at Lilleshall (Salop.) in 1618 and must have had an ironworks nearby. In 1585 Thomas Parkes had built a furnace at Deepmore (Saredon), on land leased from Walter Harcourt and he sold it to Walter Coleman in 1598; that lease also comprised other property, perhaps Stone Furnace and Chebsey Forge, of which Harcourt was also landlord.<sup>44</sup> These need not have been Thomas Parkes's first ironworks, and certainly by the 1590s his business was generating sufficient cash for him to begin investing considerably in land.<sup>45</sup>

The partnership of Middleton, Nye and Company consisted entirely of men from Sussex: John Middleton of Horsham, Thomas Nye of Slinford, Richard Middleton (John's son), Nicholas Jordan,

39 For Richard Foley (d. 1600) see Worcs. R.O., Worcester Consistory wills, 008.7 BA 3585, 1600 no.117; his gross personal estate was £38 11s., but debts totalled £33 13s. 6d. For Himley Furnace see Dudley Archives, D/DE/IV/3, leases, Himley, 1628 (*sic*); for Greens Forge and his works generally see P.R.O., SP 18/321/42; cf. Dud Dudley, *Metallum Martis* (1858 repr.), 61-63; for wood being cut at Perton see S.R.O., D.593/E/6/6.

40 *Staffordshire quarter sessions rolls*, iii, ed. S. A. H. Burne (*S.H.C.*, 1932), 194, 297ff. That Whorwood and Parkes were partners is confirmed by their jointly buying wood in Middleton Park (Warws.) in March 1596: Nottingham University Library, Middleton MSS., 5/165/45.

41 Dudley Archives, D/DE/I, Sedgley, Parkes purchase/2, deeds of 1617; E. A. Underhill, *The story of the ancient manor of Sedgley* (Tipton, 1942), 94-5.

42 P.R.O., C 3/403/93; C 3/403/94; C 2/Chas. I/M76/52.

43 P.R.O., C 2/Jas. I/A10/11; as to their identities see C. R. Blick (ed.), 'Early blast furnace notes', *Historical Metallurgy*, xxv (1991), 52-3; S.R.O., D. 615/E(M) 3/5 'The Hammers'. H. R. Schubert's date of 1574 (*History*, 388) is not supported by his source (W.S.L., D. 8/30).

44 For Lilleshall see S.R.O., D. 593/E/6/6; for Deepmore see Dudley Archives, D/DE/I, Sedgley, Parkes sale/2, deed of 1598.

45 *Final Concords*, ed. W. Boyd (*S.H.C.*, xiv-xvi [n.s. iii-iv]), *passim*, indexed under Parkes.

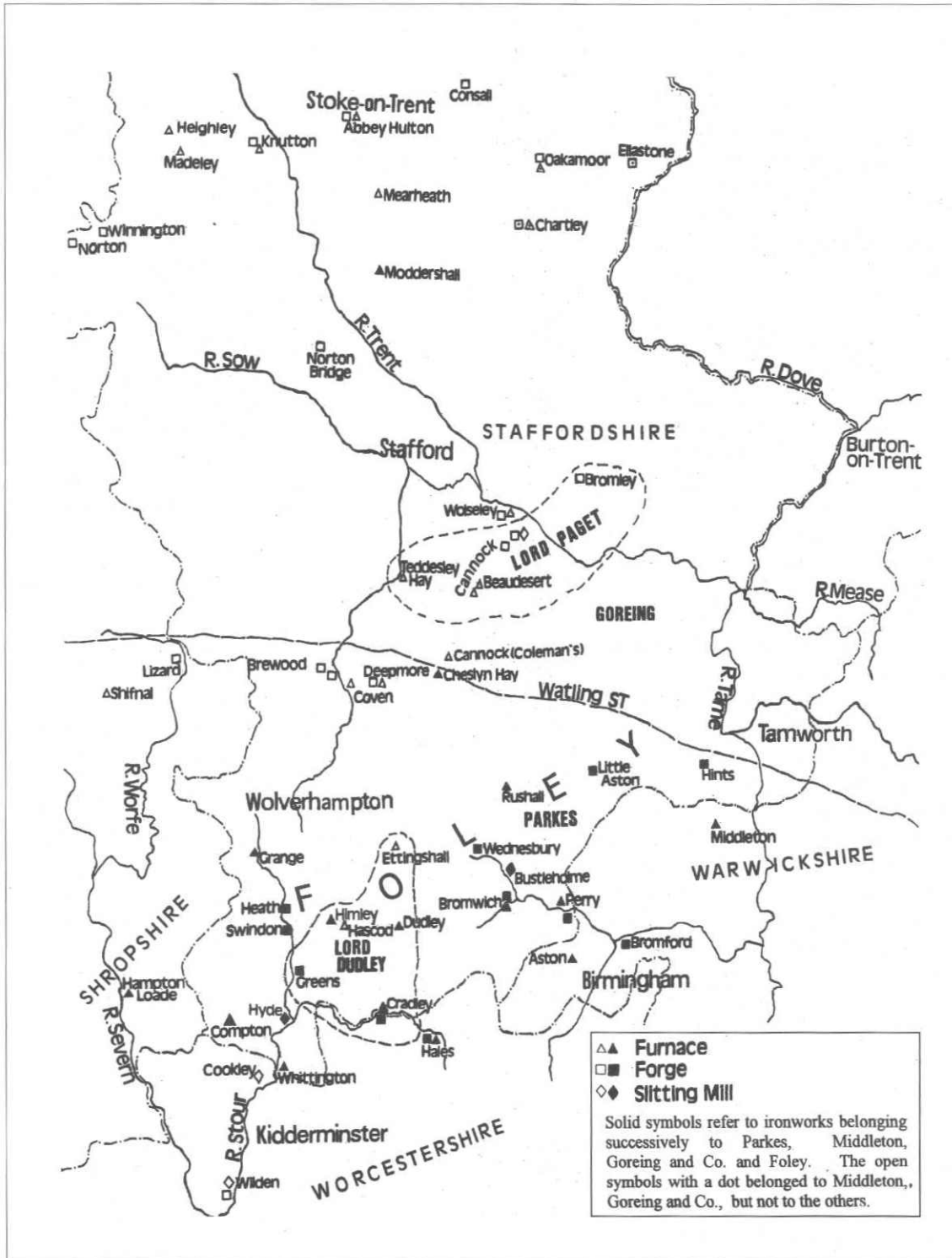


Fig. 1: Ironworks belonging successively to Richard Parkes, Middleton, Goreing and Co., Thomas Nye, and Richard Foley in the 1610s, 1620s, and 1630s



a barrister later of Chichester, and Henry Goreing, a scion of a noble Sussex family. John Middleton and Nicholas Jordan were also partners (with one Richard Gravett) in Shipley Forge and Shipley or West Grinstead Furnace in Sussex from which iron was sold to a Mr. Gott, an ironmonger in Thames Street, London.<sup>46</sup> This partnership lasted only from 1618 until June 1622. On its dissolution, most of the works south of Watling Street were assigned to Thomas Nye; those to the north of it were retained by the other partners under Henry Goreing's management. The southern group consisted of works bought from Parkes: Hints Forge, Birmingham's Aston Furnace, Perry Forge and Furnace, Bromwich Forge and Furnace, Little Aston Forge, 'Branford' Forge (probably Bromford, Warws.) and Rushall Furnace. The northern group comprised Norton Forge and Stone Furnace (lately belonging to Richard Parkes), Chartley Forge and Furnace (presumably leased from Lord Ferrers), and Ellastone Forge and Furnace with Oakamoor Furnace, for which wood had been bought from the Earl of Shrewsbury by a Mr Middleton and a Mr Goreing; Cheslyn Hay Furnace was left idle.<sup>47</sup>

The northern business was the subject of much litigation from which it appears that the partnership of Middleton, Nye and Company had begun in or before 1616 and that its works had initially just consisted of Chartley Furnace and Forge, with Henry Goreing as the managing partner. Accounts were usually passed at Easter and a dividend paid in cash until the Parkes ironworks were acquired in 1618, but much of the money for that purchase was borrowed on bond. At Easter 1622 the partners decided that the stock at Norton and Ellastone Forges should be worked out, with the result that 'the works of Stone Furnace and Oakamoor Furnace did determine [because] Norton Forge was furnished with sow iron from Stone Furnace and Ellastone Forge ... from Oakamoor Furnace'. This also resulted in a composition of £100 having to be paid to Sir Richard Fleetwood for one of these works. The next dividend consisted of 200 tons of iron (then worth £2,600), which may suggest there had been difficulty in selling iron. All these works seem to have been closed at that time, except Stone Furnace from which Henry Goreing bought 'certain sowes of iron of Thomas Crompton which were carried to Norton Forge', presumably to use up the last of the charcoal there. (Thomas Crompton may have been the owner of Consall Forge.) Oakamoor Furnace used ironstone from Caldon Low, 'far meaner and worse' than that from Mearheath (near Longton), and together with Ellastone it had been in the charge of John Middleton the younger, who had laid out £200 building that furnace.

In 1624 the other partners similarly directed Goreing to work out the stock at Chartley, but he could not do so at once because the Chartley lease had not expired and there were still unfulfilled contracts ('bargains') for ironstone from Mearheath and wood from Francis Kinnersley. The partnership finally came to an end at Michaelmas 1626 when Goreing agreed a new lease for the Chartley Works for his own benefit and had the remaining stock there valued by Mr Nye and others. The business had clearly been an unhappy one: Nicholas Jordan listed debts on bond of over £3,000 for which he was liable, apparently as guarantor. As late as 1640 Goreing was seeking relief from a bond dated 1627, that is after the partnership ended, in which he was a guarantor for John Middleton and Thomas Nye for the balance of a larger sum, probably the price of the stock acquired from Thomas Parkes in 1618. In all, at least ten Chancery actions were begun concerning these matters. One of them resulted in an arbitration in 1629, perhaps an ill-conducted one, during the course of which Nicholas Jordan died. John Middleton also seems to have died in debt, but Goreing prospered, probably by continuing to trade after 1627.<sup>48</sup>

Nothing is known for certain of the further involvement of Henry Goreing in the iron industry, but H. C. Chetwynd-Stapylton, possibly recording a family tradition, wrote that the Goreing (later Goring) family had 'got their estate from iron and coal'. In 1625 Henry Goreing purchased the manor of Kingstone near Uttoxeter, and in 1638 he and William Cotton of Crakemarsh bought Birchwood Park in Leigh. The latter purchase was initially made in the names of trustees, including

46 P.R.O., C 2/Chas. I/127/29; C 2/Chas. I/M76/52.

47 P.R.O., C 3/403/93; C 2/Chas. I/M76/52; C 2/Chas. I/M57/66; Notts. R.O., DD.4P 46/23.

48 This section is based mainly on the answer of Henry Goreing: P.R.O., C 2/Chas. I/M57/66. Other pleadings in proceedings between the partners include P.R.O., C 2/Chas. I/M76/52 (bill in same case); C 3/403/93; C 3/403/94 (counterclaim to it, but almost illegible); C 2/Chas. I/G13/19; C 2/Chas. I/13/27; C 2/Chas. I/127/29; C 2/Chas. I/131/46; C 2/Chas. I/P36/62. There was also litigation between Thomas Parkes as vendor (or bond creditor) and the partners: P.R.O., C 2/Chas. I/G42/10; C 2/Chas. I/P36/62; C 2/Chas. I/P51/18; C 2/Chas. I/P80/51. Some of the litigation was concerned with liability for money borrowed on bonds to finance the business, rather than the business itself. For Crompton at Consall somewhat later see P.R.O., E 112/513/71.



Goreing's son-in-law Thomas Orrell, whose employment as clerk of Chartley Forge at a tender age had raised objections from the other partners. A 1631 lease of the 700-acre Birchwood Park contains a detailed reservation of timber and other wood and of the right to cut it in terms suggesting that the park was the ancient kind consisting of woodland and pasture, in which case it would have been a significant source of charcoal. Cotton and Goreing were together exploiting the timber in the park when Cotton died in 1641, but his inventory does not clearly show who was using the charcoal that would have been made from smaller wood, unless that was what 'debts due by Heely and Sherratt' arose from. Henry Goreing died in 1649 and his son John bought Rowland Cotton's share of the park in 1654. A Mr. Jenkinson, probably Thomas Jenkinson, who owned Oakamoor Forge from 1647, was occupying Chartley Forge by 1657 and was succeeded there by William Chetwynd in 1660. The estate passed down the family until 1716, when John's great-granddaughter Barbara Goring and her husband, Walter Chetwynd of Grendon (Warws.), sold it for £12,500 to his cousin, John Chetwynd of Maer, later 2nd Viscount Chetwynd.<sup>49</sup>

Only one Chancery action has been discovered relating to Thomas Nye's business after 1622 and this was concerned primarily with an annuity payable to his brother Allen Nye out of his lands in Slinford and Billingshurst in Sussex. It was claimed that the annuity had been satisfied by the assignment about 1620 of 'Branford' [Bromford], 'Hince' [Hints], Perry, and Little Aston Forges, but Allen Nye said it had only been agreed in c.1628 that he should share part of 'Branford' Forge and Aston Furnace in which 'one Mr Ffolie' had the other part under a lease for 14 years, perhaps running from 1624. Thomas Nye died in 1631 before accounts between him and Allen Nye were settled and Allen took out letters of administration.<sup>50</sup> Perhaps it was somehow due to the existence of this partnership that Bromford Forge and presumably Aston Furnace did not continue in the hands of the Foleys after the 1630s, while Perry and Little Aston Forges did. Aston Furnace and Bromford and Hints Forges all belonged to John Jennens at his death in 1654, and it could be that Richard Foley and John Jennens ran the four forges and their associated furnaces in partnership after Thomas Nye's death and then partitioned the works between them. Bromford Forge and presumably Aston Furnace passed to John Jennens in 1638, while Perry Forge and Furnace had been abandoned by 1650. The remaining ironworks in the southern group, [West] Bromwich Furnace and Forge, was apparently leased by Richard Foley alone in 1624.<sup>51</sup> This group of ironworks, with minor changes, passed largely intact to his son Thomas Foley and then in the late 1660s to his grandson Philip.

Thomas Foley had a furnace at Hampton Load in Quatt (Salop.) from about 1642 to 1662. In 1654 he took over Hubbals Mill, south-west of Bridgnorth (Salop.), from his cousin, Richard Brindley of Hyde Mill, and rented Redditch Forges for a few years probably in the early 1660s.<sup>52</sup> He closed Cradley Furnace in 1662, but retained the forge, just as he or his father had closed the forge but kept the furnace at Hales Furnace.<sup>53</sup> At some stage the interests of Richard and Thomas Foley may for a time have extended further north, as Richard Foley occupied Madeley Furnace (in North Staffs.) before Walter Chetwynd leased it in 1649, and in 1662 Thomas Foley had some interest in Moddershall Furnace, perhaps as landlord, suggesting that a Foley had once occupied it.<sup>54</sup> Nevertheless in essence, the business he handed over to his youngest son Philip in the late 1660s

49 H. C. Chetwynd-Stapylton, *The Chetwynds of Ingestre* (London, 1892), 164; S.R.O., D. 240/B/1/77/1-10; D. 240/A/1/7; D. 240/B/1/87; *Abstract of probate acts of prerogative court of Canterbury v. 1650-1* (1909), 161; Lichfield R.O., B/C/11, inventory of William Cotton of Uttoxeter (1642); for Thomas Orrell see P.R.O., C 2/Chas. I/M76/52; C 2/Chas. I/M57/66; C 3/403/93; for Thomas Jenkinson see Wilts. R.O., 1883/205, 'Chartley demesnes'; H.R.O., E12/IV/AD/344.

50 P.R.O., C 2/Chas. I/G49/51. The alleged and admitted transactions were described in January 1641 as 'about 20 years since' and 'about 12 years since'.

51 The date 1624 is suggested since it was 14 years before 1638, when Bromford Forge (and probably also Aston Furnace) were let to John Jennens: Birmingham Archives, Holte 88 (*cf. ibid.* 18-23 and 88-97). For Richard Foley's works see P.R.O., SP 18/321/42; for Perry and Bromwich see D. Dilworth, *Tame Mills*, 24, 42-43; for Hints see the will of John Jennens printed in W. Harrison and C. Willis, *The Great Jennens case* (Sheffield, 1879), 141-59 (where Hints is mistranscribed as 'Hivles'). There is no direct evidence of a partnership between Foley and Jennens nor of Jennens having ironworks before 1638: the existence of this partnership is mere inference.

52 For Hampton Load see H.R.O., E12/VI/KAc/64, 92, and 161-2; for Hubbals Mill see *ibid.*/66-80; for Redditch see *ibid.*/109. The location of Hubbals Mill is indicated by 'particulars of the estate formerly belonging to Sir Thomas Whitmore ... 1735', (Shrops. R.O., 5586/5/3/30) and 'plan of Harpsford and Hubboles Myll c. 1632', (*ibid.*, 5586/3/13a-b).

53 For Cradley see Dudley Archives, D/DE/IV/3, leases, Rowley, 1662; for Hales Forge 'now turned into corn mills' containing 'one old hammer beam too short for any work' in 1710 see P.R.O., C 54/5428/9. The closure was evidently before 1667: H.R.O., E12/VI/KBf/15.

54 For Madeley see P.R.O., C 6/116/45 and C 6/135/78; for Moddershall see H.R.O., E12/VI/KAc/45 (and *cf. ibid.*/20).

differed little from that which he (and his general manager Henry Glover) had run in the late 1640s.<sup>55</sup> By that time Thomas Foley's business had expanded to include ironworks in and around the Forest of Dean (Gloucs.), which passed to his second son Paul, and which became the later core of the family iron business.<sup>56</sup> As R. G. Schafer and others have shown, Philip Foley's works were dispersed in the 1670s, and the partial re-amalgamation of works in the Forest with some in the Stour valley in 1692 did not persist beyond 1705.<sup>57</sup>

## V

The greatest rivals of the Parkes and then of the Foley families as ironmasters were the Chetwynd and Coleman families (see fig. 2). It has long been known that the Chetwynds of Rugeley rented Lord Paget's works on Cannock Chase for much of the 17th century,<sup>58</sup> but the full extent of their activities and their importance has only become apparent from newly-identified proceedings in Chancery concerning the break-up of their partnership.<sup>59</sup> The business began about 1598 with the building of a furnace on Walter Coleman's own land at Cannock,<sup>60</sup> distinct from Lord Paget's works. From 1598 until at least 1603 (and probably to 1606) Coleman had a forge at Deepmore (Saredon), bought from Thomas Parkes,<sup>61</sup> and by 1603 he rented (Abbots) Bromley Forge in partnership with Richard Almond. In 1604 this Bromley Forge was let to them and Thomas Chetwynd, Coleman's son-in-law, in 1604 (apparently for a year) with a furnace in Beaudesert Park (Longdon) and then rented alone by Almond for four years from c.1605.<sup>62</sup> When Chetwynd joined the firm in 1604, Coleman had a forge at Wolseley, on the northern edge of Cannock Chase, where the sites of a furnace and forge have recently been identified, but Chetwynd regarded it as a 'thing ... of small profit' and it soon closed.<sup>63</sup> In 1610, following the expiry of the lease granted to Fulke Greville by the Crown, the Cannock Chase works and Bromley Forge were let by Lord Paget to Coleman, Almond, and Chetwynd.<sup>64</sup> Elsewhere, perhaps c. 1614, they began to repair ironworks at Hartshorne and (Castle) Donnington on the border of Leicestershire and Derbyshire, but their owner, the Earl of Huntingdon, changed his mind, and deciding not to let the works, he refunded their expenditure.<sup>65</sup> They also bought wood at 'Hilton' (apparently Abbey Hulton near Stoke-on-Trent) and built a furnace and forge there in 1608, but Richard Almond 'disliked' this and withdrew from the firm in 1611, Chetwynd borrowing the money to pay out his share.<sup>66</sup> It is not clear when they acquired Brewood Upper (or Park) Forge, but in 1620 they decided to build a second forge there.<sup>67</sup>

Walter Coleman's interests were not confined to Staffordshire: he had ironworks in Ireland and also in Cumberland, where a wood collier called Richard Goodman worked for him before being sent to Abbey Hulton. According to Chetwynd, Coleman 'received sums [of money] from [Chetwynd] and went into Cumberland and Ireland, and became a dealer in ironworks and there as a partner with some in those countries had received great losses'. He left for Ireland in June 1612, partly to avoid recusancy fines and was away, probably intermittently for several years.<sup>68</sup> In 1622 Walter Coleman assigned his interest to his son John, on condition he paid portions to his brother and sister. John asked Thomas Chetwynd, who was managing the business, to come to account, but Chetwynd, having been left to run it alone and to pledge his own credit to do so as well as having

55 *A selection from the records of Philip Foley's Stour valley iron works 1668-74*, ed. R. G. Schafer (Worcestershire Historical Society, n.s. ix and xiii, 1978 and 1990).

56 R. G. Schafer, 'Genesis and structure of the Foley "Ironworks In Partnership" of 1692', *Business History* xiii(1) (1971), 19-23; B. L. C. Johnson, 'The Foley partnerships.'

57 R. G. Schafer, 'Structure and Genesis', 29-38; H.R.O., E12/VI/DEc/1/21, *passim*.

58 *V.C.H. Staffs.* ii, 111-12; v, 20, 161; S.R.O., D. 603/E/5/2; D.(W.) 1734/3/3/210 and 243-5.

59 P.R.O., C 2/Chas. I/C5/67; C 2/Chas. I/C20/17; C 2/Chas. I/C88/59; C 2/Chas. I/C118/11; C 21/C45/18.

60 P.R.O., C 21/C45/18, evidence of Edward Hill.

61 *Ibid.*, evidence of Richard Whistons; Dudley archives, D/DE/I, Sedgley, Parkes sales/2.

62 P.R.O., C 21/C45/18, Richard Whistons; S.R.O., D. 603/E/5/2; cf. inventory, *ibid.* D.(W.) 1734/3/3/243.

63 P.R.O., C 2/Chas. I/C5/67, answer; C 21/C45/18, Francis Chamberlain. The sites at SK 02331922 and SK 023197 have been identified by C. M. Welch: pers. comm. and his 'Cannock Chase: an industrial woodland', *West Midlands Archaeology*, xxxviii (1995), 7-8.

64 The 1610 lease does not survive, but the tools and furniture of a furnace were delivered to Richard Almond on 6 May 1610: S.R.O., D.(W.) 1734/3/3/242; cf. 1614 articles to Chetwynd only: D.(W.) 1734/3/3/245.

65 P.R.O., C 2/Chas. I/C5/67, answer.

66 *Ibid.*; P.R.O., C 21/C45/18, depositions of Richard Goodman and Richard Davies to interrogatory 5.

67 *Ibid.* C 2/Chas. I/C5/67, answer; *V.C.H. Staffs.* v, 20.

68 P.R.O., C 2/Chas. I/C5/67, answer; C 2/Chas. I/C20/17, answer; C 21/C45/18, Richard Goodman and William Brodhurst.

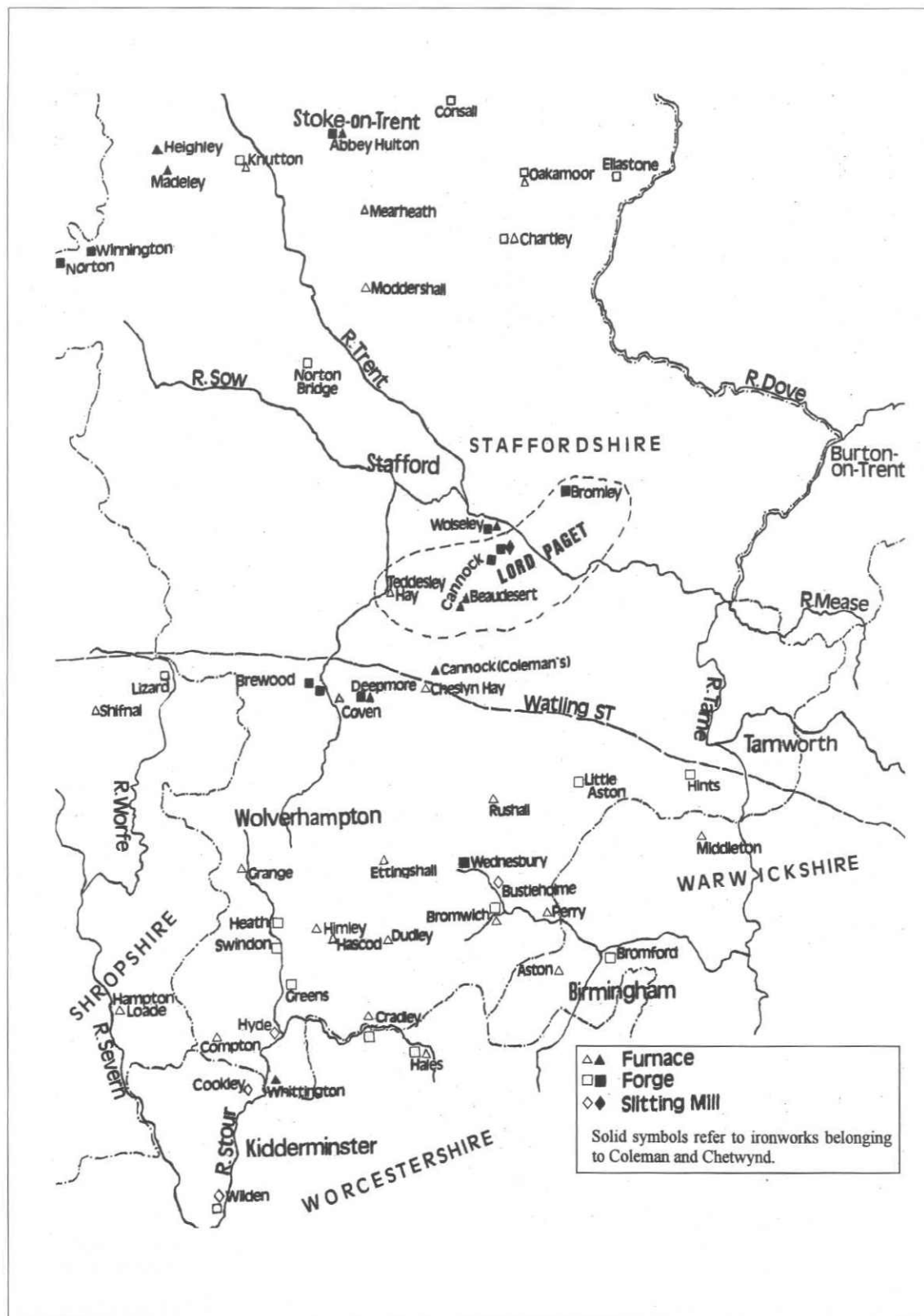


Fig. 2: Ironworks belonging to Walter Coleman and members of the Chetwynd family at various dates in the 17th century



assumed sole liability from 1614 under leases of Lord Paget's works, did not see why John Coleman should enjoy the fruit of his labours, and so in 1625 John had to exhibit a bill in Chancery to force the issue.<sup>69</sup> By mediation of Sir Thomas Wolseley, John's father-in-law, a settlement was reached, by which John received Brewood Forges (to use with his own furnace at Cannock) and £400 to be paid by instalments, later commuted to a lump sum of £250, although he later tried to re-open this settlement. Presumably his brother's and sister's £500 portions were also paid.<sup>70</sup>

In 1620 Walter Chetwynd, John Coleman and John's brother Walter with their respective fathers leased Halesowen Furnace and Forge. Thomas Chetwynd later claimed his name was forged but, finding his son was bound, decided to make the best he could of a bad bargain. The Coleman family contributed nothing to stocking the works and were treated as outsiders, being made to pay the market price for iron supplied to them. Walter Coleman the younger sought to use the Court of Chancery to extract money from the Chetwynds for the profit of these works, but the claim was dismissed because, according to Thomas Chetwynd, the lease of Halesowen had been produced in evidence in the previous action and any claim over Halesowen was included in that settlement.<sup>71</sup> The iron supplied to the Colemans was probably pig iron required for Whittington Forge (in Kinver), and John Coleman's failure to pay for it resulted in him being outlawed. This Whittington Forge was built about 1619 by George Taylor and subsequently it was also the scene of failure by the younger Walter Coleman, John Coleman, and Thomas Doughtye successively. It did not become profitable until Richard Foley took it over in 1627. John Coleman employed Thomas Bamford as his clerk at Brewood Forges and when Coleman failed to provide any working capital for them, Bamford had to find the money himself. Bamford then agreed to rent the two forges and Cannock Furnace, Coleman providing 1000 cords at 3s. 2d. each; later they agreed a 12-year lease, but when John Coleman and his father kept Bamford out of the furnace and Lower Forge for a year, he moved to the Upper Forge, which he ran for his own benefit. When the Colemans again had to seek help with their debts from Sir Thomas Wolseley, a lease was arranged to Bamford of their works for 13 years in April 1628. We know all this because John Coleman spent the latter part of the 1630s pursuing Bamford through the courts for his profits, until in 1640 Bamford was forced to seek an injunction to restrain further proceedings.<sup>72</sup> Not long after that he sold Brewood Forges and Coven Furnace, which he had built nearby, to Thomas Foley.<sup>73</sup> The latter's father Richard Foley was also a victim of persecution by the Colemans, for Walter Coleman was a principal witness, and perhaps instigator, of Richard's prosecution in Star Chamber, of which more below.<sup>74</sup>

In 1629 Thomas Chetwynd stated, in connection with the Halesowen lease of 1620, that 'if the price of iron had not since that time been raised he had been a great loser',<sup>75</sup> and his will of 1633 is that of a man of uncertain means: he gave legacies of £800 in all, making careful provision for their abatement if not all could be paid. Thomas was followed as an ironmaster by his son Walter, who had Cannock Furnace and Forge and Bromley Forge, and also Heighley Furnace and Norton and Winnington Forges (in Muclestone) when he suffered sequestration in 1646.<sup>76</sup> Heighley, however, was probably replaced by Madeley Furnace a few years later when John Offley objected to that furnace not being used.<sup>77</sup> Walter Chetwynd was in turn succeeded in 1653 by his nephew, William Chetwynd, who continued the business, not necessarily always comprising precisely the same works, until about the 1680s. They afterwards passed to the Cheshire Ironmasters partnership or to the Foley Staffordshire Partnership, as described by B. G. Awty and B. L. C. Johnson: Thomas Hall leased Madeley Furnace in 1683, and John Wheeler, Philip Foley's associate, leased Chartley Forge and Lord Paget's works in 1692, by then no longer including a furnace. At Chartley their immediate predecessors were Richard Chetwynd and Humfrey Moore, who had probably used it since the early 1680s. Those partnerships were in turn amalgamated in 1708 and remained essentially intact as a

69 *Ibid.* C 2/Chas. I/C5/67, bill and answer; cf. S.R.O., D.(W.) 1734/3/3/245 210.

70 P.R.O., C 2/Chas. I/C5/67, bill; C 2/Chas. I/C20/17.

71 *Ibid.* C 78/400/21.

72 *Ibid.* C 2/Chas. I/B96/36; C 78/480/19.

73 D. Horowitz, *Brewood* (Brewood, 1988), 111; H.R.O., E12/VI/KBc/44.

74 P.R.O., SP 18/321/42.

75 *Ibid.* C 2/Chas. I/C88/59.

76 *Ibid.* PROB 11/165/257; for his sequestration see W.S.L., Salt MSS. 330(i), 633-4.

77 P.R.O., C 6/116/45.

single business until the end of the charcoal era.<sup>78</sup> William Chetwynd died in 1691 and, like his uncle Walter, left no children. His sister Mary, who had a life-interest, died at a great age in 1750 and his property then passed to cousins, who had inherited the Grendon estate in north Warwickshire from their cousin, Walter Chetwynd the antiquary; most of the estate, however, consisting of property in Rugeley, Colton, Colwich, Handsacre, and elsewhere, had to be sold to pay the cousins' debts, and was bought by Thomas Anson of Shugborough for £35,200.<sup>79</sup> Apart from Richard Chetwynd before he inherited Brocton from Walter Chetwynd the antiquary in 1692, none of the family was ever again engaged in the iron industry, except for William Chetwynd of Grendon, who was a partner in the Principio Company, an English partnership with ironworks in Maryland and Virginia from the 1720s.<sup>80</sup>

## VI

In his Chancery proceedings of 1625 John Coleman alleged that his father had 'found out a mill called a slitting mill which kind of mill [was not before] known in this kingdom' and that James Lasher and Delionel Russell had obtained letters patent for this and Coleman had obtained a licence from them. It subsequently emerged in evidence that his 'great travill' had taken Walter Coleman no further than Dartford in Kent, where he twice visited a slitting mill with millwrights, the second of whom agreed to build him a similar mill in Cannock Wood, probably on the site of the upper forge there, at a place still called Slitting Mill. The licence was dated 1619, but the mill must have been built not later than 1611 as Richard Whistons had been its clerk since 1614 and Edward Hill had also been clerk for three years, presumably previously.<sup>81</sup>

The introduction of the slitting mill to England seems to have been the work of Bevis Bulmer, who in 1588 obtained a patent. A mill was built in 1590 on the River Darent at Dartford by Godfrey Box of Liège, who was also connected in some way with another mill at Crayford (Kent), built about 1597 and containing 'cutting works to cut nayl rods' and also 'battery works or mills ... for battering and working of iron into plates', which were used to make 'dripping pans and frying pans.' The partners in the Crayford mill were Drue Pickey and William Whitbred, the latter an alien and apparently the one with the technical know-how. The history of Dartford Mill has hitherto been obscure after Box's death without sons in 1604,<sup>82</sup> but it was presumably working when Coleman visited it. In 1627 it was sold as 'an iron mill ... engine and instruments ... in Dartford for the slitting of iron and making nails ...' by a John Bennett to William Burges,<sup>83</sup> and the mill operated almost continuously to 1790, though latterly probably making more hoops for barrels than nail rods.<sup>84</sup>

The function of a slitting mill was, as mentioned, to cut bar iron into rods of a size suitable for making nails. It is sometimes said that bar iron was previously cut with a cold chisel, obviously a difficult task, but statements in litigation concerning the supply of osmond iron (a special kind of bar iron) to the wireworks at Tintern (Mons.) suggest rods were hammered: the first stage of wire-making involved straining hammers, probably water-powered tilt hammers, those rods that 'strained hollow' being sold to Bristol nailmakers.<sup>85</sup> Persons described as 'slitters', who occur in Stourbridge and Sedgley before any slitting mills were built locally, must have been making nail rods;<sup>86</sup> and there was a rate of customs duty for 'iron slit or hammered into rods' in 1790, evidently in succession to an earlier regime where iron less than  $\frac{3}{4}$  inch square paid duty as manufactured iron, rather than as bar

78 For Madeley see Cheshire R.O., DCR 27/8; H.R.O., E12/VI/MAC/68; for Chartley see *ibid.*/66; for Lord Paget's works see *ibid.*/4. For Chetwynd and Moore see H.R.O., E12/VI/MAf/6 and 8-9; E12/IV/19/2 (buyers of pig iron). Generally see B. L. C. Johnson, 'North Staffs.' and B. G. Awty, 'Charcoal ironmasters of Cheshire and Lancashire 1600-1785', *Transactions of the Historic Society of Lancashire and Cheshire*, cix (1957), 71-121 (*passim*)

79 H. C. Chetwynd-Stapylton, *Chetwynds*, 164-172. For Grendon see *V.C.H. Warws.* iv. 76; for the sale see S.R.O., D. 615/D/81(B), deed of 25 Mar. 1768.

80 British Library, Add. MS. 29600. On this company generally see M. W. Robbins, *Principio Company: ironmaking in colonial Maryland* (Garland, New York, 1986).

81 P.R.O., C 2/Chas. 1/CS/67, bill; C 21/C45/18, Richard Whistons and Edward Hill.

82 H. R. Schubert, *History*, 304-5. As to Crayford see P.R.O., REQ 2/254/53.

83 In 1631 William Burges let it to Thomas Deacon, whose commissioners-in-bankruptcy sold it in 1651 to Nicholas Tooke, who erected 'three brassill mills and a great iron hammer': P.R.O., C 78/595/3.

84 *V.C.H. Kent*, iii. 388.

85 P.R.O., Exchequer Depositions, E 134/39 Eliz./Hil./23, defendant, William Spryntt, answer to interrogatory 12 and Thomas Hackett, answer to interrogatory 24.

86 *Sedgley parish registers*.

iron.<sup>87</sup> Hammering iron into rods would be an inefficient process because the iron would cool rapidly and have to be reheated frequently. The slitting mill was a variety of rolling mill: firstly a piece was cut off a bar using water-powered shears; it was then rolled through plain rolls into a thick plate, which was then passed between grooved rolls ('cutters') dividing it into rods.<sup>88</sup> There was also a variety of iron known as mill iron, which was probably distinguished from other bar iron only in its being drawn as a thick plate rather than with a squarer section. Thus in 1729 Graffin Prankard of Bristol told Francis (or Frans) Jennings, his Stockholm correspondent, that he 'would submit to take [15 or 20 tons of iron] 2½ to 2¾ inch by half inch thick for slitting use not drawn into the correctness of stroke iron, I mean 9 foot long but 13 or 14 foot long or 12 foot ...'<sup>89</sup>

A second patent for slitting was obtained by Clement Dawbeney of London in 1618, despite the opposition of London nailers and ironmongers, who were nevertheless reported to be being supplied with iron from his mill 'better than heretofore'.<sup>90</sup> James Lasher and Delionel Russell must have been Dawbeney's sole licensees, for it was Dawbeney, rather than Lasher and Russell, who sought to enforce the patent in the following decade.<sup>91</sup> Thus Richard Foley's Hyde Mill was neither the earliest in England, nor even in the Midlands, and the story of industrial espionage by a wandering minstrel should be consigned to the realms of myth.

## VII

The success of Hyde Mill led to the construction of others: a slitting mill was built in 1628 at Bustleholme Mill between West Bromwich and Wednesbury by Sir Edward Peyto of Chesterton (Staffs.) and Roger Fowke of Wolverhampton, and another mill c. 1633 at Wilden, below Kidderminster, by Thomas Doutye and Roger Fowlke, the latter presumably Peyto's partner and also Dud Dudley's partner in his 1638 pitcoal iron patent.<sup>92</sup> On 9 May 1633 Richard Foley agreed to supply Bustleholme Mill with 24 tons long weight (*i.e.* 120 *lb.* per *cwt.*) of 'bleue mettle drawn into bars' within a month; then, after working up a stock of sows of tough 'mettle' into iron and fulfilling a contract with 'one Jennens', presumably John Jennens of Birmingham, he was to supply six tons per week to the slitting mill and as much more as Bromford, Bromwich, and Cooks Forges could make. Fowke and Peyto were to pay him at £14 per ton weekly by 2 p.m. each Saturday so that he could pay his workmen, or alternatively they could return what iron they received, Foley paying 30s. per ton for slitting. The contract ran into trouble over the mill owners' failure to pay in full and their assertion that they should slit what the forges made and six tons more, an evident impossibility.<sup>93</sup> Subsequent practice in the west Midlands was mainly of mills slitting for hire. Iron was taken in as bars and the same iron returned in rods, in return for a fee for slitting it, an arrangement very similar to the putting-out system.

Hyde and Wilden Mills, and also Cookley Mill (Worcs.), which was the next one in the area, built about 1640 by William Winchurst and others, were placed strategically to process iron made in distant places: they all lay between the river port of Bewdley (Worcs.) and the manufacturing area of the Black Country. Winchurst came from a family of Stourbridge ironmongers, and he was assisted in building his mill, initially called Wolverley Mill, with capital from certain former customers of Hyde Mill, namely William Wilson, Sir Thomas Middleton of Chirk (Flintshire), and Sir Thomas's partners in ironworks in north-west Shropshire.<sup>94</sup> One of Winchurst's early customers was Richard Foley of Birmingham, probably the son of the ironmaster of the same name and afterwards himself an ironmaster in north Staffordshire. When Foley and Robert Winchurst (William's brother) were in London on 26 October 1646, they respectively bought 61 and 10 tons of iron and Foley travelled with it on a coaster to Bristol and so up the Severn to Bewdley. He was then annoyed that William

87 *Universal British Directory* (1791), i. 721; P.R.O., E 190, Port Books, *passim*, e.g. for Hull.

88 H. R. Schubert, *History*, 308–10.

89 E.g. *Records of Philip Foley's ... iron works*, i. 101; Somerset R.O., Letterbook of Graffin Prankard, DD/DN 424, 24 Dec. 1729; cf. 'tin bars': W. E. Minchinton, *The British tinplate industry: a history* (Oxford 1957), 250.

90 H. R. Schubert, *History*, 308–10.

91 *Acts of Privy Council 1629 to 1630*, no. 756.

92 For Wilden see P.R.O., E 112/258/144; for Bustleholme see D. Dilworth, *Tame Mills*, 58–60.

93 P.R.O., C 2/Chas. 1/F15/12; for the Jennens family generally see P. W. King, *Iron in the North* (in preparation); W. Harrison and C. Willis, *Jennens case*, 44–51, 141–52 (where some of the conclusions need to be treated with great caution).

94 Cf. M. B. Rowlands, *Masters and Men*, 11–12; P.R.O., C 8/192/54; Sir Thomas Middleton [of Chirk Castle] and his partners owned 3/20ths, £415 out of £2753: these figures are quoted in I. Edwards, 'The early ironworks of north-west Shropshire', *Transactions of Shropshire Archaeology Society*, lvi (1957–60), 197, where the transaction with Richard Foley may also be alluded to.



Winchurst charged 40s. for slitting instead of the 35s. quoted by Robert Winchurst while in London. William justified the higher charge because the iron was 'Swedish or other outlandish iron and harder and worse to slit than English'. Richard Foley was also in dispute with George Lowe of Dudley, whom he employed for 'buying and taking in of nayles'.<sup>95</sup>

In 1669 Bustleholme Mill cut 426 tons at 37s. 6d. per ton, and Philip Foley's manager paid Hester Brindley of Hyde Mill £650 for slitting slightly over 400 tons and some carriage, suggesting a fee of 30s. per ton. The issue is, however, slightly clouded by the question of scraps, as much as 5% being wasted in cutting, and the practice seems to have varied as to whether the slitting mill owner returned the scraps or was charged with the loss of weight and kept the scraps.<sup>96</sup> A mill owner was expected to keep apart the iron of different persons, and also different kinds of iron. Thus, Ambrose Crowley charged Richard Wheeler with roguery in 1703 for substituting common iron for best at Stourton Mill, 'Swedish iron or best English iron commonly called horse nail rod iron or best tough rod iron' being specified by the Navy Board for clenched nails.<sup>97</sup> The tenant of Wolverley Lower Mill in 1731 was required to bundle the rods and 'not put more ends in a bundle than is usual'.<sup>98</sup> The slitter was employed on a similar basis: in 1678 John and Richard Wheeler employed Thomas Cooke to slit at Wolverley Lower Mill on the basis that he would be paid 5s. per ton and bear half the loss if he wasted more than one *cwt.* per ton. His contract provided for him to be paid for a minimum of 350 tons per year, but he had to replace worn out slitters at his own expense.<sup>99</sup> When Stourton Forge became a slitting mill in c.1697, Thomas Cooke became its head-slitter, probably with his son John as assistant. Following Richard Wheeler's bankruptcy in 1703, Philip Foley could not persuade any of the ironmasters to take it over and so he let it to John Cook.<sup>100</sup> This was no doubt possible because slitting for hire needed little capital; thus at his death in 1730 Talbot Jewkes had £202 stock at Wolverley Lower Mill and £30 book debts there.<sup>101</sup> In 1754 Hyde and Stourton Mills each slit 1000 tons per year.<sup>102</sup> Some 3,000–4,000 tons were slit annually in the Stour valley at that time and perhaps double that amount a couple of decades later,<sup>103</sup> but the need for rolling mills for Cort's puddling and rolling process for making bar iron led to the employment of the largest slitting mills for rolling blooms from the 1790s. This applied to the mills at the Hyde and Stourton, which both belonged by then to the Homfray family, who had adopted the new process at Penyarden at Merthyr Tydfil (Glam.).<sup>104</sup>

With the exception of the mills at Dartford and Crayford and a short-lived one at Lydney (Gloucs.), all the earliest slitting mills in England were in the west Midlands.<sup>105</sup> Elsewhere, George Sitwell built one at Renishaw (Derbs.) in 1656 to slit iron he made in his own Derbyshire forges,<sup>106</sup> and this pattern of ironmasters owning slitting mills primarily to cut iron from their own forges is found in the north of England and north Midlands, at Clipstone (Notts.) by 1662, Rotherham (Yorks.) 1668, Colnbridge (Yorks.) 1675, Consall and Oakamoor (Staffs.) before 1689, and Cranage (Ches.) before 1695.<sup>107</sup> Independent slitting mills at Sheffield and in the Trent valley were not built until Russian iron became available in large quantities in the mid 18th century.<sup>108</sup> The ease with which

95 P.R.O., C 6/42/47.

96 *Records of Philip Foley's ... iron works*, i. 77–8, 96–7, 115; for waste compare Birmingham Archives, Z/10.

97 H. Lloyd, *The Quaker Lloyds in the industrial revolution* (1975), 86–87; for the Navy Board's requirements see National Maritime Museum, Portsmouth warrant books, POR/A/1, 22 Oct. 1696.

98 Worcs. R.O., 899:910 BA 10477, no. 7142.

99 Birmingham Archives, Z/10.

100 P. W. King, 'Wolverley Lower Mill and the beginnings of the tinplate industry', *Historical Metallurgy* 22(2) (1988), 109; H.R.O., E12/VI/KL/1, 15–16, and 22.

101 M. Wanklyn (ed.), *Inventories of Worcestershire landed gentry 1537–1786* (Worcestershire Historical Society, n.s. xvi, 1998), 372.

102 C. K. Hyde, 'The iron industry of the West Midlands in 1754: observations from the travel account of Charles Wood', *West Midlands Studies*, vi (1973), 39.

103 The estimate is based on the number of mills and their likely output.

104 L. Ince, *The south Wales iron industry 1750–1885* (1993), 74–9. Puddling was the process, not requiring charcoal, that replaced the charcoal finery process for making iron from the 1790s: see Charles K. Hyde, *Technological change and the British iron industry 1700–1870* (Princeton 1977), 88–92, 96–103.

105 Lydney Mill existed by 1640 but was defunct by 1673: C. E. Hart, *The industrial history of the Forest of Dean* (Newton Abbot, 1971), 44–45; for Dartford see above.

106 *George Sitwell's letterbook 1662–6*, ed. P. Riden (Derbs. Record Soc., x, 1985), 272–3.

107 For Clipstone see Notts. R.O., DD.4P 22/144, 188, and 190–1 etc.; for Rotherham see Sheffield Archives, Ph.C./136; for Colnbridge see Yorkshire Archaeological Society Library (Leeds), MD 335/70/124; for Consall, Oakamoor, and Cranage see B. L. C. Johnson, 'North Staffs.', 49–51.

108 *E.g.* Derby in 1733: P.R.O., C 11/1575/34.

iron could be slit cheaply in the Stour valley no doubt explains the almost complete absence of such mills in Shropshire, Gloucestershire, and south Wales. It also provides a context for the concentration of metal manufactures, particularly nailing, in the Black Country, although this is of course an oversimplification of a much more complicated picture.

John Hanbury's mill at Pontypool (Mons.), for which his father had bought cutters in the 1690s, was virtually the only one in south Wales; and he wrote:<sup>109</sup>

'There is noe manner of profit by the rod mill, but only the advantage of making barr soe gross which 'tis recond that 'tis 20s. per t. better to make mill iron than merchant which is the best that can be said of the rod mill.'

His figures in fact show a profit of 5s., and he added that rolling hoops (for barrels) was more profitable,<sup>110</sup> but he did not make above ten tons per year. My calculations indicate that Philip Foley made no profit by having his iron slit (by others), the price differential between bar and rod iron merely representing the cost and waste of slitting,<sup>111</sup> but there must have been a modest profit for a mill owner who slit for hire and commonly had no other ironworks.

The monopoly, apart from Thomas Chetwynd's mill near Rugeley, of Richard Foley's Hyde Mill on slitting lasted only four or five years, not long enough for him to build up a substantial fortune. He was fined heavily (perhaps £1000) by the Court of Star Chamber in 1636 for engrossing iron and timber, but whether justice was done is difficult to determine, for we have only the Secretary of State's notes on the hearing. The offence of engrossing consisted of buying up all a commodity in order to get a monopoly. Foley probably owned all the local ironworks, but it would hardly have been in his interest as an ironmaster to force up the price of timber and it is unlikely that he could have bought all the iron reaching the district: John Jennens, who was possibly then only a Birmingham ironmonger and who would have suffered if Foley had forced up prices, was a witness for the defence and that suggests Foley was not obviously guilty. The charge of engrossing in such circumstances was a most unusual one, as the proof of an intention to resell at a higher price was normally an element of the offence, because (like the related crimes of forestalling and regrating) it was usually only used in relation to sale of foodstuffs in market-places.<sup>112</sup> Foley certainly always had rivals in adjacent districts, even when there were none in his own: to the west were the Blounts at Cleobury, and Boycott and Company and Sir Basil Brooke in central Shropshire; to the north the Chetwynds; and to the east from 1638 (at the latest) John Jennens had Aston Furnace and Bromford Forge; and in the Stour valley the Winchursts had Wolverley Forge probably from 1651 and also a forge by their slitting mill at Cookley.<sup>113</sup>

The Star Chamber fine must have hit Richard Foley hard. He could have repaired his fortunes before his death in 1657, but instead he began handing over ironworks to Thomas Foley, his eldest son by his second marriage, as soon as Thomas was of age.<sup>114</sup> Richard's will is that of a successful business man, who was able to make substantial provision for his younger children.<sup>115</sup> The evidence points to the vast Foley fortune being accumulated by Thomas Foley in the 1650s and 1660s, when he laid out large sums, clearly the surplus profits of his ironworks, in the purchase of lands.<sup>116</sup> He probably also enjoyed the advantage of having cash to invest when many other gentlemen, having suffered the consequences of high taxation during the Civil War and delinquency fines, needed to

109 Cutters were supplied to Capel Hanbury: B. L. C. Johnson, 'The Stour valley iron industry in the late seventeenth century', *Transactions of Worcestershire Archaeological Society*, n.s. xxvii (1950), 46 (where the his location of a mill near Kidderminster is mistaken); the quotation is from H. R. Schubert, *History*, 429-30 (ultimately from Gwent R.O., Misc. MS. 448).

110 Hoops for barrels were made in a slitting mill, the procedure being identical to that for cutting rods, save that the grooved cutters were not needed. Indeed, hoops were often described as being 'slit'. They were sold flat, leaving the cooper to weld them into a hoop to fit his barrel.

111 Calculation from figures from *Records of Philip Foley's ... iron works*, i.

112 P.R.O., SP 18/321/42; Jennens as ironmonger: M. B. Rowlands, *Masters and Men*, 11-12; on engrossing see Sir T. E. Tomlins, *The Law Dictionary* (London, 1820) i. s.v. 'forestalling'. The amount of Foley's fine is not certain: see H. R. Schubert, *History*, 320 n. 1.

113 For Cleobury see M. Baldwin, 'Ironworking in Cleobury Mortimer', *Cleobury Chronicles*, iii (1994), 43-5; for the Boycott partnership I am grateful to the editors of *V.C.H. Shropshire* for permission to see their notes on deeds at Raby Castle (Durham), but see also Shropshire R.O., 6000/3093, 3100, and 3230; for Sir Basil Brooke see *V.C.H. Shropshire* xi. 48; for Bromford and Aston see note 51; for Wolverley see H.R.O., E12/VI/KE/1. It has been assumed that the original lease was for 21 years. The date when a forge was added to Cookley slitting mill is not certain, but there was evidently one there in 1669 when William Winchurst had a use for sow (i.e. pig iron): *Records of Philip Foley's ... iron works*, i. 97.

114 E.g. Whittington Forge in 1637: P.R.O., C 2/Chas. I/F49/46.

115 H.R.O., E12/II/1/5-8. Thomas and his next son Robert had already been provided for.

116 H.R.O., E12/VI/C/1.

raise money, but he apparently usually avoided the mistake of buying estates whose titles depended on 'usurping powers'. This accumulation of property enabled him to set up all his three sons as gentlemen and to found a school, Old Swinford Hospital, which remains well-endowed to this day.<sup>117</sup>

### VIII

With the exception of Dud Dudley's failed attempt to smelt with pitcoal, the period covered in this article was not one of technological development, but rather one of more subtle changes, principally in the organisation of the industry. The 1590 report to Fulke Greville was concerned with avoiding wasteful practices, but the only organisational change it recommended was to work one finery for twelve hours a day rather than two for six hours each.<sup>118</sup> That would actually have been a backward step, for it took two fineries to provide enough blooms to keep a single hammer occupied, and the efficiency which the author of the report sought would have been better achieved by working both fineries for longer each day. The most significant change actually made in this period was the transition from having one forge for each furnace to having two forges, more precisely four fineries per furnace instead of two, representing an increase in furnace output.<sup>119</sup> Thus in 1646, at the time of his sequestration, Walter Chetwynd had two furnaces each with two nearby forges.<sup>120</sup> Dud Dudley was apparently pleased with obtaining seven tons of pitcoal pig iron per week at 'Hasco' Furnace about 1626, but he estimated the consumption of wood by the iron industry on the basis that furnaces were producing fifteen tons per week.<sup>121</sup> For a forty-week furnace campaign this represents an increase in annual output from 250 to 550 tons per year, allowing for lower production at the beginning and end of the blast. The latter figure is confirmed by the actual production of Philip Foley's furnaces in 1669 and by the well-known list of furnaces from the archive of the Fuller family in Sussex where most furnaces are listed as making 400–500 tons; for other furnaces it can be shown that their lower average production (according to the list) is actually the mean of their output in productive and idle years.<sup>122</sup> It is not clear how far this growth in output represents an increase in the internal capacity of furnaces and how far longer campaigns; if the latter, it may result from the identification of more durable refractory materials, so that the lining of the furnace hearth did not wear out so fast.

In the Black Country the change consisted of the closure of surplus furnaces: Bromwich, Himley, and 'Hasco' Furnaces are not recorded after the early 1630s, nor that in Conigree Park at Dudley after the Civil War; and on renewing his lease of the Cradley works in 1662, Thomas Foley was permitted to remove the furnace bellows. In north Staffordshire Heighley, Oakamoor, and Ellastone Furnaces disappeared, but their associated forges at Winnington and Consall continued almost to the end of the charcoal era. Similarly Rushall and Chartley Furnaces were closed but Hints and Chartley Forges remained in use, as did those at Cradley, Bromwich, and Oakamoor.<sup>123</sup>

The earliest ironmasters, such as the Pagets and Willoughbys, were great landowners, but from the 1580s there came into existence professional ironmasters such as the Parkes family, who had to pay for the wood they consumed. Under the great landowners ironworks appeared to be highly profitable, as the cost to them of charcoal consisted only in the wages of the men who cut, corded, and coaled the wood. On the other hand when ironworks were let, the bulk of that profit consisted of the value of the wood consumed, which value still went to the landowners. Due to the quantity required, its price was the most obviously variable item of their costs. On account of its bulk and

117 *Ibid.* The only example I have found of a purchase from 'usurping powers' is that of a chief rent issuing out of the manor of Compton (in Kinver): E12/S, *passim*; H. E. Palfrey, 'Foleys'; H.R.O., E12/II/1-2 and 17.

118 A. C. Jones and C. J. Harrison, 'Cannock Chase ironworks report'.

119 For the ratio generally refer to the lists of works named as belonging to each of the firms described in preceding sections.

120 *V.C.H. Staffs.* ii. 111–12; W.S.L., Salt MS. 330, i. 633–4.

121 D. Dudley, *Metallum Martis* (1858 edn.), 63, 71.

122 *Records of Philip Foley's ... iron works, passim*; P. W. King, 'Early Statistics in the iron industry: a vindication', *Historical Metallurgy*, xxx (1996), 23–46 (revising E. W. Hulme, 'The statistical history of the iron trade', *Transactions of the Newcomen Society*, ix (1928–9), 12–33).

123 For Dudley (Conigree), Himley, 'Hasco', [West] Bromwich see H. R. Schubert, *History*, 374–7, 390; for Heighley see Peter Lead, 'The north Staffordshire iron industry 1600–1800' *Historical Metallurgy*, xi (1977), 5; for the existence of Rushall, Oakamoor, and Ellastone Furnaces see above; no later reference to them is known; the Rushall Furnace mentioned by M. B. Rowlands (*Masters and Men*, 62) was probably a new one; for the closure of Cradley Furnace see the endorsement on Dudley Archives D/DE/IV/3, leases, Cradley, 1662; for the continued existence of the forges see for example the lists of ironworks printed in E. W. Hulme, 'Statistics' and P. W. King, 'Early Statistics'. B. L. C. Johnson ('North Staffs.') found no indication of the continued existence of furnaces at Chartley or Oakamoor in the 1690s, nor is any shown by the Foley Staffordshire ironworks accounts (H.R.O., E12/VI/MAf/8-31), which are his source.



friability, it was generally not economic to move charcoal more than a few miles.<sup>124</sup> Thus, by owning all the ironworks in a district and so becoming the only potential buyer of wood, a professional ironmaster could within reason set his own price for it, and to this extent Richard Foley was indeed guilty of engrossing. Moreover, the need to control the charcoal supply was evidently a principal reason for the concentration of the industry in so few hands. The dominance of the Midland iron industry by these large integrated partnerships in the late 17th century has been known at least since Johnson, Awty, and others published their studies in the 1950s,<sup>125</sup> but it has not hitherto been apparent quite how early some of these major businesses began. In this article a focus has been on firms operating mainly within Staffordshire and it has only been possible to allude briefly to the Jennens family and their successors, whose business, mostly in Warwickshire and Derbyshire, remained a coherent entity from 1638 to 1746 (and in Derbyshire to 1780 and beyond).<sup>126</sup> Unfortunately too few records survive concerning the firms to allow us to explore the relationships of competition or co-operation between them, except occasionally. In some districts, including much of Staffordshire, the integration of the industry persisted throughout the 18th century, though not elsewhere, but the reasons for this cannot be explored here.

The conflicts of the 1620s and 1630s also had repercussions later. In this article it has been shown how Richard Foley succeeded Dud Dudley at Himley Furnace and then, through an employee, at 'Hasco' Furnace, and how he was also a successor at Cradley, though it is not known what part (if any) he played when Dud Dudley was 'outed from his works'.<sup>127</sup> In his book, *Metallum Martis*, Dud Dudley complained of four forges near his house where his invention was used without any benefit to him: this can only be a reference to the use of coal in the chafery hearths, and as H. R. Schubert has shown that was not in fact his invention, though possibly Dudley thought it was. Those forges, however, belonged to Thomas Foley.<sup>128</sup> In 1662 Dudley together with Edward Chamberlain was awarded a patent for tinplate. They made no use of the patent themselves, but it was Chamberlain's renewal of the patent (of questionable validity) in 1672, which put a stop to the development of tinplate manufacture at Wolverley Lower Mill by Joshua Newborough and Philip Foley, following two trips to Saxony by Andrew Yarranton and Ambrose Crowley and their subsequent successful experimentation, applying the results of their investigations abroad. It is possible that it was a memory of these journeys to Saxony that gave rise to the legend of Fiddler Foley, though there is no evidence that either of them was a musician.<sup>129</sup> Furthermore it was Andrew Yarranton who thwarted an intended royalist rising in 1648, capturing Dud Dudley and imprisoning him in Hartlebury Castle, with the result that Dudley was sentenced to death by the Committee of Insurrection, from which fate he was saved by escape from prison and living under an assumed name for the next two years.<sup>130</sup> At that point Dudley was an utter failure and ultimately he died one, but it is suggested that his ideas did not die with him and his reputation as the pioneer of smelting metals with mineral coal is not undeserved, but that is another story which cannot be told here.<sup>131</sup>

124 G. Hammersley, 'The charcoal iron industry', 606.

125 See B. L. C. Johnson, 'North Staffs.' and B. G. Awty, 'Cheshire ironmasters'.

126 A detailed account of the Jennens business will be included in my *Iron in the North* (in preparation).

127 D. Dudley, *Metallum Martis* (1858 edn.), 63.

128 For the use of coal see H. R. Schubert, 'Early use of mineral fuel in the chafery of the English forge', *J.I.S.I.*, clxx (1952), 313-14; the forges must be Heath, Swindon, Greens, and Cradley, whose ownership is apparent from their appearance in the Foley accounts: *Records of Philip Foley's ... iron works*, i. 70-7; ii. 31; cf. H.R.O., E12/VI/KAc/1-2 and 41; Dudley Archives, D/DE/IV/3, leases, Cradley, 1662.

129 P. J. Brown, 'Andrew Yarranton and the British tinplate industry', *Historical metallurgy*, xxii (1988), 42-8; P. W. King, 'Wolverley Lower Mill and the beginnings of the tinplate industry' *ibid.* 104-13; for its validity see the opinion of the Attorney-General, *Calendar of State Papers Domestic, Charles II, 1673*, 173.

130 P. J. Brown, 'The military career of Andrew Yarranton', *Transactions of Worcestershire Archaeological Society*, 3rd ser. xiii (1992), 195; P.R.O., C 6/191/40.

131 I intend to address this subject elsewhere.