

WILLIAM BAIRD AND COMPANY, COAL AND IRON MASTERS

1830-1914

R.D. CORRINS

Thesis submitted for the Degree of
Doctor of Philosophy of the University
of Strathclyde, 1974

Department of History
August, 1974.



IMAGING SERVICES NORTH

Boston Spa, Wetherby

West Yorkshire, LS23 7BQ

www.bl.uk

BEST COPY AVAILABLE.

VARIABLE PRINT QUALITY



IMAGING SERVICES NORTH

Boston Spa, Wetherby
West Yorkshire, LS23 7BQ
www.bl.uk

**TEXT IS CLOSE TO EDGE OF PAGE IN
ORIGINAL.**

SOME TEXT IS CUT OFF.

CONTENTS

Acknowledgements

Summary

List of Abbreviations

PROLOGUE		I
CHAPTER I	The Ironworks - their acquisition and development	16
CHAPTER II	Products and Production	54
CHAPTER III	Markets and Marketing	80
CHAPTER IV	Raw Materials - Ironstone	143
CHAPTER V	Raw Materials - Coal	207
CHAPTER VI	Entrepreneurship & Management	269
CHAPTER VII	The Employees - Life and Work	316
EPILOGUE	1914-1974	377

List of Appendices

APPENDIX A

B

C

D

E

Bibliography

MAPS	1	Gartsherrie Region	
	2	Ayrshire Region	at end.

ACKNOWLEDGMENTS

Without the initial encouragement and constant interest of my supervisor, Dr. John Butt, this thesis would not have been written. Among the many individuals who readily gave of their knowledge or assistance I would like to mention in particular Miss Alice K. Baird of the Carnegie Library, Coatbridge who so willingly placed the facilities of her library at my disposal. My thanks are also due to the many people who responded to my letters to the press. To my typists Mrs. Milne and Mrs. McGlone I express my thanks and my admiration. I must, too, express my gratitude to the Social Science Research Council for the financial assistance which made this study possible.

On a more personal level I wish to record the debt which I owe to my parents for their ready support and self sacrifice throughout my extended career as a student. Finally, I would like to acknowledge the unfailing encouragement of my wife, Catherine, which sustained me throughout the writing of this thesis.

SUMMARY

This study deals with the history of the largest firm in the Scottish pig iron industry in the nineteenth century. William Baird and Company and the Eglinton Iron Company have been treated throughout as one firm; a course entirely justified by the policy of the partners themselves, but in any case rendered inevitable by the surviving manuscript material. Indeed the nature of the surviving sources has been a major influence on both the form and the content of the entire study. There are no records of any meetings of partners or directors, and only a handful of head office papers have survived, of which few are later than 1855. Most of the manuscript sources are drawn from Gartsherrie Ironworks, though even these have important gaps, and the first twenty years of the works are almost undocumented. Nevertheless these records form the main part of the existing papers and account for the marked bias in favour of the Gartsherrie portion of the company. Apart from a small number of Muirkirk Ironworks papers and a set of Leasebooks no Ayrshire records survive - they were apparently used some twenty years ago in an experiment to demonstrate the efficiency of a document shredding machine! Despite the serious gaps which this has given rise to it was deemed important to attempt the study in view of the central role of the firm in Scottish industrial growth in the nineteenth century.

The text traces the background, family and economic, of the Baird brothers before examining the growth of their industrial empire; its products and their marketing; the acquisition and exploitation of raw materials; the entrepreneurial history of the firm; and the experience, both industrial and social, of the labour force employed. While the firm is in important respects atypical, detailed knowledge of its history sheds light on many areas of Scottish and British economic

and social history. Study of the development of the Ironworks, and the pattern of productivity underlines the importance of continuous minor technological advance as against major innovation. The central role of the firm in the establishment and operation of the Scottish pig iron market and the degree to which the partners appreciated their position is illustrated. The evidence presented concerning the managerial skills and innovating policies of the partners calls into question the traditional view of the phases of entrepreneurial ability exhibited in the history of the British Iron Industry. The latter part of the study also demonstrates how influential the firm was on the evolution of trade unionism and on the entire social fabric of the West of Scotland.

List of Abbreviations and Short References

- BITA - The British Iron Trade Association
- Coatbridge - The Carnegie Public Library Coatbridge, Local History Collection
- Digest - Digest of Leases, William Baird and Company
- E.I.C. - The Eglinton Iron Company
- G.L.B. - Gartsherrie Iron Works Letter Books
- Glasgow - The University of Glasgow Library
- JISI - Journal of the Iron and Steel Institute
- JWSISI - Journal of the West of Scotland Iron and Steel Institute
- Mitchell - The Mitchell Library, Glasgow
- NSA - The New Statistical Account of Scotland
- R.B. - Robert Baird
- S.R.O. - The Scottish Record Office
- Strathclyde - The University of Strathclyde, Glasgow
- T.S.A. - The Third Statistical Account of Scotland
- Tremenheere - Report of the Commissioner appointed to inquire into the state of the population in the Mining Districts
- W.B. & Co.- William Baird and Company

PROLOGUE

Alexander Baird was born on 12 May 1765, at the farmhouse of Woodhead, Old Monkland.¹ Six years earlier the establishment of Carron Ironworks marked the beginning of the modern development of the Scottish Iron Industry with which his family was to become so closely identified. The quickening pace of Scottish economic activity was already being experienced in the parish, where some of the land had passed to the rising class of Glasgow merchants, and some of the people were being drawn into the network of domestic cloth producers. During Alexander's youth industry came to this inland parish with the establishment of a pottery, brick, and tilework in 1785 and a Chemical works a little later.²

The coal resources of the district were well known, having been worked at least since the time of the Cistercian monks who gave the district its name. But poor communications and lack of navigable water prevented its exploitation for little other than immediately local use. In 1769 James Watt surveyed the route of a proposed canal from the Monklands to Glasgow, which had as its object the development of the area's coal reserves in order to release the rapidly growing city of Glasgow from the grip of the local coalowners who had advanced the price of coal on the Glasgow market by leaps and bounds in the immediate past.³

-
1. A. McGeorge, The Bairds of Gartsherrie, Glasgow (1876) p 27. The other biographical information in this chapter is taken from the same source.
 2. The Statistical Account of Scotland, Edinburgh (1793) ed. Sir J. Sinclair, Vol. VII, 298.
 3. Henry Hamilton, "Combination in the West of Scotland Coal Trade" Economic History, Supplement to the Economic Journal II (1930)

Work came to a halt in 1763, with funds exhausted and only a portion of the canal completed. For several years the company operated the finished section but without realising a profit. In 1782 and 1786 the concern was acquired by Andrew Stirling, laird of Drum-pellier, and his brothers James and John, who completed it in 1791.⁴ Communications were further improved, and the parish drawn more tightly into the new age, by the development of the road system. The turnpike road from Glasgow to Airdrie was extended to Edinburgh in the 1790s and regular coach services begun.

Alexander, therefore, grew up in an essentially rural farming community but one which was conscious of the changes taking place. William Baird, Alexander's father, held the farm of Woodhead on sub-tack from his elder brother John, who farmed Kirkwood, while the third brother, Robert, held the farm of Highcross, also on sub-tack from John. Generations of the Baird family had farmed these three properties, and, as he grew up Alexander was prepared to follow in the tradition. He acquired the rudiments of formal education at the local parish school, where he showed himself to be an able pupil. It is noteworthy that particular stress was laid on his ability in figures, "far beyond any of his compeers",⁵ a trait which recurs in succeeding generations. In 1785, at the age of 20, he took possession of Woodhead, his father having died some time previously, and on proving himself an able manager of the property, he was confirmed in possession by a sub-tack from his uncle John back-

4. George Thomson, "James Watt and the Monkland Canal" Scottish Historical Review Vol. XXIX (1950).

5. McGeorge, Bairds of Gartsherrie, 27.

dated from 1791. Secure in his farm, in August 1794 he married Jean Moffat, daughter of James Moffat, a farmer in the neighbouring parish of New Monkland.

He extended his activities to Highcross vacated by his uncle Robert, and in 1798 his ailing uncle John, who had no male heir, made over all the family land in subtack to him. A measure of Alexander's prosperity was his ability to pay off promptly the £300 agreed on as the price of the subtack, this in itself being a large sum to pay for a lease of which only six years remained. Not only did he pay the second instalment before it was due but he was able to take on additional commitments, which suggests that his ambition went beyond securing the traditional family niche in the community. In 1800 he leased part of Southerhouse; in 1808 80 acres of Kirkwood were leased from Robert McNair of Belvidere; in 1813 an additional 48 acres of Kirkwood were leased from Buchanan of Drumpellier, who in 1809 had already leased him the mill and mill mailing of Langloan. Thus by 1813 Alexander was principal tenant of some 250 acres plus a mill, at an annual total rental of £631.

Alexander Baird was undoubtedly fortunate in that the vital years of his adult life coincided with the French-Revolutionary and Napoleonic wars, when agricultural prices rose continuously and the upward trend of rents inevitably lagged behind. Nonetheless, the extent of his success is clear evidence of his considerable commercial acumen. Under his management the traditional family lands were converted from open run rig to enclosed fields of from eight to fifteen acres, roads were made, and carts introduced. An outstanding example of his business skill was the success of his sublease of Carlincroft from Young of Cuilhill. For the wheat crop,

which was already sown, he agreed to pay £21 per acre, and for each of the next three crops £8 per acre. The value of the straw paid the working expenses of the wheat crop, which yielded 14 bolls per acre and sold at £3 per boll, realising a 100% profit of £21 per acre. As a miller he was not content to grind only his own and his neighbours' crops, but also bought oats in Glasgow to grind.

By 1815 he was a prominent member of the community carrying on considerable commercial transactions as shown by his accounts with his bankers, Carrick Brown and Company. Local landowners recognised his ability and consulted him on agricultural affairs. Buchanan of Drumpellier, the largest landowner in the Monklands, on several occasions delegated full authority to Baird to act for him in dealing with leases, and others, such as Baillie of Carnbroe, were eager to secure his support in commercial ventures. In 1825, having spent a lifetime carefully advancing the family fortune, he achieved a dramatic step forward when he bought Lochwood, hitherto one of the properties belonging to the Colts, and forming part of their Gartsherrie Estate.⁶ The modest 370 acre estate changed hands for £9,125 paid immediately to Colt, who through financial difficulty had been obliged to place his estate in voluntary trust. Lochwood not only represented clear evidence of Alexander's rise in the world, but provided a base from which his sons could continue the expansion of the family fortune.

His family consisted of eight sons and two daughters, all of

6. Chartulary of the Estate of Gartsherrie, Vol. IV folio 28 [in possession of Allan Louison and Hood SSC, Edinburgh.

whom, rather surprisingly for the time, survived to adulthood. The manner of their upbringing was undoubtedly an important formative influence. Each child, as soon as he was able, was given a task on the farm and the virtue of hard work impressed on him from the earliest age. Discipline was strict. James said of his mother, "with her it was a word and a blow, the blow usually coming first."⁷ Work was not allowed to interfere with the family's education. The eldest children went to the parish school or the school in the village of Langloan, which at the time was the best their father could afford. As his position improved, he was able to send the younger sons on to school for longer periods, and those who wished on to the college at Glasgow. Mrs. Baird took care that the children learned their lessons, and the sons' high regard for education is a notable feature of their later life. Both parents also instilled a strong attachment to the Protestant Religion and the Church of Scotland. Every Sunday evening the children were assembled, and the shorter catechism was gone through - each child answering a question in turn. In addition, each was required to repeat a new psalm every Monday morning. Their father reared them in the Conservative tradition, another enduring legacy. He himself was actively involved in local politics. At the time of the Radical rising in the West of Scotland in 1819 his name headed a list of volunteers formed at Langloan.

Alexander was obviously aware that his numerous family could not all hope to inherit his agricultural leases, without checking or reversing the policy of advancement to which he had devoted his

7. McGeorge, Bairds of Gartsherrie, 35.

life. Nor did they appear anxious to follow his footsteps.

William, who had been sent to Tweedside to learn the most advanced agricultural techniques, returned full of knowledge but with little enthusiasm. The obvious alternative local enterprise offering good prospects of prosperity was coalmining; this with the opening of the Monkland canal, had begun rapidly to transform the district. While still heavily engaged in agriculture, Alexander had leased a small coalwork at Woodside in 1809, though it is not known for how long.⁸ In 1816 he took a lease of the coalfield at Rochsolloch in New Monkland and William, aged 20, was made manager, while Alexander, then only 16 years old, was sent to Glasgow to act as selling agent.

This small gin pit was still secondary to the family's main interest of farming, which Alexander senior still actively extended. In 1819 he leased the farm of Newmains and settled there for most of his later years. Nonetheless, the Coalworks at Rochsolloch was an ideal training ground for his sons. Although probably not as strange then as it now seems, the step of learning the job by starting at the top, albeit in a small concern, was guaranteed to reveal whether or not the brothers had ability. This they demonstrated in abundance, and in 1822 the much larger coalfield of Merryston, bordering the farm of Newmains, was taken on lease. Alexander senior also seems to have become involved in the nearby coalfield of Netherhouses, together with some other local coalmasters, but

8. This coalworks was in Dalserf parish according to McGeorge. Woodside Dalserf is however some 15 miles from Highcross farm and seems a strange choice for Alexander who was at the time heavily engaged in agriculture. There is a Woodside immediately adjacent to Highcross farm, and coal was worked there, so perhaps this was the colliery leased by Baird.

there is no evidence that his sons were concerned.⁹ They were however active at Merryston. Alexander and William were now joined by James, often considered the most talented of a formidable family. The colliery, which had already been worked by tenants forced to renounce their lease owing to financial difficulties, was quickly restarted. A new pit was sunk to complement the old one; mines were driven to hitherto inaccessible areas; and the output considerably increased. The pits had been sunk near the bank of the Monkland Canal, along which boats built for the Bairds, conveyed the coal to a newly acquired wharf at the canal basin. By 1825 Merryston was a sizeable flourishing colliery, and the family, with the exception of John, the second son, was beginning to think of farming as a secondary pursuit. The high prices which coal fetched in that year tempted the Buchanans to take advantage of a break of lease clause in the tack and reclaim the colliery. It appears that they hoped to take over the Bairds' boats and coal wharf also, but the family were by now determined to continue in the coal trade, and acted immediately to secure a new tack.

Hamilton Colt of Gartsherrie had previously offered Alexander Baird senior a lease of his coalfield, and this was now accepted. By a lease dated May 1826 in favour of Alexander senior, and his sons William, Alexander, and James, Colt granted them the right to work the coal seams under the lands of Sunnyside, Hollandhirst, and New Gartsherrie, lying to the south of a dyke which divided his estate almost in half. Deeply offended by the action of the Buchanans in breaking the lease William devoted all his time and energy to the exploitation of Gartsherrie, and before the six months notice to quit Merryston had expired, he had a pit in operation at the new

9. S.R.O., Register of Sasines, Barony 26 December 1823.

Colliery. By means of the Monkland and Kirkintilloch Railway the coal was carried to the Forth and Clyde Canal, making possible continued use of the Bairds' boats and wharf. Colt had himself been engaged in exploring the Gartgill coalfield, as the section of his estate north of the dyke was known. Six months after the signing of the original lease, a second lease was negotiated by which the Bairds took over this coalfield also. New pits were sunk and by 1830 six were in operation. By this date a branch had been dug from the Monkland Canal, and the Garnkirk and Glasgow Railway, on the Board of which Alexander had secured a seat, had been rerouted through the estate.¹⁰

The Bairds quickly became important coalmasters. Although there is no direct evidence, it would appear to have been a self-financed operation. The brothers continued to live in the far from luxurious farmhouse of Newmains, and all profits were reinvested. Lockwood does not appear to have been mortgaged, nor was the other family property consisting of a small strip of land and some houses at Woodhead. No steps were taken to realise their share in the Netherhouse minerals but they do not appear to have been directly concerned in the management of this venture.

By 1828 they had four barges employed full time in carrying their coal into Glasgow, the main market. Deliveries were also made via the Forth and Clyde Canal to both Grangemouth and Bowling, of which a proportion must have been intended for export. Some of the Glasgow coal was also shipped from the Clyde either at the

10. George Buchanan, The Glasgow and Garnkirk Railway, Glasgow (1832). 7.

Broomielaw or Greenock.¹¹

As with pig iron at a later date, Baird coal quickly earned a high reputation on the market, and consequently it fetched a higher price. In September 1828 the Bairds won the contract to supply the "Britannia" and "Londonderry" steamboats with best splint coal for one year, although, at 38p per 24 cwt, their price was $\frac{1}{2}$ p per ton higher than other offers.¹² The contract was renewed the following year and extended to include the "Foyle" and "Duke of Lancaster".¹³ In May 1829 one William Halliday accepted Bairds offer to supply him with coal, although he had received lower quotations from others. He did so because he had been supplied, "with very good coals" the previous year.¹⁴

Alexander made inroads into every available market. At 30 December 1826 payment was due from seventy-one clients.¹⁵ The average sum outstanding was only £38.26 which suggests that the Bairds were efficient in securing regular payment. Clients ranged from small bleachers up to Charles Tennant and Company. In this latter case the Bairds made full use of their boats by securing the contract to take away the soap and soda waste. At other works they carried away the ashes, and they also carried large quantities of

-
11. Strathclyde, RB MSS, "Miscellaneous papers relating to coal sales 1826 - 1830".
 12. Strathclyde, RB MSS, John Dickson to Alexander Baird 2 September 1828.
 13. Strathclyde, RB MSS, John Dickson to William Baird 28 August 1829.
 14. Strathclyde, RB MSS, William Halliday to Alexander Baird 22 May 1829.
 15. Strathclyde, RB MSS, "Coal Payments due 30 December 1826".

dung into the Monklands on the return trip from Glasgow. By 1828 deliveries into Glasgow were running in excess of 1,000 tons per month and output was expanding rapidly. At about this time, however, the Bairds had already turned their thoughts to a new field.

Since the establishment of Carron Ironworks the rising demand for iron had led to the founding of other works in Scotland. In 1779 during the American War the first Lanarkshire works was set up at Wilsontown, and in 1786 Clyde Ironworks was established on the border of Old Monkland parish itself. Several new works were established during the next decade as rising import prices made the industry more attractive. Disruption of foreign supplies and rising domestic demand during the French Wars encouraged a further burst of activity around the turn of the century, as a result of which several new works were begun, including Calder Ironworks not far from the Bairds' home. It was while manager of these works that David Mushet in 1801 recognised the real value of the hitherto despised Blackband ironstone, on which the future growth of the industry was based.

The Scottish iron industry which had shown a tendency to undergo rapid expansion during short periods of particularly favourable conditions, experienced difficulty during more normal times, and in the first twenty years of the nineteenth century it virtually stagnated. In the early 1820s there were some indications of renewed activity. By 1823 trade was definitely prosperous, and Calder works added a new furnace. Two years later the first new works in 23 years was founded with the erection of the Monkland works at Calderbank.

It was during this time of growing optimism in the Scottish Iron Trade that the Bairds leased the Gartsherrie coalfield. Small quantities of ironstone were found in conjunction with some of the seams of coal, and it is safe to speculate that rather than treat it as rubbish the Bairds sold it, or at least attempted to sell it, to some of the neighbouring works. At about the same time more determined efforts were being made to utilize the blackband seam proper, which since 1801 had been virtually unused except for small quantities added to the clayband at Calder. The improved furnaces and blowing apparatus of the 1820s seemed to offer success. Blackband was used with clayband at Clyde Ironworks and the new Monkland furnaces smelted Blackband alone. By proving that this ironstone could be smelted successfully, these companies made the Monklands a highly attractive site for ironmaking operations.

Also in the mid 1820s James Beaumont Neilson was beginning these investigations which were to lead ultimately to the patenting of the Hot Blast process. This young engineer had acquired a considerable reputation throughout the West of Scotland as a result of the many improvements introduced by him at the Glasgow Gas Works. In response to an ironmaster's query regarding the difference in working of a furnace in winter and summer, he read a paper, proposing a dry blast, before the Philosophical Society of Glasgow in 1825, but the idea was not pursued. In 1826 James Ewing of the Muirkirk Ironworks sought his advice on the problem of poor blast at one of his furnaces which was situated $\frac{1}{2}$ mile from the blowing engine. Neilson suggested that, since the volume of air is increased as its temperature is raised, the blast might be more effective if passed through a red-hot vessel immediately before

entering the furnace. After experimenting with the effects of heated air on the illuminating power of gas, and at a smith's forge, he realised that it was beneficial though not principally for the reasons he had believed. His ideas ran counter to prevailing opinion, and only after much difficulty did he secure permission to conduct full scale experiments at a blast furnace. Through the agency of Charles MacIntosh, the noted chemist, he gained permission to blow hot blast at Clyde Ironworks during 1829, at least six months after his patent was taken out in September 1828. Though far from perfect, the system was so obviously superior to the old method that Dunlop and Wilson of Clyde joined MacIntosh and Neilson in financing exploitation of the invention.

It was at one time common to allege not only that the patenting of the Hot Blast heralded the real era of expansion in the Scottish Iron Industry but that the blowing in of the first Gartsherrie furnace in May 1830 represented the first fruit of Neilson's discovery. Modern opinion contradicts this view, pointing out that the foundations of the Gartsherrie furnace were laid in the Spring of 1828, the decision to build it being taken even earlier, well before Neilson's patent, and that the Bairds' motivation must, therefore, be sought elsewhere. The general economic advance in the West of Scotland during the mid 1820s, on the one hand boosted coalmining profits and so provided the necessary capital, and on the other hand stimulated the demand for iron and so provided encouragement to enter the industry. There was, furthermore, the growing attraction of their own district as a site for such a works, particularly following the Monkland Ironworks' demonstration of the suitability of Blackband ironstone. These factors may adequately

explain the Bairds' decision, but it remains possible, nevertheless, that Neilson did have some influence.

In July 1826 William Baird, in name of his father, took formal possession of the estate of Lockwood. Two friends acted as witnesses. One was James Taylor, Writer in Glasgow, under whom Robert Baird served his apprenticeship. The other was James Beaumont Neilson.¹⁶ The Bairds almost certainly, therefore, had first hand knowledge of the direction Neilson's experiments were taking. It is possible, furthermore, that they did not take steps to enter the industry until Neilson's idea had reached the patenting stage. McGeorge quotes James Baird as saying that work began on the foundations in Spring 1828.¹⁷ McGeorge himself notes that a lease of the ironstone in Cairnhill was taken in December 1828, the formal date of entry being Whit 1830, but permission being granted to start immediately.¹⁸ Normally raw material supplies were assured before work commenced on the building of a works. McGeorge then goes on, "Having secured these supplies of coal and ironstone, Mr. Alexander Baird, about the year 1828, acquired from Mr. Hamilton Colt's trustees a lease of a piece of ground at Gartsherrie for the purpose of erecting blast furnaces thereon".¹⁹ This statement would also imply that the building of the works began after the leasing of Cairnhill, and that McGeorge had some difficulty in fitting in his information with James Baird's statement. In some financial

16. S.R.O., General Register of Sasines 1424. 86.

17. McGeorge, Bairds of Gartsherrie, 56.

18. Ibid., 55.

19. Ibid., 56.

accounts which survive details are given of the Bairds' payments to the canal company for movements of their barges along the canal. Admittedly these are incomplete but they do record most shipments between June 1827 and May 1830. In January 1829 the shipment of castings and wood is first recorded and from March onwards regular mention is made of boatloads of castings, wood, and bricks, presumably for the works being erected at Gartsherrie. If the building of the works did commence in Spring 1828, as James Baird said, then it took 27 months to reach production point, a remarkably long time even by contemporary standards. It is possible that the Bairds did not decide to erect a works till about mid 1828, just at the time when Neilson's patent was being prepared. They then secured an ironstone lease, and the ground for a furnace site, in the second half of 1828 and commenced work almost immediately.

In view of the bitter dispute between Neilson and the Bairds over the hot blast patent it seems quite probable that James preferred to obscure any link between Neilson's discovery and the brothers' decision to enter the iron industry. Whatever the accuracy of these suggestions, the first Baird furnace was blown in on 4 May 1830 and with it commenced a notable chapter in Scottish history.

CHAPTER I

The Ironworks - their acquisition and development

CHAPTER ONE

The Ironworks - their acquisition and development

The Bairds founded two ironworks - Gartsherrie and Eglinton, and acquired four others - Blair, Lugar, Muirkirk, and Portland. Of these Blair and Portland did not survive to 1914. During the period 1828 - 1914 these works were the scene of technical developments some of which were of considerable significance on a national and even wider scale. It is the object of this chapter to review the development of the various works and assess the impact of the changes introduced on the volume and efficiency of production.

Gartsherrie - The First Phase.

The Gartsherrie Estate offered an ideal location for an ironworks. Indeed its obvious attractions must have been in part responsible for the Bairds' decision to enter the iron industry. It was already known to possess large reserves of coal, and lay on the border of the Airdrie iron ore field. The Monkland and Kirkintilloch Railway provided a link with the Forth and Clyde Canal; the line of the Garnkirk and Glasgow Railway had been altered so that it began in the estate;¹ and a branch from the Monkland Canal into Gartsherrie was in course of construction. These transport developments provided not only first class links with raw materials but placed Gartsherrie closer than any other Monklands ironworks to the main outlets for pig-iron in and around Glasgow.²

The precise location took full advantage of these facilities.

-
1. George Buchanan, The Glasgow and Garnkirk Railway and others, Glasgow (1832). 7.
 2. See map "Sketch of the Lanarkshire Railways" in Buchanan, Glasgow and Garnkirk Railway.

The first furnace was built on a triangular piece of ground of which the Monkland and Kirkintilloch Rly, the branch canal, and the turnpike road, formed the sides. The original lease consisted of 4 acres, 3 roads, $1\frac{3}{4}$ falls [Scots measure], "For the purpose of erecting an ironwork or blast furnace, and other buildings and manufacturing that metal", the rent being £38.79 per annum. Legal entry was not till Martinmas 1830, the lease to run for 999 years.³ Initially the Bairds seem to have thought in terms of a works with three furnaces. The blowing engine was of sufficient power to blow only three. When it was decided to add to that number more land had to be acquired. The third furnace was apparently not built with future furnaces in mind. As a result when furnaces 4 to 7 were erected it was found to be so badly located that it had to be demolished.

The erection of the works was in itself a considerable achievement. The brothers lacked personal experience, skilled workmen and expert advice. They did have the assistance of two engineers but neither proved of great help. Alexander Fraser, an old friend of the family who had visited all the Scottish furnaces, knew a little about layout and his suggestions were in part adopted. David Doig, formerly employed at Calder Ironworks, was put in charge of the erection of the furnace and ancillary machinery. According to James, "He had a good deal of old school knowledge but was not very ready in making use of it",⁴ He was unwilling to make any decision

3. Strathclyde, W. Baird & Co. MSS - Gartsherrie Old Lease Book No.1. folio 262 - Feu contract of Gartsherrie lots.

4. McGeorge, Bairds of Gartsherrie, 58.

unless James was there to confirm it and finally left early in 1830 before the works were completed.

William and James were between them responsible for the planning and supervision of the work done. Apart from the furnace, they had to build coking ovens, lifting machinery, blowing engine buildings and blast-heating plant, this last being erected under the supervision of James B. Neilson. In contrast with the building of a blast-heater, the erection of coking ovens underlines the fact that Gartsherrie was in many ways the last of the old Scottish ironworks as well as the first of the new. This point is further illustrated by the No. 1 Gartsherrie furnace which was completely traditional, being a square-based truncated pyramid. By the end of April 1830 it was being dried out prior to being blown in. An incident at this stage highlighted the difficulties faced with regard to skilled labour. The furnacemen were unable to build in the dam or the tuyeres. In consequence James had to do the one, and William the other. At 10 a.m. on 4 May 1830 No. 1 furnace Gartsherrie began operations. At 6 a.m. the following morning the first cast, a small quantity of hard iron, was made. The furnace was soon working regularly and in the first year 3,100 tons were produced.

The capital cost of the initial plant can only be estimated. If we consider the works alone, and not the ironstone pits, workers houses and other extras, then perhaps £6,000 or £7,000 would be a reasonable approximation. If, on the other hand, we consider the total sum of money laid out by the Bairds on everything connected with the commencement of iron production at Gartsherrie, then a more

probable figure would be treble the first estimate.⁵ Even this larger figure of around £20,000 would be consistent with the impression that Gartsherrie was financed out of the family's own savings.

By the time the first years working was by, the Bairds had decided to erect a second furnace. The new one marked a significant step forward for the Scottish iron industry. On 11 September 1832 the first cylindrical furnace in Scotland was blown in at Gartsherrie. It was cheaper and easier to build, occupied less space, and was easier to bind together. The brothers, especially James, were still not satisfied and when in 1833 work began on a third furnace it was built to yet another design. Smaller than the others and of unusual shape it was erected on cast-iron pillars. Even after modifications to the hearth it could not be brought up to the production level of the other two and was decidedly unsuccessful, although the use of cast-iron pillars was a feature which re-appeared and became common later in the century. When blown in on 3 April 1834, it made Gartsherrie the most unusual works in the country.

The furnaces were not the only unusual feature of the works. James had turned his experimental drive to every aspect of the works. Most noticeable was the blast-heating apparatus which he designed to replace the unsatisfactory plant erected to Neilson's instructions. This original plant, similar to the third system used at Clyde, consisted of large pipes heated in brick flues, and

5. cf S.R.O. Blair of Blair Muniments Box 4a. John Miller of Cumbernauld House to Spiers 10 January 1837; Estimate of cost of erecting an ironworks at Blair by John Geddes c 1836. R.H. Campbell, "Growth and Fluctuation of the Scots Pig Iron Trade" (unpublished Ph.D. Thesis, University of Aberdeen) 17.

raised the temperature of the blast to about 280° F. James, in the second heater, introduced a pipe within the original pipe and passed the air through the space between. By so doing a much greater area of the air was exposed to heat, and the higher temperature achieved had a marked effect on production. James stated that the temperature was increased to from 450° F to 500° F and output nearly doubled, but these figures, like all those given by James, must be treated with caution.⁶

By 1834 William had determined on further expansion. At one stage he considered erecting new works on another site. The ground leased at Gartsherrie was fully used and nearby Thankerton had many advantages. Situated on the estate of Woodhall, where Robert was busy supervising the opening up of the coalfield believed to be equal to, if not better than Gartsherrie, Thankerton also looked fair to contain a good supply of blackband ironstone. Even if this hope proved false, the estate was immediately adjacent to Cairnhill, from which the Bairds were already drawing much of their supplies. The Wishaw and Coltness Railway, just completed and the mooted extension of the Monkland Canal through Woodhall, offered adequate communications.⁷ Nothing came of this scheme. Instead the works at Gartsherrie were expanded. For this new ground was required, and in October 1834 the existing lease was replaced by a feu contract for 6 acres 21 roods and 37³⁶/₁₀₀ falls [Scots measure] - the feu duty to be £54.49 per annum.⁸ The new furnaces, four in number,

6. McGeorge, Bairds of Gartsherrie, 61.

7. Ernest Canter, An Historical Geography of the Railways of the British Isles. (1959), 33.

8. Chartulary of Gartsherrie Estate Gartsherrie Works Feu 14 October 1834. (Allan, Louison and Hood, SSC., Edinburgh).

were improved versions of the No. 2 furnace. In place of the existing hearth, which was liable to bursting, James designed one consisting of an inverted arch made of three-feet long firebricks. This proved equal even to the heavier casts of later years, and was widely adopted in other ironworks. James also designed the new blowing engine required for these furnaces, in an attempt to remove the many defects which he had found in the No. 1 engine.

By the time these four furnaces were in blast, sometime in 1836, it had become obvious that the No. 3 furnace was badly situated in relation to the others. It had in any case proved an unsuccessful experiment in furnace design and so the Bairds decided to demolish it and build two others in its place. With the blowing in of the No. 3 (II) and the No. 8 furnaces the "old side" row was completed in 1839.

At about the same time that they resolved to replace No. 3 furnace, James was busy designing yet another blast-heater. In this he carried farther his belief that the air would be most effective heated in small quantities. The new heater was essentially an oven containing a large number of small pipes arranged so that the air passed back and forth several times. John Condie, of the Govan and Calder works, protested to Blackwood over the publication of a passage in the New Statistical Account which attributed this invention to Baird, maintaining instead that he was responsible.⁹ He asserted that he had personally explained the new system to William Baird. In later years James acknowledged that Condie had introduced a similar system but without, "stops on the

9. Strathclyde, R.B. MSS. John Condie to Blackwood and Sons
4 July 1840, copy sent to William Baird.

main pipes, by which, in my invention, the air was made to traverse the furnace so many times". It is probable that Condie was the true inventor and that James simply improved on the idea by adding the stop valves.

This was typical of Gartsherrie in the early years where the impression is given of a constant stream of innovations being introduced into an environment of seemingly continuous expansion. The brothers were alert for any new idea; ready to consider and test the merits of any feasible suggestion. They showed no hesitation in admitting the inadequacies of the No. 3 furnace and demolishing it even although it was a mere two years old. The ability to appreciate good ideas and see ways of improving on them; the confidence and perception to implement such ideas; these were the characteristics of this new force in Scottish industry. Nor was the timing of major expansion schemes quite random. The decision to build four more furnaces in 1834 came during a downswing in the trade and the furnaces were in blast in time to reap the rewards of the boom of 1836. The next phase of expansion exhibited similar timing.

In 1839 William again decided to double the size of the works, and so make it by far the largest pig-iron producing plant in Scotland. A further feu contract was arranged by which additional ground was taken on the opposite bank of the canal from the existing feu - one lot of 8 acres $22\frac{82}{100}$ poles for furnaces, and the other of 18 acres 1 rood $22\frac{2}{10}$ poles mainly for workers' houses. Till 1861, when the mineral leases on the Gartsherrie Estate were due to expire, the feu duty was restricted to £47.85, after which it was to be raised to £222.22 $\frac{1}{2}$.¹⁰ The extension meant that the entire layout

10. Strathclyde, W. Baird & Co. MSS Gartsherrie Old Lease Book No.1. folio 124 Feu Contract Gartsherrie March, September 1839.

of the works had to be rethought. William wrestled with the problem for a time without arriving at a solution, and the new works were finally laid out according to a casual sketch done by James. He also designed one huge blowing engine to supply the blast to all eight furnaces. Every effort was made to have the first four furnaces ready as quickly as possible. In November 1840 they were filled and heated and the blowing engine run for only an hour after erection before being linked to all four furnaces simultaneously, an event without precedent, at least in Scotland. By December 1841 another three were in blast and the remaining furnace followed soon after. In 1843, after fourteen years of rapid growth, Gartsherrie had reached its maximum size, at least in number of furnaces, with sixteen capable of producing some 100,000 tons of pig iron per annum.

Gartsherrie was unique in more than size. By 1843, a convenient date at which to outline the nature and layout of the works,¹¹ there were two rows, each of eight furnaces, parallel to one another on either side of the canal and about forty yards from the bank, the intervening space being taken up by the pig beds. Pigs could thus be loaded straight from the beds into scows, for distribution along the Monkland or Forth and Clyde Canal. Behind the furnaces the ground had been raised to form two vast furnace banks on which had been laid out a rail network enabling each furnace to be supplied

11. Description compiled from (1) McGeorge, Bairds of Gartsherrie, passim, (2) Ferdinand Kohn, Iron and Steel Manufacture, 1869, 9 - 11, (3) D. Bremner, The Industries of Scotland, 1869, (4) "Gartsherrie Iron Works" report in Glasgow Constitutional reprinted in Mining Journal 28 December 1850. (5) L. Gruner and M. Lan, "Traite sur L'Etat Present de la Meta)urgie en Angleterre", Annales des Mines (1860). 182-194.

with raw materials direct from railway trucks brought alongside. The "old" and "new side" systems were linked by a railway bridge spanning the pig beds and the canal.

On the old or south east side the experiments in furnace design had produced a variety of shapes and sizes. The No. 1 furnace, $32\frac{1}{2}$ feet square at the base and 38 feet high stood out from the others. Nos. 2, 4, 5, 6, 7, were probably 40 to 45 feet high, with No. 2 possibly smaller than the others. No. 3 (II) and No. 8 were probably 60 feet high. There were two such furnaces on the old site at Gartsherrie, probably in 1851 and certainly in 1860, but there is no definite proof that they were there in 1843. Production details for 1840 reveal that No. 3 (II) and No. 8 were the largest producers.¹² What information there is implies that no furnaces were replaced between 1840 and 1860, and the last two furnaces built on the old side would seem to be the most likely ones to have been built 60 feet high. These furnaces had an external base diameter of 22 feet. Internally the hearth was $7\frac{1}{2}$ feet in diameter rising straight for 5 feet then gradually widening until at half the height of the furnace it measured 18 feet across, before narrowing to 11 feet diameter at the mouth. These high furnaces were not a success, however. Because of the nature of the Scottish raw materials they could not support themselves in the boshes, the weight of the column being such that large lumps tended to break away and fall into the molten iron. These had to be cleared using long wrought iron bars inserted through the cinder-hole. Although the output was larger, the proportion of No. 1 foundry iron made, was frequently less than

12. Strathclyde, R.B. MSS, Output Details Furnaces 1 - 8, 2 August 1839 - 27 March 1840.

in smaller furnaces and there was no noticeable economy of raw materials. In order to increase the proportion of No. 1 iron and avoid the trouble and expense of keeping the hearth clear the furnaces had to be worked at less than full capacity.¹³

The "new side" furnaces were therefore built at a uniform height of 40 feet which James at the time considered the most suitable. No attempt seems to have been made to alter the internal shape of the furnace in order to support a larger quantity of raw materials, though the volume of these furnaces was probably greater than No. 2 furnace on which they were modelled. A thin wall, to protect the fillers, ran round the mouth of the furnace leaving a platform wide enough for a man and barrow. At the base there were four arched recesses, one of which contained the doorway by which the slag was drawn off, and also the opening through which the molten iron was discharged. The other three were occupied by the tuyeres. Unfortunately, there is no information concerning the number of tuyeres linked to each furnace but it is probable that Gartsherrie, like the other Scottish works of the time, was going beyond the earlier practice of using only two or three. A primitive but highly effective "hydraulic" hoist raised the charge to the furnace mouth. The lifting cage was connected over a pulley by a chain to a large tub which, when filled with water, was sufficiently heavy to raise the loaded cage. The empty tub could in its turn be raised by the weight of the cage, empty barrows and men.

The heaters were sited on the furnace bank beside the railway

13. St. John V. Day "On the Present state of some branches of Iron Metallurgy", Tr. Phil. Soc. Gl. (1868) 311-37.

branch to each furnace, where the coal slack could be conveniently delivered. Three blowing engines, all on the Cornish beam principle, supplied the blast for the entire works. The original engine, No. 1, built by Robert Baird of the Canal Foundry Port Dundas, which fed furnaces 1, 3, 8, and half of 4,¹⁴ had a 48" diameter steam cylinder and a 90" diameter air cylinder. The No. 2 blowing engine, which fed the other half of No. 4 furnace plus furnaces 2, 5, 6, and 7, was a product of James Gray's Washington Street Foundry, Glasgow, and had a 48" diameter steam cylinder and 90" diameter air cylinder.¹⁵ Gray also built the No. 3 blowing engine which fed all the "new side" furnaces. It had a steam cylinder 58" in diameter with a 10 foot stroke and worked with 7 lb. to 8 lb. of steam pressure. The steam was supplied by six double flued Cornish boilers 10 feet in diameter and 35 feet long. The air cylinder had a diameter and stroke of 120". The speed of piston in both cylinders was 300 feet per minute, giving 3,000 cubic feet of air for each furnace. The combined duty of the three engines was 300 h.p. and they supplied air to the furnaces at a pressure of $2\frac{3}{4}$ lbs. per square inch, via huge air receivers which the Bairds used instead of water regulators. The larger of these was 11 feet in diameter and 43 feet high; the lesser 10 feet in diameter and 40 feet high.

After four years of furious activity the Gartsherrie works were completed, and for the time being likely to remain unchanged. The doubling of capacity, during the depression years of 1839 - 42 was amply justified in the improved market situation of the mid 40s.

14. Strathclyde, W. Baird & Co. MSS, Managers Notebook Gartsherrie June 1858.

15. New Statistical Account, Vol VII "Lanarkshire" 659.

In spite of the rapid growth of iron-producing capacity in Britain, and particularly in Scotland, it seemed obvious that there was still further scope for expansion and the Bairds were determined to play an active part in this new phase.

Ayrshire Developments - the erection of Eglinton

By 1844 virtually every available strip of land in the Monklands likely to contain blackband ironstone had been bought or leased by one or other of the Iron companies. The phenomenal increase in the number of furnaces in Old Monkland parish - from 7 in 1830 to 60 in 1844¹⁶ - gave rise to a widespread concern that the precious blackband would soon be exhausted. Of more immediate importance was the sharp rise in mineral lordships, and local land values, occasioned by the industry's growth. It was therefore generally recognized that the industry had reached, if indeed it had not surpassed, its optimum size in the Monklands. Accordingly, the ironmasters turned to Ayrshire which was believed to contain reserves of blackband little inferior to those of Lanarkshire. Ayrshire's mineral reserves had already been exploited during the industry's earlier phase of expansion in the 1780s and 1790s when Muirkirk and Glenbuck ironworks were established.¹⁷ Glenbuck ceased operations when the partners went bankrupt during the difficulties of the Napoleonic War. Muirkirk struggled on alone until developments in Lanarkshire in the 1830s revived interest in the

-
16. Andrew Miller, The Rise and Progress of Coatbridge and Surrounding Neighbourhood, Glasgow 1864, 20. This ignores Clyde, on the border of Old Monkland Parish, which had four furnaces in 1830 and six in 1844.
17. For a general outline of the history of the Iron Industry in Ayrshire see R.H. Campbell, "The Iron Industry in Ayrshire", Ayrshire Collections Vol. 7 (1966). 90-102.

Ayrshire field, which was being opened up by the Glasgow and Ayr Railway. William Baird visited prospective sites and showed some interest in Blair¹⁸ which was subsequently leased by the company's legal agent, John Macdonald, who began to build a works on his own account. Other works were started, at Glengarnock and Cessnock but in the depression of the early 40s all three were in serious difficulties.

William had chosen to extend Gartsherrie rather than move to Ayrshire but by 1844, in common with other Lanarkshire masters, he once again began actively to pursue investigations in the county. By November 1844 work was proceeding in earnest on a number of mineral lots in Dalry, at Swinlees, Langside, Brownhill, Davidshill, Auchengree, Carsehead and Hingdo~~x~~g.¹⁹ A 50 year lease was taken of part of the estate of Wester Kersland for the erection of a works, and steps taken to link the mineral fields to the works by rail.

For at least six years there had been rumours to the effect that the Bairds intended to build a works in Ayrshire. These developments put the matter beyond doubt, and the Earl of Eglinton approached the company with an offer of a lease of the minerals in his extensive estates. He also promised to use his considerable influence to secure a suitable site for a works. It is difficult to be certain about the exact chronology of these early developments. At the beginning of January 1845 the Bairds were still actively

18. S.R.O. Blair to Blair Muniments Box 4a, Colonel William Blair to Patrick 20 January 1839.

19. Strathclyde, W. Baird & Co. MSS, William Baird & Co. Lease Book No. 1, folio 24, 36, 37, 42, 108, 169.

negotiating suitable terms for the carriage of pig iron from the Kersland site.²⁰ Apparently these were not very attractive, and this fact together with the acquisition of the Pitcon estate by the Ayrshire Iron Company, reported on the 6 January,²¹ seems to have had a decisive influence. For some months, the Bairds had been seeking, through James McCosh, their Ayrshire legal adviser, to gain control of Pitcon - the most attractive of the mineral sites in the area outwith the control of Blair or Glengarnock.²² When the Blair works won Pitcon it meant that in the immediate neighbourhood of the proposed works at Kersland the Bairds held only a few small disconnected parcels of mineral-bearing land separated by areas under the control of rival companies. Pitcon in fact lay directly between Kersland and the largest of these, Swinlees.

When James wrote to Robert on 3 January 1845 about the proposed railway rates, he noted that the Earl of Eglinton was anxious to speak to one of the brothers before any decision was made. The terms offered by the Earl were extremely favourable. The Blackband lordship, for example, was only 5p compared with 8½p and 9p in the Dalry leases. By the end of the month it would seem that arrangements had been made to build furnaces at Stobbs and to lease the Eglinton coal and ironstone.

George took charge of activities in Ayrshire, though in the initial planning and building he was assisted by James, who travelled regularly between Cartsherrie and Eglinton. The works were

20. Strathclyde, R.B. MSS, James Baird to Robert Baird 3
January 1845.

21. Strathclyde, R.B. MSS, John Jack to Robert Baird 6 January
1845.

22. Strathclyde, R.B. MSS, William Baird to Robert Baird 6
November 1844.

laid out on a site lying on a bend of the river Garnock, about six miles from the Earl of Eglinton's part of Ardrossan, and a little over 25 miles from Glasgow. The Glasgow and Ayr Railway was opened in 1840, and Ayrshire, like many other areas of Britain in the mid forties, was the scene of numerous railway proposals, which promised important improvements in communications.

The initial scheme was for four furnaces. Of these, work began on three about July 1845. James wished to have a horizontal blowing engine built at Eglinton, but his brothers vetoed the suggestion, and instead an engine, similar to the type built at Gartsherrie, was erected. The furnaces were blown in on 24 December 1846. During 1847 the Scottish Iron Industry moved rapidly towards depression, the price of mixed numbers falling from £3.90 to £2.32½. The Bairds experienced unspecified difficulties at Eglinton and towards the close of the year all three furnaces were blown out. The trend of the market may have been an inducement to take this action but it is not certain that it was the main reason. In Spring 1848 George decided to relight two of the furnaces and work was commenced on the No. 4 furnace. It is impossible to say when this furnace was completed since, between 1848 and 1852, there were apparently never more than three furnaces in blast at Eglinton although the fourth must have been ready long before the latter date, and the building of the fifth furnace was begun in 1851.

Gartsherrie 1843 - 1851

Although the number of furnaces at Gartsherrie was at its maximum in 1843, development of the works continued during the 1840s. Most notable were the improvements introduced in the blast heaters.

Those introduced in 1839 gave much higher temperatures than the original apparatus but proved expensive as a result of frequent breakages, caused by unequal expansion of the pipes. By 1846 a completely new heater had been designed by James. During the summer of 1847 it was used to heat the blast for No. 9 furnace, and proved highly successful. Heaters of this new "pistol-pipe" construction, which raised the temperature to 800° F, were fitted to the other furnaces as fast as they could be built, and similar heaters were adopted at other works throughout Scotland and England.

Since Neilson's first primitive apparatus had been successfully tested at Clyde in 1829, engineers in Britain and beyond had been introducing new forms of blast heater. Not surprisingly many of these heaters bore a definite resemblance to one another, and claims to originality are almost impossible to establish. This is particularly true of the next system used at Gartsherrie. Almost from the outset it had occurred to engineers that the blast furnace itself afforded an excellent source of heat, and attempts were made at Lloyd and Foster's in 1834 to take advantage of it.²³ Little progress was made, no doubt in part because the Hot-Blast patentees succeeded in having the all-embracing nature of their patent legally upheld. With the expiry of the patent, interest revived, and T. Palmer Budd, of Swansea, took out several patents, the first in 1845 for a method of using the furnace gases to heat the blast.²⁴ In July 1847 Budd wrote to Gartsherrie giving some details of his

23. A.H. Sexton, "On The Evolution of the Blast Furnace", Tr. Phil. Soc. Gl. (1898 - 9), 284 - 93.

24. Br. Patent No. 8,732.

latest system, in use at Ystalyfera Ironworks, and offering it to the Bairds at a licence fee of 2 $\frac{1}{2}$ p per ton of pig iron made.²⁵

Correspondence continued but in July 1848 Alexander Whitelaw wrote Budd postponing a decision on the matter, though he announced his intention of visiting Wales in the Autumn.²⁶

The following March James Baird and Alexander Whitelaw patented a process for heating the blast using an oven built into the tunnel-head of the furnace.²⁷

During 1849 - 50 experiments were carried out at three furnaces fitted with such ovens, while a further two were heated by drawing of the furnace gases and carrying them to ground level where they were burned under the existing heaters.²⁸

In January 1851 Budd wrote to Gartsherrie alleging that his patent was being infringed.

Alexander Whitelaw replied that while experiments had been carried out at Gartsherrie, he was not aware that any patent had been infringed. In any event the methods used had produced a loss and been given up.²⁹

James Baird wrote, rather cryptically, of their patented process, "It worked very well but was afterwards abandoned".³⁰

The most likely explanation would appear to be that the

25. Strathclyde, R.B. MSS, Palmer Budd to William Baird and Company 20 July 1847.

26. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 1. 118. Alexander Whitelaw to Palmer Budd 8 July 1848.

27. Br. Patent No. 12,508 1849.

28. Glasgow Constitutional quoted in Mining Journal 28 December 1850.

29. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 3. 661. Alexander Whitelaw to Palmer Budd 10 January 1851.

30. McGeorge, Bairds of Gartsherrie, 63.

alteration of the tunnel-head made necessary by any of the methods designed to use the furnace gases, upset the running of the furnace. The Bairds were intent on producing the greatest possible proportion of No. 1 foundry iron and could not permit anything to interfere with that object. Significant in this respect is the fall in No. 1 output from 74.2% during 1848-9 to 69.1% in 1849-50, the year of the experiments.³¹

Ayrshire 1850 - 1870 - the purchased works

During the 1850s and early 60s action occurred largely in Ayrshire where the Company bought and renovated four existing works, thereby becoming the county's dominant firm. Indeed these acquisitions made the Bairds the largest pig-iron producing firm in the world for a time in the late 1860s, before advances, particularly in America, set new production records, which the entire Scottish Iron Industry was quite incapable of challenging.

The first works taken over by the Bairds was Blair. These works had originally been projected by Andrew Craig a civil engineer in Glasgow, who in 1838 arranged mineral leases of Blair estate, together with a site for the erection of furnaces.³² In December 1838 these were transferred to John Macdonald, who put down pits, erected three furnaces and began to produce iron in January 1841. Mounting depression in the iron trade and rapid accumulation of stocks induced the Scottish masters to agree to restriction of the

31. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 3, 18; G.L.B. Vol. 3, 442; Production 1848-9, August 1849. Production 1849-50 David Wallace to James Bain.

32. Information on Blair works taken from Blair of Blair Muniments Box 4a deposited in the Scottish Record Office. For information concerning these papers I wish to thank John Hume of the department of Economic History, Strathclyde.

output at the end of the year. Under these conditions Macdonald, who had over-extended himself financially, found it impossible to continue and the works passed into the hands of his creditors. They were eventually sold in May 1843 to Alexander Alison, who during the boom conditions of the mid 40s planned an additional five furnaces, of which only two were built. Alison merged the Blair Iron Company with the Ayrshire Malleable Iron Company to form the ill-fated Ayrshire Iron Company. On the demise of that concern the works again fell into the hands of creditors who put them up for sale in May 1848 at a price of £65,000. With the iron industry once again experiencing difficult conditions no purchaser was forthcoming, even when the price was reduced to £50,000 and later £45,000. A committee headed by Thomas Biggart attempted to carry on the works on behalf of the creditors, but with little success, and the works were exposed for sale in March 1852. John McMurtrie, writer in Ayr, acting for the Eglinton Iron Company, made the only offer and secured the works and leases for the upset price of £33,000.³³ The works alone were said to have accounted for £20,000 of the price, although they were estimated to have cost £90,000 to build.

The items involved in the sale were:

- (1) A lease of the minerals on Blair Estate till 1920.
- (2) A feu disposition of 19 acres 2 roods 4 poles of Blair, with the buildings thereon [i.e. the ironworks].
- (3) A feu disposition of 11 acres of Blair.
- (4) A lease of Pitcon minerals till 1865.
- (5) An agreement on the use of the road through Pitcon.
- (6) The right to all agreements with Railway companies.

33. Strathclyde, W. Baird & Co. MSS, E.I.C. Lease Book Vol. 1 folio 1. Disposition and Assignment of Blair, May 1852.

All five furnaces were 48 feet high, but three had 16 feet wide boshes while the remaining two had boshes $17\frac{1}{2}$ feet wide. Each furnace had its own 30 pipe heater, "with all necessary air pipes, valves, bellows, water pipes, stop cocks etc.". There was one high pressure blast engine of 90 h.p. erected in 1841 and one condensing blast engine, expansive, 200 h.p. erected in 1847, complete with four boilers. For drawing waggons from the Ayrshire Railway to the bankhead there was a high pressure 28 h.p. engine with a barrel and wire rope. On the works ground there were two barrow weighing machines; two wooden lodges for weighers; five keepers lodges; one horse shed; and a smithy. Nearby were the manager's house; the works store; 207 workers' houses - of which 20 were only partly built; a foundry; wrights shop; smithy; and firebrick work. On ground to the north of the furnaces lay the partly completed malleable ironworks capable of producing 300 tons per week.³⁴ Strangely enough the Bairds, as mineral tenants of this last piece of land, had received £3,000 for the ironstone, when the Ayrshire Iron Company purchased the site in 1847.

When the Bairds took possession of the works on 15 May 1852 two of the five furnaces were in blast - presumably the two built by Alison. It was reported³⁵ that preparations were immediately begun to blow in the other three but in actual fact the number in blast at Blair remained at two until 1856. The three twelve year old furnaces had been out of blast for four years and would have required fairly extensive repairs if not virtual rebuilding. A more

34. S.R.O. Blair of Blair Muniments Box 4a, Description of Blair Ironworks (printed) 1 December 1857.

35. Mining Journal 29 May 1852.

serious problem was the pathetically inadequate works rail network. Whereas the Nos. 4 and 5 furnaces were served by eight lines of track the remaining three furnaces had only one line of railway among them. Steps to remedy the situation were not taken immediately; this would imply that the Bairds may have been content to operate Blair as only a two furnace works, until the improved market conditions of the mid 50s encouraged them to relight the old furnaces.

Also during the mild boom of the mid 50s they further extended their empire by purchasing Lugar and Muirkirk works from the trustees of John Wilson. Muirkirk, a malleable as well as a pig-iron works, was the oldest surviving Ayrshire ironworks, having been founded in 1787 by a company of Glasgow merchants including William Robertson, Thomas Edington, and John Gillies. After a not very successful history the works were transferred in 1816 to Robert and James Ewing, Alexander Reddell and Robert Yuille, who carried them on, again with little profit, until 1843. The changing circumstances of the industry in the early 40s, already referred to, enhanced the value of Muirkirk which the company promptly sold to Wilson of Dundyvan, Robert Napier, and Andrew and Dugald John Bannatyne. Napier and the Bannatynes were quickly disillusioned by the difficulties faced in attempting to realise the full potential of the site, and make the works a profitable concern. Napier remarked that it cost him £1,000 per annum for the honour and glory of calling himself an ironmaster.³⁶ The Wilsons, father and son, took exclusive control but even they found it impossible to make the works pay. They were, however, confident that the area could support an ironworks and in 1845 they joined with James and Colin

36. McGeorge, Bairds of Gartsherrie, 90.

Robert Dunlop in setting up the Lugar Ironworks seven miles west of Muirkirk. Built in the prosperity of the mid forties, the works were in difficulty in the depression which followed. Eventually, both works were put up for sale in May 1856 when James Stevenson, writer in Glasgow, bought them on behalf of the Eglinton Iron Company for £61,100.³⁷

The items purchased were:

- (1) A feu contract from Alexander Stewart of Glasserton of 128½ acres of Muirkirk.
- (2) A 950 year lease of 21 acres of Crossflat from Alexander Aird.
- (3) A 29 year lease, of which there were 16 years still to run, of the minerals of the Duke of Portland's Muirkirk Estate.
- (4) A fall of ground for a water lead, held by agreement with John Campbell of Auldehouseburn.
- (5) A 99 year lease, from Whit. 1845, from Sir James Boswell of Auchinleck, of 37.1 acres of Auchinleck for the purpose of erecting an ironworks.
- (6) Three mineral tacks each of 27 years, from Martinmas 1848, also from Sir James Boswell, of the minerals in the estate of Auchinleck.

At Muirkirk only one of the three furnaces was usable, and the malleable works, capable of producing 50 tons of finished iron per week, was lying idle. A second furnace was blown in at the beginning of June 1858 and the third sometime in 1860. The existing coal and ironstone pits were nearing exhaustion, and it was the raw materials situation, even more than the condition of the works, which presented problems. It was not that mineral reserves were not available but that the existing workings had reached the limit of their usefulness. By contrast, at Lugar where raw materials

37. Strathclyde, W. Baird & Co. MSS. Digest Vol. 1. folio 76.

were plentiful and the workings much more recently begun, two of the four furnaces were immediately blown in to take advantage of the prevailing demand for pig iron.³⁸ The Bairds found the works to have been very badly planned and as soon as the trend of the market turned in 1857, they were brought to a standstill. It is not certain what the Bairds proposed to do at Lugar or when the idea of completely rebuilding the works was first mooted. The scheme itself was carried out by Robert Angus, who did not go to Ayrshire until 1860, and the old furnaces were allowed to stand until 1863 or 4. About 1864 work began on the building of an entirely new works on an enlarged site incorporating the original ground. A massive earth-moving project completely altered the landscape and three new furnaces were built, of which two were in blast by December 1865.³⁹ Usual attention was paid to highly organised internal communications at Lugar where an entirely new and much enlarged railway system was laid out.

Just as work was beginning on the new Lugar furnaces the Bairds purchased their sixth, and last, ironworks. Portland Ironworks, at Hurlford on the outskirts of Kilmarnock, was, like Lugar, a product of the boom of the mid 40s. George Burns and David Chapman, with three other partners, acquired ground from the Duke of Portland in 1846. Their first furnace was not blown in until August 1849, by which time the fortunes of the industry had changed and the partnership soon found the difficulties overwhelming. In 1852 the works were sold to William Lancaster and James Thomas

38. Mining Journal 3 January 1857.

39. Hunts Mineral Statistics 1865.

Cookney, the latter's place being taken by Alexander Freeland in 1857. In the unfavourable trading conditions of the late fifties the company failed, and after the trustees for the creditors had attempted to run the works for a time, they were sold in 1864 to the Eglinton Iron Company.

The items included in the sale were:

- (1) Mineral leases on the estates of Portland, Loudon, Glenlogan, Groggar, and Norrisbank.
- (2) A railway agreement with the Glasgow and South Western Railway Company, concerning a branch line.
- (3) A lease of workers' houses at Crookedholm.
- (4) Portland Ironworks feu.

The works, with five furnaces, of which four had been constantly in blast during the previous three years, were in better condition than the others taken over by the Bairds. A sixth furnace, which may have been under construction when the works were purchased, was completed by 1865.

All the Ayrshire works purchased had had an unimpressive history and even under the Bairds they never rose to the number one rank. It seems undeniable that to survive at all the iron industry in Ayrshire required reserves of capital and skill which only major firms like the Bairds could provide. It is not, however, simple to explain why the Bairds bothered to rescue these works from disaster. The malleable works at Muirkirk provided a convenient source of many of those finished iron products in constant demand within the group. This could have been no more than an incidental advantage since it would have been a fairly simple matter to build a malleable plant at either Gartsherrie or Eglinton. Certainly the Bairds were anxious to remain ahead of their rivals, but there is no

evidence that any of the other ironmasters showed any desire to buy the Ayrshire works. Indeed, after 1852 when Merry and Cuninghame began operations at Ardeer, the Bairds were the only firm during the nineteenth century to add to the number of pig iron works under their control.

The most satisfying explanation would appear to lie in the availability of raw materials, more especially blackband ironstone. After 1865 improved communications made possible the use in Scotland of hematite ore from Cumberland; and at a later date the industry turned to Spain for supplies. Before that date, however, it seemed undeniable that whichever firm controlled the largest reserves of blackband, would survive longest. The dramatic expansion of the industry made the question of immediate, rather than remote, significance. Already the Bairds were being compelled to supply Gartsherrie from increasingly further afield at notoriously high freight rates. In Ayrshire, therefore, when the opportunity presented itself the Bairds purchased already proved and partially developed mineral leases and prepared furnace sites at well below their actual cost. The ironstone could thus be smelted within a relatively short distance of the mines.

Expansion in Ayrshire did not take the form only of the purchase of new works. At Eglinton in 1859 - 60 three furnaces were added, bringing the total to eight. In 1862 two of the original furnaces were demolished and two new ones begun, and on their completion a further two were demolished and replaced. By an agreement, signed in January 1862 the Bairds received permission to alter the course of the river Garnock, thus allowing them to extend the works and to re-arrange the railway system.

At Gartsherrie during the fifties and early sixties the works remained substantially unchanged. What evidence there is implies that no major rebuilding of furnaces or ancillary plant was undertaken. In 1864, under the supervision of John Alexander a three year project began, which modified and greatly improved the railway system in and around the works. These alterations were linked with the exploitation of the Denny-Kilsyth minerals to the north of Gartsherrie, and the proposed Coatbridge Mineral Railway. Agreement was reached with the North British Railway, the Edinburgh and Glasgow Railway, and the Monkland Railway, by which these companies altered the system around the works to suit the Bairds' internal changes.⁴⁰ In exchange, the Bairds agreed to support the amalgamation plans of the Railway companies. The furnace bank system was renewed and the bridge between the two banks rebuilt at a cost of £1,350.⁴¹ It was during these changes that the "automatic" haulage system was introduced between the Carlincroft pit and the furnaces, a distance of 150 yards. The winding engine of the pit controlled the cages in the shaft and the trucks on the surface in such a way that the raising of coal to the pit mouth coincided exactly with the supply of trucks.

In spite of this example the middle decades of the century appear in sharp contrast to the earlier years. It may seem in some respects absurd to criticise a Company which between 1850 and 1870 increased the number of furnaces under its control from twenty to forty-two, thereby becoming the world's major pig iron producer with

40. Strathclyde, W. Baird & Co. MSS, Railway Deeds & Agreements, Vol. 1 folio 18.

41. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 19, 474 A.K. McCosh to Glasgow 17 June 1867.

a capacity in excess of 300,000 tons per annum. Yet in the vital sphere of ironworks technology the firm displayed no initiative while rival districts in Britain, and foreign iron industries, reached and surpassed the best Scottish practice.

The 1870s - a watershed

The closure of the works at Blair marked, in a real sense, the beginning of the decline of the Baird Empire. It was not simply that the company controlled fewer works and fewer furnaces. This was more than counterbalanced by the building of newer furnaces and the setting of new production records at the remaining works. In the years after 1870 the company earned fresh claims to a notable place in Scottish industrial history. But the causes which brought about the closure of Blair works were to lead eventually to the disappearance of all the remaining works. Although there were many incidental aspects, there was in essence only one reason - Blair was in the wrong place. The exhaustion of the local blackband coupled with the beginnings of the company's dependence on foreign ores meant that the ore necessary to keep the Blair furnaces in production would have to be carried past Eglinton. The position had been deteriorating for some time but in the favourable trading conditions of 1870 - 71 action was postponed.⁴² By May 1871 labour troubles were making it difficult for the Scottish ironmasters to meet the growing demand for pig-iron, and production was in fact falling. The Bairds probably decided that the closure of Blair, already planned, would enable the other Ayrshire works to produce more fully. Only two of the five furnaces had been in blast for some time and

42. S.R.O., Blair of Blair Muniments Box 4E, Alexander Whitelaw to Blair 2 June 1871.

at the beginning of June these were extinguished. Steps were taken immediately to dismantle the works, most of the usable plant being transferred to Lugar.⁴³

Here the raw materials situation was much more promising, and it was decided to erect two new furnaces, thereby effectively replacing the Blair works.⁴⁴ Significantly, however, these furnaces were built on traditional lines, probably making use of the best of the old Blair plant.

Some Scottish masters had begun to react to the challenge presented by Cleveland but the Bairds were not among them. Following the visit of Ferdinand Kohn the Addies began experiments at Langloan with the Addenbrooke system, and built a 70 feet high furnace, as well as attempting to use the waste gases of their smaller furnaces.⁴⁵ At Summerlee, Coltness, and Glengarnock various schemes were attempted, in the years 1868 - 72, to raise production, reduce the raw material to output ratio, and above all utilize the furnace gases all without causing the "gobbing" to which Scottish furnaces were notoriously liable.⁴⁶ The efforts of Ferrie, manager of the Monkland works, were generally regarded as the most successful.⁴⁷ In his new 90 feet high furnace the upper forty feet consisted of four separate retorts in which the coal was coked and the temperature of the charge raised before entering the furnace proper. After a two

43. Engineer, 16 June 1871.

44. Engineering, 1 September 1871.

45. J.S. Jeans, "The Pig Iron Trade of Scotland", The Practical Magazine, Vol. 1 (1873) 241 - 248.

46. Engineer, 27 September 1872.

47. Engineering, 21 August 1875.

year trial the results of which were widely reported the Ferrie furnace was hailed as the solution to the problem which had hitherto retarded Scottish progress. At other works, such as Shotts where experiments had been going on, these were abandoned, and permission was sought to build the Ferrie furnace. The Bairds neither experimented nor sought to take advantage of the progress made by others.

The success of the Ferrie furnace marked the beginning of a fresh period of activity in the 1870s during which many improvements were made at several of the Scottish works. The practice of closing the furnace tops hitherto avoided in Scotland - even when efforts were made to utilize the furnace gases - now began to gain ground. In 1872 the Coltness Iron Company introduced closed tops on two of their furnaces.⁴⁸ By the end of 1876 the Dixons were completing their third new close-topped furnace 76 feet high.⁴⁹ By April 1878 work was proceeding at Summerlee, Langloan and Calder, to rebuild the furnaces, all the new ones to be taller, with closed tops.⁵⁰

Not until the very end of the 1870s did William Baird and Company show any signs of joining in the renewal movement. By August 1879 only three of the sixteen furnaces at Gartsherrie were close-topped, and none of these had been rebuilt or even raised.⁵¹ To avoid taking up too much room trap doors were used rather than bell and cone. Work was proceeding with the closing in of some of the others, and similar steps were being taken at Eglinton and Lugar.

48. J.L. Carvel, The Coltness Iron Company (1948), 69.

49. Engineering, 18 October 1876.

50. Engineer, 7 April 1878.

51. Engineering, 26 August 1879.

These activities were the first indications that the company had, at long last, roused itself. In Spring of the same year, 1879, the patenting of a new apparatus, by John Alexander and Andrew Kirkwood McCosh, underlined with what effect the company was about to justify its leading place in the Scottish Iron Industry.

Progress Resumes - the development of by-product recovery

It had long been known that the waste gases of the blast furnace contained valuable by-products. At gas works and coking plant these were already being recovered. It was widely held, however, that in relation to the volume of gas given off by a furnace, the products would be so small as to defy separation or be separable only at prohibitive cost. The Gartsherrie furnaces alone produced almost as much gas in a day as all the Glasgow gas works combined could produce in two weeks.⁵² In 1877 the Bairds called Dr. Wallace of Glasgow, who was arguably Scotland's foremost industrial chemist. After extensive examination he stated without reserve that the by-products were not economically recoverable.⁵³ It is frequently pointed out that the British iron industry suffered in comparison with the foreign, particularly German, industry through its failure to employ chemists and accord due weight to such highly trained researchers. The development of by-product recovery is a notable example of how the generally trained practical man could prove the expert wrong. Alexander and McCosh refused to accept Wallace's view and by 1879 they had developed an apparatus which they promptly patented, though it had not been tested on any practical scale.⁵⁴

52. A.H. Sexton, The Metallurgy of Iron and Steel (1902), 193.

53. Ibid., 194.

54. Br. Patent No. 4117 (1879).

In 1880 an experimental plant was built at Gartsherrie to extract the by-products from the gases of one furnace, and experiments were carried out at Coatbridge Gas Works using identical Gartsherrie furnace coal.⁵⁵ Besides sulphate of ammonia, tar, and creosote, Alexander and McCosh had hoped to recover anthracene and benzole from the crude tar, but by February 1881 this hope had faded. Dr. Wallace's partner Robert Tatlock stated that the tar was of little value and far inferior to the product of gas works recovery plant.⁵⁶ Although, as expected, the ammonia and tar recovered fell far short of the theoretical maximum, the patentees were convinced that the project was feasible and in July 1881 work began on a larger plant. The experience gained had already led to the taking out of a second patent in 1880, and in 1881 a third was taken out which served as the basis for the building of the new plant.⁵⁷ The patentees were not experts in tar distillation nor were they anxious to draw the company too far into the new field of chemical production. At the same time however the volume of raw tar involved - about 20,000 gallons per furnace per month - made it desirable that the tar be treated on the spot. The company had been in touch with William Maxwell of the Chemical Works Dumfries, who treated some of the tar from the early experiments. He had a high reputation in the industry and patented an improved process for distillation of tar in 1868. In 1881 McCosh negotiated an agreement whereby the Bairds built a tar works immediately adjacent to the by-product recovery plant,

55. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 33, 521, A.K. McCosh to Coatbridge Gas Company 24 January 1881.

56. Robert Tatlock, "On By-product Recovery", Tr. Phil. Soc. Gl. Vol. 1883 - 4, 1 - 17.

57. Br. Patent Nos. 1433 (1880); 3785 (1881).

leased the works to Maxwell, and sold forward the entire output of tar.⁵⁸

The new plant was connected to one furnace in May 1882, but was in operation for only a short time when an accident, probably an explosion of the gas, brought it to a standstill. By July it was in regular operation again and a second furnace was linked to it in October. Attempts were made to cool the gases using a refrigeration plant but this proved unsatisfactory. When therefore work began in August on a full scale plant to treat the gases of all the new side furnaces Alexander and McCosh were obliged to resort to huge water coolers. Work was also begun on plant to treat all the furnaces at both Lugar and Muirkirk. At the beginning of August 1883 the Gartsherrie plant was completed and the linking up of the furnaces began. At Lugar and Muirkirk the plant came into operation at the end of September. Once again the Gartsherrie plant was put out of action by an accident shortly after its commencement and it was not in full operation until the beginning of January 1884.

By then knowledge of the activities at Gartsherrie had spread. In England, where most works used coke, interest was mainly confined to the works of North Staffordshire which used coal. The Bairds had satisfied themselves of the unsuitability of the process at coke-using works, at an early stage. In June 1881 they arranged for their works chemist to test the furnace gases at North Lonsdale Ironworks. Whereas the Gartsherrie gases yielded 190.05 grammes of tar and 12.20 grammes of ammonia per 1,000 cubic feet, the North

58. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 33, 628. A.K. McCosh to William Maxwell 11 July 1881.

Lonsdale works yielded no tar and only 0.19 grammes of ammonia.⁵⁹
 Enquiries were received from America and Europe, and preparations were made to extend the patent.

Naturally, the other Scottish ironmasters were immediately interested in a process which promised to save them from what hitherto seemed inevitable decline. The patentees during the early experiments were reluctant to give too much information concerning their apparatus. McCosh hesitated to tell even Isaac Lowthian Bell very much, and expressed annoyance at the numerous rumours being published, as a result of which the price of ammonium sulphate had been driven down from £20 per ton to £15. He had, however, to admit, "of course that we are experimenting with encouraging results is a matter of notoriety".⁶⁰ At Summerlee the Neilsons were quick to follow their neighbours lead and they patented an apparatus in 1832. Soon after James Addie of Langloan patented a third process, and other variants followed rapidly.

Alexander and McCosh combined their patent with that of a Birmingham engineer, W.S. Sutherland. He had long been involved in the designing of gas producers and had patented an apparatus to recover the by-products of the gases formed in this type of apparatus. Independently of Alexander and McCosh, he had arrived at a somewhat similar system, and probably to prevent dispute or perhaps the adoption of the Sutherland apparatus by rivals the patents had been combined.⁶¹

59. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 33, 612. A.K. McCosh to E. Wadham 1 July 1881.

60. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 35, 183. A.K. McCosh to I.L. Bell, 26 July 1883.

61. Journal of the Society of the Chemical Industry (1883), 453.

It was all the more galling, therefore, to have their patents so widely ignored, and A.K. McCosh gave vent to his feelings on the matter at the 1885 Glasgow meeting of the Iron and Steel Institute. In the discussion following Jones's paper on the new process McCosh protested vehemently at the idea that he and Alexander had not been solely responsible for the development of by-product recovery, and argued that all the apparatus then in use were variants of their Gartsherrie plant and infringements of their patent.⁶²

McCosh recognized that the high initial cost of the Gartsherrie apparatus was a strong incentive to seek an alternative. It was unfortunate for the patentees that in the early years a ready sphere of economy offered itself. As already pointed out, the crude tar recovered from blast furnace gases was of considerably lower economic value than the tar recovered from either gas works plant or by-product coke ovens. Those who wished to avoid infringement of the patent, while at the same time realising most of the advantages, could do so by building a plant which ignored the tar, recovering only the ammonia. Both the Summerlee and the Langloan plant were of this kind.

Alexander and McCosh persevered with a full plant for the recovery of all the by-products, and in time their decision was justified, as more efficient methods of treatment increased the value of the tar. In 1900 when Langloan reopened after being closed for eight years, it did so with a new by-product plant which

62. Discussion on W. Jones' paper, "The Present Position and Prospects of Processes for the recovery of Tar and Ammonia from Blast Furnaces", JISI (1885 Vol. 11), 410 - 429.

like the Gartsherrie plant recovered the tar, and in 1901 Summerlee changed over to a similar system.⁶³ By then the Gartsherrie patents had expired and it would seem that the patentees never enjoyed any income from this source.

If the patent itself was unremunerative, the process was of great value to the company and to the Scottish Iron Industry generally. Unfortunately, details are slight for the period before 1900, and attempts to calculate profitability are complicated by the steady increase in efficiency of the plant on the one hand and the sharp fall in the selling price of sulphate of ammonia on the other. About 1835 the yield of by-products at Gartsherrie was around 23 lbs of sulphate of ammonia and 22 gallons of tar per ton of coal, which realised a profit equal to 29.99p per ton of pig-iron produced.⁶⁴ By 1900 although the value of the tar had increased, sulphate of ammonia prices had continued to decline and the profit per ton of pig-iron produced was 17.75p.⁶⁵ The 1885 profit was equivalent to a reduction of 12.82% in the cost of production of Gartsherrie iron. Such a saving would have been of considerable value at any point in the nineteenth century. Coming as it did in the 1880s when the Scottish iron industry experienced the most difficult market conditions for fifty years, by-product recovery saved the industry from severe contraction.

The process was not, however, an unmixed blessing. It committed

-
63. J. Gillespie, "Notes on the Evolution of Blast Furnace Recovery Plant", JWSISI Vol. 1905 - 6, 1 - 23.
64. Based on figures given in (1) Journal of the Society of the Chemical Industry (1883), 453, by W.S. Sutherland (2) I.L. Bell, "On the Use of Raw Coal in the Blast Furnace", JISI (1884), 310 - 327.
65. Strathclyde, W. Baird & Co. MSS, Abstract of Production 1900 - 1901.

the Scottish iron industry to the continuation of its distinctive practice of using raw coal in the furnaces - a practice in large measure responsible for the continued use of small, low yield furnaces. The Scots eventually recognized that this was not where the future lay, but prior to 1914 most ironworks remained entirely, or very largely, users of raw coal.

Modernization

The development of a by-product recovery system was the most outstanding single event in the history of the Baird works after 1875. From this date to 1914, however, there was a continuous modernization project underway.

At Gartsherrie the closing of the furnace tops was carried to completion. The sixteen furnaces were reduced to fourteen in 1878 when modernization began and then to twelve in 1896. It was during this phase of development that the great pyramidal No. 1 furnace was finally demolished in 1896.⁶⁶ Much of the modernization was concentrated in the 1890s during which at least £55,825.76 was spent on the furnaces.⁶⁷ These were all completely new modern structures of greater capacity than the old ones. Reconstruction extended, "to all modern improvements for making ordinary and hematite iron": To the three blowing engines still in use after more than^a forty years a fourth was added in 1882. Somewhat belatedly, even compared with other Scottish works, the Bairds abandoned their "pistol-pipe" stoves in favour of regenerative hot blast ovens. Cowper

66. Sexton, Metallurgy, 174.

67. Strathclyde, W. Baird & Co. MSS, Abstracts of Production 1890 - 1900. Not all give figures for sums spent on the furnaces during the year.

wrote giving details of his latest form of stove in 1837, but McCosh replied that the company was unlikely to take any action for some considerable time.⁶⁸ Not until the early 1890s was any move made and the company chose Ford and Moncur stoves. One was in use by 1892, and a further two were in the course of erection during 1893.

In Ayrshire the introduction of by-product recovery plant at Lugar and Muirkirk was accompanied by modernization. Lugar, where a fifth furnace had been added in 1830, was the company's most modern Ayrshire plant - hence, no doubt, the decision to instal by-product plant there. Portland by contrast appears to have been among the most antiquated works in Scotland, and during the entire period of Baird ownership little beyond ordinary maintenance seems to have been carried out there. When the furnaces were finally blown out in 1890, after twenty-five years of undistinguished survival, they were all of the oldfashioned open topped style.⁶⁹ During the years 1864 - 90 the works never produced to capacity. Apart from 1865, the first full year of Baird ownership, when five furnaces were in blast, the number blowing seldom rose to four and, over the period, averaged 2.6.

At Eglinton after the rebuilding of the 1860s the works remained substantially unchanged until the 1890s when the changing pattern of raw material supplies prompted a reconsideration of development policy. In 1877 a furnace was demolished, reducing the number to seven. During the 1880s the future of this works like that of

68. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 38, 530, A.K. McCosh to Cowper 20 July 1837.

69. Colliery Guardian, 24 August 1890.

Portland would appear to have been in doubt. The average number of furnaces in blast in the years 1884 - 94 was only 3.1, all apparently open-topped and with no plant to recover the by-products. In 1894, with Portland closed and Eglinton iron enjoying a steadily rising reputation in the market, it was decided to modernize the Kilwinning works. Four of the furnaces were demolished in 1894, and work began immediately on the erection of three larger close-topped ones linked to by-product plant.⁷⁰ A measure of the rapid strides made in the design of such plant was the company's desire to study the systems adopted at other Scottish works before designing a plant for Eglinton.⁷¹ On the completion of the three new furnaces, the three remaining old ones were demolished and replaced. By 1899 Eglinton, from being the most out-of-date, had become the most modern of the Ayrshire works.

The development of the company's works exhibits clearly defined phases. During the first twenty years Gartsherrie was the scene of not only growth but experiment and innovation in almost every aspect of ironworks technology. The next twenty-five years were distinguished by almost complete technical stagnation. Not only did no new ideas originate in the company's works but those being developed elsewhere were not adopted. Even in Ayrshire where expansion took the form of buying up established works, these were modernized along traditional lines, and the Bairds became known as the most conservative representatives of a conservative industry. After 1875 the

70. Engineering, 1 November 1895.

71. Coatbridge, W. Baird & Co. MSS, G.L.B. Vol. 40, 986. A.K. McCosh to A. Gillespie 1 March 1894.

company once again won recognition by its development of by-product recovery. Nor was this an isolated event. From then until the outbreak of the World War a continuous policy of rebuilding, incorporating many of the newest ideas which had been and were being adopted elsewhere, enabled the company to enter the twentieth century with a modern up-to-date plant.

CHAPTER II

Products and Production

CHAPTER TWO

Products and Production

The development of the works was mirrored in the production levels obtained. Such technical development was not simply dependent on the will of the company to seek or to welcome innovation. Of direct relevance, particularly to any change in the form and dimensions of the furnace, was the nature of the available raw materials¹ on the one hand and the type of iron desired on the other. Before considering the productivity of the works it is therefore appropriate to review the changing nature of the end product.

For more than half the period under consideration the Bairds were orientated exclusively towards the production of No. 1 foundry pig-iron, for which they, and Scotland, won a world-wide reputation. Other types of iron were produced, but these were little more than brief almost imperceptible deviations from the norm. Kentledge was definitely made at one stage,² and the Bairds, together with several other Scottish ironworks, held a licence to manufacture a specially toughened iron by a process patented by Andrew Stirling.³ Apparently none of this iron was ever made at Gartsherrie. So strong was the emphasis on No. 1 iron that white iron, normally considered inferior and of lower value, was charged for at a higher rate if a specific order was made on Gartsherrie for its production.⁴ To produce 100% No. 1 iron was in the nature of things beyond the

1. See below page 143ff.
2. Strathclyde, W. Baird & Co. MSS, G.L.B. 4, 411, 17 Feb. 1852.
3. Strathclyde, W. Baird & Co. MSS, G.L.B. 3, 449, 26 June 1850
D. Wallace to Alfred S. Jee.
4. Strathclyde, W. Baird & Co. MSS, G.L.B. 5, 183, 4 January 1853, D. Wallace to Mossend Iron Company; Kohn, Iron Industry, 9.

realms of possibility, and in practice Gartsherrie iron fell into the grades Nos. 1, 2, 3, 4, white, and mottled. The pigs were graded by a selector who based his decision on the visible appearance of a fracture of the iron, and the bulk of Gartsherrie iron fell into grades 1 and 3, with the selector, when occasion demanded, exercising his judgement in favour of the grade most in demand.

During the years 1830 to 1850 continuous technical change was accompanied by steady improvement in the proportion of No. 1 iron made. From 4 May to 1 November 1830 38.15% of the iron made was No. 1 grade.⁵ Bearing in mind the newness of the furnace this is probably an abnormally low figure but even so the sharp rise during 27 March to 6 May 1831 to 63.1% is particularly striking.⁶ The furnace was being blown cold blast during this second period and the improved proportion of No. 1 produced at Gartsherrie illustrates one of the criticisms often made of the early hot blast apparatus. By 1840 the proportion of No. 1 made was 41.7%, a slight improvement on the 1830 figure.⁷ Progress was more marked in the next decade. By July 1845 the percentage of No. 1 had risen to 63.08%⁸ and by 1848 - 9 it had reached 74.2%⁹. During 1849 - 50 the figure fell to 69.1%,¹⁰ which so far as it was a significant decline was probably owing to the interference with the furnaces resulting from the

-
5. Report on the Trial, J.B. Neilson and others versus William Baird and Company, page 361, evidence of Arthur Borthwick.
 6. Ibid., 360, evidence of Arthur Borthwick.
 7. Ibid.
 8. Strathclyde, R.B. MSS, 15 July 1845. Alexander Whitelaw to Robert Baird.
 9. Strathclyde, W. Baird & Co. MSS, G.L.B., 3, 18, note of production 1848-9.
 10. Strathclyde, W. Baird & Co. MSS, G.L.B. 3, 442, 19 June 1850, D. Wallace to J. Bain.

hot blast ovens then being experimented with. That the quality of Gartsherrie iron was being adversely affected at this time is made clear in a letter from James Bain to James Baird. He wrote in October 1850 that he had written to Alexander Whitelaw, "about the quality of iron we are getting down. We are receiving complaints daily and they are affecting the demand for our iron".¹¹

By 1861-2 the position had undergone a decided change, with only 51% of the iron produced being graded as No. 1,¹² and for the week ending 20 December 1862 the proportion was only 46.93%.¹³ A note for the 20 August 1868 gives the output of No. 1 as only 40.6%,¹⁴ and it seems undeniable, even allowing for the scarcity of figures, that the efficiency of Gartsherrie had definitely deteriorated in regard to production of No. 1 foundry iron. Kohn in 1868 speaks of the production of Gartsherrie as being 80% No. 1, but this is quite definitely wide of the mark.¹⁵ It must be borne in mind that the average varied significantly from day to day. For the 16 - 19 December 1862 the proportion of No. 1 made was 41.97%, 54.13%, 47.62% and 53.51%. Even so an average which did not rise above 54.13% appears inconsistent with a policy of offering the furnacemen a bonus for all No. 1 iron produced in excess of two-thirds of the total monthly output of the furnaces. A table has survived, which gives the production of each grade of iron by each furnace for the week ending 20 December 1862, and this provides a probable explanation.¹⁶

11. Coatbridge, W.B. & Co. MSS, 22 October 1850, J. Bain to J. Baird.

12. Strathclyde, W.B. & Co. MSS, Production Abstract 1861-2.

13. Strathclyde, W.B. & Co. MSS, G.L.B. 14, 65, 20 December 1862.

14. Strathclyde, W.B. & Co. MSS, G.L.B. 21, 279, 20 August 1868.

15. Kohn, Iron & Steel, 9.

16. Strathclyde, W.B. & Co. MSS, G.L.B. 14, 68, 20 December 1862.

It brings out, firstly, the staggering variation between one furnace and another. Furnace No. 6 produced only 4.5% No. 1 while furnace No. 15 produced 74.52%. In fact four out of the fourteen furnaces in blast exceeded 66% and another two were above 60%, so for those on the right furnace the bonus scheme was a real incentive. The chart also reveals another point of interest. With the exception of furnace No. 5, all the "old side" furnaces produced less No. 1 than the poorest of the "new side" furnaces. The "old side" average was 23.03% (22.07% excluding furnace No. 5) and the "new side" average was 63.95%.

The fact remains, despite these qualifications, that the Bairds were producing proportionately less No. 1 pig-iron by 1870. This change cannot be dismissed as a relaxation of effort occasioned by a decline in demand for high grade foundry iron. John Alexander took the extraordinary step of writing a formal letter to his furnace manager in January 1871 criticising his failure to improve the position.¹⁷ The company thereafter continued to seek, by various methods, the highest possible proportion of No. 1, and the average for 1878 - 9 had been improved to 56.3%.¹⁸ Even in 1881 A. K. McCosh still wrote, "Our business is at present to produce the highest class of foundry pig-iron".¹⁹ Changes in the supply of raw materials contributed to the problem, but the condition of the works must figure largely in any explanation. The period of decline coincides with the years during which no new furnaces were built, and

-
17. Strathclyde, W.B. & Co. MSS, G.L.B. 22, 217, 21 January 1871, John Alexander to A. Cameron.
18. Strathclyde, W.B. & Co. MSS, Production Abstract 1878 - 9.
19. Strathclyde, W.B. & Co. MSS, G.L.B. 33, 255, 11 January 1881, A.K. McCosh to Francis C. Knowles.

the works generally seem to have marked time. The exceptional efficiency of No. 5 furnace as compared with the others on the "old side" may well have been due to recent repair work, which if true would underline the sad condition of the other furnaces.

After 1880 the downward trend resumed, and although there were fluctuations from year to year, broadly speaking the fall continued, to reach an all time lowest figure of 23.77% No. 1 in the year 1913-14.²⁰ The matter was no longer as critical as it would earlier have been. This was owing in part to the growing opportunity to dispose of other grades; the slowly narrowing market for Scotch foundry iron; and the rise of an alternative product. These factors set the company free to improve production at the expense of quality, since although the proportion of No. 1 iron declined, the absolute quantity produced remained sufficient to meet demand.

About 1884 Gartsherrie marked its first step away from dependence on production of No. 1 foundry iron when hematite pig-iron became a regular product of the works. The first hematite iron was made at Gartsherrie long before. During October and November 1868 experiments were conducted using Cumberland and Spanish ores and the resultant pig-iron sent to Dr. Wallace for analysis.²¹ Most of the experiments were carried out using only a proportion of hematite ore added to the usual Scottish ores, but some hematite pig was made using 100% hematite ore and coke in the furnaces. The practice was given up, for reasons which remain uncertain, though probably the pig-iron produced still had too high a percentage of

20. Strathclyde, W.B. & Co. MSS, Production Abstract 1913 - 14.

21. Strathclyde, W.B. & Co. MSS, G.L.B. 20, 664, 680, 745.

phosphorus to be used for steelmaking. The hematite iron apparently remained unsold and was still in stock in April 1870.

After the failure of these experiments attention at Gartsherrie turned to a method whereby pig-iron made from native ores could be rendered suitable for steel production. Scotch pig made with blackband contained too high a percentage of both phosphorus and sulphur to be converted to steel by the existing methods. On 17 April 1868 William Gorman, best known for the development of the Gorman regenerative furnace, patented a process for improvements in the manufacture of iron and steel.²² He maintained that existing methods of steel production would remove the phosphorus and sulphur from Scotch pig-iron if only the molten iron were not covered by a protective layer of silicious slag. His process consisted therefore of introducing an additional stage in steelmaking, at which the silicon was removed. During 1869 he carried out experiments at Gartsherrie and Dr. Wallace's analysis revealed a marked reduction in the silicon present.²³ A second patent was secured in 1872 and further experiments carried out at Gartsherrie. These produced a pig-iron even lower in silicon than before and so incredibly hard that Wallace had great difficulty in crushing a sample for analysis. In spite of the theoretical success of the process it does not seem to have gained favour among steel producers - nor were the Bairds sufficiently convinced to use it on their own account. In any event, by the mid 1870s, the Scottish iron industry was becoming increasingly dependent on foreign ores and obliged to use the native

22. British Patent No. 1256.

23. William Gorman, "On producing cast steel or ingot iron from crude or pig-iron", Tr. Phil. Soc. Gl. Vol. 16 [1884-85], 289 - 296.

ores sparingly, for the production of ordinary foundry iron.

Accordingly, in the late 1870s more determined efforts were made to produce hematite iron. In July 1877 a sample of Gartsherrie No.1. hematite pig-iron, made from Cumberland hematite ore and the best coke and limestone, was sent to Dr. Wallace to be analysed.²⁴ It did not come up to the desired steel-making standard but was considered suitable for foundries and forges. Later in the year hematite pig was made using a mixture of Cumberland and Spanish ores. An analysis of the average pig-iron produced contained 0.035% phosphorus and 0.01% sulphur, which still placed it above the 0.05% phosphorus considered acceptable for steel-making. It is not certain when regular production of hematite became established at Gartsherrie. In February 1881 A. K. McCosh offered to supply the Airdrie Iron Company with Gartsherrie hematite though his letter implies that it may have been taken from stock.²⁵ He does, however, say clearly that hematite was currently being made at Eglinton. Separate figures for hematite output were first given in 1885 - 6, but the use of a considerable amount of hematite ore from 1882 - 3 makes it possible that hematite iron was made earlier. From then until 1914 both ordinary and hematite pig-iron were steadily produced. Only in the year 1912 - 13 was any basic pig-iron made at Gartsherrie. Even then it accounted for only 1,370 tons out of a total production of 168,741 tons, and was the result of an experiment using the ores of Raasay, then being opened up by the Company. Of this output, 1,314 tons were sold and the remaining

24. Strathclyde, W.B. & Co. MSS, G.L.B. 30, 554, 4 July 1877, A.K. McCosh to Dr. Wallace.

25. Strathclyde, W.B. & Co. MSS, G.L.B. 33, 388, 10 February 1881, A.K. McCosh to Airdrie Iron Company.

56 tons transferred to ordinary stock.²⁶

Productivity

Scottish and British estimates of average output per furnace are notoriously unsatisfactory because of the crude method of calculation. Carr and Taplin who use Hunt's figures for United Kingdom averages point out that those are calculated on the basis of the number of furnaces in blast on 31 December in each year, and not the average of the year.²⁷ To some extent the figures which are used below for Scotland after 1845 are more accurate since they are derived using the average number of furnaces in blast. Even so only limited confidence can be placed in an average which is itself calculated using figures some or all of which are only approximate.

Since, broadly speaking, these criticisms can be made with equal weight of all the figures to be used, for Bairds, Scotland, and the United Kingdom, then comparisons over time and between one district and another are likely to be substantially valid. Where very accurate figures can be calculated these will be alluded to but not used in the general argument - since, ironically, they would distort the picture.

Evidence given at the Neilson v Baird trial has ensured that figures concerning Gartsherrie output per furnace in 1830 are among the most accurate we have. The average output per week from 4 May to 1 November 1830 equalled 55 tons 13 cwt, using the hot blast, and during the cold blast period from 2 November 1830 to 31 May 1831 the

26. Strathclyde, W.B. & Co. MSS, Production Abstract 1912 - 13.

27. J.C. Carr and W. Taplin, History of the British Steel Industry Oxford (1962), 5ln.

average fell to 48 tons 16 cwt per week, giving an average weekly output for the year of 52 tons.²⁸ Taking into account the number of days not worked in the November 1830 to May 1831 period the average weekly output becomes 61 tons 1 cwt, with a best of 70 tons per week and a worst of 53 tons. These much higher figures demonstrate not only the inadequacy of general averages, but also the problems of working constantly faced by an ironworks of the period. In the Bairds' case these problems, no doubt intensified by the newness of the works and the poor quality of the labour force, caused the loss of 43 days out of 211 or 20.4%; this using the standard cold-blast method of working, and not the novel and depressingly accident-prone hot-blast.

It is very difficult to compare Gartsherrie performance with that of any other work or group of works at this time. Owing to the technical changes then taking place, most notably the introduction of the hot-blast, output was improving rapidly. It is, therefore, particularly important that comparisons should be made which refer to the same period of time, and broadly similar conditions of working. Since this has not proved possible, the following figures are of only limited value. During 1830 the three Clyde Ironworks furnaces, blowing hot-blast, had an average output of 54 tons per week, and during the first six months of 1831, again using hot-blast, one of these furnaces averaged 58 tons 7 cwt per week, with a best of 68 tons 2 cwt and a worst of 44 tons 9 cwt.²⁹ Broadly speaking these figures are similar to the Gartsherrie figure but Clyde, the centre of hot-blast working, was a particularly

28. Report on Trial Neilson v Baird, 360, evidence of Arthur Borthwick.

29. David Mushet, Papers on Iron and Steel (1841), 918.

progressive works, and the other Scottish furnaces were probably on average much nearer the 37 tons per week obtained at Clyde in 1829, using cold-blast.

During the seven months from 1 November 1839 to 31 May 1840, with eight furnaces in blast, average weekly output per furnace was 85 tons 19 cwt, a rise of 65.12% over the 1830 figure.³⁰ The works average conceals considerable variations among the furnaces even those of identical dimensions. The most productive furnace, No. 3, had an average output of 102 tons 8 cwt compared with 67 tons 12 cwt per week by No. 2, the least productive. The No. 1 furnace which averaged 92 tons 4 cwt per week was 77.3% above its 1830 - 31 performance. More significantly still, if we make the exaggerated assumption that the No. 1 furnace was in full blast throughout the period from November 1839 to May 1840 and adjust it to compare with the 1830 - 31 figure, it still shows a 41.4% increase in average output. While recognizing that the earlier figure for the Gartsherrie No. 1 furnace may be unusually low because of the newness of the works, nonetheless the conclusion must remain that over the first decade a significant increase was achieved in output per furnace, and that the increase was not a result of the new style of furnaces. Although many things - more efficient workers; an increase in the number of tuyeres; more regular operation - would all contribute to this improvement it is possible that the rapid strides made in the design of blast heating equipment were the most significant factor.

During the first six months of 1839 one of the Clyde furnaces

30. Report of Trial Neilson v Baird, 175, evidence of Donald Lindsay.

had an average output of 83 tons per week, with a worst of 73 tons 10 cwt and a best of 96 tons 17 cwt.³¹ At about this time, also, Dundyvan furnaces had an output of from 90 to 100 tons per week, of which forge pig-iron possibly accounted for a greater proportion than at Gartsherrie. The Baird furnaces were among the most productive in Britain. They were well above the Scottish average of 70 tons per week, which in its turn was exceeded only by the great forge pig-iron works of South Wales lying East of the river Taffe. The best South Staffordshire furnaces at Tipton, specializing in forge iron, had an output of 87 tons 10 cwt per week, and of the foundry iron makers Bradley came first with 65 tons per week, while the average for the district as a whole was only 63 tons per week. Even William Jessop's famous Butterly works, Derbyshire, averaged only 60 tons per week.³²

By July 1845, with the eight new furnaces completed average output had increased to 119 tons 3 cwt per week.³³ Since this figure is based on a note of only two weeks output it is a far from satisfactory average. Nevertheless, contemporaries estimated Gartsherrie output at 113 tons per week, which is probably about right. The Bairds were by 1845 only fractionally above the Scottish average of 111 tons 7 cwt, and lay far behind several of their rivals. Govan, Langloan and Glengarnock were well to the fore each with 130 tons per week, their higher output being achieved possibly through a greater concentration on forge pig-iron. Calder with an output of about 121 tons per furnace per week was also ahead of Gartsherrie,

31. Mushet, Papers on Iron and Steel, 919.

32. Ibid., 414 - 421.

33. Strathclyde, R.B. ISS, 15 July 1845, Alexander Whitelaw to Robert Baird.

then came a number of works; - Carnbroe (112 tons per week); Dundy-
van (111 tons per week); Monkland and Blair (each with 110 tons per
week); Clyde (108 tons per week); and Summerlee (105 tons per week);
- all at about the same average as Gartsherrie. A number of works
were grouped together at 100 tons per week - Shotts; Castlehill;
Muirkirk; Garscube; and Coltness. The remaining works were Omoa
with an average of 90 tons per week, and Devon and Carron each with
80 tons per week. Gartsherrie was therefore fifth out of the nine-
teen works then in operation.³⁴

Progress continued and by 1849 - 50 the Gartsherrie furnaces
averaged 133 tons per week, a decennial increase of 54.8%.³⁵ They
still compared favourably with the Scottish average of 131 tons 15
cwts but only by a statistically insignificant figure.³⁶

During the next twenty-five years total production at Gart-
sherrie remained almost stationary, and, as already indicated, there
were no known alterations of any importance to the furnaces or other
equipment. Nevertheless, average production per furnace did in-
crease, a fact concealed by the under-utilization of the sixteen
furnaces over the period. The average output for the year 1861 - 2
was 141 tons 1 cwt,³⁷ and for the week ending 20 December 1862, with
the two sixty feet tall furnaces (Nos. 3 and 8) out of blast, aver-

34. Scotch Reformers Gazette, 17 June 1845, and corrections of 21
June and 28 June 1845. The original table was printed as a
corrective to that which appeared in the Glasgow Chronicle, 10
May 1845. The tables differ in quite a number of instances
but the Gazette appears to be more accurate.

35. Strathclyde, W.B. & Co. MSS, G.L.B. 3, 442, D. Wallace to J.
Bain, 19 June 1850.

36. Calculated from J. Rowan, "On the Iron Trade in Scotland",
JISI 1885 (II), table II, 390.

37. Strathclyde, W.B. & Co. MSS, Production Abstract 1861 - 2.

age production per furnace equalled 143 tons 8 cwt. These figures place Gartsherrie well below the Scottish average of 180 tons per week. The works' average conceals wide differences. The least productive furnace, No. 6, had an average output of only 111 tons per week, but No. 2 furnace, the most productive, was probably as efficient as any in Scotland, with an output of 228 tons per week.³⁸ By March 1876 the output of the six "old side" furnaces in blast had been raised to 211 tons 6 cwt,³⁹ compared with 158 tons 15 cwt in 1862. Assuming the relationship between "old" and "new side" to be the same as in 1862 the average output per furnace for the works as a whole would be 190 tons 16 cwt, an increase of 33.06%.

Once again the average is deceptive in at least one important respect. The individual details for each of the six "old side" furnaces reveals that the most productive furnace during May 1876 produced 238 tons per week compared with a best of 228 in 1862. This increase of 4.4%, given possible variations, is statistically insignificant. The overall average had been raised not by any improvement in the weekly yield of the better furnaces but by bringing the poorer furnaces of the earlier period up to the level of the best. Thus No. 6 furnace, which was the least productive furnace in 1862, putting out only 111 tons per week, or less than half that of the best furnace, had by 1876 become the most productive with a weekly output of 238 tons. Taken together the three poorest furnaces of 1862 - Nos. 5, 6, and 7, - showed an increase in output of 81.04%.

38. Strathclyde, W.B. & Co. MSS, G.L.B. 14, 68, 20 December 1862.

39. Strathclyde, W.B. & Co. MSS, Managers' Notebook Gartsherrie, 1 April 1876.

If, as Alexander Whitelaw claimed, some of the Gartsherrie furnaces were already producing, "upwards of 200 tons per week"⁴⁰ in 1851, and the best of 1876 was only 238 tons per week, then the impression gained earlier, of technical stagnation, is substantially confirmed by the production figures. The fact that average output per furnace increased by only 42.89% in the twenty-five years after 1850 compared with an increase of 155.8% in the twenty years before that date, is additional confirmation. Nevertheless, an increase in average output which exceeded 40% for the works as a whole, and was over 100% for particular furnaces, brings out clearly the fact that the works must have been the scene of constant, if unspectacular, activity. The progress realised, underlines the extent to which insignificant alterations and the determined application of existing knowledge could be as dramatic as any major discovery.

Although by the mid 1870s the Gartsherrie works once again equalled the Scottish average output per furnace, this average had ceased to be the criterion of efficiency that it had been twenty-five years earlier. Between 1850 and 1876 the British iron industry had been transformed by the rise of new centres of production, most notably Cleveland, and the decline of once famous regions such as Staffordshire. The average output per furnace for Britain as a whole had risen from 110 tons per week [Scotland 140 tons per week] in 1852⁴¹ to 200 tons per week [Scotland 180 tons per week] in 1875⁴². Cleveland, by 1875, had an average production of 340 tons per week per furnace, while the best furnaces were producing 750 tons per

40. Strathclyde, W.B. & Co. MSS, G.L.B. 3, 830, Alexander Whitelaw to Bird, 30 April 1851.

41. Mining Journal, 17 October 1863.

42. British Iron Trade Association [BITA] Report 1879, 21 and 1880, 13.

week.⁴³ It would be misleading, however, to dismiss Scotland as a backwater of the iron industry at this date. Although the iron industry abroad was making rapid progress and individual furnaces were achieving large outputs, Scotland still remained on average ahead of all but Belgium.⁴⁴ The positions were decisively reversed before 1914.

After 1875 the rebuilding of the works was reflected in output per furnace. It would appear that the alterations of the late 1870s and 1880s - closing of the furnace tops, and introduction of gas utilization plant - had an adverse effect on output. By 1878-9 average output was 191 tons 19 cwt and this rose slowly to 202 tons 17 cwt by 1884-5.⁴⁵ Thereafter there was a steady fall to 165 tons 1 cwt by 1889-90. This was in marked contrast to the general Scottish average which by the same date had risen to 237 tons 17 cwt.⁴⁶ The generally poor labour relations of the period and unsatisfactory market conditions applied with at least as much force to other firms besides the Bairds, and it therefore seems unlikely that the Gartsherrie furnaces were on slack blast more often than those of neighbouring works. Perhaps effort and capital was

43. Carr and Taplin, Steel Industry, 51.

44. BITA Report 1879, 23.

45. Strathclyde, W.B. & Co. ISS, Production Abstracts 1878-9, 1884-5.

46. Iron Trade Circular (Byland's), 13 February 1915, Supplement, 10.

N.B. In order to remain comparable with earlier figures the Gartsherrie averages from this on are for ordinary iron only, unless otherwise stated. Statistics of ordinary and hematite output can be calculated for 24 out of the 29 years 1885-1914. In 11 years average output per hematite furnace exceeded the average for ordinary furnaces, which is at variance with the claim of Burnham and Hoskins [Iron and Steel in Britain 1870-1930, (1943), 145] that a furnace making foundry iron has only about half the output it would have if changed over to hematite.

concentrated on the erection of by-product recovery plant, and the furnaces allowed to decay because plans were already in hand for the building of new ones.

With the erection of these new furnaces during the 1890s the trend of falling output was reversed. Average production per furnace again exceeded 200 tons per week by 1893 and continued rising to a peak of 296 tons 8 cwt by 1906-7. Thereafter output declined and averaged 275 tons 1 cwt for the seven years before the war. In spite of this improvement - 35.62% above the best pre-1890 figure - Gartsherrie was below the Scottish average. This stood at 317 tons 2 cwt per week for all types of iron in 1906-7 compared with a Gartsherrie average of 293 tons 6 cwt for all the furnaces, both ordinary and hematite.

Scottish progress was inconsequential when set against advances elsewhere. By 1906 the British average was 556 tons per week, while that for the North East was 826 tons per week. Germany, Belgium, France and the United States had all long since surpassed both Scotland and England. In Germany average output was 850 tons per week [1,200 tons per week in Westphalia] and in the United States the figure was rapidly approaching 2,000 tons per week.⁴⁷

The relative failure of Gartsherrie and, to only slightly less a degree, of Scotland cannot simply be viewed as a failure of entrepreneurial initiative. Gartsherrie was largely rebuilt, with new furnaces, blowing engines, hot-blast ovens, and by-product plant. Considerable economies were realised and output improved. Measured

47. D.L. Burn, The Economic History of Steelmaking, Cambridge (1961), 190.

by earlier practice the firm achieved notable progress after 1875. That it failed to rival other iron-producing districts was in large measure owing to external factors beyond the firm's control. Thus the continued production of a large proportion of foundry iron inhibited adoption of the dimension of furnaces and technique of working used elsewhere. So long as it remained profitable to produce foundry iron it is naive to criticise William Baird and Company for continuing to do so. There are some indications that Gartsherrie continued to manufacture foundry iron to a greater extent than did Scotland as a whole, a reasonable policy given the great reputation enjoyed by the brand. This might well explain why Gartsherrie output lagged behind the Scottish average. The inhibitory effects of the use of raw coal have already been referred to. Forge and hematite pig-iron could not be produced in such great volume as could basic pig-iron and for this reason too Gartsherrie output failed to keep pace with foreign furnaces.

Nevertheless, the company cannot be completely exonerated. There were foreign techniques, such as separate hot-air systems for each furnace, different styles of furnace for different types of iron, and mechanical charging, which could have been introduced, although in these respects Scotland was no more backward than the rest of Britain. Equally of course Gartsherrie did not provide a lead by pioneering the introduction of any of these.

The dangers must be borne in mind of over-emphasising the significance of international and even regional comparisons of furnace output, since like is not being compared with like. Of greater relevance to the survival of William Baird and Company and the Scottish iron industry, was the degree to which they remained com-

petitive. The changes outlined were generally not introduced primarily in order to increase output. Indeed on some occasions, as for example, the closing of the furnace tops, the innovation made had an adverse effect on production. Of overriding importance was the contribution made to improving, maintaining or restoring profitability. It is, therefore, to the effect of technical change at the works on the cost of production, that we now turn.

Raw Material Consumption

Table No. II₁ shows a typical breakdown of the cost of production of one ton of Gartsherrie pig-iron. It is immediately apparent that raw materials are by far the most important factor influencing costs. In this instance they account for 83.14%, and in the years from 1873-1914 for which details survive the figure varies between 84.45% [1873-9] and 89.58% [1893-9]. Wages are the next important item, though far below raw materials, and over the same period they ranged between 4.64% [1884-5] and 7.01% [1913-14].⁴⁸ Of the remaining items only interest charges exceed 1% of costs, and even considered as groups they remain completely overshadowed by raw material costs.

Control of raw material costs was clearly of major importance. Regulation of the output cost of raw materials will be dealt with elsewhere.⁴⁹ In this section it is intended to examine the influence of technical change at the works on the consumption of raw materials. Since the effectiveness of technical change will be more clearly seen by studying the changes in the volume of raw mat-

48. For wages see p. Of course wages are an important element of mining costs.

49. See p. 49-159ff.

Gartsherrie Pig Iron : Breakdown of Production Cost 1882-3

		Pence	%	
<u>Raw Materials</u> 88.1421%	{	Coal & coke	69.37	27.26
		Ironchar, ironstone etc.	142.74	56.11
		Lime	10.693	4.202
		Blast engine & heater fuel	1.462	0.5701
<u>Wages</u> 5.0863%	{	Keepers, Assist.Keepers, Fillers & Enginemen	8.15	3.196
		Pig Lifting	1.092	0.4259
		Bar-sharping, Black-dirt & Slaghill men	0.626	0.2441
		Labouring & Repairs	1.728	0.6781
		Emptying waggons	0.584	0.2277
		Furnace manager, Policemen, time-keepers, weighers	0.806	0.3145
<u>Distributing Accounts</u> 1.684%	{	Sand	0.802	
		Foundry	0.814	
		Smiths	0.499	
		Magazine	0.899	
		Wrights	0.063	
		Brickwork	1.108	
		Engineers	0.130	
<u>Motive Power</u> 0.7174%	{	Waggons	0.647	
		Locomotives	0.432	
		Horses	0.735	
3.826%	{	Castiron rails & plates	0.244	
		Railways	1.460	
		Ground damages	0.332	
		Taxes	0.370	
		Salaries (Glasgow & local)	1.610	
		Depreciation	2.500	0.9828
		Interest	3.250	1.277
0.5307%	{	Cash : Sundries	1.360	
		<u>Total</u>	254.306p	

Source: based on Production Abstracts Gartsherrie Works 1882-3.

erials consumed, rather than their cost, comparisons will be made by weight. It is important to bear in mind that gradually over the period 1830 - 1914 the raw materials being fed into the Gartsherrie furnaces changed in character. This is particularly true of the ironstone, but is true also of both coal and limestone. In consequence comparisons over time, and between Gartsherrie and other works, would really be of fullest value only when the details of the raw materials used were known. In the discussion which follows the charge will be referred to under the headings coal, ironchar, and limestone. Coal will where necessary include coke (which has been converted to its coal equivalent); ironchar will include not only the traditional black-, clay- and slateyband ironstones of Scotland [given in all instances at the calcined weight], but also English and foreign ores, old metal, cinder, and briquettes; and limestone will include the different varieties used. Where possible the figures for dross used in blowing and heating the blast will also be given.

The figures normally used to illustrate the impact of Neilson's hot-blast on the Scottish iron industry are those by Mushet and Clarke for the Clyde Ironworks. Figures for Gartsherrie over the same period suggest a much less dramatic impact. During 1 January - 30 June 1830 using coke and hot-blast one ton of pig-iron required 103.25 cwt of coal at Clyde.⁵⁰ In the six months 4 May - 1 November 1830 also using coke and hot-blast one ton of Gartsherrie pig-iron

50. Dr. Clarke, "On the use of Hot-Blast in the manufacture of Cast Iron" Edinburgh Philosophical Transactions Vol. XIII, 374.

required 91 cwt of coal.⁵¹ Allowing for the slightly later date of the Gartsherrie example - important at a time of rapid improvement, and the possibility that Gartsherrie smelted a greater proportion of blackband than Clyde which used a mixture of $\frac{2}{3}$ blackband and $\frac{1}{3}$ clayband, the figures correspond fairly well. Usually the hot-blast is contrasted with the cold-blast by comparing Clyde in 1830 with the same furnaces in 1829. Using cold-blast in that year 171.5 cwt of coal were required to produce one ton of pig-iron. The Gartsherrie furnace was not in operation during 1829, but it did blow cold-blast from 2 November 1830 to 5 October 1831 during which time it required 107.5 cwt of coal per ton of pig-iron. At Gartsherrie use of the hot-blast produced a saving of only 16.5 cwt of coal compared with 68.25 cwt at Clyde. Allowing for partisanship in both figures, and the different periods to which they relate it seems probable that a significant proportion of the saving realised at Clyde must have been the result of general improvements quite apart from use of the hot-blast.

Nevertheless, the new process was undeniably of considerable value, and became increasingly so as improvements were made in the hot-blast apparatus. In the first six months of 1833 consumption of coal per ton of pigs was 45.25 cwt of coal at Clyde, while at Gartsherrie coal consumption was 53.5 cwt on average between 7 June 1832 and 31 May 1833, and 45 cwt between 1 June 1833 and 31 May 1834. By 1839-40 Gartsherrie consumption had fallen to 40 cwt, while at Clyde it stood at only 34.5 cwt in the first six months of 1839 [and 28.75 cwt using blackband alone or 43.5 cwt using clayband

51. Coatbridge, W.B. & Co. MSS, Abstract of quantities used in the Production of one ton of pig-iron 4 May 1830 - 27 March 1840.

alone, at about the same time].⁵² This refers to only one furnace and Mushet speaks of an average coal consumption of 45 cwt, though it is unclear to what precisely the average relates. At Dundyvan also about 1839 40 cwt of coal were required per ton of pig-iron. At Clyde during the 1830s there seems to have been little reduction in the quantity of lime required. This fell from 10.75 cwt in 1830 to 10 cwt in 1839, although at the latter date pure blackband required only 3.75 cwt of lime. At Gartsherrie limestone consumption was reduced during the decade from 12 cwt to 5.5 cwt, and at Dundyvan limestone consumption stood at 9 cwt around 1839. Gartsherrie would appear to have been particularly fortunate in this respect, a feature possibly more closely related to source of supply than to developments in smelting. Probably too it was a consequence of Gartsherrie's greater use of blackband ironstone.

Consumption of ironchar showed only slight reduction. From 39.5 cwt in 4 May - 1 November 1830 it fell to 35 cwt during 1835-36 rose again to 38 cwt during 1838-9 and then fell to 34.75 cwt from 1 June 1839 - 27 March 1840. At Clyde the reduction was more marked, ranging from 40.75 cwt in 1830 down to 34.25 in 1839, while at the latter date Dundyvan used only 31 cwt.

The 1830s were clearly a time of continuous reductions in the consumption of all the raw materials used in the manufacture of pig-iron, the fall being most marked in coal consumption, more especially after the changeover from coke to raw coal. Despite the claims of Gartsherrie as a pioneer in introducing the newest methods, particularly as regards heating the blast, it does not appear to

52. Mushet, Papers on Iron and Steel, 920.

have achieved greater economies than either Clyde or Dundyvan. Like the other Scottish works, however, it was well placed to challenge even the most efficient of its English rivals. Table No. II:2 shows Gartsherrie as consuming less of every raw material than any of the English works, the saving being particularly marked as between Scottish ironchar and English roasted ore.

TABLE II:2

RAW MATERIALS REQUIRED TO PRODUCE ONE TON OF PIG IRON
SELECTED WORKS

WORKS	COAL	IRONCHAR ETC.	LIME
Milton, Yorkshire	56.25	70.88 cwt ironstone	15 cwt
Codner Park, Derby	52.2	46 cwt roasted ironstone 7.4 cwt ore	18.3
Batterley	47.4	55 cwt roasted ore	19.3
Alfreton, Derby	55	77 cwt ironstone	18.3
Gartsherrie	37.25	35.5	7

Note - Figures for the English works relate to 2 weeks working in December 1836, and figures for Gartsherrie are averages for the year 1836-37.

SOURCE; See footnote 53.

The decisive reduction in the quantities of raw materials consumed, which played such an important part in stimulating the growth of both the Baird empire and the Scottish iron industry, was apparently confined almost entirely to the 1830s and possibly the early 1840s. Certainly by 1849-50 coal consumption had risen slightly to 42.75 cwt, limestone was also up to 8.25 cwt while ironchar consumption was almost unchanged at 34.5 cwt.⁵⁴ The rise in coal

53. Mushet, Papers on Iron and Steel, 922, and Coatbridge, W.B. & Co. MSS, "Abstract of quantities used...."

54. Strathclyde, W.B. & Co. MSS, G.L.B. 3, 442, D. Wallace to J. Bain, 19 June 1850.

consumption continued during the 1850s and by 1861-2 47.6 cwt were required to smelt one ton of pig-iron, limestone consumption had risen to 9.68 cwt, and there was again a slight reduction in iron-char consumption which stood at 33.38 cwt.⁵⁵ If figures for May 1867 are at all representative, then it would appear that the rising trend in coal consumption had been held in check. One ton of pig-iron required 47.75 cwt of coal, 33.25 cwt of char and 10.75 cwt of lime.⁵⁶ According to Kohn, Gartsherrie was one of the most efficient of the Scottish works as regards economy of fuel⁵⁷ but Scotland as a whole was notorious for its prodigality in this respect. Although the Gartsherrie figure cannot compare with Cleveland or Lancashire practice, it would appear to have been better than the average U.K. performance, assuming Hunt's figures for 1869, which give a coal consumption of 60 cwt per ton of pig-iron, are even approximately correct.⁵⁸

Unfortunately, there are no statistics for the 1870s during which determined efforts at Gartsherrie brought about an important reduction in consumption of coal. In 1878-9 only 35.62 cwt of coal were needed for each ton of iron.⁵⁹ Although the amount of coal required rose again during the 1880s, it reached a high point of only 42.46 cwt in 1890-91 before being steadily cut back during the next fourteen years to reach a record low level of 31.9 cwt in 1903-4. Thereafter it rose again but never exceeded 40 cwt and averaged 36.09 cwt in the remaining years before 1914.

55. Strathclyde, W.B. & Co. MSS, Production Abstract 1861-2.

56. Coatbridge, W.B. & Co. MSS, paper dated May 1867.

57. Kohn, Iron and Steel, 3.

58. BITA Report 1879, 22.

59. Strathclyde, W.B. & Co. MSS, Production Abstract 1878-9.

In all the above discussion of coal consumption it must be borne in mind that the quantity of fuel required to drive the blast engines and heat the blast was generally included by contemporaries in figures of coal consumed per ton of pigs. Unfortunately, figures for Gartsherrie are extremely rare before 1878-9. Probably about 8 - 10 cwt of dross were used per ton of pig-iron for most of the period 1830 - 70, tending lower perhaps as blast-heaters became more efficient. Utilization of the furnace gases quickly reduced this figure to less than 0.5 cwt by the end of the 1880s. For some uncertain reason the consumption of dross rose for a time in the early 1890s reaching 1.53 cwt in 1893-4 but thereafter it dwindled to insignificance - standing at 0.007 cwt per ton of pig-iron in 1913-14.

From the 1860s on figures for ironchar consumption per ton of pig-iron cannot really be compared to great purpose because of the almost continuous change in the nature of the materials used. In 1861-2 the ironchar used per ton of pig-iron contained 31.17 cwt of blackband and 2.21 cwt of Cumberland hematite.⁶⁰ By 1907-7 Gartsherrie used 6.127 cwt of blackband; 13.032 cwt of clayband; 11.859 cwt of own Spanish ore; 3.185 cwt of purchased Spanish ore; 1.543 cwt of Swedish ore; 0.438 cwt of Australian ore; 0.963 cwt of ore briquettes; 0.391 cwt of scale; and 0.019 cwt of old metal for each ton of pig-iron.⁶¹

Conclusion

Consideration of output per furnace, and consumption of raw

60. Strathclyde, W.B. & Co. MSS, Production Abstract 1861-2.

61. Strathclyde, W.B. & Co. MSS, Production Abstract 1906-7.

materials per ton substantially confirm the pattern which emerged in chapter one, of an early phase of striking change down to about 1850 followed by an inactive period extending into the 1870s after which development resumed. Evidence of output per furnace is a corrective in that it modifies to some extent the impression of almost complete stagnation in the middle period.

Comparisons with other Scottish works suggest that for most of the period Gartsherrie was never a leader in output per furnace except possibly for a short time in the 1830s. This may simply be added confirmation of the impression given by the Company's failure to undertake technical change in the late 1860s and early 1870s. On the other hand, the fact that Gartsherrie continued to lag in output right through to 1914 suggests that this explanation is at best insufficient. It is probable that the enduring emphasis on foundry iron exhibited at Gartsherrie provides a more complete explanation. Gartsherrie showed itself technically progressive after about 1875, not only in the development of by-product recovery. In fuel economy, for example, Gartsherrie seems to have been well ahead of the Scottish average and comparable with all but the most advanced in other regions. It is therefore unlikely that it would have lagged behind its neighbours in output except by conscious choice, especially when the renovation of the works offered an opportunity to build the necessary furnaces if desired.

While, therefore, Gartsherrie generally justified its leading position in the Scottish iron industry it failed to regain the reputation which had earlier brought foreign visitors to the works. Although this was probably inevitable, the company can justifiably be criticised for not taking from others all that could beneficially have been applied in Scotland.

CHAPTER THREEMarkets & MarketingThe Market Structure

The Bairds began with a basic marketing structure by virtue of their existing coal trade. Alexander simply added the task of iron salesman to his existing duties, and since the firm had only one furnace producing approximately 60 tons per week this was hardly an arduous extension. However, with plans already being prepared for expansion, it was obvious that the new business could not be dealt with satisfactorily from the small office at the coal wharf of the Monkland Canal basin.¹ Accordingly new premises were taken in Spreulls Court, off the Trongate, originally the heart of commercial Glasgow. With the city's growth, a new business quarter was already developing further westward. In 1837 the firm moved West to new premises at Madeira Court, Argyle Street, and finally in September 1860 they occupied their own specially built offices at 168 West George Street.²

As additional furnaces were put into blast and output expanded the need to place marketing arrangements on a sounder footing became increasingly obvious. Unlike the coal trade which could be dealt with face-to-face in Glasgow, pig-iron sales required regular correspondence with agents and potential customers throughout Britain and beyond. While admirably equipped both by personality and experience for the type of marketing which coal involved,

-
1. The Post Office Directory of Glasgow, 1829-30.
 2. Coatbridge, W.B. & Co. MSS, G.L.B. Vol.12, 27 September, 1860. This has remained the Head Office of William Baird and Company to the present day.

Alexander found the growing volume of paper work little to his liking. In 1834 therefore Robert, the fifth son, entered the office to take charge of this aspect of the business.³ In contrast with Alexander, he had been trained in Law at the University of Glasgow, served his apprenticeship to James Taylor, writer, and practised on his own for a short time before joining the firm. He was admirably suited to complement Alexander's wealth of practical experience and until his death in 1856 they shared the principal responsibility for the marketing of the iron, though the other brothers, while leaving the final decision to them, never hesitated to voice their opinions and give advice.

The increasing volume of sales necessitated the expansion of the office staff and in 1837 James Bain, son of a Glasgow merchant, entered the office to assist Robert.⁴ The Bairds saw to his commercial training and he rose steadily until on Robert's death he became commercial manager, the first person, unrelated to the family, to hold a key position in the firm. However, when the partnership was reorganized in the early 1860's, he was not included. Alexander Whitelaw and David Wallace, son and son-in-law respectively of Janet Baird, were admitted as partners in 1860 and William Weir, Janet's son by her second marriage, became a partner in 1862. The assumption of William Weir, who at 27 had played a much smaller role in the development of the firm, must have been particularly galling. In 1864 Bain left the firm, taking with him two other members of the staff, Blair and Patterson and together they esta-

3. McGeorge, Bairds of Gartsherrie, 108.

4. The Baillie, 27 November, 1892; Glasgow Herald, 26 March, 1898.

blished an ironworks at Harrington in Cleveland, the district which was rapidly growing to become the Scots industry's chief rival. The Bairds' intense family feeling was no doubt a major reason for their refusal to make James Bain a partner, but his growing interest in spiritualism must also have played an important part. In 1864 he published two pamphlets on the subject, in one of which he described how Robert Baird had given him advice from beyond the grave on how to act in the market.⁵ The nett result was that the Bairds lost a highly gifted commercial manager. His ability had enabled him to amass a sizeable fortune by operating in the market on his own account, a practice permitted by the Bairds, and his reputation was confirmed when he was called to London in 1860 to advise the Government in the negotiations concerning the Anglo-French Commercial Treaty.⁶

The Bairds acted immediately to fill the gap left by this unexpected rupture and took the unique step of bringing in an outsider to fill a top position. The new appointment was a classic example of their unerring ability to choose men, and also of their willingness to ignore normally important considerations for the sake of the firm. Alexander Fleming was an exception to the normal Baird type, being neither Church of Scotland in religion nor actively Conservative in politics, though like the Bairds, and indeed to a much greater degree, he could claim to be a self-made man.⁷ The son of a poor Campbeltown farmer, he came to Glasgow at the age of

5. Spiritualism. A Narrative of Facts Observed (Glasgow) 1864 - Anon. [James Bain].

6. Engineer, 27 April, 1860.

7. The Baillie, 23 February, 1881; Glasgow Herald, 18 October, 1909.

CHAPTER III

Markets & Marketing

14 and in the classic manner gained an education at evening classes while rising from office boy to manager in the service of the Monkland Iron and Steel Company. He then set up on his own account as an iron merchant, but was in business for only a short time before being asked to join William Baird and Company. For 40 years he ruled the marketing sphere of the company's activities until forcibly retired by a paralytic stroke, occasioned by overwork, in 1902. Rumoured to have had his proposal of marriage rejected when still a fairly humble young man, he never married and devoted virtually his entire activities to the firm. Nicknamed 'Sir Oracle' on the Glasgow exchange he was for many years its dominating figure and arguably the most powerful individual domestic influence on the price of Scotch pig-iron.

The structure within which these men operated was formed right at the outset and remained virtually unchanged throughout the nineteenth century. The Glasgow office assumed the character of an independent merchanting firm, which bought the iron from the works, and this applied to each of the works as the company expanded, at cost price free on board at various ports of distribution, and then assumed responsibility for sales. Even the pig-iron consumed at the works' own foundry was purchased through the Glasgow office. No order could be supplied, without written authorisation from Glasgow, though in practice small orders to regular local customers were often sent out, and word sent to Glasgow to forward written authority after delivery had been made.

Sales might be made in a variety of ways. If direct to a consumer, a formal contract was agreed on, stating the quantity and

quality, rate of delivery and price, either nett cash or due by a given date in the future with interest. Nett cash, meant in practice, payment on the second Saturday of the month for the quantity delivered during the previous month. If sold to middlemen, either merchant or simply speculator, the contract, known as scrip was much more vaguely worded. The iron was sold in multiples of 500 tons, each lot being made up of a proportion of different numbers of pig. Commonly though not always, the proportion was $\frac{3}{5}$ No. 1 and $\frac{2}{5}$ No. 3. The price was agreed, but the date of payment was related to a frequently unspecified date of delivery.

Prior to recognition of Glasgow as an important pig-iron merchandising centre in the late 1840s Liverpool, London and Bristol were the leading centres of the trade. In view of their frequent dealings in each of these ports the Bairds established agencies; Thomson and Forman in London;⁸ Jones, Mann, and Foster⁹ in Liverpool; and William W. Davies¹⁰ in Bristol. The early creation of these agencies is in itself a testimony to the importance of demand from outside Scotland.

Concern with cheap and efficient distribution of their pig-iron led the Company into an immediate and enduring involvement with Scottish Transport developments. As soon as the decision to exploit Gartsherrie was made, Alexander Baird, senior, bought shares in, and quickly secured a seat on the board of, the Glasgow and Garnkirk

-
8. Trial Neilson v Baird, evidence of James Bramwell.
 9. Strathclyde, R.B. MSS, Francis Foster to William Baird and Co. 19 April, 1845.
 10. Strathclyde, R.B. MSS, Defences for William Baird and Company, in Trial Robertson and Company v William Baird and Company, 26 November, 1845.

Railway, immediate steps were taken to have a branch canal made from the works to the Monkland canal, and the route of the projected Monkland and Kirkintilloch railway was altered so that it too passed alongside the works, which soon lay at the centre of an unrivalled transport network.¹¹ Naturally the Bairds, like their contemporaries, viewed transport undertakings as a field of investment and their monetary involvement became, in the course of time, very large. In the early years, however, when there was no surplus capital available, the principal if not sole reason for investment was the desire to exert some influence on an important external factor bearing on the prosperity of the firm. Douglas, at his death in December 1854 had only £27,194 - 50 invested in Transport undertakings,¹² while Robert on his death the following year had £39,834 - 50 so invested.¹³ By the time Alexander died in 1862 his transport shares were valued at £183,094 - 37.085¹⁴ while William on his death in March 1864 left transport shares to the value of £478,779 - 25.834¹⁵ and the last surviving brother James

-
11. For a general assessment of the role of the railways in the development of the Scottish Pig-iron Industry see, Wray Vamplew, 'The Railways and the Iron Industry: A Study of their Relationship in Scotland', in Railways in the Victorian Economy, ed. M.C. Reed (1969), 33-75; for the significance of one of the main companies see J. Butt and J.T. Ward, 'The Promotion of the Caledonian Railway Company', Transport History 3 (July 1970), 225-57 and 3 (November 1970) 164-192.
 12. Inventory of the Personal Estate of the late Douglas Baird recorded at Dumfries 13 February, 1855. Admittedly this was large at a time when few individuals held above £20,000 and the average was between £5,000 and £10,000. However by comparison with later Baird shareholding this was a small investment.
 13. Inventory of the Personal Estate of the late Robert Baird recorded at Glasgow 18 June, 1857.
 14. Inventory of the Personal Estate of the late Alexander Baird recorded at Glasgow 2 March, 1862.
 15. Inventory of the Personal Estate of the late William Baird recorded at Ayr 19 March, 1864.

left similar shares valued at £561,558 - 33.334 on his death in June 1876.¹⁶ Unquestionably this rising volume of shareholding represented a growing interest in transport developments from the point of view simply of investment. Shareholding outside Scotland, particularly in North and South America was exclusively of this character. Irrespective of their principal reason for holding shares in certain companies, it is logical to assume that they took the opportunity, where possible, to at least defend and more probably foster their interests as coal and ironmasters.

The natural extension of this shareholding policy was the acquisition of directorships. By 1854 the brothers, among themselves, held the chairmanships of The Glasgow, Garnkirk and Coatbridge Railway; The Clydesdale Junction Railway; The Caledonian and Dumbarton Railway, and the Caledonian Railway; and were represented on the boards of The Wishaw and Coltness Railway; The Edinburgh and Bathgate Railway, and the Edinburgh and Glasgow Railway, besides controlling the deputy Governorship of the Forth and Clyde Canal.¹⁷

Their position as major users of the Scottish railways and canals provided an additional lever in any circumstance where they could transfer trade from one company to another, while as one of Scotland's largest companies, they could rally other railway users to influence railway policy. Finally, their extensive land holdings and leases, usually of course in those areas through which

16. Inventory of the Personal Estate of the late James Baird recorded at Ayr 18 August, 1876.

17. Bradshaws Directory, 1854.

railway companies wished to build lines provided yet another means of exerting pressure,

This influence was used in a variety of ways, often concerning minor issues such as bridges, sidings, depots, and junctions. Although of slight individual importance, they were collectively of benefit to the Bairds. More important was the achievement of special freight rates and every effort was made to secure and defend these. Early in their existence they secured special low rates on the Monkland Railways and as these were absorbed into the North British Company's system the new Company was compelled to retain these special terms.¹⁸ Writing to Glasgow in November 1863 concerning a particular account for the carriage of iron, Jardine noted that, 'The Railway Company would prefer of course that Napier paid as they would get 21.043p per ton from him but cannot charge us more than 15.73p'.¹⁹ Again later the same year, he reported that 'The Railway Company charged Hurl, Young and Company 3.438p per ton because they would only get 2.5p per ton from us'.²⁰ These examples represent unit transport savings in favour of the Bairds of 25.26% and 27.27% respectively. Similar steps were taken in Ayrshire. The exact rates are unknown, but they unquestionably represented a significant saving. When the Bairds purchased Lugar and Muirkirk, the existing freight rates per mile from these works were higher than those being paid from Eglinton and Blair and one of the first steps taken by the Eglinton Iron Company was to negotiate with the Ayr-

18. Coatbridge, W.B. & Co. MSS, 'Agreement between 1. North British Railway Company; Edinburgh and Glasgow Railway Company; The Monkland Railway Company, and 2. William Baird and Company, signed March, 1865.'

19. Coatbridge, W.B. & Co. MSS, G.L.B. Vol.15, 28 November, 1863.

20. Ibid., 3 December, 1863.

shire Railways to have their lower rates extended to the new works.²¹ Later in the century such obvious preferential treatment came under increasing attack from other railway users, and from the state. By 1875 traders using the Glasgow and South Western railway were threatening to take the company before the Railway Commissioners because they were allowing William Baird and Company special rates. Alexander Whitelaw attempted to draw out the negotiations, but the Railway company was finally compelled to grant a general reduction.²² The smaller and less obvious concessions were more easily continued. In 1865 The North British Railway Company agreed to provide free ground at Haymarket and Leith for storing pig-iron and make no extra charge for carrying such pig-iron from store to ship. The Forth and Clyde canal company paid the 15p per boat toll due by the Bairds to Colt of Gartsherrie for use of the Hornock branch canal.

The second important area in which the Bairds acted to improve their transport facilities was in their constant efforts to ensure that the Railway companies built lines which favoured them. Thus in 1868 the Caledonian Railway Company presented a Bill to Parliament which sought to have various schemes cancelled or postponed, including a line which would have reduced the distance from Muirkirk to Leith by over 50 miles. The only petitioners against the Bill were The Eglinton Iron Company who succeeded in having the clause relating to the Muirkirk line cancelled.²³ When not opposing

-
21. Strathclyde, W.B. & Co. MSS, Railway Deeds Book p. 221 'Agreement between Glasgow and South Western Railway Company and Eglinton Iron Company, May, 1857'.
22. Ibid., p. 241, extracts from correspondence Alexander Whitelaw and Sir James Lumsden (of Glasgow and South Western Railway Company).
23. Engineering, 15 May, 1858.

unfavourable schemes, they vigorously supported favourable ones. At the beginning of 1868 the North British Railway Company convened a meeting in Glasgow to consider the formation of a new line from The College Station, Glasgow to Coatbridge, with a proposed capital of £250,000. Alexander Whitelaw who was appointed to the provisional committee headed the subscription list on behalf of William Baird and Company with £50,000.²⁴ Even where they failed to ensure the building of the most favourable line, they often secured the benefits which such a line would have provided. When in 1865 the Caledonian Railway and the Glasgow and South Western Railway were busy negotiating concerning several different route proposals, the Bairds signed an agreement by which they agreed not to oppose any Bills which might arrange for the cancellation of routes which best suited their Ayrshire works. In return it was agreed that they would be charged the rates which would have operated if such lines had in fact been built.²⁵ The expansion of the harbour at Ayr in the 1870's was primarily due to the efforts of the Company. In June 1872 a motion was made at a meeting of the Ayr Harbour Trust that the berthage be considerably extended but this was defeated. Later the same year the matter was raised again, and it was announced that James Baird had offered to advance £110,000 of the estimated cost of £120,000 at 4%, provided the Glasgow and South Western Railway advanced the remaining £10,000 as provided for in their Act of 1866.²⁶ In fact the final cost was £135,000 of which James Baird advanced

24. Engineering, 28 February, 1858.

25. Strathclyde, W.B.& Co. MSS, Railway Deeds Book p. 232 'Agreement between Glasgow and South Western Railway Company and Eglinton Iron Company'.

26. Engineering, 27 June, 1872 and 20 December, 1872;
Engineer, 19 June, 1878.

£120,000.

1830 - 1870 : The Confident Years

In the forty years 1830 - 1870 Scotch pig-iron won and held a world-wide reputation as an ideal foundry pig. Though the period was not without years of depression, makers, even in the darkest days, looked forward confidently to the inevitable return of better times. Production rose from 37,500 tons in 1830 to 1,206,000 tons in 1870, the most rapid increase occurring in the first twenty years. In these same twenty years Scots production rose from 5.5% to 30% of United Kingdom output before declining slowly to just over 21% by 1870. Although for any given year production and sales did not coincide - and in some years the divergence was considerable - nevertheless this rapid growth of production was reflected in vigorously expanding sales.

William Baird and Company spearheaded the Scots efforts to meet this ever-expanding demand. From 7.5% of Scots output the Bairds' total rose to 17% in 1840, remained almost stationary throughout the 1840's, rose again during the 1850's to 22.5% and stood at 20.5% in 1870. Although the Bairds had quickly established their own marketing system to handle this rising output the Industry's marketing system was in a state of flux. The emergence of the West of Scotland as a leading producer, and more especially as a supplier of pig-iron to the rest of the United Kingdom and indeed the world, made Scots production, sales and prices the principal determinants of market trends. This at first resulted in Scotch pig becoming the main item dealt with in the old marketing centres and later in the rise of Glasgow as the centre of dealings in Scotch pig. The

erratic fluctuations in demand which became an increasingly noticeable feature of the market, reinforced by a growing speculative interest in iron dealings which concentrated on Scotch pig-iron, placed a severe strain on the old system of selling iron by scrip. The new practice of issuing warrants for iron held in public store was introduced at Glasgow and became the basis of the United Kingdom iron market for the next half century.

The Bairds were prominent in the dealings which determined the nature of this new market structure. By the mid 1840's dissatisfaction with the existing system reached a peak. Late in 1844 the makers attempted to weaken the influence of speculators by adhering strictly to their legal right to recognize only the first holder of scrip. The Darbys of Coalbrookdale supported by leading merchant firms such as Bailey Brothers responded by proposing to open a store to take delivery of iron sold by scrip, which would have restricted the freedom of the makers to deal in scrip not backed by manufactured pig.²⁷ The plan was seriously weakened because the Bairds and other Scottish firms could not be made to deliver iron into store in Liverpool, since their terms of sale were for delivery free on board at Glasgow. At the beginning of May the Liverpool merchants formed the Scotch Pig-Iron Association with the intention of arranging a store in Glasgow under William Connal and Company to take delivery of all iron purchased. After the meeting Joseph Robinson of the Coalbrookdale Company approached the Bairds' Liverpool agent Foster and asked him to find out the Bairds' attitude

27. Strathclyde, R.B. MSS, Alfred Radcliffe to Robert Baird, 10 February, 1845. Alfred Radcliffe was a member of Bailey Brothers and Company, Ironmerchants, Liverpool.

towards a new style of document to be used in the sale of pig-iron.²⁸
 On 5 May a meeting took place at the Coalbrookdale office in Liverpool at which a document was agreed on, corresponding almost exactly with that proposed by the Bairds.²⁹ Later the same month, a Liverpool deputation visited Glasgow to see to the successful launching of the new system. The Bairds, though broadly in favour of the scheme, were reluctant to lose the greater freedom of action which the old system had allowed to skillful operators, nor were they anxious to give up the storing of pig-iron at Gartsherrie which they felt had a good effect on the behaviour of the men. Other members of the trade were even more unwilling to give up the scrip system, and it continued in use alongside the new practice for a number of years. By 1850 dissatisfaction with the continuing use of scrip led to an agitation to take all iron ordered into store but this was defeated by extensive purchases of scrip from makers.³⁰ By the end of the year, however, with the market remaining slack, in spite of an agreement among the masters to restrict the make by one third, a meeting was called for 22 November in the George Hotel Glasgow to discuss the situation. Alexander, James, George, Robert and David Baird headed the list of those present. Robert Baird was made chairman by acclamation and the meeting proceeded to condemn Scrip and propose the adoption of warrants to be issued only for iron actually in the store.³¹ By the end of the month Connals reported

-
- 28. Strathclyde, R.B. MSS, Francis Foster to Robert Baird, 2 May, 1845.
 - 29. Ibid., Francis Foster to Robert Baird, 5 May, 1845.
 - 30. Mitchell, William Connal and Company Papers, Connal's Price Circular, December, 1845.
 - 31. Glasgow Herald, 25 November, 1850.

that Scrip was unsaleable and the new warrant system successfully launched. The other Scottish ironmasters at the vital meeting were comparatively minor figures - George Burns of Portland Ironworks, Robert Stewart of Omoa Ironworks, and George Muir of Forth Ironworks. The proposals which emerged were obviously either fashioned by or approved by the Bairds and they can therefore be recognised as the chief architects of the Scotch Pig-Iron Warrant market.

The 1830's and 40's saw not only the creation of a standardised selling system for Scotch iron but also the development of the industry's position as primarily a producer of pig-iron which was shipped to other districts of the United Kingdom or abroad to be worked up into finished iron. If the relative importance of domestic and external demand in the early 1830's is still open to question, there can be no doubt that by the mid 40's the fortunes of the Scots iron industry were determined by English and foreign demand. Even using admittedly unreliable figures, the degree of this dependence is seen to be so great as to be beyond question. In the years 1845 to 1849 pig-iron sent furth of Scotland represented 51.75%, 56.5%, 62%, 66%, and 62.5% of total sales, and this in spite of a 100% increase in domestic malleable iron production from 45,000 to 90,000 tons in the years 1846 - 8. Although these exports were on a world-wide basis the bulk went to the rest of the United Kingdom, North America, and Western Europe. These areas took 61.75%, 18%, and 19.5% respectively of total exports in the years 1846 - 9.³²

William Baird and Company concentrated its attention on this

32. Based on figures in J. Barclay, Statistics of the Scotch Iron Trade (Glasgow 1850). 18.

market. When, in December 1844, Boorman, Johnson and Company sought the Bairds' American agency, they spoke in terms of importing 600 to 1,000 tons of Gartsherrie iron per month during 1845.³³ Actual imports of all Scotch iron to the United States in that year did not exceed 10,000 tons, and this was not an unexpectedly low figure. Even assuming a somewhat exaggerated estimate on the part of New York's principal metal-importing firm, the conclusion still remains that Gartsherrie iron was even more important in the export field than its dominance of production would suggest. Circumstantial evidence reinforces this impression. Firstly, the Bairds made every effort to maximise their output of No. 1 pig-iron, the quality in greatest demand abroad - French demand for example was exclusively for No. 1. In the six weeks 27 March - 6 May 1840 No. 1 accounted for 41.7% of total production.³⁴ In the first two weeks of July 1845 63.08% of output was No. 1³⁵ and in the year from 1 June 1848 to 31 May 1849 the proportion of No. 1 had risen to 74.2%.³⁶ Secondly, the emergence of a price differential was linked directly with foreign demand. This differential first of all marked the distinction between the brands in demand abroad and the rest and secondly ranked the export brands in order of preference. Connals who began regular monthly market reports in September 1845 first refer to the premium enjoyed by Gartsherrie in February 1849 when at £2-75 it stood 10p above other brands. The

33. Strathclyde, R. B. MSS, M. Cruickshank to W.B.& Co. 26 December, 1844.

34. Trial Baird v Neilson, evidence of Thomas McClymont.

35. Strathclyde, R.B. MSS, Alexander Whitehaw to Robert Baird, 15 July, 1845.

36. Coatbridge, W.B.& Co. MSS, G.L.B. Vol.3, 18 August, 1849.

following month they stated that 'Gartsherrie and other shipping brands' enjoyed this premium, and from August onwards they give a regular quotation for Gartsherrie No. 1 as against 'common brands'. Even allowing for the probability that Connals' practice recognized a feature of the market which had existed for some time nonetheless it is clear that it was 'shipping' (i.e. export) brands which held the premium and that Gartsherrie was recognized as the export brand 'par excellence'.

Any attempt at a detailed study of the marketing of Baird iron in this period is impossible owing to the disappearance of the Company's sales records. In the circumstances the best that can be done is to examine those aspects on which surviving documents shed some light.

Unquestionably, for the Bairds as for the small number of other Scotch ironmasters, the 1830's were highly profitable. Indeed in terms of profit per ton of pigs the boom of 1836 was arguably the most lucrative in the history of the trade and even in the years before and after the margin remained highly remunerative. With production costs of £2-24.6 in 1830 the price stood at around £5-00 giving a crude profit margin of equal to 122.2% of production cost³⁷. Although by 1834 the price had fallen to only 85% of the 1830 level costs of production had been reduced to 68.45% of the 1830 level leaving a crude profit margin equal to 176.4% of cost of production. The boom of the mid decade produced an average price of £6-75 for 1836 which gave Bairds a crude profit margin of 338.3%. Even as the industry was entering depression in 1840 with the average price

37. Coatbridge, W.B. & Co. MSS, 'Abstract of Quantities of raw materials and Cost per ton of make 1830-1840'. The cost includes, raw materials, wages [unspecified but probably only furnacemens], heater and blast engine fuel, and repairs. Obviously therefore it is not even a true production cost at the works, and totally ignores selling costs. The crude profit margin given would have to allow for these deficiencies.

for the year down to £3-75 and a rise in production costs the margin stood at 123.9% or fractionally above the level of 1830. These margins were reflected in steadily rising total profits. For the year to 31 May 1840 profits equaled £54,855 - 7.035 having risen in every year of the decade except 1838, and for the seven years to 31 May 1840 total profits were £269,655 - 00.³⁸

The depression of the early 1840's was for the Bairds and probably, though perhaps to a lesser extent, for the Scots as a whole little more than a phase during which they experienced the sort of profit level which the Industry might be expected to have in the long run. For this reason, as well as the discord among them occasioned by the dispute over Neilson's patent, they felt little incentive to join the English makers in reducing production. Of the proposal the Bairds said that 'as far as they had considered it' they would abide by it,³⁹ tempted no doubt not by the hope of avoiding loss but of re-establishing high profits. In spite of the agreement Scots production crept slowly up, and preparations were such that at the first sign of rising prices production leapt ahead.

It has been alleged that, 'the unreliability of the speculative demand had never been experienced before early 1845 and the high prices at that time gave the ironmasters a wrong impression of their long run prospects' and that this speculative demand 'induced

38. Trial Neilson v Baird, Pursuers opening address.

39. Shotts Iron Company Letter Book vol. 4, December 1841, quoted in R.H. Campbell, 'Growth and Fluctuation of the Scotch Pig Iron Trade' [unpublished Ph.D. Thesis, University of Aberdeen].

expectations of a long period of high profits'.⁴⁰ However true this may have been of Scots ironmasters in general, it was certainly not true of the Bairds.

The upward turn of the market during 1844 accelerated rapidly in the opening months of 1845 driving the price up to £6-00. With Alfred Radcliffe of Bailey Brothers and their Liverpool agent Charles Foster writing often twice per week on market developments, the Bairds had very full information. Alexander was reluctant to sell too freely in the belief that the price might yet reach £7-00 but William unreservedly dismissed this hope as 'madness'.⁴¹ He argued that production was exceeding consumption and that the price rise was due to speculators who were holding iron off the market. With the price ceiling reached, the best policy was to sell as much as could safely be contracted for. He proposed that Alexander check the quantity of iron available in Glasgow, Alexander Whitelaw establish the stock at the various works, and James estimate daily output. Using this knowledge Robert could then decide whether those who had already purchased from them could cause difficulty by demanding delivery. If there was no danger of their being bought out of the market, they could take advantage of the high price by continuing to sell. Robert reported that they were sufficiently free of speculative control to take more orders, but that Alexander still thought the price might rise further. William was so certain that the price was already artificially high that he rejected this

40. R.H. Campbell, 'Developments in the Scotch pig Iron Trade 1844-1848', Journal of Economic History vol. XV (1955). 209-226.

41. Strathclyde, R.B. MSS, William Baird to Robert Baird, 18 March 1845.

completely and pointed to the beginning of the end of the railway mania, and the fact that though foreign demand would offer reasonable prices for two or three years it would not keep its present high rate, as two of the factors which would bring price down. On 21 March he wrote that he had been introduced to the 'great Crawshaw' [sic] who was 'in great glee about the trade' and felt prices would stay high for many years. Far from making William alter his views in any way, Crawshaw's remarks caused him 'to doubt either his wisdom or his sincerity'. Nor was he influenced by the behaviour of the other Scots masters and cautioned Robert against being 'humbled by the trade'. Although certain that a price fall was inevitable, they tried to postpone it by selling above the accepted price but once the trend was clear towards the end of April William urged Robert to copy the merchants and be 'beforehand with sales in a falling market'. 'These are stirring and money making times' he wrote 'soon to be followed by the reverse'.⁴² With supply already exceeding demand the position would be much worse in two or three years, and William's advice was 'to be well sold while prices fall from £6-00 in 1845 to £1-50 by 1850 or even sooner'. When the Scots masters at their May meeting fixed the price at £4-50, William recognized that this was probably the best thing to do but took it for granted that Robert would be 'slipping away a few hundred tons under the Rose' and he urged him to sell as much as he could safely contract for before the price dropped further.⁴³ When the price fall halted and showed signs of reversing in mid June the Bairds attempted to encourage it by selling above the rising price, though they were under no illusions

42. Strathclyde, R.B. MSS, William Baird to Robert Baird, 26 April 1845.

43. Strathclyde, R.B. MSS, William Baird to Robert Baird, 26 May 1845.

about the temporary nature of the trend and sought only to fill their order books before the fall resumed.

In this they were successful, and as the industry gradually moved into more difficult times in the second half of the decade, Gartsherrie was able to continue fairly steadily in production. When the colliers sought a rise in March 1846 the Bairds were willing to concede it 'seeing we have a large quantity [of iron] to supply got at good prices'.⁴⁴ William recognized the undesirability of raising wages when they would soon have to be reduced again but believed that 'On the whole considering our position both as regards orders on hand and the stock of raw material on hand I am strongly of the opinion that we will benefit ourselves most and our rivals least by going with the men for some time yet'.

The conclusion must be drawn that the Bairds did not misunderstand the forces behind the high prices of 1845, and did not expect a long period of high profits. Indeed in speaking of a fall in price to '£1-50 and even less' they overestimated the actual decline. This seems to have been the result of underestimating the extent to which foreign demand would bolster the market. When the export figures are analysed, the Bairds' expectation that they would gradually decline is seen to be not so wide of the mark. Between 1846 and 1849 continental shipments dropped from 96,463 to 45,080 tons while coast-wise shipments fell from 257,000 to 221,700 tons. Although total shipments were down by only 1,100 tons this was due to a dramatic rise in exports to North America from 21,278 to 101,500 tons.

The continuance of foreign demand went far towards mitigating

44. Strathclyde, R.B. MSS, William Baird to Robert Baird, 20 March 1846.

the severity of the depression of the late 40's and early 50's but even so conditions were such that late 1851 saw for the first time Gartsherrie No. 1 being quoted below cost. There are however indications that the Bairds fared better than most during this difficult period. Although the Bairds blew out their three furnaces at Eglinton for some time in the winter of 1847-8, it is not certain that this was for financial rather than technical reasons. While these furnaces were out they were busy erecting a fourth and the works were restarted with the price of iron lower than when they had been stopped. Comparing the number of furnaces in blast at different times, we find that on 31 December 1849 the Bairds had 19 in blast out of a possible 20 compared with 112 out of 141 for Scotland as a whole; on 30 March 1850 Bairds' total was still 19 compared with 115 for Scotland;⁴⁵ and at 1 July 1852 the Bairds were in full blast with 20 furnaces while the Scots total had fallen to 104 out of 143.⁴⁶ Nor do the Bairds appear to have experienced any particular difficulty in disposing of their output. It is true that for a time in 1850 they did co-operate with the other masters in an agreement to reduce output in order to halt the steadily growing stocks, but it would seem that they were more concerned with boosting the market generally rather than reducing their own stocks. The scheme failed to achieve the desired end. Stocks of Scotch pig-iron grew from 88,000 at the close of 1847 to 440,000 at December 1852. In spite of a rapid reduction during 1853 stocks were 215,000 tons or 30% of the total production at the close of the year. At Gartsherrie on the other hand there were only 7,435 tons in stock equal to approximately

45. Mining Journal, 6 July 1850.

46. Ibid., 27 November 1852.

7½% of annual production and of this a mere 19 tons were No. 1.⁴⁷

The rising demand of 1852 marked the beginning of a period of satisfactory if undramatic prosperity for the Scotch Iron Industry. There was no real boom as in the mid 30's and 40's but until the financial crisis of 1857 the industry experienced satisfactory market conditions. In spite of an increase in the number of furnaces in blast from an average of 109 to 123, demand exceeded supply, and consequently, stocks gradually diminished and prices kept up. When, at the beginning of 1852, Gartsherrie No. 1 was being quoted at an all time low of £1-90, the Bairds showed their confidence in the future by purchasing the Blair Ironworks in Ayrshire. In 1856 they added Lugar and Muirkirk, and were therefore well placed to take advantage of the period to expand their share of the market. From an estimated 17% of production in 1851, the Company's proportion of Scottish output increased to 20.5% in 1857.

Although the decade was not marked by such violent price movements as had characterised the earlier prosperous phases, nonetheless, there were periods of quite marked fluctuations. The close of month price of G.M.B. warrants for each month during 1855 was £3-32.5; £2-80; £2-97.5; £3-00; £3-75; £3-70; £3-67.5; £4-10; £4-00; £3-77.5; £3-97.5; £3-75.⁴⁸ Although all quotations on the Glasgow market, including Gartsherrie and Eglinton moved in a similar manner, it does not follow that the realised price obtained by the Bairds fluctuated to the same extent. Nor do the reports in the merchant circulars and trade papers of either a 'dull' 'languid' or 'drooping'

47. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 6, David Wallace to Glasgow Office, 25 October 1852.

48. Mitchell, William Connal and Co. Papers, Connal's Price Circulars 1855.

market or 'buoyant' 'excited' market necessarily reflect the experience of the Bairds at the same time.

Firstly, the Bairds were able to choose their moment of sale with comparative freedom. Even as the warrant market had come into existence, the reality of the market situation was already causing the term G.M.B. to begin that metamorphosis which rendered its meaning quite different at the end of the century from what it was originally. With every year that passed Gartsherrie and some other Lanarkshire brands such as Summerlee, Coltness, and Calder, were less frequently dealt in as G.M.B., except on rare occasions when speculative activity drove warrant prices up to a par with the maker's quotation for these 'special' brands. As a consequence, Gartsherrie iron was rarely held by anyone other than the Bairds, and this was true of Eglinton also, since Ayrshire brands were not at this time recognized as G.M.B. The Bairds, therefore, did not face, to the same extent as did some other makers, the experience of having demand for their iron satisfied by a middleman who undercut their prices. Nor were they ever under pressure to sell regardless of the trend of the market because of financial difficulty. On the contrary the purchase by the brothers of landed estates at a total cost of £789,000 during this period demonstrates their financial reserves. Examples have already been given of their ability to interpret correctly the trend of the market, and the often quoted speculative sally in the Spring of 1853 which is said to have netted them £600,000, makes it reasonable to assert that the bulk of their sales would occur towards the higher price rather than the lower.⁴⁹

49. The Economist 1852, p. 1225, quoting the Falkirk Herald.

As for merchant's descriptions of the market it is important to remember that these refer to the buying and selling of warrants, which it has just been suggested did not involve Baird Iron. For example, in April 1855 Connal reported that the market was very quiet with transactions limited but he also noted that shipments were 'very good', and this final comment is more likely to have been the Bairds' opinion of the month. It is therefore probable that deliveries of Baird iron would flow fairly steadily over time and would earn prices which fluctuated less frequently and within narrower limits than the published quotations would imply.

Once again as the old decade closed and the new one opened, the market slipped into the doldrums. Steadily rising sales from 840,000 tons in 1858 to 980,000 tons in 1862 were insufficient to prevent stocks from doubling from 340,000 to 690,000 tons. In spite of strikes and agreements among the makers, production kept steadily ahead of consumption. Nonetheless, the Bairds continued to make steady profits.

The average selling price of Gartsherrie No. 1 for each of the years from 1858 to 1862 was £2-97.5, £2-75, £2-85, £2-78.75, £2-85.⁵⁰ The cost of production in 1861 was £2-24.46,⁵¹ leaving a workable margin of never less than 50p on No. 1, or approximately 35p on No. 3, the second major category. They continued to experience higher, more stable prices than the less fortunate makers of common brands, and were less affected by sudden fluctuations. During 1858 for

50. Prices of Baird iron between 1856 and 1914 are based largely on the weekly market reports published in the Engineer, supplemented by quotations in Engineering.

51. From this point on costs of production are much more accurate than those used earlier, but still do not allow for selling costs. They are taken from an irregular series of Gartsherrie Production Abstracts, (almost complete from 1883 on) among the Baird MSS, Strathclyde.

example their reputation in the export market was sufficient for them to hold the price of Gartsherrie No. 1 steady or even raise it a little, while that for common brands dropped. When in April 1859 political rumours and alarm about rising stocks caused common brands to drop 13.75p and warrants to lose 16.25p in the month, Gartsherrie number 1 fell by only 5p. The news of the boarding of the Trent in November 1861 caused common brands to drop 10p, while Gartsherrie remained unchanged.

Nonetheless, the lean times were reflected in rising stocks. From 9,673 tons 10 cwt at Gartsherrie in December 1859 they had increased to about 35,000 tons by December 1861, and were increasing at the rate of almost 900 tons per week, while a contemporary estimate put their stocks in Ayrshire at 125,000 tons,⁵² and attributed the rise in makers stocks to the fall in shipments to North America which at 51,500 tons for the year, were down by 41,000 tons on the 1860 figure. There is some evidence that the Bairds prevented the usual Scottish response of a restriction of output. Rumour had it that some of the wealthier members of the Industry were prepared to endure bad times in order to crush their weaker brethren.⁵³ The 'wealthier members' were not named but it is not without significance that on the announcement of the breakdown of negotiations on restriction at the beginning of the year, warrant prices fell 1.25p but Gartsherrie No. 1 rose 2.5p.⁵⁴ The 'incipient panic' which spread

52. Mining Journal, 7 December 1861.

53. Ibid., 21 March 1862.

54. Engineer, 21 February 1862.

on the exchange when the Bairds announced an all round reduction of 5p per ton on their prices,⁵⁵ reinforces the impression that they were actively attempting to depress the market. But as speculators became increasingly confident that the market would soon rise warrants were snapped up as fast as the iron could be delivered into store, and the price, in consequence, held up well.

The years 1863-70 can scarcely be said to have exhibited any real boom or slump and only strong speculative activity in the second half of 1863 and again in the first half of 1866 did anything to move a remarkably steady price which in the case of Gartsherrie No. 1 generally hovered in the region of £2-75 to £3-25. The Company took full advantage of these brief surges. As early as April 1863, when the price was still falling, sales were so pressing that extra boats were being hired and William Jardine reported to Glasgow in mid-May that every available scow was being taken on.⁵⁶ The beginning of a rise in the price in July and August caused sales to drop a little, but with the entry of speculators into the market, the rise was accelerated, and Gartsherrie No. 1 at £3-35 stood 50p above the July quotation. Sales recovered their high level of the earlier part of the year and at 71,754 tons 2 cwt for the last seven months of the year they stood well above production.⁵⁷ The speculation of 1866 drove Gartsherrie No. 1 to £3-95 at the end of April, the highest quotation of the decade and again caused the Bairds to draw from stocks to meet deliveries. The abrupt collapse of the speculation

55. Mining Journal, 21 June 1862.

56. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 14, William Jardine to Glasgow Office, 16 May 1863.

57. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 15, Dassim. Irregular monthly notes of pig-iron deliveries ex-Gartsherrie.

in May followed by a dispute with the colliers led to the masters agreeing to blow out $\frac{1}{3}$ of their furnaces. Falling shipments and a stagnating malleable industry at home added to the general gloom, and in order to avoid any accumulation of stocks, the Bairds blew out even more furnaces than had been agreed on, and by August 1866 had only 16 of their 41 furnaces in blast.⁵⁸ This determined policy had a marked effect on the price. At the height of the speculation warrants were being quoted at £4-10 compared with £3-95 for Gartsherrie No. 1. The collapse of the following month restored quotations to their natural order with Gartsherrie at £2-95 and warrants at £2-60. Their policy of restriction enabled them to boost this price to £3-32.5 by the close of the year, while warrants only rose to £2-71.25.

The masters continued to restrict the number of furnaces in blast during 1867, but the maximum number permitted was raised in March from $\frac{2}{3}$ to $\frac{3}{4}$. This relaxation was almost certainly due to the demands of the Bairds, who immediately increased their furnaces in blast.⁵⁹ In June it was reported that although casting was going on steadily at all the furnaces in the Coatbridge area only Gartsherrie was experiencing any real demand for pigs. Nevertheless, as the year drew to a close, the difference between Gartsherrie and warrants narrowed again, and with the market showing no signs of improvement the Bairds agreed with the others to continue the policy of restriction. The following year, however, they experienced more favourable conditions than the industry as a whole. Sales at 96,671 tons 10 cwt were well

58. Engineer, 3 August 1866.

59. Ibid., 3 May 1867.

above those of the previous year and 6.9% above those of 1866. By contrast sales for the Industry as a whole were down by over 14% on the 1866 figure. The Bairds increased sales were achieved at the cost of a distinct fall in price. The extreme restriction of 1866-7 meant that the average price of Gartsherrie No. 1 was down by 6.7% on the 1866 average, compared with a fall of 10.9% for common brands and 11.8% for warrants. The average for 1868 was 15% below the 1866 figure compared with 12.3% and 12.7% for common brands and warrants respectively. Nonetheless in spite of the decrease in the relative advantage enjoyed by Gartsherrie, it remained on average some 20p above common brands during 1868.

The Bairds were remarkably quick to sense the return of better times. As early as 1868 they were making preparations at Portland to increase the number of furnaces in blast from three - the maximum number since the fall in American demand at the close of the Civil War - to five. With the industry generally in possession of similar excess capacity the steadily growing demand of the next two years was easily met, without any marked pressure on prices. The decade closed with the market showing signs of buoyancy and encouraging greater optimism than had been felt for some considerable time.

1870-1914 - The Uncertain Years

Although any date chosen as a watershed cannot but appear in some respects arbitrary, nevertheless the years from 1870-1914 saw profound changes in the market for Scotch pig-iron. The growth of pig-iron making capacity in other centres had far reaching consequences. The expansion of the American and Continental iron industries led first to a decline in the demand from these areas for

Scotch pig and secondly to fiercer competition in the remaining markets. American pig-iron production increased from 1,710,000 tons in 1870 to 30,970,000 tons in 1913 while that of Germany rose from 1,240,000 tons to 16,490,000 tons. In 1870 Scottish production at 1,206,000 tons compared well with the American and German figures. By 1913 Scottish output at 1,378,000 tons was almost unchanged compared with the advance of the others. Obvious external factors made a relative decline in the Scottish position inevitable, as in the position of the United Kingdom as a whole. The virtual stagnation of the Scottish industry in the face of a rising world consumption - 11,800,000 tons in 1870; 79,400,000 tons in 1913 - is however less obviously explained.

In 1870 Scotland, which produced 20.25% of United Kingdom output of pig-iron, accounted for 51.25% of the exports of the world's major exporting country, and was therefore superficially well placed to take advantage of the growth in world demand. The bald statistics of this upsurge are however misleading as an indication of the market opportunity for Scotch pig. Firstly, by far the largest proportion of this increased consumption was accounted for by these types of pig-iron notably basic pig, in the production of which Scotland had no advantage, and no world wide reputation. The market in high grade foundry iron, the Scottish speciality, was the least expanding of all the pig-iron markets. Scotland's ability to supply this market was affected by both Scottish and world developments. Initially the growing pig-iron industries on the Continent and in the United States, lagged behind the iron-consuming industries, and began with the production of lower grade pigs than Scotland supplied, and thus a market for Scotch pig continued to exist. As these industries became

established, they turned increasingly to the production of high grade foundry pig and so restricted the Scottish opportunity. In America foundry iron, marketed significantly as 'Scotch American' steadily supplanted the foreign product,⁶⁰ while German metallurgists sought to identify and reproduce the characteristics which had made Scotch pig unique.⁶¹ Foreign customers bought steadily smaller quantities of Scotch to enrich the home product. As the market became increasingly competitive, the favourable conditions which had made possible the rise of the Scottish industry steadily disappeared. The best seams of domestic ore, notably the famous black band, were exhausted, while those that remained became more expensive to work. The easily worked, conveniently situated seams of splint coal likewise became exhausted. The Scottish response of importing foreign, mainly Spanish, ore made it possible for the industry to survive but only at the expense of increasing difficulty in smelting a unique pig-iron.

Questions regarding the general response of the Scottish Industry to the new conditions which it faced after 1870 will be dealt with elsewhere. At this point its response in the field of marketing only will be considered. There was a gradual trend among the makers towards direct selling at the expense of the iron merchants. Cargoes were sent by specially chartered ships, whenever the volume of sales, and prevailing freight rates justified it. More significantly, in what was formerly the high profit market, pig was sold on occasion below market quotations, and perhaps even at a loss. This may have been simply the Scottish adoption of their rivals' practice of dual pricing or dumping. In this period, however, the Scots were quite

60. Engineering and Mining Journal, annual reports from 1880 on.

61. Engineering and Mining Journal, 10 May 1890.

unable to dictate the domestic price, and make dual pricing feasible. More probably, rather than seeking to offload surplus output, their object was to hold traditional customers. It was feared that if a consumer used an alternative pig-iron, even for a short time, he might find that it suited his purpose equally as well as Scotch and never purchase Scotch again. The Bairds, apparently with some success, sought actively to hold their position in the overseas market. They seem deliberately to have decided to reduce their Gartsherrie iron to a price equal to, and sometimes below, that of the other Scotch special brands. Whereas in the earlier period strong foreign demand and a virtual monopoly for Scotch pig-iron had made the Gartsherrie premium both desirable and easy to maintain, the new situation made the Bairds opt for a competitive price in order to win the largest possible share of the market. Eglinton iron which generally sold some 30p to 50p below Gartsherrie, remained competitive even when Gartsherrie was not. It was highly regarded abroad and by the 1890's its reputation was so good that the Bairds attempted to raise it to the status of a special brand. Although the attempt failed, Eglinton iron did hold a higher position thereafter. In pursuing this policy they differed markedly from their main rivals, the Coltness Iron Company, who in the course of this period emphasised the superiority of their iron by increasing the price differential between it and the other Scotch brands, and appear to have continued to hold a good reputation abroad, at least in America. On 11 April 1884 the prices of five special brands - together with Eglinton and Monkland - were as follows:⁶²

62. Engineer, 11 April 1884.

No.	Gartsherrie	Coltness	Langloan	Summerlee	Calder	Eglinton	Monkland
1	£2-63.75	£2-90	£2-70	£2-60	£2-67.5	£2-30	£2-21.25
3	£2-55	£2-55	£2-55	£2-40	£2-37.5	£2-12.5	£2-06.25

The margin varied as often as the price, occasionally disappearing completely, and occasionally increasing to as much as £1-00, but the essential point remained that, on the one hand, the Bairds reduced their prices to a par with other Scotch brands, while Coltness did not.

Circumstantial evidence suggests that the Bairds secured a large share of what foreign sales there were. Thus, Coltness, Gartsherrie and Eglinton are the three prices most regularly quoted in the market section of the Engineering and Mining Journal. To reinforce the remarks made earlier with regard to Eglinton it is significant that as the 1880's progressed, quotations for Gartsherrie became increasingly irregular, but those for Eglinton continued unbroken.⁶³ The Colliery Guardian in quoting French prices, gives Gartsherrie and Eglinton only, and it holds true of foreign market reports generally that Baird brands are most often quoted.

The growth of iron-producing capacity in other districts of the United Kingdom had broadly similar consequences for Scotland as had foreign developments. The coastwise trade, much larger than the export trade, contracted in a similar manner. English rivals began to export to traditional Scottish markets just at the time when they were beginning to decline. They also began to send English pig-iron into the Scottish domestic market with the result that Scotland, by the 1890's was a nett importer of pig-iron. The challenge from the

63. Of specific sales noted in the Engineering and Mining Journal during 1880, Eglinton accounted for 2,800 tons, Gartsherrie 1,200 tons, Coltness 200 tons, and Glengarnock 350 tons.

North East and North West of England was obvious before 1870, by which date the former had already surpassed the output of Scotland, and Scottish imports from England equalled 110,000 tons. The English challenge was felt least by firms such as the Bairds, and most by those Scottish firms which made a large proportion of forge iron, and No. 3 and 4 foundry pig-irons, for the domestic finished iron Industry. Hence, right to the end of the period the Bairds sent Gartsherrie iron to the North of England at the same time as North of England iron was being sent to Coatbridge. Therefore, while works such as Omoa, Quarter and Lochgelly closed down, the Bairds, Merry and Cuninghame and the Houldsworths were able to continue.

It is not intended to imply, however, that the domestic market was of little concern to the Bairds, but only that English competition was less disastrous. The company's policy from the outset reflected their concern for domestic trade. Naturally the proliferation of pig-iron producing works in the vicinity of Coatbridge in the 1830's and 1840's attracted pig-iron consuming industries. This natural tendency received active encouragement from the Bairds. They had pursued a policy designed to win control of as much of the local mineral resources as possible, and in consequence, they came to own almost the entire land area on which the Burgh of Coatbridge, as it stood in 1914, was built. They actively promoted and fashioned the early growth of the town and many of the firms which provided employment for the rapidly growing community, were attracted by the terms offered by the Bairds, who could also ensure favourable treatment by the railway companies.

When even this market was invaded by English pig-iron, the Bairds

insisted that any item made for them by the local works, be 100% Scotch iron.⁶⁴ Increasing competition abroad made the expanding home market all the more important. The expansion of the Scottish malleable iron industry and its survival at a time when the world was moving away from malleable iron to steel has often been pointed to as a sign of backwardness in Scottish heavy industry. Whatever the merits of this allegation, the endurance of the malleable trade meant a continuance of the domestic market for ordinary Scotch iron, as well as large English imports. Sales to ironworks in the immediate vicinity of Coatbridge in 1871 were 3,928 tons, or approximately 4% of production. By 1881 the figure was 4,368 tons 10 cwt and by 1887 6,221 tons 10 cwt or approximately 8% of ordinary production. Assuming that sales to these works reflect the general trend of Gartsherrie sales to the Scottish finished iron trade the implication is that an increasing proportion of ordinary production was sold in this market.

In the domestic market the development of the steel industry was of much greater significance than the continuance of the finished iron industry. Early experiments revealed the unsuitability of Scotch pig-iron for the Bessemer process and although some Bessemer works were built in Scotland the real advance in the Scottish Steel Industry came after the development of the open hearth process. The transition from iron to steel shipbuilding stimulated the growth of the Steel Industry in Scotland and it quickly became the most important region for the production of acid open-hearth steel.

64. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 28, A.K. McCosh to L. Gray and Company, 3 January 1876.

The growing dependence on supplies of Cumberland, and later of Spanish ore, after 1870 proved a fortunate coincidence for the Scottish makers of pig-iron since these ores, unlike the native Scottish ores, were suited to the production of the pig-iron required by the steel producers.

The Shotts Iron Company are generally credited with being the first of the Scottish pig-iron producers to make hematite for the new Steel industry, when they commenced production in 1872. In 1868 the Bairds made hematite at Gartsherrie but it would seem to have interfered with the working of the furnace.⁶⁵ Nor would it appear to have had a ready sale since in April 1870 there was still some available.⁶⁶ It is difficult to establish when the company resumed production of hematite pig-iron but by 1877 it was definitely being produced at Gartsherrie, and by 1881 at Eglinton also. No separate figures were given until 1885-6 when hematite accounted for 10,197 tons 10 cwt of the 98,872 tons produced at Gartsherrie works.

These production figures cannot be used to demonstrate the growing importance of hematite production in any simple straightforward chronological progression. Production was transferred back and forth between ordinary and hematite depending on market conditions, and this greater freedom was in itself of considerable value to the makers. Nevertheless, from 1900 on, hematite production never fell below 53.9%, reached as high as 64.6% and averaged 58.4% of Gartsherrie output. The overwhelming bulk of this output was

65. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 20, 27 March, 21 October, 28 October 1868.

66. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 21, 20 April 1870.

sold in Scotland except when, as in 1902, there was a short-lived world scarcity of hematite, creating a demand sufficiently strong to allow Scottish hematite to compete abroad. Scotland was never able to determine hematite prices as she had done with ordinary iron. Instead the now dominant Cleveland district exercised that role. In the marketing of their hematite the Scots from the outset pursued that policy which they gradually attempted to introduce also in the ordinary market. Sales were arranged direct between maker and consumer. Merchants despite constant efforts were unable to break into the market until 1896, and even then their role always remained small.⁶⁷ Use of the public stores was rigorously avoided, the consistency with which makers either balanced production with sales, or stored the surplus themselves, suggesting the possibility of a definite agreement among the Scots. As they steadily abandoned the domestic forge and foundry trade to English competition, only the expansion of the steel industry made absolute expansion possible in the Scottish pig-iron industry.

Basic pig-iron production in Scotland was confined for almost all of this period to the Glengarnock works, and Glasgow Iron Company works at Wishaw, and was used by these companies for their own production of basic steel. Basic pig was not made at Gartsherrie until 1912-13 and even then accounted for only 1,370 tons of a total production of 168,741 tons 10 cwt. Marketing of basic pig-iron therefore played an insignificant part in either the Baird or Scottish activities before the first World War, though its importance was to increase considerably thereafter.

67. Engincer, 23 October 1896.

Their retention of a sizeable share of the ordinary market and acquisition of a considerable section of the new hematite market enabled the Bairds to increase their share of Scottish output from 20.5% in 1870 to 25.6% in 1913, which in fact placed them in a better position than during the 1850's, though allowing for English imports reduced this to a not quite so attractive 16.4%. The fluctuations, through which the Bairds and the Scottish Industry passed after 1870, will now be considered in greater detail.

The period opened with a boom which recalled the glories of the past. The normal winter dullness, reinforced by the knowledge that the industry's excess capacity had been more than able to meet the increased demand of the latter half of 1869 and had indeed caused a rise in stocks, produced a fall in the market price at the beginning of the year. The situation improved with the beginning of Spring demand and prices hardened, and then with the increasing knowledge that special brands for export were in short supply, the price began to move up. Gartsherrie was in full blast in April, and the entire output was going directly to meet orders. Andrew K. McCosh reported to Glasgow in April that every effort was being made to dispatch iron and that stocks were exhausted. There were only 80 tons No. 3 on hand to meet orders for 2,772, and 400 tons No. 1 to meet orders for 1,400 tons.⁶⁸ At the beginning of June a furnace at Portland which had been out of blast for more than a year was relit,⁶⁹ and by the end of the month the number of railway waggons being sent to Gartsherrie to uplift pigs had to be curtailed, because the only iron

68. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 21, 19 April 1870.

69. Engineer, 10 June 1870.

available was coming direct from the pig beds. The outbreak of the Franco-Prussian war caused a temporary check, but with Continental and American demand continuing to increase, Gartsherrie and the other top brands were scarcely affected and after the initial fall, prices quickly steadied. As the situation brightened again at the beginning of 1871 Bairds raised their prices, while labour difficulties in America and reduction in the American import duty together with the settlement of a strike among the malleable ironworkers at home all combined to give increased momentum to the rising market. Even the settlement of the American strike had little effect, because of the large contracts arranged, and the recovery of French demand in the summer further increased the pressure. The Glasgow office was obviously urging the works to greater efforts, and in August Gartsherrie rather angrily replied that every possible effort was being made, and they could do no more.⁷⁰ They attempted to take maximum advantage of the high export demand by stopping domestic deliveries, until letters from irate customers forced them to resume.⁷¹ In spite of such efforts foreign demand was insatiable and reports at the end of the year from America were that Gartsherrie iron was unobtainable.⁷² Prices rose even more rapidly the following year as enduring foreign demand was reinforced by heavy speculative activity. Labour unrest which had restricted output throughout the boom at length culminated in a strike, and the year closed with many furnaces damped down. As a result of the shortage of raw materials experienced

70. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 22, W. Jardine to Glasgow Office, 1 August 1871.

71. Coatbridge, W.B. & Co. MSS, G.L.B. Vol. 22, W. Jardine to Glasgow Office, 23 October 1871.

72. Engineering, 22 December 1871.

during 1871 and 1872 output and sales were inevitably reduced. From 96,329 tons 6 cwt during 1870, deliveries from Gartsherrie fell to 87,669 tons in 1871 and 75,668 tons 12 cwt the following year. The friction between head office and Gartsherrie was exacerbated by the relatively greater decline in deliveries from Gartsherrie compared with those from the other Scottish ironworks. While total deliveries from Scottish works fell to 97% and 91% of the 1870 level Gartsherrie deliveries were only 91% and 78.5% of the 1870 figure.

In spite of the reduction in home demand, which was blamed on the high price and a slackening of activity in the shipyards, the strike halted the price fall which the realisations of speculators had precipitated in October. The strike was short-lived, but labour troubles in England boosted the market, and the price rose to the highest levels of the boom. Gartsherrie No. 1 was quoted at £8-37.5 at the beginning of March 1873, the highest price of the century, but with production rising rapidly as the strike collapsed, and demand, both home and foreign, falling off in the face of such prices, the peak had clearly been reached. Continued rumours of possible labour troubles in England, the revival of the malleable trade as the price fell, and speculative efforts to halt the fall, combined to ensure only a gradual decline, and the year closed with Gartsherrie number 1 being quoted at the still highly attractive price of £5-70. The recovery in the malleable and foundry trade at home had a more marked effect on the price of No. 3. Gartsherrie No. 3 fell by only 26.4% compared with 31.6% in the case of No. 1.

Irrespective of the rate, a falling price was the principal feature of the market and, with the exception of a few short-lived

rallies, it continued to be so until the summer of 1879. Labour troubles during 1874 severely restricted production of Gartsherrie No. 1, and other special brands and caused high prices to rule for a short time. The Bairds vigorously forced wages down. The initial 20% reduction was increased to 40%, and at Lugar, where there was no union, the men were compelled to return at a 45% reduction.⁷³ At the end of July the masters decided to blow in $\frac{3}{4}$ of the furnaces extinguished during the lockout, and an improved export demand caused complete abandonment of restriction the following month. The revival was short-lived, however, but the masters succeeded in holding the price up until the end of the year. As 1875 opened with no sign of improvement, the Bairds abandoned efforts to keep the price up and instead announced a 10p reduction which the other masters were obliged to follow. They again unilaterally cut their prices in March, and reduced wages in May. By this policy they succeeded in raising sales which at 96,000 tons for the year were back to the 1870 level. At the first sign of any improvement they were quick to act. When demand showed signs of improving at the beginning of December, they attempted to encourage a rise by raising their prices, and as with price reductions they led the other masters.

Sales continued steadily and again exceeded 90,000 tons the following year, while production was held back to avoid any large accumulation of stock, though with a steady policy of wage reductions among furnacemen, colliers and miners, production costs became steadily more attractive, making stock accumulation more acceptable. 1877 opened with indications of a possible improvement, which was greatly

73. Engineer, 5 May 1874.

encouraged by the Bairds' action in increasing their price. A lock-out in the shipbuilding trades destroyed any hope of improvement, and when the ironmasters' colliers sought a rise in July following the salemasters' advance to their colliers, the ironmasters responded immediately by agreeing to reduce the number of furnaces in blast. By mid-August Bairds had only 20 furnaces in blast, and in November the agreement was extended for a further three months. The same month it was announced that owing to the continued depression the two furnaces at Portland were to be blown out, and this was put into effect by mid-December.

1878, characterised by the failure of the City of Glasgow Bank, was even more dismal than the previous year. Again the Bairds responded by cutting wages, and by November furnace keepers tonnage rates for number I iron were 59% below the March 1873 rate.⁷⁴ They also took the lead in further price reductions, and the trade papers began to speak of a struggle between the Scottish and Cleveland masters. With production costs now so low, the Bairds began to increase the number of furnaces they had in blast and produce iron for stock. At Gartsherrie stocks reached 31,443 tons 10 cwt by May 1878 and rose steadily to 47,488 tons 9 cwt by May 1879. Stock accumulation was accentuated by declining sales which fell 10,000 tons to 81,000 tons in 1877 and showed a similar drop to 70,361 tons in 1878, almost certainly the lowest level in fifteen years.

It seemed at first as though 1879 would prove another poor year, and only the heavy purchases which the low price encouraged, offered any comfort. The market moved up hopefully on news of the Durham

74. Strathclyde, W.B. & Co. MSS, Managers Notebook Gartsherrie, March 1873 and November 1878.

strike but collapsed again with the settlement of the dispute. By midsummer Gartsherrie was being quoted at £2-25 for No. 1 and £2-07.5 for No. 3, while cost of production stood at £2-32.125. With their colliers pressing for a wage increase in line with their fellows in the salemasters' pits, the ironmasters agreed to restrict the number of furnaces in blast and if necessary blow them all out rather than concede a rise. Developments in the second half of the year completely altered the situation. Purchases for the American market provoked a rise which was encouraged by increasing domestic demand, caused by fresh orders placed in the Clyde shipyards. In September the Bairds granted a wage increase, the first in eight years. In October it was agreed that makers were free to blow any number of furnaces they chose and Bairds immediately prepared to blow in the furnaces at Portland which had been out of blast for the previous two years.⁷⁵ The following month however, although home demand continued strong a drop in orders for North America alarmed the masters who were suddenly afraid that the price rise had been a false alarm. The Bairds reduced wages again to what they had been before the increase, and this action, pursued also by the other ironmasters seriously disturbed labour relations and interfered with production. This, together with the reappearance of demand from the United States, caused the rise in price to resume, and by mid-January 1880 Gartsherrie No. 1 was being quoted at £4-50, double the price of six months earlier, while in New York it had risen in the same six months from 20 to 34 dollars.⁷⁶ At the first sign of a fall the Bairds cut

75. Engineering, 17 October 1879.

76. Dollar quotations are taken from the market reports published in the Engineering and Mining Journal.

their prices sharply, much to the annoyance of the other makers who were obliged to follow suit, and the price fell sharply till June when Gartsherrie No. 1 was quoted at £2-55. The Gartsherrie Company's action was obviously aimed at embarrassing these rivals who had not secured good orders at the high prices. At their own works in spite of blowing full blast, iron was being taken from stock to meet deliveries. When the masters refused demands for a wage increase a strike ensued, and a large number of furnaces were immediately damped down. With Gartsherrie in short supply the strike boosted the price, but fear of a slackening general demand was reflected in a continuing fall in the price of warrants. The continuance of steady demand from the United States and the Continent as well as a steady home demand owing to 'the almost marvellous expansion of shipbuilding'⁷⁷ led to the Gartsherrie furnaces being relit immediately the strike had been settled, and in spite of the resultant increase in production the price steadily rose, and as the year closed Gartsherrie and a few other brands were being sold forward and stocks were reported to be low.

Although by 1881 the boom, if it can be called one, was definitely over, nevertheless deliveries from Gartsherrie continued unabated, and American buyers still showed a marked preference for the brand. Rumour was widespread, however, that large sales to the United States were being effected only at prices below market quotations.⁷⁸ With Gartsherrie No. 1 down to an unattractive £2-55 by June the Bairds supported the proposals which brought about an Anglo-Scottish agreement by which the make of Scotch and Cleveland iron was

77. Engineer, 22 October 1880.

78. Engineer, 4 February 1881.

restricted by 12½% from October, and this raised the price above £3-00 again before the close of the year. If the sag in price was threatening a dangerous squeeze in the profit margin during 1881, no anxiety was felt about sales which at 120,294 tons 4 cwt were a record for the works.

The agreement on restriction was renewed in February 1882 for a further six months, but good export demand at first for America and later for Germany kept sales running strongly, and in June a statement by the Scottish masters that their stocks were falling, combined with good North American and Russian orders, brought a steady rise in price. Most activity was centred in makers iron, and indeed mainly the top special brands, rather than warrants. Accordingly, when in August the English and Scottish masters began negotiations to again extend the agreement on restriction, the Bairds were reluctant to agree.⁷⁹ Without their support it was pointless for the other Scottish ironmasters to attempt any continuance of restriction, and the agreement was abandoned. With Gartsherrie iron in short supply and demand strong, the price advanced in spite of the termination of the agreement and the Bairds' preparation to increase the number of furnaces in blast. Gartsherrie number 1 advanced to £3-30 and even at the lower price of £3-20 at which it closed the year, it was 10p per ton above the August quotation, whereas warrants were 4.167p down over the same period. Throughout 1883 the warrant market continued dull, while the direct trade in makers iron, albeit at low prices, continued active. Deliveries from Gartsherrie in 1882 were 119,066 tons 14 cwt, only a fraction below the record of 1881. In the first ten months of 1883 sales ran at the same high level and despite a

79. Engineering, 8 September 1882.

marked drop in the last two months were, at 112,964 tons 5 cwt, still well above the year's production.

Although the Scottish masters did not arrange a formal agreement on restriction, like that concluded among the Cleveland makers, the fall in sales at the end of the year made them conscious of the need to take some action, and some furnaces, including four at Gartsherrie, were blown out. The Bairds and some of the other makers of special brands, had come to the conclusion that with a strong regular demand for their iron, the continuance of low prices was, in no small measure, due to the store system, which acted as a damper on the market. They, therefore, began a campaign against the large stock of 585,037 tons of iron stored in Connal's yards. Rumours were circulated to the effect that much of the iron put into the store the previous year, and possibly in earlier years, was in fact cinder pig and was not entitled to the description of G.M.B. An acrimonious correspondence raged in the trade papers, with the Glasgow ironmerchants issuing a manifesto stating that the iron put into store was identical with that which had passed into production from the works involved.⁸⁰ T. Mann Thompson, chairman of William Dixon and Coy, announced that while his firm had indeed made cinder pig, it was still up to the standard of G.M.B. In order to investigate the truth or otherwise of the assertions being made, the masters set up a committee, composed of Andrew Kirkwood McCosh of William Baird and Company, John Cuninghame of Merry and Cuninghame, John Addie of Langloan, Grieg of Coltness, and John Ormiston of Shotts.⁸¹ Connals refused to divulge any information about their stocks, pleading that,

80. Iron and Coal Trades Review, 8 February 1884.

81. Ibid., 29 February 1884.

as mere storekeepers of the property of others, they had no authority to do so. The masters reported that although they had been unable to prove that adulterated pig had been stored, they themselves were certain that such was the case.⁸² The attempt to destroy the value of the pig-iron in store failed, because of the united action of the brokers and merchants in maintaining the warrant price, and Bairds tried fresh tactics. In the summer and autumn good continental demand affected the price of special brands, and furnaces were relit at Gartsherrie and Eglinton. By December the price was beginning to drop again, and Bairds staggered the market by announcing an all round reduction of 12.5p on their prices, at a time when some firms were already selling below production costs. Coltness quickly followed suit with a 10p reduction, and it was reported that one works would have to close entirely, while several others would be compelled to blow out some of their furnaces.⁸³ The bitterness which such action aroused was reflected in the failure of the masters to publish their usual summary of annual production.

The Bairds would seem to have resolved on a policy of waiting out the depression in the belief that their rivals were less able to withstand a long period of poor prices. No attempt was made to curtail output severely at any of the works, though the slow growth of stocks suggests that attempts were made to balance supply and demand. When in 1886 proposals were put forward for a joint Scottish-Cleveland reduction of the number of furnaces in blast, negotiations broke down because 'some of the larger Scottish firms' insisted that they required all the furnaces they were blowing.⁸⁴ The Bairds, who

82. Ibid., 4 March 1884.

83. Engineering, 12 December 1884.

84. Engineer, 12 March, 1886.

were undoubtedly one of 'the larger Scottish firms' referred to, actually increased the number of furnaces in blast just as the negotiations were given up. The Glasgow correspondent of the Engineer commented that some firms who had been producing largely for store would be compelled to reduce their output even without an agreement, but 'One or two important houses can of course look upon the change with complacency, seeing that in addition to pig-iron they have an important interest in coke, coal, and chemicals'.⁸⁵ This applied above all to the Bairds, who besides being among the country's major producers of coal, were the largest coke manufacturers in Scotland and pioneers in the field of by-product recovery. This last was producing a profit of around 25p for every ton of pig-iron made, which was clearly of tremendous advantage, at a time when Gartsherrie No. 1 was being quoted at £2-15 per ton and No. 3 at £2-02.5 per ton, against a production cost of £2-30.

The Company still pursued the traditional policy of paring the most easily reducible item in costs, namely wages, by announcing further reductions in July 1836. When, at the close of the following month, the salemasters increased their colliers' wages they were followed by the Coltness Iron Company, the Glasgow Iron Company and Dunlop, but the Bairds refused, and partial strikes ensued in Lanarkshire, Stirlingshire, and Ayrshire. This, together with an accident at Gartsherrie which put eight furnaces out of blast during October drove the price up from the low levels of the summer months, and in December the Bairds restored the colliers to the rates ruling before the reduction. The colliers were still pressing for a further rise,

85. Ibid., 28 May, 1836.

and this forced the masters to display the greatest unanimity in many years, when they met at the end of the year and agreed to blow out all their furnaces rather than yield to the men.

The opening months of 1887 were therefore distinguished by strikes, and marked reduction of the make, in spite of which the demand for pig-iron was such that prices of even Gartsherrie No. 1 fell, and the Bairds had no incentive to seek a settlement. Nevertheless Gartsherrie secured a good proportion of what orders there were and deliveries of 102,223 tons in 1886-7 were higher than in the two previous years. With the make at its lowest level of the decade, stocks which had been growing since 1883 were reduced to 11, 704 tons 17 cwt. The improvement in sales was due entirely to the increased share of deliveries accounted for by hematite pig, production of which was 34,707 tons 10 cwt compared with 10,197¹⁰ the previous year, while ordinary pig production had fallen from 88,674 tons 10 cwt to 59,123 tons. On the other hand, the continued improvement in sales, recorded over the twelve months to 31 May 1888, was made possible by a recovery in the demand for ordinary Gartsherrie brands, while demand for hematite remained practically stationary. Although sales of ordinary dropped back slightly during 1888-9, the Bairds were able to transfer furnaces to hematite production thanks to the expanding demand of the shipyards for steel, and by so doing they not only avoided any accumulation of stock but actually reduced production below consumption and drew the balance from stocks. While the malleable and steel works continued active, the foundries which had hitherto shown less improvement now began to take a greater quantity of pig-iron, and with shipments fractionally above the level of recent years, demand increased. Production meantime was falling

because of the inadequate supplies of raw materials occasioned by disturbed labour relations, and as it became known that for the first time in five years, stocks in Connal's stores were being reduced, speculators came into the market. Reports that makers' stocks of several of the best brands were all but exhausted gave added impetus to the rising price, and the year closed with Gartsherrie No. 1 being quoted at £4-00 which was £1-50 above the price of twelve months before. Significantly, this, the highest price of the 'boom', was the lowest peak price of any of the nineteenth century booms in the Glasgow market and was quoted for only a few days.

By the beginning of February 1890 the price was already below £3-50, and as the year progressed signs of impending depression in the finished iron trades, coupled with an absence of fresh orders for the future, in the as yet fairly active steel industry, eroded all hope that the 1890's were going to be better than the 1880's. At Gartsherrie sales fell from 122,225 tons 19 cwt in 1888-9 to 104,546 tons 18 cwt in 1889-90, and a reduction of 8,000 tons in production was not sufficient to prevent additions to stock. The price rise would seem to have discouraged sales of Scotch pig, an impression reinforced by the reversal of the trend of steadily declining imports of English pig-iron which had been a feature of the previous five years of low Scottish prices. As the prices sagged to their by now almost traditional summer trough, top brands such as Gartsherrie were still commanding at least £3-00 which by recent standards was far from unsatisfactory, but future prospects were depressing.

The time seemed ripe, therefore, to destroy the nascent Trade Unionism among the furnacemen which threatened to make them as

troublesome to deal with as the miners and colliers had become. The masters therefore refused even to discuss the men's proposal that part of the Sunday shift should be paid at time and a half - a request which even the trade papers considered very reasonable. At the end of September they determined instead that as from the 4 October all furnaces would be blown out, and the men dismissed. By 10 October only three furnaces at Carron and three at the Wishaw works of the Glasgow Iron Company were still in blast, both firms being independent of the Pig-Iron Trade Association.⁸⁶ At Gartsherrie, all the furnaces were silent for the first time in sixty years, and even at Lugar where none of the men were unionists, the works were at a standstill.

From a marketing point of view the astonishing feature of the strike was its failure to raise prices. Stocks of Gartsherrie No. 1 were so scarce that quotations ceased immediately the strike commenced. There was sufficient number 3 available to permit quotations to continue till mid December. After rising sharply from £2-80 to £2-97.5 in the first week of October, it fell again to £2-95 by the end of the month, recovered to £3-00 by mid November and dropped back to £2-97.5 when quotations ceased. When quotations resumed in March, they opened at the pre-strike level of £2-80, while Gartsherrie No. 1 at £3-00 was 12.5p below the closing quotation of September. During the strike the Bairds bought up as many warrants as possible for Eglinton iron, in order to meet deliveries, though rumour had it that the purchases represented also an attempt to remove all stocks of Eglinton from the public stores as a prelude to raising the brand

86. Engineering, 10 October, 1890.

closer to the special Lanarkshire brands. For a time such warrants fetched a premium of 12.5p above G.M.B. quotations, but the attempt did not meet with immediate success. With this special exception prices sagged, since consumers, although drawing from store, were free also to buy English pig-iron, imports of which leapt up from 435,000 tons in 1890 to 700,000 tons in 1891.

Under these conditions the masters had no incentive to seek an early settlement and extended the terms on which the men would be allowed back to include a 20% wage reduction. When the resolve of the men did show signs of weakening, the first furnaces blown in were at Lugar. The combination of non-unionism and a healthy demand for Eglinton iron explain the speed with which the four furnaces were relit, and when the strike collapsed in Lanarkshire in March the Gartsherrie furnaces relit were used to produce ordinary iron, stocks of which were exhausted.⁸⁷ With general dullness in the steel trades production of hematite accounted for only 16.2% of Gartsherrie output during 1890-91 compared with 36.7% in the previous year. For a time the shortage of special brands kept the price steady around £3-00 in the case of Gartsherrie No. 1. By June with production back to normal the price began to fall, and even a 'corner' in warrants engineered from London, which practically stopped all dealings in Scotch G.M.B., was unable to arrest the decline in makers' iron.

The price fell steadily, till by January 1892 Gartsherrie No. 1 stood at £2-72.5. Foreign demand, already small, declined steadily, and Bairds announced a 15p reduction in Gartsherrie and 7.5p in

87. Colliery Guardian, 3 April 1891. Of the 11 Baird furnaces in blast 9 were producing ordinary iron.

Eglinton quotations, which the other makers were obliged to copy.⁸⁸ Following this action the price steadied and for the remainder of the year varied little either side of £2-50. The North of England strike had little influence on the price, even in the case of hematite which had fallen sharply from the heady heights of around £5-00 fetched in the excitement of late 1889 to settle beside Gartsherrie No. 1 at £2-50. The considerable increase in the number of Scottish furnaces making hematite during 1892 led observers to believe that makers were stocking it against a future rise in price. Stocks at Gartsherrie do not support this conclusion. From the extremely low level of 119 tons 11 cwt in May 1891 they increased to 1,983 tons 8 cwt in May 1892 only to decline to 1,184 tons 8 cwt twelve months later.⁸⁹

The years 1893 and 1894 were plagued by labour troubles with both colliers and furnacemen. Although these demonstrated yet again that interruption of the make of Scotch had scarcely any effect on price, they also revealed that the Bairds found the prevailing low level of prices far from unprofitable. From January to June 1893 output ran at unprecedented levels, averaging 11,000 tons per month, yet iron had to be taken from stock to meet deliveries. The high coal prices caused by the colliers' strike in England tempted some makers to blow out furnaces and sell their coal on the open market. At Gartsherrie, although production was reduced, this may well have been caused by difficulties with their men, and a policy of balancing supply and demand, which some observers say was the agreed policy of

88. Engineer, 12 February 1892.

89. Strathclyde, W.B. & Co. MSS, Gartsherrie Production Abstracts 1890-91; 1891-92; 1892-93.

the makers. Whereas at the end of August the number of furnaces in blast in Scotland had been reduced to 55 out of 118, at the Baird works there were still 19 in blast out of 29. Not until the colliers finally came out on strike in December were the Gartsherrie furnaces damped down. Gartsherrie No. 1 was immediately withdrawn from the market, and as soon as the strike had collapsed the furnaces were relit, although observers had expected that with the New Year holiday imminent the makers would have postponed such action. By March 1894 new production records were being set, although Gartsherrie No. 1 was priced at only £2-55 and hematite at £2-50. In May the masters agreed to reduce the colliers' wages by $2\frac{1}{2}\%$ and the following month saw the most widespread colliers strike ever experienced, to which the masters responded by blowing out their furnaces. At Gartsherrie every effort was made to keep the furnaces going and not until the second week in July was the last furnace damped down, at which point two at Lugar and two at Muirkirk were still in blast, though these were extinguished the following week. As soon as the men began to drift back to work at the end of September, the furnaces were relit. By 2 November the Bairds had 17 out of 29 in blast compared with 55 out of 113 for Scotland as a whole.⁹⁰ All 17 Baird furnaces were making ordinary iron the demand for which was particularly strong, though the price was unchanged.

Between January 1895 and May 1898 Gartsherrie No. 1 moved between a bottom price of £2-47.5 and a top price of £2-65 but generally stayed even closer to the quotation of £2-57.5 at which it opened and closed the period. Between these dates Scottish hematite fluctuated

90. Colliery Guardian, 2 November 1894.

between £2-50 and £2-65. Both production and sales of Gartsherrie iron expanded steadily during this same period. From 137,293 tons in 1895-96 production increased to 157,205 tons in 1897-98, while sales rose from 141,695 tons to 155,521 tons 19 cwt. The great activity in the steel industry caused by strong demand from the Clyde shipyards meant that sales of hematite increased from 56.7% of total sales to 66.9%.

This drive to increase sales at prices which were generally but mistakenly regarded as unremunerative becomes more understandable when set against production costs. In 1889-90 the cost at the works of ordinary Gartsherrie pig-iron was £2-48.33 and of hematite £2-65.42. By 1895-6 the respective costs were £1-87.92 and £1-90.83 after which they began to rise again though only slowly and in 1897-8 were calculated at £1-97.5 for ordinary and £1-97.92 for hematite. Bearing in mind the profit which by-products realised over the period, of around 20p per ton of pig-iron, the steadily increasing attraction of a price of £2-57.5 becomes apparent.

The growth in sales from Gartsherrie during the 1890's far surpassed the expansion in those of the other Scottish ironworks. Comparing sales in 1892 and 1897, these from Gartsherrie show an increase of 56.5% while those of the rest of Scotland expanded by only 30.2%. There are some indications that sales of Eglinton brands were also doing well over the same period. For example, it was decided to replace three of the furnaces at Kilwinning in 1896 with more modern plant.

These furnaces were blown in just in time to be used during the most profitable period in almost twenty years. The settlement of a

strike on Clydeside at the beginning of 1898 was soon followed by a rising demand for hematite. The market was strengthened on publication of the annual statistics which revealed that a year of increased production had also been a year of decline in the stocks in Connal's stores and in makers' yards. The firmness of the market was reflected in the steadiness of the price for No. 1 Gartsherrie which remained at £2-57.5 from February till the beginning of August. Hematite responded sooner to the improving conditions and from £2-50 at the beginning of the year it had risen to £2-75 by mid May. The Bairds responded by transferring furnaces to hematite production both at Gartsherrie and in Ayrshire, and displayed their optimism by granting an advance on wages in April and again in August. Increased production of hematite did little to restrain the rising price which reached £3-00 by the close of the year, while the corresponding reduction in ordinary output began to push its price up and Gartsherrie No. 1 rose to £2-80 by October, where it remained for the rest of the year.

The annual statistics were again favourable, particularly as regards makers' stocks which showed a reduction of 53,000 tons to 74,000 tons. The only unfavourable item was the decline of 11,000 tons in foreign shipments, but exports, though important, had long since ceased to make or break a boom in Scotch pig-iron. Domestic consumption remained very good and indeed the demand for some special brands exceeded the restricted supply. Gartsherrie No. 1 advanced steadily from £2-80 in January 1899 to £3-50 by the beginning of May and at the end of the month there were only 349 tons 3 cwt of ordinary Gartsherrie in stock.⁹¹ The Bairds made no attempt to increase

91. Strathclyde, W.B.& Co. MSS, Gartsherrie Production Abstract 1898-99.

production of ordinary iron, obviously preferring to sell their smaller output at high prices. Instead the Gartsherrie works concentrated on the production of hematite iron, the output of which reached 106,101 tons during 1898-9 - more than twice the output of ordinary iron. Even so sales were such that stocks at 31 May 1899 were only 2,610 tons 19 cwt. Demand continued to exceed supply and the price rose from £3-22.5 in February to £4-00 in July and £4-25 by the end of November. Every department of the home trade continued busy, and during December makers' order-books were so full that for the first occasion in a very long time they were refusing to accept fixed date orders, agreeing only to deliver when circumstances permitted.⁹²

1899 had been a prosperous year marked by several wage increases and the Bairds opened 1900 by granting further advances.⁹³ Hematite which had shown a slight price fall recovered quickly and was once again quoted at £4-25 by the beginning of February. Ordinary Gartsherrie reached £4-25 by mid March at which point quotations for No. 1 ceased, all available stocks and forthcoming output being contracted for. When quotations were resumed a month later, £4-50 was the opening price. The pressure on ordinary iron was particularly strong, as domestic consumers sought it in preference to Cleveland iron which had for the time being virtually priced itself out of the Scottish market. Foundries, which had taken 189,000 tons of Scotch pig-iron in 1899 took 295,000 tons in 1900. As demand from the steelworks began to fall off, the Bairds transferred furnaces from

92. Engineer, 1 December 1899.

93. Strathclyde, W.B. & Co. MSS, Manager's Notebook Gartsherrie, January 1900.

hematite to ordinary production. By October demand was also slackening in this sector, and the Bairds cut the price of Gartsherrie No. 1 from £4-25 to £4-15, after which it declined steadily to £3-87.5 at the end of December, though their sales were not believed to have suffered 'in thus boldly meeting the market'.⁹⁴

The stock in Connal's stores had fallen sharply during the year from 245,000 to 71,000 tons, but the report at the beginning of 1901 that makers had been storing heavily in the closing months of 1900 and held 63,000 tons compared with 32,000 tons produced a much greater effect in the market. Consumers realised that makers had been attempting to conceal the extent to which the market had turned. The result was a sharp fall in prices. Gartsherrie No. 1 dropped from £3-90 at the beginning of the month to £3-50 at the close. The sharp reduction in price in October had, therefore, ensured good orders before the inevitable reduction which the company knew would come at the end of the year. Accordingly, production continued at record levels, and stocks remained slight, although higher than the very low levels of recent years, particularly in the case of hematite. Indeed, after increasing in the closing months of 1900 and opening months of 1901, they began to decline again as sales moved ahead of production. In spite of a contraction in domestic, English, and foreign demand Gartsherrie sales remained high, and the price remained attractive. Hematite pig-iron never fell below £3-05 during the year, while the lowest quotation for Gartsherrie No. 1 was £3-30. Allowing for a profit of 17.71p per ton of pigs as a result of by-product sales,⁹⁵ the cost of production at May 1901 was £2-38.96 for ordinary

94. Engineer, 19 October 1900.

95. Calculated from data on by-product costs and sales in Gartsherrie Production Abstracts.

iron and £2-37.71 for hematite, a marked increase on the costs prior to the boom but still low enough to leave an attractive margin of not less than 91.04p on ordinary iron and 67.29p on hematite.

The next four years were quietly profitable. Although Gartsherrie No. 1 fell for a time to £2-80, it was for much of the time above the £3-00 mark. The average prices for the years 1902 to 1905 were £3-31.88, £3-15, £2-87.5, £3-01.25, which compare with average production costs, again allowing for by-product profits, of £2-18.33; £2-08.75; £2-11.04; and £2-18.75. Average hematite prices were £3-05, £2-95, £2-80 and £3-20 against production costs of £2-26.67; £2-25.42; £2-22.92 and £2-21.67. In 1902 sales were higher even than during the boom, thanks to good North American demand, mainly for hematite, which more than offset a decline in Continental demand. In 1903, 1904 and the best part of 1905 sales fell off slightly, and reduction in the make was not sufficient to prevent a build-up of stocks. Even so stocks were far from excessive - 9,401 tons 18 cwt at 31 May 1905. By the autumn prices were rising, as domestic consumers arranged future deliveries, prospects being bright in almost every branch of the finished iron and steel trades, with the exception of those manufacturing household furnishings. Increasing enquiries from abroad, particularly the Mediterranean countries reinforced the trend, and the new year opened with Gartsherrie No. 1 standing at £3-42.5 higher than at any time since February 1901. With current demand satisfied in the finished iron and steel trades optimism waned, and the price fell back, though only to £3-25 which was still higher than any quotation between May 1903 and October 1905. Domestic demand seemed likely to ensure good sales at this price, when American enquiries for good foundry grades suddenly entered the market and

Gartsherrie No. 1 advanced rapidly to close the year at £3-87.5. The Scottish special brands were required in America to mix with the scrap from the San Francisco disaster, and the rapid advance in price was due mainly to the pressure from America for prompt delivery. Vessels were chartered to avoid excessive freight charges, and this enabled makers to send iron at 15p to 20p below the prices asked by the regular steamers. The Bairds had secured such good orders that reports in December of a sharp reduction in the price of American iron which caused Scotch warrants to fall, had no effect on the price of Gartsherrie No. 1.

The sharp increase in prices had checked domestic purchases and also to some extent reduced Continental orders. When therefore, American demand dropped off at the beginning of 1907, the price began to fall, and by April Gartsherrie No. 1 was £3-67.5. The lower price brought out Continental and Asian orders. Domestic consumers who had held off during the high prices at the close of 1906, realizing that the price was not likely to go any lower also came in, and the price more than regained what it had lost, Gartsherrie No. 1 being quoted at £3-95 by mid-May. The continuing high level of exports were more than offset by a marked fall in domestic activity, and at Gartsherrie deliveries fell off quicker than production, causing an increase of stocks. The recovery of prices was accordingly short-lived, and by December Gartsherrie No. 1 had declined to £3-37.5.

It was entirely fitting that this brief recovery of American demand should have brought forth Scotland's highest annual output of pig-iron prior to 1914. Exports dropped steadily back after 1907, and for a time domestic consumption did likewise. At Gartsherrie

furnaces were transferred from ordinary to hematite production, as foreign demand for foundry iron declined. But in this sector too, demand dropped from the peak of 1904-1906, and with hematite prices running below Gartsherrie No. 1, there was no real incentive to make a major alteration in the proportions between the respective furnaces. The company clearly decided, however, that future recovery was more certain in the hematite than in the ordinary market. Accordingly, in so far as they produced for stock, they did so in the hematite branch. From 407 tons 1 cwt in May 1907 stocks rose to 30,919 tons 13 cwt by May 1911 at which point ordinary stocks, at 2,490 tons 4 cwt, were the smallest for seven years. Admittedly, the high figure was in some measure a consequence of the lockout of the Boilermakers on the Clyde, but hematite stocks at any point between May 1909 and May 1911 were higher than any previous figure recorded.

This phase cannot, however, be described as a depression in any real sense. With the warrant store now an irrelevancy and makers firmly in control of the trade, stock accumulation took place in their own yards. Sales, though lower in every branch of the trade, were not disastrously so, and makers were able to prevent any sharp decline in prices. The tail end of the boom made the average price of Gartsherrie No. 1 for 1907-8 a rather high £3-51.25. In the next three years the average price was £3-05, £3-13.75, and £3-10. The respective production costs were £2-70.21, £2-37.92, £2-39.8, and £2-32.5. The average prices were therefore 30%; 28.2%; 30.3%; and 33.3% above production costs.

By mid 1911, No. 1 Gartsherrie, at £3-00, was lower than for two years past, as was hematite. Improved sales of ordinary were

recorded at the low price, but these were more than counterbalanced by poor deliveries of hematite. The relaxation of the Russian tariff stimulated foreign shipments - the first large sale of Scotch pig for Russia was 1,500 tons of Eglinton iron⁹⁶ - and by September enquiries were coming in from India, Canada, Australia and South America. These were mostly for ordinary iron which was also in better demand in both Scotland and England, and as a result Gartsherrie No. 1 improved to close the year at £3-22.5. Hematite too showed some signs of buoyancy but the colliers' strike at the beginning of 1912 showed how weak the recovery was. Ordinary Gartsherrie was immediately withdrawn from the market, stocks being low. The price of hematite rose, but only at much the same rate that it had been doing for several months before the strike occurred. Quotations of Gartsherrie No. 1 resumed after a fortnight, although the strike continued for another month. The price of £3-27.5 was only 5p above the previous quotation which had been unchanged for three months. Nor when the strike did end was there any rush to relight the furnaces.

The rapid advance in prices, when it did occur, owed nothing to the strike. In ordinary iron it was partly caused by an increased demand, largely independent of the improvement at the end of 1911 which had shown signs of petering out before the strike started. This fresh advance was barely beginning to make itself felt when the strike ended. Nor was the extent of the advance in price due to any diminution of stocks. These had, in fact, been low before the strike and for a considerable time previously, as a result it would seem of a conscious policy on the part of the masters of just

96. Engineering, 9 June 1911.

producing sufficient to feed the market. While the advance in price was due to an upsurge in demand, its extent was arguably a consequence of the policy of the makers. At Gartsherrie, in spite of the advance, production of ordinary was smaller than at any time since the beginning of the new century. Not only did they not rush to relight the furnaces, but even when they did re-start production, they were content to replenish stocks rather than to press sales.

This policy was made possible by the marked upsurge in demand for hematite which enabled the makers to increase production without checking the advance in price. Sales here leapt up during 1912-13 to 125,426 tons 11 cwt, higher than the previous best by 20,000 tons. This record tonnage was sold at an average price 41% above production costs, while of the much smaller volume of 58,700 tons 7 cwt of ordinary iron the No. 1 sold at 37.5% and the No. 3 at 32.8% above production cost. These two numbers accounted for 91.3% of the ordinary iron sold.

Although in May 1913 the finished iron and steel works were still busy, there was some anxiety about future prospects, and this soon affected fresh orders for pig-iron. Prices of ordinary iron had been declining slowly since the beginning of the year in spite of the efforts of the masters to keep the production low, and the price up. The trend of falling imports of English iron was reversed. Gartsherrie No. 1 which had fallen 15p in the first half of the year dropped 50p in the latter half to close at £3-50, and the drift downwards continued during 1914. Sales of ordinary during the twelve months 1913-14 were 49,000 tons 6 cwt. With the exception of 1890-91, when the furnacemen's strike severely curtailed production, this was

the lowest volume of sales since the works had come into full production.

Deliveries of hematite, though lower than the previous year, were nevertheless considerable, and the total for 1913-14 was second only to the record of 1912-13. The steam had clearly gone out of the boom, however, and as foreign producers felt the same pressures, German and Belgian dumping of finished products further increased the air of despondency among the malleable and steel manufacturers. Therefore although deliveries of hematite were large, they were made at steadily falling prices, and by July 1914 the makers had no hesitation in blowing out furnaces rather than accede to a demand of the colliers for wage increases.

The outbreak of war completely altered the situation though the change was not immediate. Gartsherrie went on to play a key role in the Great War and along with other Scottish and British works, suffer the consequences in the years which followed.

CHAPTER IV

CHAPTER FOURRaw Materials - Ironstone

The evidence provided by the success of the Monkland Iron Company that the local blackband ores could be smelted efficiently in the improved furnaces of the 1820's was an important factor in encouraging the Baird brothers to enter the iron-smelting industry. With the effective development of Neilson's Hotblast process blackband ironstone became of fundamental importance in the expansion of the Scottish Pig-iron industry. The overriding necessity of securing adequate supplies influenced the pattern of the firm's growth at least as much as did fluctuating market conditions. Right from the outset the Bairds were aware of the need to procure supplies sufficient to meet long-term requirements and set about the task with characteristic thoroughness.

Every conceivable method was adopted. Firstly, they leased sections of the Airdrie blackband field from the landowners. Their original supplies were taken from Cairnhill leased in 1829 from George More Nisbett for forty years.¹ In the following year the ironstone in the lands of Commonhead and Easter Mavisbank was taken on a nineteen year lease.² Rawyards, Wandsmalling³ and Stanrigg⁴ were leased in 1833, the first two for thirty, and the latter for

-
1. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 90.
 2. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 56.
 3. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 91.
 4. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 25.

nineteen, years. Following the proving of rich ironstone deposits on the Rochsolloch estate, the local ironmasters competed keenly for the right to work them. In 1836 A. J. Alexander agreed to lease the field in lots to the Calder, Calderbank, Gartsherrie, Dundyvan and Summerlee companies. With the exception of Calderbank the companies co-operated in the exploitation of their lots in order to avoid wasteful duplication of effort.⁵ By 1839 output was running at approximately 44,500 tons per annum from the jointly worked sector.⁶

Existing ironstone leases held by others were bought out. The Burnbrae lease held by James Shanks and James Johnstone was acquired in 1839,⁷ when it had fifteen years to run, and the lease of the ironstone of Bellsdyke and Gartlee was purchased from the Monkland Iron and Steel Company in 1841.⁸

The Bairds also purchased lands within the known limits of the Airdrie blackband field. In 1836 William bought Cliftonhill from Archibald Stirling⁹ and to this he added the neighbouring lands of Coats purchased in the following year from his brother-in-law, Thomas Jackson.¹⁰ In 1840 he added the lands of Raw for which Alexander Henry was paid £3,000.¹¹ Alexander and James jointly acquired

-
5. Miller, Rise and Progress, 31.
 6. Strathclyde, William Baird and Company MSS, Statement of Rochsolloch Ironstone, December 1839.
 7. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 177.
 8. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 134.
 9. S.R.O., General Register of Sasines, 8 July 1836.
 10. S.R.O., General Register of Sasines, 3 April 1837.
 11. Strathclyde, William Baird and Company MSS, Railway Deeds, vol. 1, p. 122.

Faskine and Palacecraig in the following year from the trustees of John Dixon of Daldowie and William Dixon of Galaknow.¹²

As an alternative to this policy the brothers simply purchased the ironstone without bothering about the land or any of the less important minerals. In 1836 the ironstone under the lands of Kipps, Blacklands, Gunnie and Hollandhirst, bordering on Gartsherrie was bought.¹³ A slightly different example was the case of the ironstone of Thrashbush in New Monkland which was bought in 1836 for the limited period of thirty years.¹⁴ George Baird after buying a two-acre plot of land on the Northburn of Airdrie soon sold the land but was careful to reserve the minerals.¹⁵ In 1838 fifteen acres of ironstone under the lands of Craigmaucken were bought.¹⁶ An additional eight acres of the Kipps ironstone together with that under the land of Kippsbyre was acquired in 1841,¹⁷ in which year also the Whinhall ironstone was bought from William Dixon.¹⁸ In 1847 the Mavisbank ironstone was bought¹⁹ and to this was added the neighbouring ironstone of Easter Mavisbank in 1854.²⁰ James Baird bought the ironstone in two small lots of ground in North Street, Airdrie in 1848,²¹ and two years

-
12. S.R.O., General Register of Sasines, 23 September 1841.
 13. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 95.
 14. Ibid., folio 92.
 15. S.R.O., General Register of Sasines, 21 December 1836 and 10 May 1837.
 16. S.R.O., Particular Register of Sasines for Lanarkshire, 18 May 1838.
 17. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 94.
 18. Ibid., folio 93.
 19. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 237.
 20. S.R.O., Particular Register of Sasines for Lanarkshire, 11 March 1854.
 21. Ibid., 16 February 1848.

later added that under a further two small portions in North Bridge Street and Main Street.²² The ironstone in the lands of Rawyards, worked by the company, were purchased in 1854, together with additional portions of the Kipps and Kippsbyre ironstone. In 1859 part of the Drumbathie ironstone was bought²³ and in the following year the ironstone beneath the Eastertown Mailing of Airdrie and Easter Mavisbank was added.²⁴ No odd lot however small was thought unworthy of consideration provided it was suitably located in relation to existing or probable pits.

The evidence is somewhat ambiguous as to who actually owned all these lots. Under Scots Law at this time land or minerals could be the property of individuals, not of firms; hence one, or sometimes two, of the brothers had his name in the Sasine. Although in 1859 the surviving brothers formally transferred the lots held in their name to the company,²⁵ the courts had to settle a dispute with Douglas' daughters who claimed that the lots held in his name were his own and not the company's. The issue was decided in the company's favour.²⁶

In the early 1830's the Bairds acquired control of areas of the blackband field, 'at a time when there was little or no opposition, and such leases could be and were secured on very reasonable terms'.²⁷ During the thirties and early forties following the erection of the

22. Ibid., 11 June 1850.

23. S.R.O., General Register of Sasines, 15 April 1859.

24. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 92.

25. S.R.O., General Register of Sasines, June-September 1859 passim.

26. Ibid., 27 November 1862.

27. Miller, Rise and Progress, 110.

first Gartsherrie furnace, five new ironworks were started in the Coatbridge area. From seven furnaces in 1830 the number had risen to sixty by 1844. Not only had the market for raw materials changed from a buyer's to a seller's market, but the sellers had learned a great deal about the technicalities of leasing, or about other ways of disposing of their minerals. Hitherto modest landowners found themselves the fortuitous owners of lucrative properties thanks to the existence of a mineral which previously had been despised as worthless wildcoal.

In an endeavour to avoid exorbitant demands the Bairds deliberately sought anonymity and acted through a middleman. James T. Rankin, himself a small landowner and sometime provost of Airdrie, bought or leased a number of properties for which the Bairds provided the money. In August 1850 the company sent Rankin payment for three recent transactions and enclosed a plan of the Airdrie ironstone field on which they asked him to mark all the lots he had purchased on their behalf.²⁸ In some cases, as with the property of Rushiehill, Rankin and the Company were ostensibly in competition, although their tactics had been agreed beforehand.²⁹

The Bairds' intensive policy during the 1830's placed them in a fortunate position. As royalties advanced rapidly during the 1840's, the brothers were able to pass the decade 1841-51 without entering into any new ironstone lease with Monkland landowners, and this despite the greatly increased requirements of the Gartsherrie Works.

-
28. Coatbridge, William Baird and Company MSS, G.L.B., vol. 3, 779, Alexander Whitelaw to James Thomson Rankin, 8 November 1850.
29. Coatbridge, William Baird and Company MSS, Agreement regarding Rushiehill, March 1851.

Instead the minerals held by the various partners, were leased to the Company: James and Alexander leased the Faskine and Palacecraig minerals in 1845;³⁰ those of Coats and Cliftonhill were leased by William in 1846,³¹ and those of Whinhall by Alexander in 1847;³² in 1849 William leased the Drumbathie³³ minerals and James those of Kipps and Kippsbyre.³⁴

Because the firm was able to bring these reserves into use, it did not experience, to the same extent as did other Scottish pig-iron producers, the marked rise in blackband royalties which took place between 1830 and 1850. Comparisons between different leases are not entirely satisfactory because of the varying quality, ease of working, and so on, of the respective deposits. Nevertheless, it is significant that in the early leases as Table IV, shows the Bairds paid about 6.67p per calcined ton of 22½ cwt. By the mid 1840's the norm facing the company was a royalty of 12.5p. This increase represents an advance of 87.5% over the 1830 level.

TABLE IV:1 IRONSTONE LORDSHIP IN THE GARTSHERRIE AREA 1829-1850

IRONSTONE LEASED	DATE OF ENTRY	LORDSHIP PER 22½ CWT CALCINED B.B.	IRONSTONE LEASED	DATE OF ENTRY	LORDSHIP PER 22½ CWT CALCINED B.B.
CAIRNHILL	1829	7p.	FASKINE & PALACECRAIG	1845	10p.
COMMONHEAD	1830	10p.	COATS & CLIFTONHILL	1846	12½p.
RAWYARDS	1833	5p.	DRUMBATHIE	1849	12½p.
STANRIGG	1833	7p.	KIPPS & KIPPSBYRE	1849	12½p.

30. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 245.
31. *Ibid.*, folio 244.
32. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 93.
33. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 334.
34. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 94.

That the royalties facing the Bairds were unusually low is brought out in a letter from David Wallace to the Company's legal agent. It would appear that the assessor of the Parochial Board of New Monkland intended to 'aim at setting aside the lease between James Baird and William Baird and Company on the grounds that the Lordship does not represent the full value of the minerals'.³⁵

Two leases taken by the Bairds show the extent of the rise more clearly and illustrate the effect on royalties of strong competition. Thus, the last lease signed with a non-member of the firm, that of Bellsdyke & Gartlee in 1841, was agreed on at a royalty of 20p for one area and 27.5p for another.³⁶ Likewise the Bairds' share of the famous Rochsolloch field was taken on a royalty of 42.5p per 22½ cwt.³⁷ In this instance a number of factors combined to establish a particularly high price. Firstly, the quality of the ironstone, much of it only a few feet below the surface, enhanced its value. Secondly, the lease was entered into during an unprecedentedly prosperous year for the Scottish pig-iron industry. In 1836 the price of No. 1 iron averaged £6.75 per ton, which was 338.3% above the Bairds' cost of production.³⁸ Such profits encouraged expansion. At the various Monkland works four new furnaces were brought into production, and work was begun on several others.³⁹ With three new companies making plans to enter the industry the demand for raw materials was such that

35. Coatbridge, William Baird and Company MSS, G.L.B., vol. 4, page 2, David Wallace to James Ritchie, 20 June 1851.

36. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 134.

37. Ibid., folio 60.

38. For details see pp. 95-96.

39. Miller, Rise and Progress, 20.

landowners could ask almost any price. With five companies competing for the Rochsolloch ironstone Alexander was able to extract a very favourable royalty.

The rise in Blackband royalties is all the more striking when contrasted with those for coal during the same period. The royalty on splint coal for Gartsherrie and Gartgill in 1834 was set at 2.5p and 2.92p per 13 cwt for the respective fields⁴⁰ while at Thankerton it was 2.29p per 13 cwt.⁴¹ By 1841 the coal at Bellsdyke was being leased at 2.92p per 13 cwt,⁴² and that of Woodhall, bordering Thankerton was leased for 2.5p per 13 cwt in 1844.⁴³

The high royalty for Rochsolloch ironstone was increasingly becoming more like the norm by the middle of the following decade. With the recurrence of prosperous conditions the ironmasters again began to consider fresh expansion. By that date almost the entire Airdrie field was already taken up, and for those portions that were not, the royalties asked were high. Fears that the precious mineral would soon be worked out were increasingly expressed. Not surprisingly the ironmasters turned to Ayrshire where iron ore deposits were known to exist. The Bairds joined in this movement and established the Eglinton ironworks in 1845.⁴⁴

Nonetheless, the Bairds had no intention of winding up their Gartsherrie business as Wilson chose to do at Dundyvan. Once the

40. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folio 12.

41. *Ibid.*, folio 114.

42. *Ibid.*, folio 134.

43. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 134.

44. For details see pp. 26ff.

wider expansion of the industry had weakened the strong bargaining position of the Monkland landowners, the Bairds were always ready to acquire any attractive property. To the part of Mavisbank already in their possession they added Easter Mavisbank in 1854.⁴⁵ In the same year they bought a third portion of the Kipps and Kippsbyre ironstone⁴⁶ and the unworked part of the Rawyards ironstone, held in lease since 1836.⁴⁷ In this year also they bought out a lease of the Riggend ironstone.⁴⁸ Part of Drumbathie was bought in 1859⁴⁹ and the Eastertown Mailing of Airdrie in 1860.⁵⁰

Their continuous policy of piecemeal acquisition of any appropriate lot, large or small, resulted in their achieving a dominant position in the Airdrie field. Although they owned only 26.23% of the furnaces, they held, according to one local writer, 31.25% of the Airdrie blackband field.⁵¹

Any attempt to estimate the volume of ironstone put out from these holdings is complicated by the varying terms of the early leases. Firstly the measures of weight used were not uniform. A ton could be 20 cwt, 21 or even 22½ cwt, while one hundredweight could itself be 112, 120 or 126 lbs. Secondly leases differed regarding what percentage of the output was to be allowed for waste, what size of riddle was to be used, and whether or not dust was to be

45. S.R.O., General Register of Sasines, 11 March 1854.

46. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 94.

47. Ibid., folio 91.

48. Ibid., folio 96.

49. S.R.O., General Register of Sasines, 15 April 1859.

50. Ibid., 22 September 1860.

51. Miller, Rise and Progress, 30.

free of royalty. Finally, leases varied according to whether royalty was to be based on the raw or calcined tonnage.

Figures which do survive for the output from the land belonging to the partners in the years 1847-8, and 1849-50 illustrate the impossibility of making any long-term estimates based on a few isolated figures. As Table IV:2 shows the period was one of significant short term change.⁵²

TABLE IV:2 IRONSTONE OUTPUT FROM PARTNERS PERSONAL PROPERTIES
1847 - 1850

Property	Ironstone output [tons]	
	1847-8	1849-50
Faskine and Palacecraig	9,196	24,066
Craigmauken	3,201	1,117
Thrashbush	3,980 [$\frac{1}{2}$ year]	6,650
Cliftonhill	20,839	29,190
Coats	10,511	12,724
Whinhall	776	4,006
Kippsbyre	1,469	4,361
	Total 49,972	82,114

Approximate figures for the total quantity of ironchar consumed at Gartsherrie can be estimated for the years 1830 - 1850, and these are given in Table IV:3. Assuming that production and consumption corresponded fairly closely, or at least followed the same broad trend, and that neither sales or purchases of char were important, the table offers a general guide to the growth in Bairds' production

52. Coatbridge, William Baird and Company MSS, G.L.B. vol. 4, 430, David Wallace to James Bain, 14 June 1850.

of ironstone.⁵³

TABLE IV.3 ESTIMATED CONSUMPTION OF IRONSTONE GARTSHERRIE
1830 - 1850

YEAR	CALCINED CHAR	RAW IRONSTONE	YEAR	CALCINED CHAR	RAW IRONSTONE
1830	3,745	6,217	1841	103,500	172,500
1831	5,795	9,620	1842	129,375	215,625
1832	8,165	13,554	1843	94,875	158,125
1833	12,775	21,207	1844	129,375	215,625
1834	17,390	28,983	1845	155,250	258,750
1835	18,000	30,000	1846	125,625	209,375
1836	31,590	52,650	1847	162,150	270,250
1837	47,450	79,083	1848	172,500	287,500
1838	46,938	78,230	1849	175,950	293,250
1839	59,221	98,701	1850	155,250	258,750
1840	67,575	112,625	TOTAL	1,722,494	2,870,620

Though the Bairds may still have been less alarmed than their rivals concerning ore reserves in the 1840's the reality of future exhaustion was brought home to them by the middle of the following decade. In 1851 the workings at Stanrigg were abandoned.⁵⁴ Two years later, steps were being taken to wind up the co-operative venture which had worked Rochsolloch.⁵⁵ By 1855 Commonhead was exhausted,⁵⁶ and by the summer of 1856 the ironstone of Coats, Clifton-hill and Thrashbush had all been worked out.⁵⁷

53. The figures are arrived at by using a statement of the 'Quantity of Char per ton of pig-iron 1830-40' (Coatbridge, William Baird and Company MSS) in conjunction with the Gartsherrie pig-iron output figures given in appendix. B, Table 2.

54. Coatbridge, William Baird and Company MSS, G.L.B. vol. 4,7, David Wallace to James Baird, 26 June 1851.

55. Ibid., vol. 6, 380, David Wallace to Dixon of Calder, 18 November 1853.

56. Ibid., vol. 8, 620, 8 November 1855.

57. Ibid., vol. 9, 385, John Campbell to John Miller, 16 July 1856.

The realisation that the finest blackband was rapidly being consumed forced the ironmasters to accept the fact that the lower grades of ironstone existing in the area would have to be brought into use. The Bairds, therefore, turned eastwards into the parish of Slamannan, which bordered on New Monkland. In 1851 they leased the ironstone of Luckinburn, Blackhill, Playmuir, East Glentore, Bogside and Wester Burnhead, by one tack, Greenhill by a second, Muiravonside by a third, and Middlerig by a fourth.⁵⁸ Todsbuchts in the same parish was leased the following year.⁵⁹ Turning north they bought out the lease of Twechar minerals, held by James Prentice⁶⁰ and leased the neighbouring minerals of Auchinvole and Shirva in 1854.⁶¹ To these were added Broomhill, Milton and Overcroy in 1858, and Cumbernauld, Denny, Neilston and Gartshore in 1859.⁶²

While the Slamannan area proved of only limited importance, the fields in the Denny-Kilsyth area were much more encouraging and in the 1860's the Bairds sought control of it as vigorously as they had earlier established their premier position in the Monklands. The minerals of Riskend and Currymire were leased in 1860; those of Quarter and Auchinbaes in 1863; of Risk in 1864; of Drum in 1867; and of Springhill in 1869.⁶³

This expansion was accompanied by a significant easing of the

58. Strathclyde, William Baird and Company MSS, Lease Book, vol. 1, folios 377, 386, 397 and 407.

59. Ibid., folio 467.

60. Ibid., folio 521.

61. Ibid., folio 544.

62. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folios 271, 147, 156, 136, 109 and 113.

63. Ibid., folios 117, 149, 152 and 158.

pressure on ironstone royalties. By the mid-1860's the Bairds were paying from 10p to 15p per calcined ton in the newly negotiated Denny-Kilsyth leases. This was partly a result of the reduction in competition which the development of Ayrshire, and the general opening up of ironstone fields other than Airdrie, brought about. It was also, however, a reflection of the different quality of ore which the new fields possessed. The lease of Gartshore referred to the ironstone as blackband or slateyband because of the difficulty in deciding which it was. Another lease stipulated that the Bairds would, for royalty purposes, accept a certain seam as blackband. Obviously, there was some room for doubt.

The new field quickly began to make a significant contribution to Gartsherrie's requirements. As early as May 1859 of 13,622 tons of calcined ironstone produced by the company's pits, the Denny field provided 2,699 tons or 19.9%.⁶⁴ By 1861-2, 43.7% of the 148,970 tons supplied to Gartsherrie was being brought from the Denny field,⁶⁵ and as Kilsyth was opened up, the continued decline of the Airdrie district became even more marked. In absolute terms output in the latter area had probably reached its peak of about 175,000 tons in 1849. By 1861-2 it had declined to 88,779 tons and by 1879-80 stood at only 13,000 tons.⁶⁶ By this latter date Denny-Kilsyth accounted for 68% of Gartsherrie's consumption, with the Gartshore estate alone contributing 44.2%.

64. Coatbridge, William Baird and Company MSS, Gartsherrie Works Abstract, May 1859.

65. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract, 1861-2.

66. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract, 1878-9.

Compared with 1861-2 when the Airdrie field was being worked from Faskine 7 and 8; Faskine Hillhead 2, 5, 6, and 10; Palacecraig 2, 3, 5, and 7; Rawyards 2 and 5; Drumbathie 1, 2 and 3; Raw 5; Cairnhill 5; and Cottonmill 1, a total of eighteen pits, only Faskine 8, Faskine Hillhead 5, Palacecraig 2 and 3 and Raw 3 were still in operation in 1878-9. These five pits produced only 6,848 tons, the remaining 6,635 tons of the Airdrie field being produced from a pit at Stand bought from Thomas Jackson of Coats.

The pits of the Denny-Kilsyth district undoubtedly proved to be Gartsherrie's salvation during the 1860's and 1870's, and enabled the company to consider calmly the need to find alternative future resources. In order, however, to satisfy Gartsherrie's requirements the area had to be worked intensively.

In 1862 the Colliery Guardian reported that the Bairds were then sinking twelve ironstone pits in the region and building houses for their workers,⁶⁷ and this was at a time when the industry was experiencing depressed market conditions. Gartshore provides a good illustration of the company's vigorous activity. Leased in January 1859, the ironstone had been reached by number 1 pit in January 1861⁶⁸ and the pit was in operation in 1861-2 when 1,977 tons 13 cwt were produced. In December 1861 Gartshore Nos. 3 and 4 were being sunk⁶⁹ and in October 1863 Nos. 5, 6 and 7 were begun. By March 1872 Gartshore No. 10 was being planned.⁷⁰

67. Colliery Guardian, 16 August 1862.

68. Coatbridge, William Baird and Company MSS, G.L.B., vol. 12, 372, John Alexander to the Edinburgh and Glasgow Railway Company, 21 January 1861.

69. Ibid., 1116, John Alexander to William Laird, 3 December 1861.

70. Ibid., vol. 23, 453, A.K. McCosh to Inspector of Mines, 30 March 1872.

The other leases were worked with similar intensity, and every possible source of ore was eagerly sought. Continued boring resulted in the discovery of the Haugh ironstone in 1883, and pits were put down to work it.⁷¹ In 1884 after a protracted law suit had been fought through the Court of Session, some feuars in Kilsyth were recognised as the owners of the ironstone beneath their feus. The Bairds then paid £25,000 in sums ranging from £80 up to £3,000, to fifty feuars for the ironstone beneath their land.⁷²

Inevitably, the manner of the company's operations in the area shortened the life of the field. As early as 1871 operations at the Neilston mine were stopped. By 1877 Tygetshaugh pit was abandoned,⁷³ as drainage became a problem and by the close of the year work had ceased at Gartshore No. 10 and Barrwood No. 1.⁷⁴ In the same year the lease of Wester Shirva was renounced⁷⁵ and in January of the following year notice was given of the company's intention to renounce the lease of Milton minerals.⁷⁶ Later in 1878 Turnahill ironstone pit was abandoned.⁷⁷

Despite the opening of some new pits in the 1880's contraction continued. From 128,448 tons 18 cwt in 1882-3 production had fallen to 37,939 tons 16 cwt by 1890-91. In 1899-1900 no ironstone was

71. Engineer, 15 June 1883.
72. Engineer, 21 November 1884.
73. Coatbridge, William Baird and Company MSS, G.L.B., vol. 30, 57; A.K. McCosh to J.B. Macdonald, 25 January 1877.
74. Ibid., 970; A.K. McCosh to Inspector of Mines, 20 December 1877.
75. Ibid., vol. 30, 428; A.K. McCosh to J. Maitland, 15 May 1877.
76. Ibid., vol. 31, 12; A.K. McCosh to Glasgow Office, 11 January 1878.
77. Engineer, 1 November 1878.

was produced in the region under Gartsherrie control, and for the first time in its history the works was entirely dependent on supplies of ore from outside the immediate vicinity. None was produced the following year but in 1901-02 production resumed with the recommencement of ironstone mining at Dumbreck. Production rose to over 20,000 tons by 1906 and held fairly steady at around that level prior to 1914.

Also in the decade before the outbreak of war the Bairds opened up their last 'local' source of ore, when they began to draw supplies from the Hopetoun Estate, West Lothian, which they took over from the Balbardie Colliery Company with pits already sunk.⁷⁸ In 1906-7, Gartsherrie received 6,415 tons 15 cwt from this source and output rose slightly to 6,858 tons 10 cwt in the following year. Thereafter deliveries dropped to 3,972 tons 11 cwt in 1908-9, to 1,133 tons 13 cwt the following year, and in 1910-11 to 226 tons by which date production had ceased.

Although, therefore, the search for ironstone within reasonable distance of Gartsherrie continued into the twentieth century, nevertheless the company had long since recognized the need to bring supplies from outside. With the exhaustion of the more suitable and accessible seams, the difficulty and hence the costs of working increased, and at the same time the quality of the ironstone posed problems. In August 1885 Donnachie, the Gartsherrie chemist, wrote to Twechar indicating the number of waggons of char to be sent from each pit per day.⁷⁹ The proportions requested were intended to

78. List of Mines, 1906.

79. Coatbridge, William Baird and Company MSS, G.L.B., vol. 36, 993; Donnachie to Twechar Office, 6 August 1885.

achieve a suitable mixture of the different qualities of ironstone. In turning to foreign supplies the need to keep a high quality ore in the burden in order to ensure the standard of the resulting pigs was an important consideration. The necessity of finding an ore suitable for the production of hematite pig-iron, and the steady increase in the comparative cost advantage of other ores sealed the fate of the company's local ironstone mines.

Techniques and Costs in the Gartsherrie Region

Although the ironstone districts of the Glasgow area contained fourteen different seams of ironstone, not all were present in any particular locality, and of those which were, some were either too thin, too irregular, or too poor in quality to be of any practical value. In the Airdrie field the seams of importance were the Palacecraig blackband which was a unique occurrence above the upper coal seam, the upper blackband, the lower blackband, and the slatey-band.⁸⁰ Although the relative distance between the seams was fairly constant, extensive faulting greatly altered the depth at which the seams lay below ground level. In the Denny-Kilsyth area four seams were of importance. The upper blackband, which was found only in the eastern and western parts of Kilsyth, the Haugh ironstone which occurred over a small area of eastern Kilsyth, the Neilston seam which was of workable thickness over much of the field, and the Banton blackband which, although found all over the field, was only infrequently of workable thickness. Clayband seams did exist but at considerable depth.⁸¹

80. J. Prentice, 'On the Mineral seams of New Monkland', Trans. Instit. of Mining Engineers, vol. XII, 435-449.

81. Mark Brand, 'Calcination of blackband ironstone at Dumbreck', Trans. Instit. of Mining Engineers, vol. XXV, 253.

In the early years only blackband was worked, and not until this was becoming scarce did the ironmasters turn to the use of slateyband. The importance of the blackband as such did not lie in its high metal content. Indeed at about 32 to 34% on average it was not only little different from Welsh ore (33% on average) or Staffordshire ore (30% on average) but actually poorer than the average slateyband (40% on average). Blackband ironstones were valued for their high bituminous content, and were accepted as true blackbands only if they contained a sufficient proportion of such matter to enable them to be calcined without the use of additional coal. Different blackbands were then ranked in order of value according to metal content, with the famed Mushet blackband of the Airdrie field holding pride of place having a metal content of 42% iron. It is important to bear in mind, therefore, that blackband is a generic rather than a specific term.

In the Airdrie area the pits were relatively shallow although, on account of faulting, some pits had to be considerably deeper than others nearby where the same seam of ironstone was being worked. Although the workable seams varied in depth from 30 to 140 fathoms pits were seldom below 70 fathoms. Raw No. 2 for example was 51 fathoms.⁸² In the Denny-Kilsyth district pits had usually to be sunk to much greater depths. Although Gartshore No. 1 was only 58 fathoms, and No. 7 69 fathoms, Gartshore No. 3 was 80 fathoms, No. 4 was 110 fathoms, and No. 5 was 140 fathoms.⁸³ Likewise Twechar No. 1

82. Coatbridge, William Baird and Company MSS, G.L.B., vol. 13, 296; John Campbell to Glasgow Office, 8 March 1862.

83. Ibid., vol. 12, 116; John Alexander to William Laird, 3 December 1861, vol. 15, 184; A.K. McCosh to William Laird, 6 November 1863.

was 128 fathoms and Quarter No. 1 was 110 fathoms.⁸⁴

There were instances in both fields where the ironstone was very near the surface. At Rochsolloch part of the bed was so close to the surface that it had been cut by the plough, and in this and other instances in the Monklands opencast working was possible.⁸⁵ At Inglestone a shallow mine was driven to the ironstone which lay only 8 fathoms below the surface.⁸⁶ In general, however, the seams were worked by conventional pits.

Because of frequent faulting, together with variations in the thickness and quality of the seams, many pits had to be sunk to work comparatively small areas. High costs of sinking coupled frequently with a short lifespan were an important factor in the economic viability of such fields. Faskine had ten pits, Palacecraig eight, Cairnhill eight and Rawyards five. In the Denny-Kilsyth area Gartshore was the classic example with ten pits, though Fygetshaugh had four.

So far as general mining techniques were concerned, certain aspects such as haulage, ventilation, or pithead machinery were developed in common with coalpits. The actual underground working techniques had unique characteristics. Ironstone miners were a distinct class largely because the methods of mining required specialised skills. The appearance of the blackband generally made it difficult to identify. Moreover seams were thin, and skill had to be used in order to avoid much wasteful working. Even so, with

84. Ibid., vol. 15, 307; A.K. McCosh to Laird, 3 December 1863.

85. Miller, Rise and Progress, 31.

86. Coatbridge, William Baird and Company MSS, G.L.B., vol. 14, 266; John Alexander to William Laird, 25 February 1863.

seams at best only 18 inches thick in the early years and often less than 8 inches later in the century, much waste material was inevitably worked out along with the ironstone. Accordingly the general practice was for the miner to move forward along the seam stowing waste behind him as he went. This not only saved taking it to the surface but also reduced propping to a minimum and made possible the maximum extraction of ironstone.

Even so, large quantities of rubbish were carried to the surface. No precise figures survive for the Bairds' pits in the nineteenth century. Brand, however, gives details for Dumbreck in the early years of this century, though of course in the earlier years, when seams were thicker, conditions would presumably have been better than at Dumbreck. There, the roads were sixty feet apart, and waste was stowed in the workings in the normal fashion. Despite this, rubbish taken to the surface was equal to 1.4 tons for every ton of clean ironstone.⁸⁷

At the surface the ironstone was calcined. Early in the nineteenth century it would appear that this process was performed on the open ground or perhaps on a layer of sand. Later special hearths were built, with surfaces raised sufficiently to make for easier loading into railway trucks brought alongside. The raw stone was heaped in bings approximately 68 feet broad by 200 feet long. In the 1860's the bings were generally some 5 - 6 feet high and contained about 2,000 tons.⁸⁸ At Dumbreck, where overhead gantries carried the hutches straight from the pit head over the calcining hearths, the

87. Brand, op. cit., 261.

88. Colliery Guardian, 21 March 1868.

bings were 8 feet high and contained 3,000 tons of raw ironstone. The bing when ready was set alight along one end and the fire slowly burned its way through the raw ironstone in a period ranging from 3 - 4 weeks in the smaller bings and up to 5 - 6 weeks in the larger. In the process, the bing shrank to half its former height, and the ironstone underwent both chemical and physical changes which made it much more suitable for smelting. The conversion from iron protoxide to iron peroxide, as well as driving off of the carbonic acid altered the character of the resulting pigs and prevented the formation of scouring slag. The weight of the material to be transported was considerably reduced, each 100 tons of raw stone giving, when calcined, about 60 tons of char. Depending on the quality of the ironstone, which could range from 30% to 40% metal content, the calcined char contained from 55% to 65% iron. Finally, the much more porous nature of the char caused it to be more easily penetrated by the heat of the furnace.

Although technological developments during the 1830's reduced the quantity of char required per ton of pigs, this was more than offset by the rapid rise in costs, which advanced by 63%, from 30p to 49.5p per ton between 1830 and 1840.⁸⁹ Costs rose every year but increasingly rapidly after the 1836 boom. Although high wages in that year no doubt had an effect on costs, the reductions of the following year did not check the upward trend of costs which must presumably have owed more to actual working costs and increased royalties.

By 1861-2 the cost of Airdrie char at the furnace bank had risen

89. Coatbridge, William Baird and Company MSS, 'Abstract of Cost of Producing a ton of pig-iron 1830-1840'.

to approximately 73.33p per ton. Since the new Denny-Kilsyth area was just being opened up, costs were high. For example Neilston No. 1 produced only 45 tons 6 cwt at a total cost of £2,491-73.33. The average cost per ton from this source exceeded 87.5p. The good quality of the char, compared with the poorer grades by then being taken out in the Airdrie district proved some compensation.⁹⁰ As the field came fully into production, costs fell and in 1878-9 averaged only 78.65p per ton for the district.

By contrast the Airdrie field faced relentlessly rising costs as seams became thinner and quality poorer. Drainage, only one problem among many, added to the difficulty and expense of working the ironstone. By 1866 every ton of ironstone raised from Faskine and Palacecraig carried a surcharge of 2.5p per ton, and that from Burnbrae and Kippsbyre a surcharge of 3.33p per ton to cover the cost of keeping the workings free of water. At Faskine and Palacecraig 10 tons 10 cwt of water were taken out for every ton of ironstone, while at Burnbrae and Kipps the ratio was 13 tons of water per ton of ironstone.⁹¹ By 1878-9 the cost of Airdrie char at the furnace bank had risen to 80.45p.

Even as Airdrie ceased to be of relevance in the 1880's the Denny-Kilsyth district began to experience rising costs as it too faced all the problems which had made its predecessor uneconomic. By 1890-91 the cost per ton stood at 88.33p. Although the next few

90. Coatbridge, William Baird and Company MSS, 'Gartsherrie Works Abstract May 1859' has the marginal comment, 'Use of Denny char reducing quantities considerably'.

91. Coatbridge, William Baird and Company MSS, G.L.B., vol. 18, 472; A.K. McCosh to D. Wallace, 11 May 1866.

years saw costs steadily cut back to 69.17p by 1876-7, the upward trend resumed and in the year 1898-9 before production was suspended the price at Gartsherrie stood at 76.87p. When Dumbreck re-opened, costs were quickly brought below the 75p mark and held there till two years before the war when costs leaped up to 81.67p in 1912-13 and 86.67p in 1913-14.⁹²

Such costs had long since led to unfavourable comparisons with alternative sources in Cumberland, Ireland, Sweden, Norway, Russia, Canada, Algeria, and above all, Spain. Not surprisingly, therefore, Gartsherrie's own pits supplied only 6.1% of the char used in 1913-14.

Ayrshire⁹³

Although the Bairds showed some interest in the Ayrshire ironstone fields in the late 1830's, the first definite moves were taken in 1844. After initially considering operations in the vicinity of the Blair works, Dalry, the offer of the Earl of Eglinton proved too attractive to refuse and the Bairds began their first Ayrshire works at Kilwinning.⁹⁴ As in Lanarkshire, ironstone was to prove a constant priority. William Baird wrote in 1845 that coal would be no problem but that the speed with which ironstone pits could be sunk, and sufficient quantities accumulated, would determine everything else.⁹⁵

-
92. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstracts 1882-1914, *passim*.
93. For a sketch of the history of the Iron Industry in Ayrshire see R.H. Campbell, 'The Iron Industry in Ayrshire', Collections of the Ayrshire Archaeological and Natural History Society, vol. 7, (1966), 90-102.
94. See page 26ff.
95. Strathclyde, Robert Baird MSS, William Baird to Robert Baird, 17 February 1845.

Generally there was, in the various Ayrshire districts where the Bairds became involved, a greater number of workable seams of ironstone than was the case in Lanarkshire, but the blackband was leaner than the average of Lanarkshire. On the other hand, it was frequently thicker - and in many instances lay at a shallower depth - than in the Denny-Kilsyth area. At Blair, for example, the blackband lay between 40 and 70 fathoms down and in the early years at least was from 18 to 22 inches thick. In addition, the Ayrshire clayband ironstone played an important role, especially later in the century when it was used in Lanarkshire as well as in Ayrshire.

With the sole exception of Auchingree the original Ayrshire leases of 1844 - at Brownhill, Davidshill, Carsehead and Todhills - were for ironstone alone, a clear testimony of the company's priorities.⁹⁶ In the following year the leases of Swinlees, Langside, and Hingdog included both coal and ironstone while those of Hillend and Wester Kersland were for ironstone alone.⁹⁷ In 1846 the Eglinton estate was leased.⁹⁸ With the exception of this latter property these early leases were all for quite small areas.

After this initial burst of leasing there was a pause for a number of years. Between 1846 and 1850 no new ironstone leases were entered into. Indeed, only one minor coal lease was signed during this same period. The generally gloomy situation in the pig-iron market during these years, and the temporary closure of the Eglinton works in the winter of 1847-8, no doubt accounts for this. In any

96. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folios 23, 42 and 108.

97. Ibid., folios 36, 37, 40, 58 and 169.

98. Ibid., folio 1.

case, since the works had only three furnaces in blast by 1850, ironstone demands throughout these years must have been quite modest and well within the capabilities of the existing leases.

Following this lull, 1850-51 saw renewed activity with the leasing of Merkw^sorth and Burnhouse, Easter Mains of Kersland, Temp-lands and Ladyband, Townend, Bailliespark Linn, and Monkcastle.⁹⁹ Once again, most of these properties were of the order of only 100 to 200 acres. No large estates were sought. The leasing of these properties corresponded with the decision to increase production at Eglinton where the number of furnaces in blast rose to four in 1851 and the building of a fifth furnace was begun.

During the next two decades the most important extensions of the Bairds' mineral reserves were achieved mainly through the purchase of other Ayrshire ironworks together with the rights to the former company's leases. In 1852 the lease of Blair estate, said to contain 600 acres of unworked blackband, and an even larger area of clayband, was bought by the company.¹⁰⁰ Also included in the same sale was the lease of 210 acres of Pitcon which besides having clayband ironstone under nine-tenths of its surface area had an 80 acre field of blackband 20 inches thick. In 1856 the purchase of Lugar and Muirkirk Ironworks brought with it the large Auchinleck properties of the Boswells and the mineral-rich estate of Muirkirk consisting of 17,500 acres, and including five seams of ironstone. The purchase of Portland Works in 1864 brought with it important mineral leases on the estates of Portland, Common and Darnconner, Bankhead, Barrhill and

99. *Ibid.*, folios 34, 35, 44, 45.

100. S.R.O., Blair of Blair Muniments, Box 4C, 'Printed Description of Property and leases at Blair 1851'.

Glenlogan.

The Bairds did enter into some leases besides these. Bankhead, in Ardrossan Barony, leased from the Earl of Eglinton in 1857, was an important acquisition, as was the small but valuable property of Clonbeith.¹⁰¹ The lease of Lightshaw, near Muirkirk, negotiated with the Countess of Hume in 1859 put another important field in the Bairds' hands.¹⁰² Apart from these the 50's and early 60's saw mainly a rounding off of existing holdings by the acquisition of small lots. In 1854 an additional part of the much fragmented Davidshill property was leased, as well as the ironstone beneath Dalry gasworks.¹⁰³ The ironstone in a number of small fields and feus in Dalry was acquired in 1856. Dalry Glebe was leased jointly by the Eglinton Iron Company and the Glengarnock Iron Company in 1858.¹⁰⁴ In 1861 Patons Bog, the Kirkton of Dalry, Little Auchingree, Glenhead, and Hairshaw were leased.¹⁰⁵ The blackband of Meiklemire was leased in 1864 for only four years, but at the unusually high Lordship of 13.75p per ton.¹⁰⁶ Almost all of these leases were acquired through the agency of James McCosh, a Dalry lawyer, and father of A.K. McCosh, later to become a partner in William Baird and Company. James McCosh also acted for the company in their outright purchase of a few small properties in Ayrshire.

The purchase of lands, large and small, was, however, much rarer

-
101. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folios 6, 7.
 102. Ibid., folio 85.
 103. Ibid., folios 34, 46.
 104. Ibid., folio 49.
 105. Ibid., folios 57, 58.
 106. Loc. cit.

than in Lanarkshire. The Muirkirk estate, with rich mineral reserves, was bought by James in 1863,¹⁰⁷ but this was not in reality a company purchase, as had so often been the case in Lanarkshire. The only important company purchase was the estate of Pitcon, which the company had long desired, having attempted to buy it in 1844, on first moving to Ayrshire.¹⁰⁸ On that occasion they were outbid by Alexander Alison. Following the collapse of Alison's fortunes and the failure of the Ayrshire Iron Company the property fell into the hands of The Western Bank of Scotland. Having failed to dispose of the property separately the Bank included it among the leases offered at the sale of the Blair works and on its purchase by the Bairds in 1852 they became lessees of Pitcon. In 1859, encouraged no doubt by the unusually high blackband Lordship of 12.5p per ton, they bought the property for £17,500.¹⁰⁹ Even allowing for the removal of large quantities of blackband the price was very attractive. The Bairds had originally sought to buy it for about £20,000 but had been outbid by Alison's offer, said to be £33,000. In 1848 the Western Bank had asked £37,000 for the property.¹¹⁰

By the mid 1860's as some of the original leases expired, several were considered to be not worth renewing, and it became necessary to look elsewhere. There were, however, very few properties left. The Dumfries estate, near Cumnock, which belonged to

-
107. Practical Mechanics Magazine, vol 1 (1873), 246.
 108. Strathclyde, Robert Baird MSS, William Baird to Robert Baird, 6 November 1844.
 109. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 318.
 110. S.R.O., Blair of Blair Muniments, Box 4E, James Patrick to W.F. Blair, 24 May 1848.

the Marquis of Bute, was leased in 1865.¹¹¹ Spireslack near Muirkirk was leased from Sir D.C. Anstruther in 1866, and in the same year Garrallan, property of the Boswells, was also taken.¹¹² These were the last Ayrshire ironstone leases signed until 1878.

This first generation of Ayrshire leases differed in several respects from the first Lanarkshire leases. Both sides had obviously learned much from the earlier experience of the Monklands. Weights were much more standardised, almost invariably referring to tons of 22½ cwt in the case of ironstone. Lordships varied within much narrower limits, usually 8.75p to 10p for blackband and 4.17p to 5p for clayband. The significant exception in the case of Eglinton estate was presumably a deliberate choice on the part of the Earl in his efforts to persuade the Bairds to build a works at Kilwinning. Terms concerning such items as arbitration, calculation of Lordship, breaks, percentages allowed for dirt, and compensation for damages, were all less ambiguous. Disputes were not of course eliminated.

The consistently lower Lordship rates were partly owing to the poorer quality of the Ayrshire ores, and this in turn was responsible for the lower standing and price enjoyed in the early years by Ayrshire brands. Later in the century 'Eglinton' pig-iron, the brand name given to the output of all the Bairds' Ayrshire works was described as 'of very superior quality',¹¹³ and it enjoyed a high reputation in export markets. Its price, however, never rose to a par with the best Lanarkshire brands. How far this lower price was

111. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 199.

112. *Ibid.*, folios 314, 187.

113. *Mining Journal*, 13 July 1872.

consciously permitted to exist because of lower costs of ore is a difficult question to resolve. If the Bairds' experience at Blair is at all typical of Ayrshire conditions generally, then lower costs as a result of lower Lordship must to some extent have been offset by greater difficulty in working.

Although the clayband seam was abundant, covering perhaps nine-tenths of the estate, the blackband ironstone was much less common. Slips, dykes, and frequent intrusions of greenstone hampered working. The history of Blair No. 6 pit offers an admittedly extreme example of the problems faced. The Bairds began sinking the pit about August 1857, on a site too close to the mansion house for Blair's satisfaction. Shanking was delayed at first until Blair No. 5 had reached the ironstone. The shaft reached the clayband in February 1859 and where the blackband ought to have been on 10 April 1860, only to find none there.¹¹⁴ Plans were made to drive a mine in search of the blackband. In April 1862 the Bairds sought permission to use the pit for taking out minerals from neighbouring lands, but Blair refused on the grounds that it would smoke him out of his house. At that date only about 10,000 tons of ironstone had been taken from the pit, all of it clayband. By May 1863 things looked more promising, although little blackband had actually been taken from the pit.¹¹⁵ In December prospects were still bright, but Blair's agent, Patrick, suspected further trouble ahead. By April 1864 only the second fire had been lit, and Blair commented in a memo that the Bairds must have expended much money with no return. A third fire

114. S.R.O., Blair of Blair Muniments, Box 4E, Note by W.F. Blair (N.D.).

115. Ibid., Andrew Patrick to W.F. Blair, 12 May 1863.

was lit on 1 December 1864 but it proved to be the last one. On 3 November 1865 the pit was finally abandoned after yielding an estimated 25,000 tons of ironstone, mostly clayband.¹¹⁶

Although Blair No. 6 was an extreme case, the fact that the Bairds persevered with it suggests that it was not uniquely different from their experience elsewhere. Similar problems were constantly faced in other workings. For example, the Stoopshill pit reached where the blackband ought to have been in July 1858, but found only boulders. A mine had to be driven to locate the ironstone.¹¹⁷

As the 1860's drew to a close many of the Bairds' blackband mining centres were becoming exhausted. In the Dalry region ironstone output reached a peak in 1865.¹¹⁸ As the small leases arranged through McCosh became exhausted, they were terminated between 1867 and 1870. The leases of Swinlees and Langside were allowed to expire in 1866. Although that of Merksworth and Burnhouse was not due to expire till 1874, it was renounced in 1870. At Wester Kersland the blackband was exhausted by 1865.¹¹⁹ The Blair papers illustrate the problem. Reporting on the state of the workings in February 1869, David Patrick noted that in No. 5 pit the working conditions were still fair but that the stone was becoming gradually thinner - falling from 15 inches to only 6 inches. In No. 4 pit the ironstone was becoming exhausted, and where it had not turned into coal it was only 5½ inches thick. In Ryefield where the mineral

116. Ibid., Note by Blair, 3 November 1865.

117. Ibid., Note by Blair, 28 July 1858.

118. W.S. Douglas, In Ayrshire-Cunninghame (Kilmarnock 1874), 83.

119. Strathclyde, William Baird and Company MSS, Eglinton Iron Company Lease Book, vol. II, folio 89.

seams were badly faulted the thickest parts were 6 inches and much was only $1\frac{1}{2}$ to 3 inches. Despite the good condition of the workings with an excellent roof and little water he concluded that it could not long continue to be worked.¹²⁰ Alexander Whitelaw wrote to Blair in December 1869, informing him that the output would shortly be much reduced.¹²¹ The area had yielded considerable quantities of ironstone and although total figures are not available, some indication can be gained from the fact that Ryefield alone, which covered only $39\frac{1}{2}$ acres, yielded over 10,000 tons per annum between 1863 and 1868,¹²² and that the output of the Blair estate which stood at 32,384 tons in 1855-56 rose to 63,994 tons in 1860-61, and was still higher by 1865.¹²³

As the blackband became exhausted, the Bairds turned increasingly to the still plentiful supplies of clayband. Unlike Lanarkshire where the clayband seam had been ignored, there had always been some clayband worked in Ayrshire. This was often because, as in Dalry, a clayband seam was cut on the way down to the blackband whereas in the Monklands it lay well below the lower blackband. Nevertheless, the Bairds had concentrated on the blackband seam. In Ryefield, for example, as late as 1868 the clayband seam, estimated to contain 86,900 tons of char, was completely untouched.¹²⁴

Increasingly from 1870, leases were modified in the company's

-
120. S.R.O., Blair of Blair Muniments, Report by David Patrick, 3 February 1869.
121. Ibid., Alexander Whitelaw to Blair, 13 December 1869.
122. Alexander Cameron's Notebook, in possession of his grandson.
123. S.R.O., Blair of Blair Muniments, Box 4E, 'MINERAL RETURNS' 1855-1868.
124. Alexander Cameron's Notebook, in possession of his grandson.

favour in order to encourage the working of clayband. Blair was an important example. By an agreement of October 1871 the Bairds undertook to begin sinking a pit immediately to work the clayband and the Lordship was reduced from 3.33p to 2.92p per ton.¹²⁵ In 1876 the fixed rent was reduced from £1,500 to £1,000 per annum, common working with neighbouring minerals was permitted free of charge and free wayleave was granted.¹²⁶ By a further agreement of 1880 all prohibitions on working minerals near buildings were ended with the exception of the immediate vicinity of the Mansion house.¹²⁷ Similar agreements were reached with other proprietors. From Whitsun 1871 the clayband Lordship for Wester Kersland was reduced from 5p to 2.92p.¹²⁸

For the first time the company negotiated leases with the specific intention of working the clayband only. Nisbet Thomson's Davidshill clayband was leased in 1868.¹²⁹ In 1869 the small portion of clayband in Davidshill which belonged to William Bain was leased.¹³⁰ In 1879 that beneath Dalry Glebe was taken on a 25 year lease.¹³¹ In the following year the clayband in the Douglas property of Glenhead was leased together with Douglas' Brownhill and Davidshill seam, at a Lordship of 2.92p per ton.¹³² In 1883 two separate portions of the Townend of Dalry seam were taken by the company.¹³³

-
125. Strathclyde, William Baird and Company MSS, Eglinton Iron Company Lease Book, vol. II, folio 102.
126. Ibid., folio 191.
127. Ibid., folio 312.
128. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 40.
129. Strathclyde, William Baird and Company MSS, Eglinton Iron Company Lease Book, vol. II, folio 36.
130. Ibid., folio 73.
131. Ibid., folio 328.
132. Ibid., folio 347.
133. Ibid., folios 400, 405.

The almost complete exhaustion of the Dalry blackband led to the closing down of the Blair works in 1871. There were, however, still workable seams in the other parts of Ayrshire where the company had acquired leases. In the Cumnock district, where the company had taken over some leases with the purchase of the Lugar and Muirkirk works in 1856 and Portland in 1864, the old leases were in most cases renewed, usually on terms more favourable to the Bairds. If the lease was not soon due for renewal, the terms were modified. In January 1871 the lease of Common, Darnconner and Roundelshaw was altered. The existing blackband Lordship of 10p per ton was to remain unchanged at only three pits, numbers 2, 5 and 9. At No. 6 pit the Lordship was to be 7½p and at pits 3 and 7 and all future pits it was to be 6.25p. The fixed rent of £2,500 was to be reduced to £1,500 in 1877.¹³⁴ Likewise the lease of the Dumfries estate was altered by an agreement negotiated in the same year, under which the blackband Lordship was reduced from 10p to 7½p, and the fixed rent was reduced from £2,000 to £1,000. The proposed increase in the fixed rent to £3,000 at 1873 was reduced to £1,500.¹³⁵ A new lease signed in 1876 confirmed these charges but introduced a temporary 5p Lordship for the blackband in Barrhill, to cover the years 1876-78 after which it would, like the rest, be reckoned at 7½p per ton.¹³⁶ By an agreement of July 1870 the Lordship for Auchinleck estate was reduced from 7½p to 5p, at Commondyke and all new pits. The fixed rent of £3,000 was to be reduced to £2,000 in 1875, and to £1,250 in 1880.¹³⁷

134. Strathclyde, William Baird and Company MSS, Digest of Leases, vol. 1, folio 204.

135. Ibid., folio 199.

136. Ibid., folio 210.

137. Ibid., folio 89.

Such changes ensured the survival of blackband ironstone mining in the district throughout the 1870's. A list of pits working blackband in 1878 gives Barrhill, Blackstone, Carbello, Common, Commondyke, Craigstone, Cronberry, Glengyron, Glenlogan, Shankstone and Stepends, all in the Cumnock district. The only other blackband pit operated by the Bairds at this date was at Wellwood, in the neighbouring parish of Muirkirk.¹³⁸

As the 1880's progressed the clayband pits were the first to suffer from the poor state of the market for Scottish pig-iron, as well as the increasing cost of working the deposits. In 1887 the Dalry pits at Brownhill, Davidshill and Kersland were abandoned, the machinery removed and the leases renounced.¹³⁹ By this date many of the pits in the Cumnock district had either stopped production of ironstone altogether or were switching from blackband to clayband working. Thus Shankstone had closed by 1884 and Common and Commondyke had become clayband as well as blackband producers. Contraction continued with the closure of Stepends in 1892 and Dykes in 1894 and by 1900 the surviving pits in the parish of Cumnock proper were all coal producers only.¹⁴⁰

In the Dalry district only Blair estate was producing ironstone at the beginning of the 1890's. By the middle of the decade the clayband workings at Carsehead had been reopened and these continued in operation until September 1906 when the pit was finally abandoned.¹⁴¹ The mid 1890's saw not only the reopening of Carsehead but also the

138. List of Mines, 1878.

139. Engineer, 15 July 1887.

140. J. Strawhorn, Cumnock (1966), 114.

141. List of Mines, 1906.

resumption of ironstone mining in the Muirkirk region at Grasshill, Lightshaw, and Wellwood but this lasted only a few years.

Although the ironstone pits lying near the town of Cumnock were exhausted by 1900, mining continued in the surrounding parishes. Cronberry and Braehead were abandoned during the 1890's, but in 1901 a new ironstone pit, Berryhill No. 3, was sunk to the blackband, and nearby Carbello and Common continued active. By the time of the outbreak of war in 1914 only three ironstone pits remained under the Bairds' control in Ayrshire. Of these, Common No. 15 and Berryhill No. 3 were blackband producers, and Blair No. 9, produced clayband.¹⁴²

The Ayrshire works had, however, an additional source of domestic ironstone from the 1880's when the company leased the minerals of William Stevenson of Househill, Paisley.¹⁴³ The clayband was worked by using the Victoria pit once famous as the deepest coalpit in Scotland. The value of this property was augmented by the lease of the minerals in part of neighbouring Pollock estate from Maxwell of Pollock signed in 1891.¹⁴⁴ By a wayleave agreement with Stevenson these minerals were also worked out of the Victoria pit. A similar agreement signed in 1907 enabled the company to work the clayband of Saterland belonging to Lady Cochrane.¹⁴⁵ The minerals in a second portion of Maxwell's estate were leased in 1902, and pits sunk during 1905.¹⁴⁶ From this source, where by 1912 some 327 men were employed,

142. List of Mines, 1914.

143. Strathclyde, William Baird and Company MSS, Eglinton Iron Company Lease Book, vol. II, folio 464.

144. Ibid., vol. III, folio 18.

145. Ibid., folio 308.

146. Ibid., folio 205.

large quantities of clayband were sent to the Ayrshire works and to Gartsherrie. In 1882-3 at the commencement of operations Gartsherrie received 602 tons 10 cwt from Victoria. The following year the figure was 6,453 tons 10 cwt but towards the close of the decade deliveries declined to 1,005 tons 7 cwt in 1886-7 and stopped thereafter. The signing of the Pollock lease coincided with renewed deliveries and by 1893-4 the quantity sent to Gartsherrie exceeded 30,000 tons per annum, and it rarely dropped below that level in the period up to 1906. In that year the opening of the new Pollock pits gave a boost to activities, and deliveries were 51,933 tons 10 cwt. In the following year the figure fell to 46,368 tons 15 cwt and in the years before the outbreak of war deliveries ranged between 33,000 and 40,000 tons per annum. In all these leases provided over 759,831 tons to Gartsherrie in the thirty years before 1914¹⁴⁷ and presumably the Ayrshire works received similarly large amounts.

The exploitation of the Paisley clayband was not sufficient to enable the Ayrshire works, anymore than Gartsherrie, to remain independent of foreign ore supplies. Part of the explanation for the company's development policy in the period after 1870 may be found in the geographical relationship between the surviving domestic seams of ore and the location of the works.

In outline the policy unfolded as follows. With the exhaustion of the Dalry/Kilwinning blackband by about 1870 it was considered uneconomic to keep both Eglinton and Blair works in production. Although Blair had plentiful supplies of clayband, it was thought best to close the works and to keep Eglinton open, since any imported ore

147. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstracts 1882-1914.

or other Ayrshire blackband for Blair would have to be shipped past Eglinton to Blair - and much of Blair's output of pig-iron would have to be carried back past Eglinton to Ardrossan. Accordingly, Eglinton survived, but virtually no modernisation was undertaken. At Muirkirk - and more especially at Lugar - the still plentiful supplies of blackband justified modernisation in the 1870's and early 1880's. Portland too, although not modernised, continued in operation because it was reasonably well situated in relation to several of the Cumnock leases, which had been held originally by the Portland Iron Company. By the 1890's, however, the continued decline of the Cumnock ironstone fields meant that modernisation of the antiquated Portland works was not justified, and it was accordingly dismantled, the remaining mineral supplies being used at the modernised Muirkirk and Lugar works. By that date the greatly increased output of Paisley was available to the Eglinton works. In addition, it was best situated to use the foreign ores which by then were being imported, particularly from Spain. Accordingly, the Eglinton works were modernised in the early 1890's. The location of raw materials was not the sole factor in determining Ayrshire policy but it was an important one, and more so in relation to ore, than the more widely dispersed and more abundant reserves of coal.

With regard to both the Ayrshire works and Gartsherrie the steady contraction of the Bairds' local supplies of ironstone was part of a natural decline. Scottish output, after reaching a peak of 2,500,000 in 1857 dropped back steadily to only half that level by 1868. Renewed activity, closely linked to the pig-iron boom of the early 1870's, led to a rapid but brief recovery during which a record output of 3,270,000 tons was produced in 1872. The industry then

stagnated at around 2,400,000 tons during the rest of the 1870's before resuming a steady downward trend.¹⁴⁸ Unfortunately, the absence of comprehensive statistics for the company makes it impossible to decide whether their extensive mineral holdings were sufficient to enable them to contract their output less rapidly than was the case in Scotland as a whole.

What can be said with certainty is that in both of the centres of pig-iron production owned by the company there was an awareness from about 1860 of inevitable decline in domestic ore reserves and a consequent realisation that ore would have to be sought further afield if the works were to continue in operation in the long term.

English Interests

It would be misleading to date the involvement of William Baird and Company in Cumberland mining from their lease of Knockmurton in 1869, and explain this by any simple reference to a growing concern about declining reserves of Scottish ironstone. As early as 1854 trial purchases of Cumberland hematite were made from several companies. Firm orders were placed in the following year, and for the next fifteen years supplies from this source were of continuing significance at Gartsherrie.¹⁴⁹ The use of two ore-carrying ships on the trade is clear evidence of its importance.

Nevertheless, the company did not seek to become directly involved by buying or leasing any Cumberland ore fields. The as yet poor transport facilities may have been part of the explanation.

148. Report of the British Iron Trade Association 1880, page 87, and 1890, page 100.

149. See below pp. 202ff.

Probably too, the company's continued expansion policy within Scotland during the 1850's and 1860's absorbed the energy of the partners. Muirkirk, Lugar and Portland ironworks, together with their mineral leases, were acquired in Ayrshire, while in Lanarkshire the company became heavily involved in the opening up of the Denny-Kilsyth area.

By the late 1860's the reality of eventual exhaustion of Scottish ores was being increasingly felt. The company's two oldest centres of blackband ironstone production, Airdrie in Lanarkshire, and Dalry-Kilwinning in Ayrshire, were declining rapidly. Although Scotland could still respond to improved pig-iron prices by increasing ironstone output as it did in the early 1870's, this was achieved mainly by exploiting clayband seams rather than blackband. Accordingly, alternative sources of high grade ore were willingly considered. In view of their existing links with Cumberland, it is hardly surprising that the Bairds should have concentrated on that area. An additional attraction was the decision made at that time to open up a direct railway link between Cumberland and the West of Scotland.¹⁵⁰

By 1868 the decision to lease a Cumberland ore field had been made, and several possible properties were considered. Knockmurton, currently worked by John Jenkin's Knockmurton Mining Company, had emerged by July as the likeliest site, and borers were sent from Scotland to examine the property.¹⁵¹ The survey was apparently satisfactory and a 21 year lease of the ore was entered into with

150. Engineering, 20 August 1869. The Solway Junction Railway was the line in question.

151. Coatbridge, William Baird and Company MSS, G.L.B., vol. 20, 446; J. Munro to William Baird, 22 July 1868.

Walter Lamplugh Brooksbank with entry at 1 January 1869.¹⁵² The property consisted of 2,800 acres of Lamplugh Hall, Bird Dyke, Skelsmoore, Lamplugh Common and Minton Common, at a royalty of 6.25p per 21 cwt of iron ore. In 1874 a 21 year lease was taken of the iron ore in the neighbouring property of Kelton, belonging to the Earl of Lonsdale.¹⁵³ For the first 13 years the royalty was fixed at 2.92p per 20 cwt, rising to 7.5p for the next two years before being fixed at one-eighth of the selling price for the remainder of the lease.

These arrangements seem to have been made largely through John Alexander and Andrew K. McCosh, although neither of them was at this time a partner. Their involvement led to the rather surprising situation that the Cumberland mines came under the general control of the Gartsherrie office, as was the case with pits at Airdrie or Kilsyth.

At the start the main problem lay not in working the deposits but in transporting the ore from the mines. Only two months after taking possession of the property the Bairds were already seeking land for a railway from Lamplugh to the nearest existing railhead at Rowrah.¹⁵⁴ The process was unusually slow, and in the interim the Bairds had to rely on horse-drawn carts. The Rowrah and Kelton Fell (Mineral) Railway was not authorised until 1874. On its completion a tramway was necessary to provide the final link with the mines. Although Edward Wadham, and Robert Alleyne Robinson, the

152. Strathclyde, William Baird and Company MSS, Lease Book, vol. II folio 1.

153. *Ibid.*, folio 48.

154. Coatbridge, William Baird and Company MSS, G.L.B., vol. 21, 22; A.K. McCosh to J. Dickinson, 20 March 1869.

Earl of Lonsdale's agent, were among the directors the company was virtually a subsidiary of William Baird and Company who held the remaining seats on the board. From 1877 the chairman was always a partner of William Baird and Company.¹⁵⁵ Wadham's shares were reluctantly repurchased at par in September 1878, but the Bairds, anxious to keep Robinson on the board, offered to repurchase twenty of his shares, leaving him just sufficient to remain qualified as a director.¹⁵⁶ After his death in 1893 the board consisted exclusively of directors of William Baird and Company.

The Bairds provided the locomotive, and, at first, all of the rolling stock. An agreement was entered into whereby the Bairds managed the line, bearing all the expenses of running and upkeep, in exchange for 50% of the receipts.¹⁵⁷ Serious negotiations occurred in 1883-4 concerning a possible merger with the Cleator and Workington Junction Railway. Although the Bairds welcomed the proposal, their insistence on a guaranteed return of 4%, and through freight rates for their ore traffic proved unacceptable.¹⁵⁸ Alternative proposals that the line should be extended further into the Cumberland mountains to encourage exploitation of undeveloped ore reserves also came to nought.¹⁵⁹

As a source of ore for the Scottish works, the Cumberland mines were of relatively short-lived importance. In the early years of the 1870's production was low, and outside sales took a significant

155. Bradshaw's Railway Directory 1855 on.

156. Coatbridge, William Baird and Company MSS, G.L.B., vol. 31, 670; A.K. McCosh to Edward Wadham, 26 September 1878.

157. *Ibid.*, vol. 30, 779; A.K. McCosh to J. Berwick, 26 October 1877; vol. 34, 29; W. Jardine to T. Howson, 8 March 1882; vol. 36, 259; A.K. McCosh to J.S. Ainsworth, 10 November 1884.

158. *Ibid.*, vol. 36, 350; A.K. McCosh to J.S. Ainsworth, 19 December 1884.

159. *Ibid.*, vol. 33, 1113; A.K. McCosh to Arthur Poland, 10 February 1882.

proportion of deliveries; hence the quantities sent to the Scottish works cannot have been large, though both Ayrshire and Lanarkshire shared these early supplies. By December 1874 deliveries to Eglinton were at a level of 250 tons¹⁶⁰ per week, or the equivalent of 12,500 tons per annum, and in January of the following year Lugar and Muirkirk were taking between 300 and 350 tons per week.¹⁶¹ During 1877 and 1878, with the market price of Cumberland ore at its lowest point since the beginning of the decade, the entire output of the Cumberland mines was consumed at the Scottish works.¹⁶² In the year from June 1877 to May 1878 Gartsherrie received 14,178 tons. With the resumption of sales, deliveries dropped to 9,598 tons 6 cwt in 1878-9, and 7,965 tons in 1879-1880. Production rose rapidly and deliveries were very high at the beginning of the new decade amounting to 24,980 tons 15 cwt during six months of 1880. Decline in deliveries was rapid thereafter, being 9,360 tons 5 cwt in 1882-3 and they came to an abrupt halt in the latter half of 1883 after only 360 tons 14 cwt had been transported.¹⁶³

When explaining the Bairds' policy of not using any of their Cumberland ore in Scotland A.K. McCosh wrote to the Cleator Railway Company:

The matter of drawing ore supplies from your area is constantly before us but even at the rate for carriage that you name Spanish ore is cheaper in pigs.¹⁶⁴

-
160. Ibid., vol. 27, 350; A.K. McCosh to Eglinton Office, 22 December 1874.
161. Ibid., vol. 27, 421; John Alexander to Robert Angus, 18 January 1875.
162. Coatbridge, William Baird and Company MSS, 'Note of Hematite Profit 1872-1886'.
163. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract 1878-1884 passim.
164. Coatbridge, William Baird and Company MSS, G.L.B., vol. 40, 417; A.K. McCosh to the Cleator Workington Railway, 8 April 1893.

This letter, however, referred to 1893 and is less satisfactory as an explanation for the cessation of supplies some ten years earlier. In 1883 the last deliveries of Cumberland ore cost 72.82p at the furnaces compared with 81.33p per ton for Spanish ore of approximately equal metallic iron content.¹⁶⁵ More significantly Gartsherrie did not stop using Cumberland ore, but only the company's own Cumberland ore. Indeed consumption rose to unprecedented levels, reaching 68, 329 tons 14 cwt in 1889-90, in which year it cost 91.96p per ton compared with 83.78p for Spanish ore. It may possibly have been more profitable to sell their own Cumberland ore to ironworks in the North of England and at the same time buy ore from others to supply their own requirements. More probably their decision was determined by the unsuitability of their own ore for making Bessemer pig-iron, which they began to produce on a regular basis from about 1883. In 1887 they complained about the silica content of ore being received from Harrison, Ainslie and Company and finally cancelled their contract with that company in February 1888 because the ore was unsuitable for making Bessemer iron.¹⁶⁶ The analysis of Harrison's ore gave a silica level of 13.10 which was exactly the same as that given in an analysis of an average sample of the Bairds' own Cumberland ore in 1881.¹⁶⁷

While the trade did take place it was greatly hampered by transport difficulties. Even after the Kelton Fell Railway was

165. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract 1882-3.

166. Coatbridge, William Baird and Company MSS, G.L.B., vol. 38, 994; J. Dunnachie to Glasgow Office, 10 February 1888.

167. Ibid., vol. 33, 602; A.K. McCosh to E. Talbot, 28 June 1881.

finally opened in November 1875, long range transport continued to pose problems. The bulk of the traffic was carried by sea, and the Bairds bought or leased two steamers to run between Whitehaven and either Bowling or Ardrossan.¹⁶⁸ Repeated difficulty was experienced in keeping them both from arriving at Whitehaven together.¹⁶⁹ Attempts to persuade either the Glasgow and South Western Railway or the Caledonian to offer competitive rates do not seem to have provided any long term solution, although during the years of high deliveries, in 1877, 1878 and 1880 some of the ore was carried directly by rail.

After 1883 deliveries to Gartsherrie, and probably also to Ayrshire, ceased. Production continued, however, with the output going directly for sale in the North-West. It would be seriously misleading to see these sales as an attempt by the Bairds to do as best they could in circumstances where working of the ore for use in Scotland was no longer possible. Sales on the open market, far from being a second best, had been actively pursued from the outset. Bain, Blair and Paterson, after examining a sample load of four waggons, placed an order for 10,000 tons in December 1870.¹⁷⁰ Although the Bairds declined an offer by J. Jennings, in January 1871, to become their agent for ore sales in the Middlesbrough district, they had made some kind of deal with him by March of the same year.¹⁷¹ In April James Davidson of Whitehaven became their sales agent, on the

168. Ibid., vol. 30, 667; W. Jardine to Kincaid Small and Coy. 15 August 1877.

169. Ibid., vol. 30, 34; A.K. McCosh to Glasgow Office, 20 January 1877.

170. Ibid., vol. 22, 133; W. Jardine to A.K. McCosh, 19 December 1870.

171. Ibid., vol. 22, 315; Memo of 8 March 1871.

basis of a 2% commission.¹⁷² By March 1872 orders were such that A.K. McCosh wrote to Wallace that it would take some years to put out the amount already contracted for.¹⁷³ From that point sales were an almost continuous part of the Cumberland operation, with the exception of 1877-8 when the company itself took the entire output.

TABLE IV:4 Profits on Cumberland Ore Sales 1872-1886¹⁷⁴

YEAR	PROFIT	YEAR	PROFIT
1872	£2,504 - 84.17	1880	£14,439 - 35.42
1873	£1,318 - 31.25	1881	£20,428 - 82.09
1874	£6,117 - 85.834	1882	£10,174 - 19.59
1875	£4,522 - 5.83	1883	£13,486 - 42.09
1876	£446 - 88.75	1884	£7,822 - 1.25
1877	£2,606 - 15.834	1885	£5,339 - 93.33
1878	All Ore sent to Scotland	1886	£2,840 - 2.92
1879	All Ore sent to Scotland	TOTAL	£92,041 - 88.33

Table^{IV:4} brings out clearly that far from turning to sales when deliveries to Scotland ceased in 1883, the Cumberland mines seem to have experienced a decline in sales after that date. The Bairds clearly did not simply seek to sell ore when its exploitation for their own use became unnecessary. When this situation did occur, they were able to keep the mines in operation, because they had an established sales network and regular customers in the North West.

The Bairds did not simply wait out the remaining years of an

-
172. Ibid., vol. 22, 413; J. McKinlay to James Davidson, 15 April 1871.
173. Ibid., vol. 23, 420; A.K. McCosh to David Wallace, 15 March 1872.
174. Coatbridge, William Baird and Company MSS, 'Note of Profit on Hematite Sales 1872-1886'.

inconvenient lease. Output declined steadily during the 1880's as production above the water level in the existing workings exhausted the available veins of ore. The company on several occasions showed an interest in extending their mineral holding, but nothing was actually done. When both leases expired, Lamplugh in 1890 and Kelton in 1895, they were renewed on the same terms as before, except that minerals from below the existing levels were paid for at one-twelfth of the selling price.¹⁷⁵ For minerals above the existing level the Lamplugh royalty was 6.25p and the Kelton royalty one-eighth of the selling price.

The opening up of Kelton No. 3 raised the output for a time but the peak of 35,000 tons in 1902-3 was well below even the poorest year in the 1880's.¹⁷⁶ During the early years of the twentieth century stocks rose sharply from 1,925 tons 18 cwt in 1902-3 to 31,553 tons 10 cwt in 1909-10, and this despite falling output and the resumption of deliveries to Gartsherrie during the years 1904-1910. In 1912 production ceased at Knockmurton and in June 1914 both properties were given up.¹⁷⁷

As a source of raw materials for the Scottish works the Cumberland mines were only briefly of importance. On the other hand figures for the early period show that the venture was profitable. The fact that the Bairds renewed the leases and considered extending their involvement in the area would imply that this profitability endured.

-
175. Strathclyde, William Baird and Company MSS, Lease Book, vol.II, 123, 135.
176. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstracts 1882-1914 passim.
177. List of Mines, 1914.

Spanish Interests

As with Cumberland, so when considering the Bairds' involvement in Spain, one must look back to some twenty years before the acquisition of the mines. On 20 April 1863 samples of Bilbao ore were sent from Gartsherrie to be analysed by Dr. Wallace in Glasgow. These were probably taken from a small quantity of 34 tons 7 cwt received from Silverio de Echevaria Guinea on 13 April following the abolition of the export duty on Spanish ore on 1st January. Whether this led to any sizeable purchases is not known, and it seems probable that Spanish ore was of little importance during the 1860's.¹⁷⁸ Reference to the making of some samples of Bessemer pig-iron in 1868 using a mixture of Cumberland and Spanish ore indicate that it was again present at Gartsherrie.

The boom in the pig-iron market in 1870 stimulated the ironstone mining industry in Scotland. Although the decline of the 1860's was reversed, the high level of output recorded was caused largely by expanding the output of clayband and slateyband rather than blackband. The Scottish masters turned to Spain in search of a high grade ore, as their counterparts in Wales had already done, in the face of a similar decline in native ore. The Scottish masters were also encouraged to look abroad in order to free themselves from the grip of organised labour whose actions many of them blamed for the reduced output of pig-iron during the boom.

The first fruit of this interest was the formation, in Glasgow of the Marbella Iron Ore Company in December 1871.¹⁷⁹ The Bairds

178. For fuller discussion of Bairds' purchases of Spanish ore see below pp.204ff.

179. M.W. Flinn, 'British overseas investment in Iron Ore mining 1870-1914' [unpublished M.A. Thesis, Manchester 1952-3].109.

were active on their own account. In the winter of 1872 David Wallace spent several weeks touring the mining areas of Northern Spain.¹⁸⁰ In the spring of 1873 samples of Spanish ore were again being sent to Glasgow for analysis.¹⁸¹ In April 1875 James Mitchell, an experienced member of the Glasgow staff, who was later to specialise in importing ore, was being briefed for a Spanish journey.¹⁸² That nothing definite emerged from any of these events was probably owing to the political disturbance then affecting Spain. The unrest of the 1860's which had culminated in the flight of Queen Isabella in 1868 had been felt in the North, but major upheaval came with the outbreak of the Carlist War in 1872 and lasted until the flight of Don Carlos in February 1876. During this period the output of ore declined sharply,¹⁸³ and foreigners were probably hesitant about investing in the industry.

Large-scale trials of Spanish ore were made at Gartsherrie in September 1877 with a view to making large purchases. The trials were apparently unsatisfactory, because the proposed contract with the Marbella Iron Ore Company was declined.¹⁸⁴ Between this date and November 1880 it would seem from a few surviving documents that no Spanish ore was used at Gartsherrie. It was not until 1883, twenty years after the first trials were made, that the first regular

-
180. Coatbridge, William Baird and Company MSS, G.L.B., vol. 24, 438; John Alexander to Waddell and MacIntosh, 11 December 1872.
181. Ibid., vol. 24, 843; A.K. McCosh to Wallace, Tatlock, and Clark, 31 March 1873.
182. Ibid., vol. 27, 767; John Alexander to J. Mitchell, 8 April 1875.
183. J.D. Kendall, 'The Iron Ores of Spain', Trans. of the Fed. Instit. of Mining Engineers, vol. III (1891-2), 604.
184. Coatbridge, William Baird and Company MSS, G.L.B., vol. 30, 782, A.K. McCosh to Marbella Iron Ore Company, 27 September 1877.

shipments were begun. By April 1883 the integration of Spanish ore into the burden had become so complete that fears about the damaging effect of a possible shortage of supply were being expressed at Gartsherrie.¹⁸⁵ From that date deliveries of Spanish ore were of enduring importance.

Clearly, the Bairds were interested in Spanish ore in the 1860's and on the verge of large-scale involvement in the 1870's. The action of 1883 cannot be explained simply as a consequence of the need to procure ore suitable for the manufacture of hematite pig-iron, though this was probably part of the explanation. Production figures for hematite pig-iron were first given in May 1884, though regular production may have begun several months earlier. The low phosphorus content of Spanish ore, which made it suitable for the manufacture of hematite pig-iron, is usually mentioned when explaining its importation into Scotland. However, the Bairds began importing it in large quantities a year before they commenced the production of hematite pig-iron. Even much later they still used a significant proportion of this ore in the manufacture of ordinary iron. Thus, of 45,842 tons of Spanish ore consumed at Gartsherrie during 1887-8 exactly 11,400 tons, or almost a quarter of the total, was used in the production of ordinary iron.¹⁸⁶ Perhaps quite simply, the fact that it was a high grade ore which was becoming steadily cheaper at a time when the Scottish equivalent was becoming more expensive provides the main explanation for rising imports by the Bairds, and by Scottish ironmasters generally. B.J. Forrest refers

185. Ibid., vol. 34, 1018; A.K. McCosh to J. Mitchell, 2 April 1883.

186. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract 1887-8.

to the steady reduction in the price of Bilboan ore in the late 1870's and early 1880's.¹⁸⁷ On the other hand blackband delivered at the Gartsherrie furnace rose from 79.63p in 1878-9 to 94.25p per ton in 1883-4; at this latter date Spanish ore cost only 80.51p delivered at the Gartsherrie furnaces.¹⁸⁸

Once the decision had been made to become regular users of Spanish ore, the Bairds were not long content to leave their source of supply entirely in the hands of others. In 1884 the company considered a mine suggested to A.K. McCosh by Robert Calderwood of Dudley but decided not to act at that time.¹⁸⁹ Over the next two years the trade became even more important, and the company purchased the Camargo mines at Santander in 1886.¹⁹⁰ The Bairds were among the later arrivals in the crowded complexity of Spanish ore mining, and were fortunate to get the chance of acquiring an existing concern. By the time they had commenced production, many commentators were already forecasting the imminent decline of the area.¹⁹¹ The company compensated for its tardiness by being the first foreign concern to take the bold step of becoming involved in ore mining in Southern Spain. In 1893 they purchased the large Monte de Hierro [Mountain of Iron] mineral field above Seville.¹⁹² At a later date

-
187. B.J. Forrest, 'The Bilbao Iron Ore District', Trans. of the North of England Instit. of Min. and Mech. Eng., vol. 33 (1883-4) p. 213.
188. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract 1878-9, 1883-4.
189. Coatbridge, William Baird and Company MSS, G.L.B., vol. 35, 1029; A.K. McCosh to Robert Calderwood, 25 June 1884.
190. Engineering, 12 February 1886.
191. James Jenkins, 'On the Iron Ore Industry of Northern Spain', Proceedings of the Philosophical Society of Glasgow, vol. 14 (1882) p. 161; see also B.J. Forrest, op. cit.
192. Engineering, 12 May 1893; Engineer, 19 May 1893.

they acquired a third property in Almeria, on Spain's Mediterranean coast.

The ores of Spain were of four types. The finest quality red hematite known as Vena was unimportant in international trade because its tendency to crumble easily made it unsuitable for long distance transportation. The Campanil, also a red hematite, was of high quality but harder than Vena and consequently more suited to the demands of shippers. The rubio, or brown hematite, while third in quality was harder than Campanil and absorbed less water. The fourth quality called Carbonato was a siderite ore.

By the time the Bairds were seeking a mining concession in Northern Spain, the Campanil deposits, all of which were already taken by other firms, had begun to decline in both quantity and quality. The Camargo mines, of which there were four, worked the rubio ore by opencast quarrying giving an ore with 50-54% iron. Labour costs were higher than at Campanil mines largely because the ore required greater cleaning and care in classification. From the mines the ore was transported two-and a half miles by rail to a stocking gantry at the head of an inclined plane which connected with the Guarnizo station of the Northern Railway of Spain. From there the ore was carried to the Port of Santander where it had to be loaded by hand on to the waiting ships. The only known output figure for the Camargo mines is for 1895 when 75,667 tons were produced.¹⁹³ In view of the large quantities of impurities found in rubio ore and the high cost of shipping such rubbish to Scotland the

193. William Gill, 'On the present position of the Iron Ore Industries of Biscay and Santander', Journal of Iron and Steel Institute 1896, vol. II, 37.

Bairds paid much attention to cleaning. Such a policy produced a waste with a significant proportion of small rubio. The Bairds resorted to washing their small ore in a Patouillet trough. Although Gill does not explicitly say so, the implication of his report is that the Bairds pioneered the technique.

The Bairds' purchase of the Sevillan minerals was a risk not just because they lay in the South of Spain. The mines themselves were at Pedroso which in 1893 lay 10 miles from the nearest railway station; this in its turn was 53 miles from Seville thus giving the Bairds the doubtful honour of operating by far the longest land haul for exported ore in Spain.¹⁹⁴ A railway was immediately begun but even so the ore had to be transported via Seville, an inland port 50 miles from the mouth of the Guadalquivir river. On the other hand, the ore deposit was very large, yielding an ore of 55%-65% iron content. In addition, the climate was better, an important factor in opencast mining, and the labour cheaper. The mines quickly became of importance to the Scottish works. Figures for 1896-97 show that of 266,322 tons shipped to Scotland Gartsherrie took 142,397 tons 16 cwt; Lugar 41,319 tons 14 cwt; Eglinton 28,274 tons 17 cwt, and Muirkirk 4,341 tons 16 cwt; and cargoes divided among the works accounted for the remaining 49,987 tons 19 cwt.¹⁹⁵ From 1895 till 1914 deliveries from this one source to Gartsherrie alone amounted to 2,903,801 tons or 162,831 tons on average per year.

194. A.P. Wilson, 'The Iron Ores of the Mediterranean Seaboard', Journal of the Iron and Steel Institute 1894, vol.II, 182.

195. Coatbridge, William Baird and Company MSS, 'Note of Sevillan deliveries 1896-97'.

Of critical importance in the trade were transport costs which, when high, could wipe out all the advantages of low mining costs. A selection of cost figures for Spanish ore at the Gartsherrie furnaces shows that transport charges usually exceeded 50% of the total. It was, therefore, important to exercise some control over this item. Curiously, the Bairds do not appear to have become owners of their own ore-carrying vessels as some other companies did. They appear instead to have formed close links with certain shippers and presumably agreed on long term contracts which mitigated the sometimes sharp pressure on freight charges. The company had connections with a Cardiff firm which owned a number of ships engaged in the ore trade between Spain and Scotland. Ships, registered at Cardiff, which were engaged in the trade included the S.S. Closeburn, Kilmaho, Adamton, Kildonan, and Ladykirk all named after estates belonging to partners of William Baird and Company.¹⁹⁶ Specific examples of the company's involvement in the development of transport facilities within Spain have not survived, though it must have played a leading role in the opening of a railway link to Pedroso. Within Scotland the company won favourable terms giving it exclusive use of an unloading quay at Glasgow. The high cost of the short overland haul in Scotland was probably less for the Bairds, because of their generally favourable railway terms, than for some other works.

Within Spain the mines were managed by Scottish officials. Apparently, any young executive in the Scottish management who declined an invitation to spend some time in Spain lost all hope of future advancement.¹⁹⁷ As with Cumberland, supervision was

196. Mitchell, Clyde Shipping Lists 1900-1910.

197. According to the verbal evidence of J. Alexander Henderson, former employee of William Baird & Coy.

exercised from Scotland not by the Glasgow office but by one of the works offices. In the case of Spain control was exercised from Ayrshire; hence all Spanish ore used at Gartsherrie was treated in the accounts as purchased ore, payment being made to Robert Angus's office in Ayrshire. In consequence, no separate figures are given for the ore bought from the Bairds' own mines until 1893 when the company was reorganised. After that date deliveries were listed as being from Seville or Santander, and control may have passed to the Glasgow office. In October 1913 the management structure was reorganised when the Bairds registered Bairds Mining Company, in Edinburgh, with an authorized capital of £300,000 to take over the exploitation of the Spanish mines.¹⁹⁸ This remained a wholly owned subsidiary of William Baird and Company.

The significance of the Spanish mines cannot be over emphasised. They played a vital role in the years after 1884 in enabling the company to survive in the face of dwindling and increasingly expensive supplies of domestic ore. In 1890 Spanish ore accounted for 7.92% of the char used at Gartsherrie. Between 1895 and 1914 the Gartsherrie works drew 55.23% of its total ore supplies from the company's Spanish mines and a further 18.64% from Spanish mines belonging to others.¹⁹⁹ When it is borne in mind that the Spanish ore was of higher mineral content than native sources, the contribution from this area takes on even greater significance.

198. Company Registration Office, Edinburgh, Baird Mining Company File.

199. Derived from the figures in Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstracts 1882-1914.

Purchases - within Scotland

Despite all that has been written about the Bairds' vigorous policy of securing and developing their own supplies of ironstone from Scottish, British, and finally European sources, it remains true that for most of the company's history demand exceeded its own ability to supply. Although there is no information for the early years, it was probable that the company's own mineral holdings were able to meet the increased demand for ore consequent on the expansion of the number of furnaces from one to nineteen and of productive capacity from 3,000 tons to 120,000 tons of pig-iron per annum, during the first twenty years.

From c. 1855 the company began to purchase ore on a small scale whenever suitable types of ore could be secured at attractive prices. When in 1855 the Devon Iron Company experienced financial difficulties, the Bairds agreed to buy 6,000 tons of calcined ore already put out at Killaimy, Fife.²⁰⁰ A works abstract which has survived gives details of three firms, James Wallace of Neilston, James Watson of Barrhill, and William Black of Stanrigg who together supplied 755 tons 16 cwt of ironstone to Gartsherrie during May 1859.²⁰¹ This was equal to 5% of the ironstone used in that month. Although Stanrigg was probably an ironstone pit, the other two suppliers almost certainly took out the ironstone as a by-product of coal-mining. It is significant that this abstract, as well as one for 1861-2 had a special section for details of ironstone purchases, the

200. Coatbridge, William Baird and Company MSS, G.L.B., vol. 8, 400; D. Wallace to James Ritchie, 27 August 1855.

201. Coatbridge, William Baird and Company MSS, Gartsherrie Works Abstract May 1859.

inference being that this was a regular policy.

So far as purchases within Scotland were concerned, there was apparently no regularly contracted supplier. Rather there was a steady policy of purchasing relatively small quantities of a few thousand tons wherever and whenever suitable lots were offered for sale. Some sources are only referred to once. Others recur though at irregular, often lengthy, intervals. Thus in 1864 a quantity of ironstone from the Barrhill pit of Watson and Company, already mentioned, was bought according to a price tied to a sliding scale of pig-iron prices, the rate for February 1864 being 85p per 22½ cwt.²⁰² In January 1866 the Boness Chemical Company sold a lot, probably pyrites.²⁰³ In September 1867 the St. Andrews Iron and Coal Company supplied some ironstone,²⁰⁴ and letters of May 1869²⁰⁵ and June 1870²⁰⁶ refer to purchases from Struthers and Company and Adam and Forsyth, both of Airdrie.

The 1870's continued in similar fashion. In April 1873 3,000 tons of char were bought from the Benhar Coal Company to be delivered at 85p per ton on the North British Railway at the rate of 15 - 20 tons per day.²⁰⁷ In 1875 char was bought from W.S. Dixon's Carfin

-
202. Coatbridge, William Baird and Company MSS, G.L.B., vol. 15, 620; W. Jardine to D. Wallace, 2 March 1864.
203. Ibid., vol. 18, 36; A.K. McCosh to Boness Chemical Works, 10 January 1866.
204. Ibid., vol. 19, 650; W. Jardine to St. Andrews Iron and Coal Company, 5 September 1867.
205. Ibid., vol. 21, 84; A.K. McCosh to North British Railway Company, 1 May 1869.
206. Ibid., vol. 21, 918; Memo of June 1870.
207. Ibid., vol. 24, 862; A.K. McCosh to Benhar Coal Company, 7 April 1873.

pits,²⁰⁸ and in 1877 a quantity was purchased from the Omoa Ironworks.²⁰⁹

This decade also saw the beginnings of longer term agreements with the signing of a contract with Robertson and Eadie of the Kippsbyre Colliery to take their blackband at 95p per 22½ cwt, and riddled dust at 47.5p with unriddled dust at 22.5p.²¹⁰ In 1878-9 William Black supplied 22,089 tons 3 cwt of slateyband from Stanrigg, and the Blackston Mineral Company supplied 22,420 tons 2 cwt of clayband from Paisley. A third large supplier in that year was Ferguson and Reid of Garscadden who delivered 16,980 tons 19 cwt of blackband. The Nitshill and Lesmahagow Coal Company, The Craignethan Gas Coal Company, the Drumpellier Coal Company, and Kerr and Mitchell, made the total purchases up to 67,553 tons 13 cwt.²¹¹ From that date until the year 1893-4 both William Black and the Blackston Mineral Company were constant suppliers of ironstone to Gartsherrie, and at varying times for a few years other companies such as James Dunlop and Company, the Kinneil Iron and Coal Company, and Rankin of Darnagavil, made deliveries. In 1893 all purchases of ironstone from within Scotland ceased, a development probably closely linked with the Bairds' purchase of the Monte de Hierro mines, as well as with the more general decline of the increasingly uneconomic ironstone mining industry of Scotland.

208. Ibid., vol. 27, 655; W. Jardine to W.S. Dixon and Company Ltd. 16 March 1875.

209. Ibid., vol. 30, 146; A.K. McCosh to Omoa Ironworks, 12 February 1877.

210. Ibid., vol. 21, 919; W. Jardine to Robertson and Eadie, 5 July 1870.

211. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract 1878-9.

William Black, who bought the Stanrigg pit from Bairds following the exhaustion of the blackband, was also the owner of the Blackston Mineral Company.

Apart from ironstone, two other domestic sources of 'char' were of importance. The first was purple ore, the residue after iron pyrites had been processed by chemical companies. An isolated reference to the Bairds' early use of a by-product of the Chemical industry occurs in a letter of November 1862 in which John Campbell of the Gartsherrie works complained of short weight in deliveries of oxide of iron from the British Metal Extracting Company, of St. Rollox.²¹² In May 1875 the Bairds declined to make a trial of purple ore from the Tharsis Sulphur and Copper Company.²¹³ The first purchases were apparently made in 1889-90 when 5,248 tons 1 cwt were bought from an unnamed source although it was probably the Tharsis Company.²¹⁴ Certainly this company was the source of supply in 1892. By 1893-4 deliveries amounted to 23,531 tons 6 cwt of ore and from that time with only one exception deliveries exceeded 20,000 from the Tharsis Company for the next five years, before declining to 15,009 tons 11 cwt in 1898-99 and 13,333 tons 5 cwt in 1899-1900, and nothing thereafter. In the two years 1897-8 and 1898-9 supplies were augmented by purchases of 13,333 tons 17 cwt and 6,618 tons 9 cwt respectively from the United Alkali Company of Glasgow. During the four years from 1907-11 small purchases of a few thousands tons annually were bought from J. and G. Cunningham of Leith and finally, in the two years 1912-14 Richard Turpin and Company of Grangemouth

-
212. Coatbridge, William Baird and Company MSS, G.L.B., vol. 13, 944; John Campbell to the British Metal Extracting Company, 24 November 1862.
213. Ibid., vol. 27, 930; A.K. McCosh to Tharsis Sulphur and Copper Company Ltd., 14 May 1875.
For the position occupied by the Tharsis Company in this trade see, The Mines of Tharsis, S.G. Checkland, 1967.
214. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract 1889-90.

sold the Bairds 1,079 tons 11 cwt and 727 tons 8 cwt of purple ore (commonly known as 'bluebilly'). Only therefore, in the 1890's does purple ore appear to have been of more than marginal importance.

A final source of domestic raw material was provided by the numerous malleable iron works which sprang up in the Coatbridge district mainly in the latter half of the nineteenth century, and the steel works which followed. At least as early as 1861-2 the Bairds fed 'old metal' into the furnace; by this term was probably meant some of the scrap which became available at Gartsherrie works, a conclusion suggested by the fact that the cost of carriage for this item was nil.²¹⁵ Old metal never amounted to more than fifty tons in a year and was generally considerably less. In 1888-9 546 tons of steel scale were bought, and in the following year 5,232 tons 18 cwt were bought. During the six years 1891-7 purchases ranged between 10,000 and 15,000 tons per annum. In 1897-8 they reached a peak of 29,976 tons 2 cwt before dropping back to around 15,000 tons for the next few years. After 1903 supplies from this source dwindled to insignificant quantities. Like purple ore, malleable scale and cinder was of importance during the 1890's. Perhaps the explanation as to why the Bairds bought significant quantities of these materials during these particular years should be sought, not by examining the availability or price of the materials but by considering the supply needs of the Bairds. During the 1890's reorganisation and modernisation made possible a greatly increased output and hence an increased demand for char just when the Bairds' domestic supplies were declining. Thus, consumption

215. Ibid., 1861-2. These abstracts for the years 1873-9 and 1882-1914 provide the data for this and the preceding paragraph.

of Scottish ironstone, both the Bairds' own and purchased, fell from 91,911 tons in 1889-90 to 44,077 tons 15 cwt in 1900-1901, while in the same period total consumption of char rose from 181,693 tons 11 cwt to 315,612 tons 19 cwt. Increased imports could not compensate for reduced home supplies and, therefore, the Bairds bought both purple ore, and scale and cinder, as acceptable substitutes.

Purchases - from outside Scotland

Once the Bairds began buying ore in the mid 1850's, red hematite from Cumberland seems to have been one of the first ores bought. Unlike the apparently irregular pattern of Scottish purchases the trade with English suppliers seems from the start to have been on a more regular basis. This trade was not begun as a result of any panic about shortage of the company's own supplies. Alexander Whitelaw wrote, probably in all honesty, that the company's mines were quite able to meet Gartsherrie's requirements.²¹⁶ Apparently, the hematite was used mainly in a few furnaces producing No. 4 iron.²¹⁷ The Bairds' policy at this date may have been to use Cumberland ore in these furnaces rather than to pay high royalties on blackband only to dissipate the qualities of this char by using it in the production of a pig-iron for which it offered no special advantage.

At first contracts were signed for only 1,000 or 2,000 tons at a time, because variations in quality were difficult to detect. Later, orders for over 5,000 tons were signed. By December 1856

216. Coatbridge, William Baird and Company MSS, G.L.B., vol. 8, 232; Alexander Whitelaw to James Bain, 16 June 1855.

217. Ibid., vol. 8, 897; David Wallace to James Bain, 9 February 1856.

efforts were being made to ensure deliveries of 50 tons daily.²¹⁸ There may have been some interruption of the trade in the late 1850's. Certainly an abstract of materials used in May 1859 does not mention it, although it is significant that a space for it was provided and reference made to its use the previous year. By 1860 consumption had resumed, and during 1861-2 deliveries were 30,779 tons, although only 10,668 tons were actually used in the furnaces.

Regular contracts were negotiated with a number of Cumberland firms for ore supplies to Gartsherrie and the Ayrshire works. In order of importance, according to 1861-2 deliveries, these companies were the Parkside Mining Company; S.W. Smith; the Eskett Iron Ore Company; S.B. Ashburner; Harrison Ainslie and Company; J.H. Allwood; and John Stirling.²¹⁹ In view of the unsatisfactory state of the railway network linking the Cumberland mines with the West of Scotland, and also the relative freight charges, the ore supply was generally transported by ship from Whitehaven to either Bowling or Ardrossan. Management of the shipping was in the hands of James Jeffries and Thomas Moffat at Bowling and Ardrossan respectively where these men were company agents, handling all the Bairds' products passing through these ports.²²⁰

Apparently, even as late as 1867 the Bairds were anxious not to give too much publicity to the fact that their pig-iron was no longer made from pure Scottish blackband. Kohn, on visiting the works, was told that the large stock of hematite ore on the furnace bank had

218. Ibid., vol. 9, 755; John Campbell to James Jenkins, 18 December 1856.

219. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstract 1861-2.

220. Coatbridge, William Baird and Company MSS, G.L.B., vol. 11, 912; Alexander Whitelaw to James Jeffries, 19 March 1860; vol. 15, 21; Alexander Whitelaw to Thomas Moffat, 7 September 1863.

been an exceptional purchase and did not enter into the current mixture.²²¹

When the Bairds leased their own Cumberland minerals in 1869, sales stopped abruptly and from that date until 1884 no reference occurs to the purchase of English ore by the Gartsherrie works. When purchases did resume, the ores were bought for reasons quite different from those which had led to the original contracts. By the 1880's the invention of the Bessemer process had been followed by the realisation that the low phosphorus hematite ores of Cumberland were suitable for the process while the Scottish blackband was not. The decision to purchase Cumberland ore again must have been linked with the commencement of Siemens pig-iron production at Gartsherrie.

For a decade purchases ran at a high level rising from 24,967 tons 16 cwt in 1884-5²²² to 68,337 tons 18 cwt in 1889-90 before falling in the 1890's to the more modest but still significant figure of 20,739 tons 2 cwt in 1894-5. The sharp decline to 2,622 tons 6 cwt in 1895-6, 1,752 tons 5 cwt in 1896-7, and nothing thereafter was probably owing to the Bairds' purchase of the Monte de Hierro mines in 1893, from which they were able to obtain ore which was cheaper and better. The average price of the Spanish ore delivered in that year was 68.26p compared with 82.95p per ton for the Cumberland ore.

The second major source of purchased ore from outside Scotland

221. F. Kohn, Iron and Steel Manufacture (London 1869), 67.

222. Strathclyde, William Baird and Company MSS, Gartsherrie Works Annual Abstracts 1882-1914 provide the data for this paragraph.

was Spain. Although the first supplies of this ore were made in 1863 - and it was purchased occasionally during the 1860's and 70's - regular deliveries did not begin until 1882-3,²²³ when 8,938 tons 9 cwt were bought mainly from the Bilbao Iron Ore Company. No distinction was made in the abstracts between purchases from the Bairds' own mines and purchases from others until 1895-6, but prior to that date deliveries must have fluctuated quite markedly in line with figures for total Spanish ore deliveries. Probably, the figures given for the late 1890's, of from 13,000 to 25,000 tons gives some indication of the general level for the earlier period. After 1900 Spanish purchases became more significant; the peak was reached in 1912-13 with deliveries of 131,708 tons 9 cwt and for most years after 1900 purchases exceeded 65,000 tons per annum.

During much of the century Ireland supplied small but regular quantities of ore. As early as October 1856 Gartsherrie had already used such ore, and Wallace instructed Bain to buy any that became available at Bowling or the Broomielaw for 75p per 22½²²⁴ cwt. The 1861-2 Abstract records the purchase of 1,712 tons 2 cwt from the Ballycastle Mining Company for a total cost at the furnaces of 69.31p. Supplies from this source continued at least until 1863. In 1878 although none was used in the furnaces and none bought, there was a stock of 244 tons on the furnace bank, and reference was made during 1877 to the purchase of some Irish ore. During the years 1885-6 to 1896-7 small quantities ranging from 500 to 4,000 tons per annum were bought.

223. Ibid., 1882-3.

224. Coatbridge, William Baird and Company MSS, G.L.B., vol. 9, 619; David Wallace to James Bain, 25 October 1856.

Although the most important, Spain was not the only source of foreign ore. An isolated trial of some Norwegian ore occurred in 1856 but it was given up as unsuitable.²²⁵ During 1890-92 and again in 1905-6 a few thousand tons of Swedish ore were bought. Also in 1905-6 2,492 tons 7 cwt of Russian ore were bought at the very high price of £1 - 39.17p. Between 1902 and 1906 43,500 tons of ore were bought from the famous Wabana mines of the Nova Scotia Steel and Coal Company on Bell Island off Newfoundland, but although a hematite ore with 56% iron content it was not suitable for making Bessemer pig-iron on account of its high phosphorus content.²²⁶

The purchase of ore was clearly a long standing practice. Although no single source of purchased ore, nor all sources taken together were ever of dominant importance, their wide-ranging nature is in itself testimony to the Bairds' willingness to investigate any possible means of augmenting their own reserves, particularly in the years after 1870 when these were obviously in decline.

225. Ibid., vol. 9, 690; David Wallace to Salvesen of Grange-mouth, 24 November 1856.

226. Iron and Coal Trades Review, 15 September 1911.

CHAPTER V

CHAPTER FIVERaw Materials - Coal

For some sixty years prior to the formation of William Baird and Company the abundant coal resources of the Monklands were the major factor in the area's industrial development. The coals had been known and worked for centuries but the establishment of a modern coal industry only began following the construction of the Monkland canal [authorised 1770]¹ to link the supplies of the Monklands with the rapidly expanding city of Glasgow. Later the first three modern railways in Scotland, - the Monkland and Kirkintilloch [begun 1824]; The Ballochney [begun 1826]; and the Garnkirk and Glasgow [begun 1827], - all had as their object the exploitation of the coal deposits of the Monklands to supply not only Glasgow but also Edinburgh and the East of Scotland.² For the sons of Alexander Baird the coal industry was a natural choice in their search for a profitable career, and by the time they had leased the coal in the Gartsherrie estate in 1826 they were already experienced coalmasters.

When the decision to erect the first blast furnace was taken, the brothers already had an important colliery in operation, easily capable of meeting the needs of several furnaces. At that time deposits of coal seemed so widespread and reserves so vast that there appeared to be little likelihood of any difficulty in obtaining supplies in the foreseeable future. Accordingly, the company's policy concerning

-
1. George Thomson, 'James Watt and the Monkland Canal' Scottish Historical Review, Vol. XXIX (1950). 121-133.
 2. Ernest Canter, An Historical Geography of the Railways of the British Isles (1959), 18, 30, 33.

coal leases was quite different from that relating to ironstone. There was no vigorous campaign to secure every available deposit of coal however insignificant. In the early years the demands of the furnaces were easily met. The Gartsherrie field was supplemented by the reserves in the Woodhall estate three miles east of the works which the company leased in 1834.³ For twenty-five years, despite the expansion of the works from one to sixteen furnaces, these two sources supplied virtually all the coal required.

Many of the leases were for both coal and ironstone, but in practice the company did not work the coal, except in so far as it was needed for pithead purposes, either steam-raising or calcining. Such was the case with the coal in Rawyards for example.⁴ By leasing all the minerals the Company made certain that it would benefit should a particularly good seam of a valuable coal be found. More importantly the possibility that a dispute might arise if the coal were leased to another party was avoided. In some cases as with Stanrigg the Company decided, after having opened up the field, that it was pointless to hold onto the coal lease and so it was renounced.⁵ On other occasions the Company concentrated exclusively on the working of the ironstone and sublet the coal to others, a clear indication that it was superfluous to their requirements. The coal in Kipps, Blacklands, Gunnie, and Hollandhurst was sublet.⁶ The most striking example is provided by Bellsdyke, sublet to Lockhart Dobbie, which by 1847-8 was producing 66,423 tons per annum.⁷

3. Strathclyde, W.B. & Co. MSS, Old Lease Book No.1, folio 114.

4. Ibid., folio 97, Supplementary Coal Agreement.

5. Ibid., folio 279.

6. Ibid., folio 70.

7. Coatbridge, W.B. & Co. MSS, G.L.B. Vol.3, 430, David Wallace to James Bain, 14 June 1850.

The extent to which the Gartsherrie furnaces were supplied from only a few sources, is shown clearly by the details of rental payment as late as 1849-50.⁸ Apart from the Woodhall estate, Gartsherrie, and the adjoining land of Gunnie, coal lordship was paid only for Coats. It amounted to £99-75p or only 1.7% of the total coal lordship of £5,840-38p paid in that year.

The pattern changed considerably in the 1850s. Thankerton which had been producing 140,000 tons p.a. of splint coal was given up on expiry of the lease in 1854. The gap was filled by stepping up production at Gartsherrie and by extending coal working to several of the leases where the main emphasis had hitherto been on ironstone mining. In these properties the sinking of ironstone pits had established or confirmed the presence of suitable coal.

In the interval since the signing of the Thankerton lease the Bairds had bought the adjoining lands of Faskine and Palacecraig from the Dixons of Govan.⁹ Under William Dixon the property had been an important source of coal for the Glasgow market.¹⁰ It was logical to give up the Thankerton lease and exploit their own minerals. This argument was reinforced by the difference in freight rates. Whereas the cost of haulage from Woodhall was 3.33p per ton, that from Faskine was only between 1.88 and 2.5p.¹¹ Moreover, the Thankerton Lordship

8. Coatbridge, W.B.& Co. MSS, G.L.B. Vol.3, 432, David Wallace to James Bain, 14 June 1850.

9. Miller, Rise and Progress, 112.

10. James Cleland, Account of the minerals in the Public Green belonging to the Corporation of Glasgow (1836), 53.

11. Strathclyde, W.B.& Co. MSS, Railway Deeds Book folio 132, 'Agreement between James Baird and Alexander Finlay of the Monkland Railway 30 May 1849'; folio 154 'Agreement between the Caledonian Railway Company and William Baird and Company August 1848'.

was 2.3p per ton as against 1.64p for Faskine.¹² Finally the Company had probably taken from Thankerton as much of the splint seam as could easily be mined. In twenty years seven pits had been sunk - all to the splint coal.

On the Gartsherrie estate the first coal from the pits in the new Espieside sector was put out in April 1856.¹³ By April 1859 there were three pits in production at Espieside producing 6,779 tons or 30.86% of the output of the estate.¹⁴ In the same month the 'new' pits of Faskine, Palacecraig, Raw, and Burnbrae produced 10,873 tons. The increased output from Gartsherrie together with the development of the newer pits proved easily capable of supplying the works during the 1850s. With the works at their maximum size with sixteen furnaces, and production for a time levelling off at between 90,000 and 100,000 tons of pig-iron annually the pressure to achieve a rising annual output of raw materials did not occur.

The opening up of the mineral supplies in the area first around Denny and later towards Kilsyth, which began in the late 1850s was determined by the Company's need to find fresh supplies of ironstone. The properties leased also contained considerable reserves of coal but these were not worked for use in the furnaces. The coals were not of the kind best suited for iron smelting, though some proved ideal for coking and served as the basis for the Company's expansion into the field of coke making.

Throughout the 1860s the Gartsherrie furnaces continued to rely

-
12. Strathclyde, W.B. & Co. MSS, Old Lease Book No.1 folio 245, folio 114.
 13. Strathclyde, W.B. & Co. MSS, Coal Abstract Book, April 1856.
 14. Coatbridge, W.B. & Co. MSS, 'Abstract of Production Gartsherrie April 1859'.

on the Monklands. The existing pits were, however, becoming exhausted, and during the decade several were stopped - Raw 1 [1860-61]; Faskine 9 and Espieside 4 [1861-2]; Sunnyside 2 [1862-3]; Broomhill 1 [1865-6]; Kippsbyre 3 and 4 and Burnbrae 2 [1866-7]; and Gartgill 6 [1867-8].¹⁵ The only new pit was Raw 2 where sinking began in 1860. In addition some of the ironstone pits, upon exhaustion, were developed as coal pits. Kippsbyre 3 and 4 became coal producers in 1859-60 though they were stopped in 1866-7. In 1860-61 Faskine Hillhead 2, 5, and 10 began to produce coal as well as ironstone and in the following year Faskine 7 and Coats 3 ceased to produce ironstone and became coal producers. Cairnhill 5, a long abandoned ironstone pit, was re-opened as a coal pit in 1868-9.¹⁶ The reliance on the Monklands fields during the decade resulted in a rapid depletion of reserves. Of the coal owned by the Company in Old and New Monkland in 1860 the workable reserves amounted to 5,216,648 tons. By 1868 this had fallen by 41.3% to 3,058,300 tons, of which approximately 303,368 tons was splint coal.¹⁷

During the 1870s the Monklands field experienced its final decade as the Company's main source of furnace coal. Problems which had begun to make working difficult and expensive during the 1860s were accentuated. Drainage was particularly important. Between 1862 and 1868 the average production cost in the Gartgill field was 51.1% higher than at neighbouring pits, because of flooding.¹⁸ In 1866 for every

-
15. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol. 1, passim.
 16. Coatbridge, W.B. & Co. MSS, G.L.B. A.K. McCosh to the Glasgow Office 13 March 1868.
 17. Coatbridge, W.B. & Co. MSS, 'Valuation of Minerals Gartsherrie 1868'.
 18. Coatbridge, W.B. & Co. MSS, 'Cost of Output Gartgill No.2 1861-1868'.

ton of coal and ironstone produced at Faskine and Palacecraig 10.5 tons of water were raised at a cost of 2.5p per ton of minerals.¹⁹ At Burnbrae and Kipps 13 tons of water were raised for every ton of minerals at a cost of 3.33p per ton.²⁰ In May 1873 40% of the Splint coal and 47.4% of the Main coal was under water at Faskine and Palacecraig.²¹

The final phase was marked by the commencement of Espieside No. 6, Gartgill No. 7 and Lockwood No. 1 pits in 1870-71 and of Raw No. 3 in 1871-2. Significantly Espieside No. 6 which was only 13.5 fathoms deep, and Gartgill No. 7, which was 15.5 fathoms deep, were small concerns both of which ceased production in 1876.²² Many other pits in the Monklands also closed at this time - Faskine 7 in 1871; Coats 3 and Gartgill 2 in 1871-2; Gartcloss 2 and Cairnhill 7 in 1872-3; and Greenhill No. 1 in 1877-8. By 1876-7 if not sooner Gunnie 1, Palacecraig 6, Raw 2 and Gartcloss 2 had stopped producing coal. At Martinmas 1880 the Company gave up its lease of the coal in the lands of Gartsherrie, Gartgill, Hollandhurst, and Lockwood and so stopped the pits at Gartsherrie 1; Carlincroft 1; Opencast 2; Gartgill 2, 4, 6 and 7; Hollandhurst 1; and Espieside 3, 4, and 5.²³ Some of these pits had almost certainly ceased to produce coal several years before the end of the respective tacks but the actual termination of the leases was in a sense formal recognition of the ending of a fifty year

-
19. Coatbridge, W.B. & Co. MSS, G.L.B. Vol.18, 472, A.K. McCosh to D. Wallace May 1866.
20. Ibid.
21. Coatbridge, W.B. & Co. MSS, 'Valuation of Minerals Gartsherrie 1873'.
22. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol. 2 passim.
23. Strathclyde, W.B. & Co. MSS, Digest of Leases Vol.1, folio 100.

old link between the Gartsherrie furnaces and the coalfield immediately surrounding the works.

The Company leased the minerals of Springhill, near Bargeddie in 1869, in an area which had the reputation of containing little workable coal at the beginning of the century.²⁴ This was the first step in the attempt to find alternative supplies of furnace coal. The adjoining minerals of Rhinns and Bredisholm were leased in 1872, and those of Bargeddie in 1873.²⁵ To work these fields, pits were sunk at Springhill 1 and 2, Mainhill and Bartonshill. Before the sinking of Springhill 1 was finished, the minerals were subleased, partly to Brand and Addie, but mainly to the Springhill Coal Company; the latter also leased the pits and machinery.²⁶ The coal in Hallhill, Fauldspark, Bredisholm and Rhinns, with the exception of the splint seam under part of these properties was sublet to Robert Robson in 1873.²⁷ William Baird and Company, therefore, worked coal only from Bartonshill 1, Mainhill 2, and later from Bartonshill 3 (begun 1879-80) and Hallhill 1 (begun 1885-6).²⁸ For twenty years these pits did contribute to the supply of furnace coal for Gartsherrie but as each of the leases expired between 1896 and 1902, they were not renewed.

The second, and more important area, to which the Company turned in the 1870s was the Bothwell/Blantyre district. This formed part of the Mid-Clyde Basin which during the next forty years developed as the main focus of coalmining within Lanarkshire. The general assumption

24. Ibid., folio 224.

25. Ibid., Vol.2, folio 25.

26. Ibid., folio 16, 19.

27. Ibid., folio 26.

28. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol. 3, passim.

that the Bairds' activities in this area were part of the great upsurge of mining activity brought about by the boom of the early 1870s, requires qualification. Certainly of the eighteen pits being sunk in the Bothwell district in July 1873, two belonged to William Baird and Company.²⁹ However Bothwellpark 1 and 2, begun in August 1871 were being sunk on a property leased in December 1870, with entry at Martinmas 1870. During that year the average price of coal F.O.B. in the United Kingdom, although slightly up on the 1869 price, was lower than in any of the four years 1865-8.³⁰ Likewise the sinking of the pits at Craighead was not begun until 1875 when the price of coal had fallen 36% from the peak of 1873 and was still declining.³¹ In the month that the lease was formally signed a commentator on the Scottish coal industry reported that, 'demand is much below potential production and some smaller collieries are almost crushed out of existence'.³²

For William Baird and Company the primary consideration was clearly the need for furnace coal, rather than general conditions in the Scottish coal industry. Both the timing of developments around Bothwell and the Company's readiness to sublease much of the coal around Baillieston confirm this view. The sub-leasing also illustrated the shrewd business acumen of the firm's partners. Not only did the Company secure what splint there was but it also earned a considerable profit by setting the lordship at 5p per ton, though it had

29. Engineering, 18 July 1873.

30. A.J. Taylor, 'Labour Productivity and Technological Innovation in the British Coal Industry, 1850-1914' Economic History Review 2nd Ser. Vol.XIV (1961) 48-70.

31. Ibid.

32. Engineer, 19 March 1875.

to pay only 2.5p per ton [2.92 in the case of Rhinns] to the lessor.³³

The Bothwell district remained the firm's chief source of furnace coal prior to 1914. Following the lease of Bothwellpark (entry 1870), the Company leased Bothwellbank (entry 1872), Craighead (entry 1872), and Bothwell Castle (entry 1874).³⁴ In 1874 also it purchased the 46 acre property of Little Parkhead, adjoining Bothwellpark, for £12,000.³⁵ In 1886 the Company bought a portion of the minerals of Blantyre for £2,000 and leased another portion from Monteith of Carstairs, and in 1891-2 the minerals of Elmwood were leased from James Naismith.³⁶ In 1892 an additional area of the Bothwell Castle estate was leased and two new pits, Bothwell Castle 3 and 4, were begun in 1893.³⁷

In the generation after 1890 the Company became even more firmly entrenched in the Bothwell area. The Bothwellpark lease was renewed in 1903, and Craighnowe leased in 1905.³⁸ Small lots of minerals were bought in Elmwood in 1909-10, and 1912-13, and in Old Mill of Bothwell in 1908-9; and the larger deposits of Bothwellbank for £7,750 in 1903, and of Laighlands and Castlebank in 1907-8 for £4,894.³⁹ Of particular significance was the purchase, in 1894, of the Craighead estate at a price of £36,600.⁴⁰

-
33. Strathclyde, W.B. & Co. MSS, Lease Book No.4 folios 86 and 95; Digest of leases Vol.2 folio 26.
34. Strathclyde, W.B. & Co. MSS, Lease Book No.4 folios 18, 121, 124, 482.
35. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol.2.
36. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol.5.
37. Engineering, 1 April 1893.
38. Strathclyde, W.B. & Co. MSS, Lease Book No.7 folio 536.
39. Strathclyde, W.B. & Co. MSS, Lease Book No.8 folios 513, 392, 400; Valuation Book Gartsherrie Vol.7 'Lands 1903'.
40. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol.6 'Lands 1894'.

As the Bothwell district grew in importance, the decline of the Monklands continued. In 1880 coal was produced from Faskine Hillhead 2 and 5, Cairnhill 5, 6, and 7, Espieside 5, and Lockwood 1.⁴¹ By 1890 only the pits at Faskine Hillhead, and Cairnhill were still working.⁴² Those at Cairnhill had all stopped production by 1903-4 if not sooner and those at Faskine Hillhead by 1906-7.⁴³ By this latter date the original sources of Gartsherrie furnace coal were all exhausted.

Despite the expansion of coalmining by the Company in the Bothwell district, the area did not prove capable of supplying the fuel required by the furnaces, especially following the modernisation of the works in the 1890s. Increasingly from the 1880s the coal from the Kilsyth district, after having been coked, was used at Gartsherrie. This marked the beginning of a revolution in the nature of the fuel used at the furnaces, which was carried to completion after 1914.

Ayrshire

A detailed reconstruction of the precise pattern of coal supply for the Ayrshire furnaces is not possible given the inadequacy of the surviving information. The existence of the Eglinton Iron Company lease books permits the formation of a general outline.

The location of the Bairds' first Ayrshire works at Stobbs on the edge of the Eglinton estate was determined largely by the very attractive terms offered by the Earl in a lease of the minerals in part of his estate.⁴⁴ This lease of the minerals under the lands of Black-

41. Ibid., Vol.3 'Coal Pits 1880'.

42. Ibid., Vol.5 'Coal Pits 1890'.

43. Ryland's Directory of the Iron, Steel, and Colliery Trades 1906 and 1909.

44. McGeorge, Bairds of Gartsherrie, 79.

lands, Nethermains, Stoneyflat, Bridgend, and Dirrans was entered into in 1846.⁴⁵ In 1848 the coal under the property of Corsehill Moor, extending to 30 acres was leased also from the Earl, and in 1852 the minerals under, Bartonholm, Snodgrass, Longford and Bogside which formed the remainder of the estate of Eglinton were leased by the Company.⁴⁶ In 1849 the Company purchased, from Robert Cunninghame of Auchenhavie, the coal in Byrehill, bordering on the Eglinton estate, at a cost of £4,100.⁴⁷ In 1861 by arrangement with Patrick Warner and A.W.R. Cunninghame the Company acquired absolute right to the coal under part of the lands of Bog and Bogend and a lease of the remainder.⁴⁸ As with Byrehill these minerals also bordered on those of Eglinton. Two other minor mineral leases were entered into, that of Fairlie bog in 1857, for five years, and of Todhills in 1865, for ten years - both lots to be worked from the Company's Byrehill pits.⁴⁹ The conclusion is inescapable that with a few minor exceptions the Eglinton furnaces were fuelled mainly from the Eglinton estate.

As each of the other Ayrshire ironworks was acquired so also were the leases. The lands of Blair were the major source of coal, as well as of ironstone, for the furnaces on the estate. Likewise Muirkirk and Lugar works were supplied principally from the estates of Muirkirk and Auchinleck. Portland, purchased in 1864, had the most dispersed supply situation of all. Coal leases of Portland, Loudon, Glenlogan, Grotgar, and Bankhead fell into the Company's hands.

45. Strathclyde, W.B.& Co. MSS, Digest of Leases Vol.1 folio 1.

46. Ibid., folio 2.

47. Ibid., folio 44.

48. Ibid., folio 17.

49. Ibid., folios 13 and 48.

In Ayrshire, as in Lanarkshire, there was, therefore, a small number of major coal-producing fields to supply the needs of the furnaces. Prior to 1870 a few important leases were entered into. The Dumfries estate, a property of the Marquis of Bute, which spanned the parishes of Old Cumnock, Auchinleck, and Ochiltree, was leased for thirty-one years from 1865.⁵⁰ Spireslack, Muirkirk, the property of Sir. W.C. Anstruther, and Garrallan, Old Cumnock, which belonged to S.C.D. Boswell were leased in 1866, and in the following year Glenmuir, Auchinleck, was leased from Major-General F.C. Burnett.⁵¹ At first however the Company concentrated its attentions on the ironstone in these properties and it was not until later in the century that the coal deposits were worked intensively.

There was no burst of fresh leasing in the 1870s to coincide with the coal sales boom, or the developments in the Clyde valley. To some extent this reinforces the view that the Company's leasing policy continued to be determined by the needs of the furnaces. Only one new coal lease was entered into. In 1876 the portion of Ardeer estate known as Misk lying east of a fault in the mineral seams was taken in sub-lease from the Stevenston Coal Company.⁵² This coal was immediately adjacent to the seams in the Bankhead section of the Eglinton estate. Two years later the much larger portion of the field which lay south-west of the fault was sublet from the Ardeer Coal Company.⁵³

Thereafter there was a very striking gap until 1903 when the Craig

50. Strathclyde, W.B. & Co. MSS, E.I.C. Lease Book No.1 folio 199.

51. Ibid., folios 314, 187, 201.

52. Ibid., folio 16.

53. Ibid., Vol.2 folio 265.

minerals in Dundonald parish, were leased from R.M.P. Morris.⁵⁴ In 1912 the adjoining coal of Girtrig^d was taken in lease from Lady Montgomery^e, and in the following year the liquidation of the Doura coal company provided William Baird and Company with the opportunity to acquire, at the modest price of £1,050 a working pit immediately adjoining their existing Eglinton leases.⁵⁵

Leases alone do not, however, provide an adequate picture of the growth of the Bairds' coalmining activities. Ideally the evidence of the precise operating dates and production details of individual pits would be required but neither of these sources now exists. Hunt's Mineral Statistics provide the only long run series giving the names of collieries but these do not begin until 1854, rarely distinguish individual pits, and are not completely reliable.⁵⁶ Only isolated production figures survive and these are mainly for the late nineteenth century. To some extent employment figures give an indication of the importance of particular collieries but again these figures do not begin until late in the century. Despite the deficiencies of the data some conclusions are possible.

In the period up to the acquisition of Portland Ironworks in 1864 each of the works had a principal centre of furnace coal, as the leases indicate. There were, however, a number of distinct collieries or individual pits operating on each of these leases. In 1854 the Eglinton furnaces were supplied from the collieries of

54. Ibid., Vol.3 folio 217.

55. Ibid., Vol.3 folio 419.

56. Mineral Statistics of the United Kingdom [Published annually in Memoirs of the Geological Survey of Great Britain and the Museum of Practical Geology] Compiled by Robert Hunt.

Eglinton Ironworks, Bartonholm, Redburn, and ^{MONCOUR}Mount Carr. Besides the Blair pits themselves the furnaces at Dalry may have received some of their coal from pits at Pitcon, Hawthill, Stoopshill, Auchingree, and Merklands bordering the estate. Pits at Airdsgreen, Burniknowe, Glenbuck, Lugar, Muirkirk, Wellwood, Welltrees and Gaswater, mainly situated on the Auchinleck and Muirkirk estates, provided fuel for the Muirkirk and Lugar furnaces. Portland works drew from several quite distinct locations with coal pits operating at Bankhead, Grougar, Glenlogan and Loudon as well as on the Portland estate at Hurlford.

With the stopping of the furnaces at Blair all the coalpits which had not already been abandoned were given up apart from several of the Blair pits themselves where the coal was used in calcining the clay-band ironstone. At Muirkirk many of the older workings had been known to be approaching exhaustion at the time the Bairds purchased the works. Gaswater ceased production in 1862, Burnieknowe in 1865, Welltrees in 1867, and Muirkirk and Glenbuck in 1872.⁵⁷ At Kil-winning Mount Carr ceased production in 1873,⁵⁸ but activity continued at all the other collieries and of course Misk became a company pit in 1876. Although Portland Colliery itself remained a major source of coal during the 1870s, there is no indication of any fresh activity in the immediate Hurlford area. The centre of new developments at this time was the parish of Old Cumnock, with activity extending into the surrounding parishes of Auchinleck, Ochiltree, New Cumnock, Sorn and Muirkirk. New pits were opened up at Kaimes (sinking 1870), Lightshaw (1872), Grasshill (1873), Stottencleugh (1873), Berryhill,

57. Strathclyde, W.B. & Co. MSS, volume entitled Rails and Plates Muirkirk, passim.

58. Hunt, Mineral Statistics, for 1873.

Dykes, Knockterra, and Glengyron (all 1876), and Hindsward (1877).⁵⁹ These developments give a quite different impression of developments during the decade than that suggested by the leasebooks. Obviously there was considerable development during the 1870s though it is not possible to decide whether it can be attributed to the wider events of the Scottish coal market or to the needs of the Ayrshire furnaces. It is hardly surprising however that when the decision was made to introduce by-product recovery plant in Ayrshire in 1881 it was at Muirkirk and Lugar in the heart of the new mineral workings that modernisation was carried out.

During the last twenty years of the century the older fields continued to decline. The Lugar Ironworks colliery stopped in 1880 and Maidenbank and Stottencleugh at Muirkirk in 1881.⁶⁰ By 1888 the forty years old Bartonholm colliery, on the Eglinton estate had been abandoned and in 1890 and 1894 the Bankhead and Grongar collieries, taken over from the Portland Iron Company, ceased. New pits were opened to replace those closed down. On the fringes of the Kil-winning field Bogside and Ladyha' were producing coal by 1888.⁶¹ At Maxwood adjoining the Loudon pits a new colliery was in production also by 1888.⁶² The Cumnock field remained the principal growth area with Braehead commencing in 1888, Barglachan in 1889 and Highhouse and Whitehill in 1894.⁶³ In addition Carbello, Common, and Glengyron

-
59. Strathclyde, W.B.& Co. MSS, Volume entitled Rails and Plates Muirkirk, passim; Hunt, Mineral Statistics for 1870, 73, 76, 77.
60. Hunt, Mineral Statistics 1880; Strathclyde, W.B.& Co. MSS, volume entitled Rails and Plates Muirkirk, passim.
61. List of Mines 1888.
62. Ibid.
63. Ibid., 1888, 1889, 1894.

concentrated increasingly on coal at the expense of ironstone production.⁶⁴ Several new pits were started at Moncur on the eastern edge of the Eglinton Estate in 1906 and on the opposite side five new pits were being developed at Auchincruive in 1909.⁶⁵ The pits at Craig were in production by 1906⁶⁶ but these seem better located for general sale purposes, especially by coastwise trade, than the provision of furnace coal. At Cumnock new workings were opened up at the long abandoned Berryhill Colliery in 1904 and Burnnockhill and Gilminscroft began production in 1906. In the same year sinking of the ultra-modern Barony colliery began.⁶⁷

The overall impression is that each works was supplied with furnace coal from a major field in the immediate vicinity of the furnaces. These supplies were generally so large that no serious pressure existed throughout the century. In Ayrshire of course the Company's furnaces were spread throughout the country, rather than concentrated on the one site as at Gartsherrie, and all the works were much smaller than Gartsherrie. Naturally the area of the coalfield rarely coincided with the distribution of land or mineral ownership and accordingly the Company, whenever possible, took a lease of these portions of the field extending into neighbouring properties, or into other parts of the estates originally let. This of course became more necessary as the century progressed and the underground workings moved steadily outwards. Secondly the Company was able to satisfy its coal

64. H.J. Steven, Old Cumnock (1899), 5.

65. Ryland's Directory of the Iron Steel and Colliery Trades 1908, and 1910.

66. Ibid., 1908.

67. Ibid.

needs towards the close of the century by sinking collieries on properties which had been leased earlier in the century but in which it had worked only the ironstone.

Production and Productivity

Few figures survive from the early years of the Company's history but it would seem logical to deduce both from its restricted leasing policy, and readiness to sublet, that it was not concerned to achieve an aggressive expansion of the coal side of its business as a semi-independent activity. Coal production long remained a closely related subsidiary of iron production.

Steadily increasing economy in the consumption of coal per ton of pig-iron probably meant that the output of coal did not expand as dramatically as did pig-iron production in the twenty years 1830 to 1850. Nevertheless it must have increased considerably. On the basis of Gartsherrie pig-iron production the minimum output of coal must have been about 15,250 tons in 1831, 75,000 tons in 1839-40, and 195,000 tons in 1849-50.⁶⁸ Production estimates based on rental figures for the same three years, being the fixed rental from the leases in the first two cases and the actual rental paid in the third year, give output figures of 28,970 tons, 84,000 tons, and 259,280 tons severally.⁶⁹ The estimate for 1839-40 is probably too low on

68. Calculated on the basis of the coal consumed per ton of pig-iron as given in Coatbridge, W.B. & Co. MSS, 'Materials consumed per ton of pigs 1830-1840', together with the estimated output of pig-iron as given in appendix.B. Table 2.

69. For 1831, and 1839-40 the rentals are taken from the leases known to be worked at those dates; for 1849-50 the figures for rental are given in Coatbridge, W.B. & Co. MSS, G.L.B. 3, 430, David Wallace to James Bain 14 June 1850.

account of the surprisingly low fixed rental of Thankerton.

Although Thankerton, capable of producing 140,000 tons per annum, was given up in 1854 the opening up of Espieside, Faskine and Palace-craig meant that production was expanded during the 1850s. By 1861-2 it stood at 375,089 tons.⁷⁰ The production of pig-iron and hence the consumption of furnace coal at Gartsherrie stagnated during the 1850s. The growing discrepancy between coal production and consumption at the furnaces led to a significant growth in sales, but despite this stocks accumulated rapidly. By 1864-5 the stock of coal at the pits stood at 132,692 tons the highest recorded level of the forty years for which figures are available.⁷¹

From the early 1860s there are sufficient figures to show the development of three associated trends. Firstly the long run movement of output was upward. In the 28 years between 1861-2 and 1889-90 production doubled from 375,089 tons to 752,102 tons, and doubled again in the 18 years to 1906-7 when it was 1,569,459 tons.⁷² Expansion continued till the peak year of 1910-11 when it stood at 1,737,584 tons before falling slightly to 1,577,140 tons in the year before the outbreak of war. The proportion of this output going for sale rose rapidly, from 26% in 1861-2 to above 60% by the turn of the century. In addition the quantity being consumed at the Company's coke ovens increased from approximately 50,000 tons in 1878-9 to 415,345 tons in 1910-11. The combined effect of general sales and coke production was to reduce the proportionate significance of the

70. Strathclyde, W.B.& Co. MSS, 'Abstract of Production 1861-2'.

71. Strathclyde, W.B.& Co. MSS, Valuation Book Gartsherrie Vol.1 'Coal Pits 1864-5'.

72. See appendix.C, Table 2.

Gartsherrie furnaces as a consumer of the Company's raw coal, as Table V:1 indicates.

Table V:1

The Percentage of Gartsherrie district raw coal consumed at the furnaces.

YEAR	%	YEAR	%
1861-2	74.8	1901-2	14.4
1882-3	35.5	1910-11	10.6
1891-2	19.7		

Turning from the long to the short term several interesting features emerge. Output remained almost stagnant from the middle of the 1860s until late in the 1870s. From 475,129 tons in 1865-6 output slowly declined to 358,609 in 1872-3 before recovering gradually to reach 489,413 tons in 1878-9.

There was considerable emphasis during the 1860s on developing the ironstone resources of the Denny/Kilsyth district. At the same time the Monklands - the Company's coal producing centre - was running down but it was not until the 1870s that Baillieston and the Bothwell/Blantyre areas were developed and not until towards the end of the 1870s that they began to produce coal in significant quantity. In addition, throughout the period, but most notably in the early 1870s labour problems - partly shortage of labour and partly the restrictive policy of the colliers - acted as a check on production.

The accumulation of large stocks in the early 1860s suggests that the Company had been finding that production was expanding too rapidly. At the same time the subleasing of coal to others, the renunciations of small leases in the Monklands, and the absence of an aggressive leasing policy, all already referred to, clearly indicate that there was no

desperate desire to boost coal production during these years. There is evidence that the Company did not welcome the actual decline in output which occurred, but neither did it show undue alarm at the fact that the marked rise of earlier decades had been halted.

With the coming into full production of the first series of Bothwell pits overall production moved sharply upwards, but there was not constant annual growth during the 1880s. Rather there was a rapid expansion of output in the three years from 1879 to a peak of 672,904 in 1881-2. Thereafter until the strike of 1887 production fluctuated around 600,000 tons before steady expansion resumed. With consumption at the furnaces falling year by year from 219,295 tons in 1881-2 to 150,687 tons in 1886-7 and coke production also feeling the effects of the general depression, the slow rise of sales was not sufficient to prompt an expansion of output.

After 1890 consumption at the furnaces again expanded but never reached the volume of 1881-2. The rate of growth of coke production and general sales were the decisive factors determining the course of expansion of output. Although the Baillieston field was given up in 1897,⁷³ fresh developments elsewhere ensured continued growth. Bothwell Castle 3 and 4 pits which were begun in 1893 came into production about 1897, and in the twentieth century the Baldardie pits further added to output. In addition there were significant new sinkings in the Kilsyth field from which the rapid expansion of coke production was sustained.

Table E in the appendix⁷⁴ shows the differing rates of

-
73. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol.6 'Minerals leased 1897'.
74. See appendix. E.

growth of coal output for the Gartsherrie district, Scotland, and the United Kingdom. Although the Company's performance in the early 1860s compares favourably with that for Scotland and the U.K. its record after that date is in marked contrast with the U.K. figure and even more surprising when set against the growth in output of the whole of Scotland. Following general stagnation in the early 1880s growth resumed. The Scottish rate of growth exceeded that of the U.K., but the Company's growth was even more impressive and despite some slowing down in the early 1900s the growth in output of William Baird and Company remained ahead of the Scottish and United Kingdom averages.

Production statistics do not exist for the Eglinton Iron Company's pits and circumstantial evidence is slight. The increase from 13 to 25 in the number of collieries belonging to the Company between 1860 and 1913 provides some evidence of growth.⁷⁵ Details of all the individual pits at each of these collieries are rare before the twentieth century, however. Using the figures for numbers employed at the Ayrshire pits as given in the Gov. returns, in conjunction with O.P.M. figures for Scotland the estimated production from the Company's Ayrshire pits is as shown in Table V:11.⁷⁶

TABLE V:11 ESTIMATED COAL OUTPUT AYRSHIRE

YEAR	OUTPUT	YEAR	OUTPUT
1894	750,959	1906	1,496,992
1899	1,088,640	1913	1,643,700

75. Hunt, Mineral Statistics 1860; List of Mines 1913.

76. These estimates are based on the employment figures given in the List of Mines for the appropriate years and the O.P.M. figures given in Anthony Slaven, 'Coal Mining in the West of Scotland in the Nineteenth Century - The Dixon Enterprises' [unpublished B.Litt. Thesis, The University of Glasgow, 1967].

The value of the first estimate is affected by the fact that the number of employees includes ironstone miners at several of the collieries, notably Blair and Common. Their numbers, and hence their distorting effect on the estimates, declined rapidly after that date. If, as seems likely, the company's Ayrshire colliers had a higher O.P.M. than the Scottish average, in common with their fellows under Gartsherrie supervision then the underestimation on this account will tend to cancel out the overestimation caused by the inclusion of ironstone miners.

A.J. Taylor has ably pointed out the weaknesses of the traditional statistics of productivity for the British coal industry in the nineteenth century, yet he saw no alternative but to make of them what use he could.⁷⁷ In the case of William Baird and Company the statistics generally allow of only similar calculations to the traditional ones - some comparisons are therefore possible. Using the details of two notes which survive it is possible to calculate productivity in the Gartsherrie area for 1866 and 1871.⁷⁸ For all workers in the whole area O.P.M. was 352.8 tons in 1866 and 359.8 in 1871. These compare favourably with the West of Scotland figures (296.01 and 335.07) and those for the United Kingdom (c.300 in 1871). The Monklands figures alone of 363 and 389.3 in the respective years are even more markedly superior to the West of Scotland average. The poorer performance in the Denny Kilsyth pits may be explicable partly on account of the fact that many of the workers were employed primarily as ironstone miners. More importantly perhaps, the area was only being opened up

77. A.J. Taylor, 'Labour Productivity...' ,48.

78. Coatbridge, W.B.& Co. MSS, copy of 'The return made to the Inspector of Mines 1866' and 'The return made to the Inspector of Mines 1870'.

during this period and therefore there must have been a relatively large number of workers in partially developed pits. Unfortunately the details are lacking to make possible a comprehensive survey of O.P.M. or to indicate exactly when the high point came, but by 1897 the trend, in common with that for the United Kingdom, was downwards. In that year Gartsherrie O.P.M. was 325.9 tons, virtually the same as the Scottish average of 326 tons, but still superior to the United Kingdom figure of 299 tons.

The figures for 1904 and 1911 show a continuation of the downward trend. From 323.8 tons in 1904 the Gartsherrie figure declined to 285.3 in 1911. This compares with Scottish figures of 314 tons and 301 tons and United Kingdom figures of 281 tons and 260 tons. Throughout the period therefore the Baird performance was superior to the United Kingdom average and only dropped below the Scottish average in the last year quoted - perhaps no more than a temporary phenomenon. It is of course logical that a major concern should own the deepest, most efficient and most productive pits and therefore have higher productivity than the national average. The company's performance is noteworthy however when one bears in mind the fact that the Gartsherrie pits were situated in a region steadily becoming one of the country's older coalfields. Bothwellpark colliery illustrates the way in which the modern large scale capitally intensive pits had particularly high O.P.M. figures. William Baird and Company probably owes its especially favourable average to collieries like this. For the three years 1897, 1904, and 1911 the O.P.M. at Bothwellpark was 392.3 tons, 383.8 tons, and 359.2 tons or 31.2%, 36.5% and 38.2% above the United

Kingdom average.⁷⁹ Thus, although showing a distinct fall in productivity the rate of decline was less than the national average.

Furthermore there are two factors which probably justify the belief that the performance of William Baird and Company was even better than the O.P.M. figures suggest. Firstly the firm employed a greater than average number of ironstone miners at a time when such mining was becoming increasingly costly both in money and in miners' time. Some of these miners also worked coal and were counted in the statistics of colliers employed by the company; hence they must have tended to reduce the average O.P.M. Moreover the firm became the major producer of coke in Scotland and must therefore have had a disproportionately large number of surface workers at certain pits. In 1897, for example, the above ground workers at Gartshore, Dumbreck and Haugh in the Kilsyth coking field represented 26.4% of the total labour force at those collieries compared with 14.3% for the above ground workers at the other pits belonging to the company.⁸⁰ These also must have had an unfavourable effect on the overall O.P.M.

Techniques and Technology

Apart from the fact that some of the coal at Gartsherrie was won by opencast mining very little is known for certain about the methods of working adopted. When longwall working - initially used in ironstone mining - was first used by the company in coalmining is not known. Leases indicate a mounting preference for longwall. The

79. The employment figures are taken from the List of Mines 1897 and Ryland's Directory of the Iron, Steel, and Colliery Trades 1906 and 1913. O.P.M. was then calculated taking the output figures for Bothwellpark given in Strathclyde, W.B. & Co. MSS, 'Return of the output of coal from Bothwellpark 1888-1914'.

80. Calculated from figures in List of Mines 1897.

1834 lease of Gartsherrie simply required that the coal be worked in, 'the best manner'.⁸¹ At that time only ironstone leases - for example that of Rochsolloch in 1836⁸² - clearly stipulated longwall. When the company began to develop the Denny/Kilsyth district the emphasis when referring to methods of working continued to be on ironstone, not on coal. Thus the Gartshore lease insisted on 'longwall not post and stall'⁸³ for ironstone but made no specific reference for coal. The Overcroy lease of 1862 required the use of, 'Longwall for iron, and for coal whenever practicable'⁸⁴ and in the same year the Riskend and Currymire lease made no stipulation for coal but insisted on longwall working for ironstone.⁸⁵ By the 1870s the emphasis on longwall was stronger though still not mandatory. At Bredisholm, leased in 1872, the company was to use, 'Longwall when suitable',⁸⁶ at St. Flannans, leased in 1873, 'Longwall where practicable',⁸⁷ and at Auchinreoch, leased in 1876, 'Longwall preferably'.⁸⁸ From about that date onwards leases obliged the firm to use 'Longwall where practicable' or, 'the most approved regular and systematic manner'.

In the absence of precise knowledge of the nature of the seams to be worked the best that lessors could do was to insist, as at Quarter in 1872 that the company should, 'work according to the most approved methods of working seams of similar thickness'.⁸⁹ Likewise

-
81. Strathclyde, W.B.& Co. MSS, Old Lease Book No.1 folio 12.
 82. Ibid., folio 60.
 83. Strathclyde, W.B.& Co. MSS, Digest of Leases Vol.1 folio 113.
 84. Ibid., folio 147.
 85. Ibid., folio 152.
 86. Ibid., Vol.2 folio 19.
 87. Ibid., folio 13.
 88. Ibid., folio 11.
 89. Ibid., Vol.1 folio 244.

the Countess of Home required that at Bothwell Castle the company should adopt, 'any method that will completely remove the coal'.⁹⁰ William Baird and Company when leasing or subleasing coal to others was in possession of relatively full geological information and this was reflected in the precise terms which were laid down. On subleasing Springhill to the Springhill Coal Company in 1871, and the Sourmilk and Kiltongue seams at Garturk to the Rochsolloch Iron Company in 1872 all the coal had to be worked Longwall.⁹¹ On leasing the Bogside coal, near Easterhouse, to the Bogside Coal Company in 1878 it was stated that the Kiltongue seam had to be worked by the Longwall method but the company could choose with regard to the other seams.⁹² In the same year on leasing the coal at Raw to Alexander Cameron no stipulation was made concerning the Kiltongue but all the other seams had to be worked Longwall.⁹³

Although therefore there was a clear trend towards favouring the adoption of longwall working for coal as well as ironstone the process was gradual and complex, and the company avoided any absolute requirement to use Longwall. Much depended on the nature and thickness of the particular seams, and the associated mineral strata. In 1856 the company resisted efforts by Captain Colt to make them use Longwall on the Gartsherrie Estate,⁹⁴ and ten years later stoop and room was still being used.⁹⁵ By 1866 Twechar No. 2 pit had changed

-
90. Strathclyde, W.B. & Co. MSS, Lease Book No.4 folio 482.
 91. Ibid., folio 86; Strathclyde, W.B. & Co. MSS, Digest of Leases Vol. 1 folio 242.
 92. Strathclyde, W.B. & Co. MSS, Lease Book No.5 folio 301.
 93. Ibid., folio 203.
 94. Coatbridge, W.B. & Co. MSS, G.L.B. Vol.9, 367, David Wallace to J. Stewart 9 July 1856.
 95. Notebook of Alexander Cameron.

to Longwall working⁹⁶ but there is no information concerning any of the other pits. At Bothwellpark in 1877 the Splint coal seam was worked Longwall,⁹⁷ and the system was said to be the normal one in the district, and at Bothwell Castle in 1902 the Splint, Main and Pyotshaw seams were all worked Longwall.⁹⁸ On the other hand at Bartonshill and at Quarter in 1884 the coal was worked by the Stoop and Room method.⁹⁹

The surviving evidence is insufficient to permit a comprehensive survey of innovation in all areas of mining technology - winding, pumping, hauling, ventilating, conveying, screening, boring and so on. Nevertheless there are some indications of the company's performance in certain respects. All the information is limited to the period after 1860 by which date much change must already have taken place since the days of the Baird brothers' primitive horse-gin pit sunk at Rochsolloch in 1816. One interesting point is that as late as 1860 Palacecraig No. 1 pit was equipped with an Atmospheric engine,¹⁰⁰ though this may have been taken over from William Dixon. It was apparently the only one owned by William Baird and Company at that date.

There were a few cases of mechanical fanners being used for ventilation at British collieries in the first half of the nineteenth century - one of the earliest examples was erected at a pit near

96. Ibid.

97. The Mining Journal 6 October 1877.

98. Trans. Mining Inst. Scot. Vol.24 (1902), 295, 'Description of Bothwell Castle Colliery'.

99. Strathclyde, W.B.& Co. MSS, Managers Notebook Gartsherrie, November 1884.

100. Strathclyde, W.B.& Co. MSS, Valuation Book Gartsherrie Vol.1 'Coal Pits 1860'.

Paisley in 1827.¹⁰¹ Nevertheless fans did not begin to make serious headway until the middle of the century and in Scotland not until after the tightening up of the general rules concerning ventilation in the Mines Regulation Act of 1872. The Addies of Langloan are generally credited with introducing the first modern fan. It was erected at Rosehall No.4 pit, Coatbridge, about September 1872,¹⁰² though the actual decision was taken before the passage of the Mines Regulation Act. William Baird and Company followed hard on the heels of the Addies. In March 1872, it notified the Inspector of Mines of its intention to erect a fan at a pit to be known as Barrhill No.3¹⁰³ This pit - an old shaft reopened and deepened expressly for ventilating the coking coal workings - came into operation during 1873. From that date on, all the company's new collieries had at least one fan, and occasionally two. Fans were also installed at the existing collieries but this was a gradual process. It was not until 1895, for example, that one was erected at Faskine Hillhead No.2.¹⁰⁴

A sphere in which the company made a significant contribution was in the development of mechanical coal-cutters. Ever since the patenting of a mechanical pick by Michael Menzies in 1761, attempts had been made to develop some means of applying mechanical power

-
101. Mining Association of Great Britain, Historical Review of Coalmining (1924), 141.
102. Hamilton Public Library, Local Collection, Newspaper Cuttings Concerning Mining, cutting dated 30 September 1872.
103. Coatbridge, W.B. & Co. MSS. GLB Vol.23, 453. A.K. McCosh to Inspector of Mines 30 March 1872.
104. Strathclyde, W.B. & Co. MSS. Valuation Book Gartsherrie Vol.6 'Coal Pits 1895'.

to the cutting of coal, but it was not until the middle of the nineteenth century that real progress began with the patenting of disc, chain and bar types of machine.^{105.}

William Baird and Company encouraged and assisted the Gartsherrie works engineer, John Nisbet in experiments which resulted in the patenting of a machine in April 1864.¹⁰⁶ By that time preparations to test the machine were well under way. As a source of power it was proposed to use compressed air and in December 1863 A.K. McCosh wrote to his old professor at Glasgow University, W.J. McQuorne Rankine, asking for his 'experience and guidance embodied in a short practical report'.¹⁰⁷ By April 1864 the specifications for a machine had been sent to the Canal Basin Foundry. Preparations were made in great secrecy and the foundry was ordered to keep 'everything as much out of sight as possible'.¹⁰⁸ The original Nisbet machine was one of the last examples of the reciprocatory action pick type of cutter and was not persevered with. Nisbet developed a new model, patented in May 1866, in which the pick was attached to a pivot arm pulled round by a tack and pinion system.¹⁰⁹ This may have been the machine installed at Gartsherrie No.1

105. M.D. Williams, Practical Machine Mining (1928), 2

106. Brit.Pat. 895 [1864]

107. Coatbridge, W.B. & Co. MSS, GLB. Vol.15, 334. A.K.McCosh to Professor Rankine, 10 December 1863.

108. Ibid. p.753 A.K. McCosh to Canal Basin Foundry 19 April 1864.

109. Brit.Pat. 1224 [1866].

pit in June 1866. It too was rejected. By that date the company was already beginning to explore alternative possibilities.

Peter Gledhill a Newcastle engineer, developed a pick type of coal cutter in conjunction with Peter Haggie, which they patented in November 1864,¹¹⁰ shortly after the original Nisbet Patent had been taken out. Gledhill then developed a primitive form of chain coal-cutter and in 1866 he came to Glasgow where he approached William Baird and Company which agreed to pay for the taking out of a provisional patent. By an agreement signed in September 1866 the Company was granted the use of the Gledhill patent.¹¹¹ John Alexander requested a number of modifications in the machine and in June 1867 an altered model was tested. By that date the company had four coal-cutters at work but they were still considered inadequate.¹¹² Variations were built and tested in an attempt to develop a satisfactory version. In 1869 a significantly improved model was patented under Gledhill's name,¹¹³ but the relationship between him and the company was becoming somewhat strained and by an agreement signed in January 1870 the company bought over all Gledhill's interest in both his 1866 and 1869 patents.¹¹⁴

Four new machines were built and put into Espieside No.3 pit where they were kept constantly at work on night shift during 1870.¹¹⁵

-
110. Brit.Pat.2929 [1864.]
 111. Strathclyde W.B. & Co. MSS, Lease Book No.3, folio 364.
 112. Strathclyde W.B. & Co. MSS. Valuation Book Gartsherrie Vol.1, 'Coal-cutters 1867'; Coatbridge, W.B. & Co. mSS. GLB.19, 460. John Alexander to ? 8 June 1867.
 113. Brit.Pat.3759 [1869].
 114. Strathclyde, W.B. & Co. MSS. Lease Book No.3, folio 583.
 115. Coatbridge, W.B. & Co. MSS. GLB. Vol.22, 116, John Alexander to Henderson,Wallace & Co. 15 December, 1870.

The knowledge gained enabled John Alexander to develop a modified version in 1871 which he patented in December¹¹⁶, and it was this machine which aroused widespread interest.¹¹⁷ After extensive trials in March 1872 the company decided that they were at last in a position to undertake the making of coal-cutting machines in numbers.¹¹⁸ Inquiries from colliery companies and the trade press were now welcomed. In August the Iron and Steel Institute held its meeting at Glasgow and many of its members visited Gartsherrie where they saw the coal cutter at work.¹¹⁹ By October 1872 when members of the Lanarkshire Colliery Managers Institute visited Espieside orders had been received from the Hetton Coal Company, Newcastle, Highleigh Colliery Manchester, the Reading Coal Company, John Galloway and Company, Hurlford, and Jonathan Hyslop, Wishaw. William Baird and Company itself had six on order.¹²⁰

In November 1872 an agreement was signed whereby Miller and Anderson of the Vulcan Works undertook to produce machines for sale at £200 of which £20 was to go to William Baird and Company.¹²¹ However in the following February William Baird and Company decided in view of the great interest in their machines, that they would build their own engineering works to produce coal-cutters.¹²² In the

116. Brit.Pat. 3438 1871

117. Engineering 21 July 1871.

118. Coatbridge, W.B. & Co. MSS. GLB. Vol.22, 430 John Alexander to Miller & Anderson, 19 March 1872.

119. Glasgow Herald 8 August 1872.

120. Engineer 11 October 1872.

121. Coatbridge, W.B. & Co. MSS. GLB.Vol.24, 379 William Jardine to Miller & Anderson, 28 November 1872.

122. Ibid. p.686. John Alexander to Miller & Anderson, 21 February 1873.

meantime Miller and Anderson continued to produce machines and in July 1873 their works was fully employed in coping with orders including at least one from France.¹²³ During the 1874 strike the company had six machines constantly at work producing 400 tons per day - the output of 150 men - and 30 machines were being assembled for sale to eager customers.¹²⁴ Modifications of the machine were patented under Alexander's name in 1874 and 1875.¹²⁵ A machine embodying all the improvements was exhibited in America at the Philadelphia Exhibition of 1876 where it won a medal.¹²⁶ A number of versions were produced including a stoop-and-room model,¹²⁹ a specially strengthened version for use in the shale pits of Young's Paraffin Oil Company,¹²⁸ and a model only two feet high for particularly narrow seams.¹²⁹ James Brownlie of Glasgow was appointed the company's agent in 1876 responsible for publicity and sales.¹³⁰

William Baird and Company did most of its experiments with different machines at Gartsherrie No.1 pit and at Espieside No.3, one in Espieside No. 5 and one at Lockwood No.1 pit.¹³¹ In the

123. Engineering 25 July 1873.

124. Engineer 22 May 1874.

125. Brit.Pat.3009 [1874]; Brit.Pat. 674 [1875].

126. United States Centennial Commission, International Exhibition, 1876 Reports and Awards Group I (1878).

127. Coatbridge, W.B. & Co. MSS. GLB.Vol.30, 181, John Alexander to David Gray & Co. 23 February 1877.

128. Ibid.Vol.24, 779 John Alexander to Managing Director, Young's Paraffin Light and Mineral Oil Company, 15 March, 1873.

129. S.F. Walker, Coal Cutting by Machinery (1902), 41.

130. Coatbridge, W.B. & Co. MSS. GLB.Vol.28, 791, William Jardine to James Brownlie, 11 January 1876.

131. Strathclyde, W.B. & Co. MSS. Valuation Book Gartsherrie Vol.2, 'Coal-cutters 1873-4'.

following year three machines were added at Cairnhill No. 7 and in 1876-7 Haugh No.1 had one machine, and Barrwood had three. Finally, two were introduced at Bothwellpark and four were added the following year.¹³²

Although inquiries were received during the 1880s¹³³ and the machines were still manufactured in the early 1890s,¹³⁴ there would seem to have been a very distinct decline in interest after 1880. The company itself had apparently stopped using them at Kilsyth by 1880 and with the closure of the Espieside and Lochwood pits in 1881, their use in the Monklands also ceased. There is indeed a possibility that even before that date the machines had been converted to serve as underground haulage engines.¹³⁵ They continued in use at Bothwellpark until 1894.¹³⁶

Basically the machine consisted of a bogie on rails to which was fitted a single or double cylinder engine driven by compressed air which drove an endless chain fitted with cutting teeth round a jib projecting from the side of the bogie. Particularly important modifications - mostly introduced by Alexander - were the fitting of an additional system which caused the machine to haul itself forward; the alteration of the angle of the jib and the perfection of a swivel system for withdrawing the jib to allow freer movement; and an improved form of teeth and simpler method of fitting them to the chain.

The company claimed that in an eight hour shift the machine could

-
132. Ibid. Vol.2, 'Coal-cutters 1876-7 and 1877-8', Vol.3; 'Coal-cutters 1878-9'.
133. Coatbridge W.B. & Co.MSS. GLB. Vol.34, 965.
134. Ibid. Vol.40, 539. A.K. McCosh to A.M.Rendel 8 June, 1893.
135. Strathclyde, W.B. & Co.MSS. Valuation Book Gartsherrie 'Coal-cutters 1878-9' a marginal note in pencil refers to the possible use of some machines as haulage machines.
136. Strathclyde, Managers Notebook Gartsherrie 'Pay rates June 1894'. (W.B. & Co.MSS).

could cut along a face of 350 feet using a driver and two assistants producing with the additional aid of 19 oncost men 75 tons of coal, the equivalent production of 33 colliers.¹³⁷ In 1872 the difference in cost in favour of the machines was put at 3.02p per ton.¹³⁸ At trials carried out by the Hetton Colliery Company the Gartscherrie cutter proved superior to a Firth machine though Firth insisted that the model of his machine used in the trials was an outdated one.¹³⁹ At Hyslop's Cobbinshaw pit Wishaw, the best daily output was only 54 tons, though this was obtained under adverse conditions and using an early version of the machine.¹⁴⁰ Moreover after the initial teething troubles had been ironed out the saving in costs ranged between 4.17p and 5p per ton. At Berlieth colliery despite the exceptional hardness of coal, the Gartscherrie machine cut through 414 feet in a shift of 9 hours.

Despite such successful trials and favourable comments the machine fell into disuse nationally, and was eventually abandoned by the company itself. One reporter, writing with the advice of Mark Brand, a director of William Baird and Company stated that employee hostility compelled the company to give up using the machine,¹⁴¹ while another claimed to 'have it on good authority' that inadequacies in the machine tool industry were to blame.¹⁴² No doubt both factors played a part. It can hardly be mere coincidence that the last

137. Coatbridge, W.B. & Co. mSS, GLB.Vol.27, 362 'Cost of working by machine and by hand' 30 December 1874.
138. Hyslop, Colliery Management, 360.
139. Walker, Coal Cutting by Machinery, 41.
140. Hyslop, Colliery Management, 361.
141. Colliery Guardian 28 May 1901.
142. The National Coal Board Scottish Division, A Short History of the Scottish Coal-Mining Industry (1958), 76.

Gartsherrie cutters were given up at the time of the great strike of 1894. Hyslop also had difficulty in getting his men to work with the machine.¹⁴³ Equally there were considerable problems involved in actually building a machine which did not experience rapid deterioration in the conditions under which it had to operate. Chain coal cutters suffered particularly in this respect in comparison with other machines. There were other reasons. The machine was difficult to operate. John Alexander wrote to Johnston at Bothwellpark that the Gartsherrie engineer would instruct the Bothwellpark engineer in the working of the machine. He continued, 'There need be no nasty feeling in the matter because neither Black nor any other man (without a great deal of experience) can know the little nick nacks connected with them'.¹⁴⁴ In addition the rapid fall in miners' wages after the peak of 1873 and the steady expansion of output during the late 1870s and 1880s removed the twin factors of high costs and restricted output which had provoked the widespread demand for the introduction of mechanical coal cutting.

Although it had a rather short life span the Gartsherrie coal-cutter was of enduring significance. It was the first machine fitted with proper cutters instead of modified pick teeth which meant that it cut through the coal like a metal-cutter instead of like a miner's pick.¹⁴⁵ Its self-hauling action and movable jib were also important features. Mavor and Coulson who became a leading manufacturer of coal-cutters began production of their original machine in 1897 following

143. Hyslop, Colliery Management, 361.

144. Coatbridge, W.B. & Co. MSS, GLB.Vol.30, 746, John Alexander to J. Johnston 17 September 1877.

145. Walker, Coal-Cutting by Machinery, 42.

detailed examination of a model of the Gartsherrie cutter found by one of their employees in a Glasgow junk shop the previous year.¹⁴⁶ Although during the 1880s and 1890s disc and bar cutters overshadowed chain cutters in Britain the evolution of chain coal-cutters continued in America. Many of the features of the Gartsherrie machine exhibited at Philadelphia were embodied in the American machines and subsequently re-introduced in to Britain. In the twentieth century chain machines rapidly overtook both disc and bar types as the most widely used form of coal-cutter.¹⁴⁷ The Gartsherrie machine was the first practical machine of this type ever used.

Just before the First World War coal-cutters were re-introduced at the company's pits though there are no details concerning the type used, or the nature of the power source. In 1912 coal-cutters were in use at Bothwellpark, Bothwell Castle, Craighead and Dumbreck. In Ayrshire where some Gartsherrie coal-cutters had been used in the 1870s¹⁴⁸ - and where they presumably suffered the same fate as in Lanarkshire - machines were also at work in 1912. They were in use at Craig, Auchincryvie, Bartonholm and Gilminscroft.¹⁴⁹ In this respect the company reflected the strong Scottish trend towards mechanisation which was more marked than that in England. This was probably an indication of the poorer nature of the coal seams being worked in Scotland.

-
146. From information supplied by Mr. Alastair Warren, whose source was J.B.Mavor of Mavor and Coulson.
147. R.A.S. Redmayne, Modern Practice in Mining 5 vols (1908-1932) Vol.5, 132.
148. Coatbridge, W.B. & Co. MSS, GLB.Vol.22, 147, John Alexander to Robert Angus, 23 December 1871.
149. List of Mines 1912.

Although the company did not pioneer the development of coal-face conveyors - the first was at work in 1905¹⁵⁰ - it developed its own machine at an early date. At the beginning of 1909 a 'Bothwell' conveyor, designed and patented by Richard McPhee the manager at Bothwell Castle, was erected at Bothwell Castle Colliery. It consisted of 'a series of bogies running on patent rails and sleepers of ingenious construction [which] reduce the cost of lifting and laying to a minimum'.¹⁵¹ The number of men at the face was reduced by half compared with hand labour and during its first fifteen months of operation it cost nothing for either upkeep or repairs. By July 1910 the company had three such conveyors at work with a fourth under construction and one was being made by Dickson and Mann of Armadale for a Yorkshire colliery company.

The first colliery to use electricity was probably the Trafalgar Colliery, Forest of Dean in 1882.¹⁵² In Scotland, Earnock Colliery, Hamilton used electricity possibly in the same year.¹⁵³ The Bairds showed some interest in electricity for lighting, but in November 1884 it was decided that 'in view of modifications at present in prospect in electric lighting we do not propose going further in the matter meanwhile'.¹⁵⁴ Almost three years later McCosh wrote that, 'we are not likely to need the electric light unless the time should come when it is cheaply and efficiently applied to colliery work in the working faces of the mine.'¹⁵⁵ The company's attitude towards

150. Coal Mining Practice (1958) edited I.C. Statham, Vol.1, 11

151. Iron and Coal Trades Review 29 July 1910.

152. Electrical Equipment in Mines, ed. H.Cotton (1955), 13.

153. Mining Association of Great Britain, Historical Review of Coal Mining, 167.

154. Coatbridge, W.B.&Co.MSS, GLB.Vol.36, 241, A.K. McCosh to Mason Brothers and Company 6 November 1884.

155. Ibid. Vol.38 482. A.K. McCosh to W.Geighal 5 July 1887.

the use of electricity as a motive power is not recorded but in 1894 the new pit, Dumbreck No.2, had an electric motor.¹⁵⁶ A second was added in 1899 in which year one was also set up at Bothwell Castle. From that date on the extension of the use of electricity was rapid; to Gartshore and St. Flannans in 1901-2; to Craighead and Haugh in 1903-4; to Bedlay 1906-7; to Barrwood in 1908-9; and to Twechar in 1909-10.¹⁵⁷ By 1914 electricity was in use in Ayrshire at Auchincryvie, Craig, Loudon, Portland, Bartonholm, Common, Barony, Doura, Eglinton, Highhouse, Ladyha and Tofts.¹⁵⁸

In the treatment of coal after it had reached the pithead many new technological aids were introduced in the latter part of the nineteenth century, in order to improve quality and reduce wastage. In 1877 McCosh began to inquire into the possibility of erecting a mechanised sorting table,¹⁵⁹ and in 1880 something of the sort was at work at Bothwell Castle.¹⁶⁰ By 1886 powered screens were in use at Springhill and Hallhill.¹⁶¹ In 1876 inquiries were made concerning the different kinds of coal crushing plant available

-
156. Strathclyde W.B. & Co. MSS, Valuation Book Gartsherrie, Vol.6 'Coal Pits 1894.'
157. Ibid. Vol.6 'Coal Pits 1902'; Vol.7 'Coal Pits 1903-4, 1906-7, 1908-9, 1909-10'.
158. List of Mines 1914.
159. Coatbridge W.B. & Co. MSS. GLB. Vol.30, 758, A.K. McCosh to James Brownlie 18 December 1877.
160. Strathclyde, W.B. & Co. MSS. Valuation Book Gartsherrie Vol.3, 'Coal Pits 1880.'
161. Ibid. Vol.4, 'Coal Pits 1886'.

and in August two Carr's Disintegrators were bought for £435¹⁶².

The earliest coal washer would seem to be one erected at Gartshore at a cost of £405 in 1878, and made for the company by David Gray

and Company.¹⁶³ In 1885 McCosh wrote to R.Robinson, patentee of a new coal washer which had been favourably reported on by Robert

Angus.¹⁶⁴ At least one was erected shortly afterwards and at the beginning of 1888 two others were erected and three more were

being built.¹⁶⁵ By 1890 washers were at work at Gartshore, Bothwell Castle, Springhill, Bothwellpark, Mainhill and Palacecraig.¹⁶⁶

At the beginning of 1893 two sample lots of anthracite were sent to Schuch-Kermann and Kremer of Dortmund, and following successful trials the company decided to buy a washing machine to handle 100 tons per day of each of the two types of coal.¹⁶⁷

No doubt similar developments took place in Ayrshire. In only one instance, however, is there detailed evidence of progressive innovation. At Lugar, the company erected the first Scottish plant and one of the first in Britain, for the manufacture of briquettes.¹⁶⁸ The plant, capable of producing over 50,000 tons per annum was built in 1886 to make use of the fine Bute Jewel dross which had previously been used to heat the blast at the Lugar and Muirkirk furnaces. With the introduction of closed tops and the erection of by-product recovery plant recycled furnace gases had replaced dross.

-
162. Coatbridge, W.B. & Co. MSS. GLB. Vol. 29, 466 A.K. McCosh to Frederick G. Tyler 22 August 1876.
163. Strathclyde, W.B. & Co. Valuation Book Gartsherrie, Vol. 3 'Coal Pits 1878'.
164. Coatbridge, W.B. & Co. MSS, GLB. Vol. 36, 823. A.K. McCosh to R. Robinson, 19 June 1885.
165. Ibid. Vol. 38, 959, Lawrence Crawford to R. Robinson 27 January 1888.
166. Strathclyde, W.B. & Co. MSS. Valuation Book Gartsherrie, Vol. 5 'Coal Pits 1890'.
167. Coatbridge, W.B. & Co. MSS, GLB. Vol. 40, 348 A.K. McCosh to Elsneth and Co. 2 March 1893.
168. Iron and Coal Trades Review 24 September 1886; Engineer 24 September 1886.

The timing of most of the innovations discussed confirms the general impression gained when considering the pig-iron side of the business. The company was somewhat lacking in imaginative leadership until after the mid-1870s. The drive to perfect a workable coal-cutter during the 1860s may be put down to the strong personal interest shown by James Baird even though he was semi-retired. The company's record in the latter part of the nineteenth century shows it to have been fully alive to the need to innovate in order to maintain and improve its position in the Scottish coal industry.

Coke Production.

An important subsidiary of coalmining in which William Baird and Company became prominent in the second half of the nineteenth century was the manufacture of coke. Though it did not promote any new inventions the company's rise to a leading position in the trade was characterised by a progressive policy of innovation. In England the manufacture of coke was closely identified with the production of both pig and finished iron. This remained true during the second and third quarters of the nineteenth century because few areas had coal suitable for direct charging into the furnace. The Bairds built coking ovens at Gartsherrie along with the first furnace but with the change over to the use of raw coal these became redundant. For a generation thereafter the manufacture of coke was irrelevant to the company's interests.

The discovery of a good quality coking coal at Faskine led to a re-awakening of interest and early in 1863 some coking ovens were built at Faskine No.7 pit.¹⁶⁹ The early 1860s also marked the commencement of the firm's involvement in the Kilsyth district and

169. Coatbridge, W.B. & Co. MSS. GLB Vol.14, 345 John Alexander to J.J. McLintock 26 March 1863.

though the company's main interest was in the deposits of ironstone the properties leased proved to be richly endowed with good coking coal. In October 1863 the company decided to sink Gartshore No.5 to the coking coal and when this had been successfully shanked in 1867, 48 coking ovens were built at a cost of £1,536, and £300 spent on railway sidings.¹⁷⁰ During the next half century the district was the centre of the company's coking activities.

Using figures supplied by Ralph Moore, the Inspector of Mines, A.K. McCosh estimated that the annual output of coking coal in the Kilsyth district was 120,000 tons, and in Slammanan 60,000 tons, and that Scottish foundries would consume 80,000 tons of coke in melting 264,000 tons of pig iron.¹⁷¹

Encouraged by such estimates plans were made in December 1868 for the erection of a further 12 ovens at Palacecraig at a cost of £360.¹⁷² In order to reduce the amount of handling required after the coal had been coked, ground at Port Dundas was leased early in 1869 from the canal company and 31 coking ovens were begun at an estimated cost of £950.¹⁷³ These came into full production in 1871, though only 29 were actually built and the final cost came to £1,207.24p. In the same year 40 ovens situated on an adjoining plot at Port Dundas were bought from J.Watson.

The ovens built were all of a standard beehive type but the

170. Ibid.Vol.19, 725, A.K.McCosh to Glasgow office 9 October 1867.

171. Ibid.Vol.20, 757, A.K.McCosh to David Wallace 7 December 1868.

172. Ibid. Vol.20, 771, A.K. McCosh to Glasgow Office 14 December 1868.

173. Ibid.Vol.21, 42, A.K. McCosh to Glasgow Office 3 March 1869.

174. Strathclyde, W.B.& Co.MSS. Valuation Book Gartsherrie, Vol.2, 'Coke Ovens 1870'.

company was constantly on the watch for new ideas. In October 1872 John Alexander wrote to A.M.Chambers of Sheffield asking him for statistics showing in what way his patent copper coking ovens were superior to the beehive type, but nothing apparently came of this.¹⁷⁵

Following a lull of a few years the purchase in 1874 of the coke ovens at Dovecotwood, Kilsyth, belonging to Messrs Black and Rennie for £300, marked a resurgence of activity.¹⁷⁶ Ground was selected at Haugh and preparations made for the building of 112 ovens¹⁷⁷ but later in the year it was decided to restrict this to two benches of 56 ovens.¹⁷⁸ Instead 30 new ovens were built at Port Dundas to burn Kilsyth coal and these were completed by March 1876, at a cost of £1,469.44p.¹⁷⁹ Attention was turned back to Haugh where by March 1878 an additional 20 ovens had been built and agreement reached on the building of another 84.¹⁸⁰ It was in connection with these ovens that McCosh wrote to the Gartcosh Brickworks asking their opinion on the feasibility of glazing the interior of the new ovens.¹⁸¹ By February 1878 the number of ovens

-
175. Coatbridge, W.B. & Co.MSS. GLB.Vol.27, 69 John Alexander to A.M.Chambers 12 October 1872.
176. Strathclyde, W.B. & Co.MSS.Valuation Book Gartsherrie Vol.2 'Coke Ovens 1874'.
177. Coatbridge, W.B. & Co.MSS.GLB.Vol.27, 826 A.K.McCosh to A.R.Duncan of Kilsyth. 20 April 1875.
178. Ibid.Vol.28, 521 A.K.McCosh to Jones & Wilson 2 November 1875.
179. Ibid. Vol.28, 761 A.K.McCosh to A.R.Duncan 6 January 1876; Strathclyde, W.B. & Co.MSS, Valuation Book Gartsherrie, Vol.2 'Coke Ovens 1876'.
180. Coatbridge, W.B. & Co.MSS. GLB.Vol.30, 246 A.K.McCosh to Jones & Wilson 14 March 1877.
181. Ibid.Vol.30, 246 A.K.McCosh to Gartcosh Brickworks 15 March 1877.

at Haugh stood at 160,¹⁸² erected at a total cost of £11,301.83p. These new furnaces enabled the company to produce a firmer and better coke than before.¹⁸³ By this date the Faskine and Palacecraig ovens had been demolished and coke production was now confined to Kilsyth and Glasgow.

The expansion of the later 1870s made William Baird and Company the most important firm of coke manufacturers in Scotland.¹⁸⁴ A small amount - 1,425 tons in 1878¹⁸⁵ was consumed at Gartsherrie, partly in the furnaces and partly at the works foundry. Some was also sent to the Ayrshire works.¹⁸⁶ Most of the output of the ovens was intended for general sale and the firm continued to tie its policy decisions to market research. As early as December 1871 inquiries were made concerning the current price F.O.B. of good coking coal at North of England ports, and also the price F.O.R. of good foundry coke.¹⁸⁷ In the following May McCosh again inquired about these prices explaining that 'our object is to judge if possible competition with our Scotch coking coal'. In fact it was William Baird and Company who competed with English manufacturers by selling coke in the North of England. Besides supplying foundries, breweries, glassworks and forges, the company included among its customers some fellow pig iron makers such as the Summerlee Iron Company and Carron Company.¹⁸⁹

-
182. Strathclyde W.B. & Co. MSS, Valuation Book Gartsherrie Vol. 3 'Coke Ovens 1878'.
183. Engineer 15 February 1878.
184. Engineering 14 August 1879.
185. Strathclyde W.B. & Co. MSS, Gartsherrie Furnace Abstract 1878-79.
186. Coatbridge, W.B. & Co. MSS. GLB. Vol. 20, 234 William Jardine to Eglinton Iron Company, Kilwinning 4 April 1868; Ibid. Vol. 21, 301 William Jardine to Charles Howatson, Muirkirk Ironworks 28 August 1869.
187. Ibid. Vol. 23, 129 John Alexander to P. Haggie 18 December 1871.
188. Ibid. Vol. 23, 521 A.K. McCosh to P. Haggie 20 May 1872.
189. Ibid. Vol. 27, 129 Memo to North British Railway Company; Ibid. Vol. 3, 93 J.B. Thorneycroft to Summerlee Ironworks 1 May 1878.

During the early 1880s the 32 ovens at Dovecotwood were demolished¹⁹⁰ but later in the decade as the economy began to show signs of recovery, fresh plans were made. These included - apparently for the first time - an important development in Ayrshire. With the continuing decline of ironstone mining the company closed several of its Dalry ironstone pits but in April 1887 an arrangement was made by which the company would work some of the Dalry coal using the abandoned ironstone pits.¹⁹¹ Samples of the coal were sent to the famous Creusot works in France belonging to Schneider and Hannay, where they were tested and found to give satisfactory results in the Bauer patented by-product ovens. By an agreement of June 1887 Elsner and Neuhardt, holders of the patent agreed to build a 40 chamber oven of the new circular type guaranteed to produce not less than 60 tons of coke per 24 hours. The royalty was to be only half that paid by Schneider and Hannay.¹⁹² When the British rights were transferred to an English agent, a supplementary agreement was signed by which William Baird and Company and the Eglinton Iron Company were to continue to enjoy a lordship of half that ruling at any time they agreed to build additional Bauer ovens.¹⁹³ With the erection of the plant under the supervision of Paul Schramm, sent from Germany, the company became one of the first in Britain to commence the movement away from the hitherto virtually universal beehive oven.¹⁹⁴ In so doing it showed itself to be ahead of not only most British firms but even the best American practice.

190. Strathclyde, W.B. & Co. MSS, Valuation Book Bartscherrie, Vol.3 'Coke Ovens 1884'.

191. Engineering 13 May 1887.

192. Strathclyde W.B. & Co. MSS, E.I.C. Lease Book No.2. folio 513.

193. Ibid. folio 516.

194. Iron and Coal Trades Review 16 March 1888.

By 1889 with the demand for coke outstripping capacity and the price rising steadily 124 new ovens were added at Kilsyth at a cost of £11,400.¹⁹⁵ During the 1890s the ovens at Port Dundas which by then were between twenty-five and thirty years old, were demolished.¹⁹⁶ At Haugh modernisation of the older plant including the building of three more ovens, was carried out at a cost of £5,167.25p.¹⁹⁷

Another significant advance occurred in 1897 with the signing of an agreement with the Semet Solvay Company of Brussels giving William Baird and Company the right to erect 50 of their patented by-product coking ovens,¹⁹⁸ and these were begun at Dumbreck in the same year. By 1899 these had been completed at a cost of £27,750 for the ovens and £29,420 for the associated by-product plant.¹⁹⁹ A further 50 Semet Solvay ovens were begun immediately and 50 more were added in 1905.²⁰⁰ By 1907 the total additional cost of the coke ovens and by-product plant at Dumbreck came to £88,297.79p.²⁰¹ In the meantime some of the older ovens at Haugh were pulled down - 28 in 1902, and a further 45 in 1903.²⁰²

195. Strathclyde, W.B.& Co.MSS, Valuation Book Gartsherrie Vol.4 'Coke Ovens 1889'.

196. Ibid. Vol.6 'Coke Ovens 1894'.

197. Ibid. Vol.6 'Coke Ovens 1894, 95, 96'.

198. Strathclyde W.B.& Co.MSS, Lease Book No.7 folio 45.

199. Strathclyde WB.& Co.MSS, Valuation Book Gartsherrie Vol.6 'Coke Ovens 1899'.

200. Ibid. Vol. 7 'Coke Ovens 1905'.

201. Ibid. Vol.7 'Coke Ovens 1907'.

202. Ibid. Vol.7 'Coke Ovens 1902 and 1903'.

The erection of the Semet Solvay ovens confirmed William Baird and Company's leading reputation. At the turn of the century only a handful of British companies had adopted by-product ovens.²⁰³ On completion of the Dumbreck plant the company turned to its new Bedlay Colliery and began the erection of Semet Solvay ovens there. By 1911 a total of £65,488.20p had been spent at Bedlay on the ovens and by-product plant.²⁰⁴

The growth of productive capacity was reflected in a steady increase in the consumption of coking coal and a corresponding growth of output and sales of coke. From about 50,000 tons of coal in 1878-9 consumption trebled to 150,510 tons in 1890-91.²⁰⁵ The demolition of the Port Dundas ovens and the modernisation of those at Kilsyth corresponded with a gradual reduction of consumption of coking coal in the first half of the 1890s. With the renewed expansion of productive capacity at Dumbreck consumption again began to expand. During the years 1900-1905 it ranged between 200,000 and 250,000 tons as expansion at Dumbreck counteracted contraction at Haugh. Thereafter expansion at Dumbreck and the developments at Bedlay led to rapid growth of consumption, which by 1910-11 stood at 415,345 tons. Productivity remained remarkably constant over the period. At Gartshore hard coke required between 30 and 33 cwt. of coal for every ton.²⁰⁶ With the erection of the by-product ovens at Dumbreck the amount of raw coal required was reduced to around 27 cwt.²⁰⁷ In general therefore the figures for

203. Ryland's Directory of Iron Steel and Colliery Trades 1906, 487.

204. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie, Vol. 6 'Coke Ovens 1911'.

205. See Appendix C Table 2.

206. Strathclyde, W.B. & Co. MSS, Gartsherrie Furnace Abstracts 1882 on.

207. Ibid. Abstract 1906-7 and 1908-9.

coke production move in a similar way to those for coking coal consumption with the underlying trend throughout the period being very strongly upwards.

Besides a constantly growing market for coke in Scotland, the North of England and Ireland, the company also became a significant consumer itself. In 1879 1,425 tons of coke were sent to Gartsherrie for use in the furnaces, and by 1882-3 this had risen to 2,092 tons.²⁰⁸ Thereafter, until 1886, deliveries fell, coinciding with reduced pig iron output, the introduction of by-product recovery plant at the furnaces, and expansion of furnace coal output from the new pits at Bothwell. In 1887, however, deliveries turned sharply upwards to 3,775 tons and had more than doubled to 8,843 tons by 1896.²⁰⁹ Expansion was rapid thereafter, being particularly marked as the new ovens at Dumbreck, and later Bedlay, came into production, and by 1913-14 the Gartsherrie furnaces were consuming 74,890 tons of coke per annum.^{210.}

In fifty years the coke manufacturing sector of the company's business expanded rapidly to become a significant user of the company's capital and major consumer of its output of coal. Moreover it not only extended the range of the company's market involvement but latterly came to make a sizeable contribution to the supply of fuel for the pig iron furnaces.

Sales.

William Baird and Company had its origins in the small coal business carried on by some of the Baird brothers in the fourteen

208. Ibid. Abstract 1882-3.

209. Ibid. Abstract 1896-7.

210. Ibid. Abstract 1913-14. Appendix C, Table 4.

years prior to 1830. When Gartsherrie works was built, the sale of coal continued. Although there is no information for the 1830s the implication of the gap between the estimated production of coal by the company and the consumption of the Gartsherrie furnaces is that sales did occur. However, the narrowing gap between the two sets of figures, and the leasing policy already described, indicate that the sale of coal quite definitely became a secondary pursuit during the years 1830 to 1860.

Alexander Baird continued to have charge of the Glasgow end of the coal sale business while the Gartsherrie office took responsibility for overseeing local sales. At Gartsherrie a small fraction of sales were 'on the hill', that is at the pithead. In June 1845, such sales realised a revenue of £19.49p in sums of between 17.5p and £2.42.5p per day.²¹¹ This practice persisted into the 1860s, with the contractor or manager of each pit being responsible for his own sales. Sales to local industry were much more important. Through the Glasgow Office contracts were arranged such as that signed with James Kelly in 1841 by which he was supplied with 4,000 tons of coal in lots of 400 tons for the first three months and 300 tons thereafter.²¹² A fruitful source of orders was the various local works erected on land leased or feued from the Baird brothers such as Coats Ironworks, the Caledonian Tubeworks, and McGilchrist's Foundry.²¹³ Coal was sold to other local businesses such as the Holm Forge of Robert Donald at Bellshill, Thomson and

-
211. Strathclyde, W.B. & Co. MSS, Cash Book Gartsherrie 1845-6 'June 1845'.
212. Strathclyde, Robert Baird MSS, James Kelly to W.B. & Co. 27 July 1841.
213. Coatbridge, W.B. & Co. MSS, GLB. Vol. 6, 105 'List of some coal buyers August 1853'.

company Glenboig, the Coatbridge Gas Light Company, the Garnkirk Coal Company and the Bedlay Limestone Company.²¹⁴ In 1845 William Dixon and Company, a rival pig iron manufacturer at Calder Ironworks, bought coal from William Baird and Company at a cost of approximately £400 per month.²¹⁵ Regular sales were made to various local companies including the Wishaw and Coltness Railway Company, the Garnkirk and Glasgow Railway Company, the Scottish Central Railway Company and the Monkland Railway Company.²¹⁶ Other West of Scotland companies also appear as purchasers of Gartsherrie coal such as Fergus Miller and Company Heathfield, Meldrum and Company, and the Chemical Works, Bathgate.²¹⁷ For several years prior to 1858 the Glasgow and Suburban Gas Company took the entire output of parrot coal from the pits at Faskine and Palacecraig.²¹⁸

It is inaccurate to write of William Baird and Company as entering the market as sellers of coal at some particular point in its later history in response to developments in either the pig iron or the coal market. It was a seller of coal throughout its history, though in the early years it did not actively seek to expand this branch of its activities as a sector equal to pig iron manufacture. Nevertheless, gradual growth of sales was such that by 1861-2 they accounted for 26.24% of the coal produced in

214. Ibid. Vol.2, 301; Vol.5, 79; Vol.12, 159.

215. Strathclyde, W.B. & Co. MSS, Cash Book Gartsherrie 1845-6 passim.

216. Coatbridge, W.B. & Co. MSS, GLB. 2, 17; Vol.2, 378; Vol.3, 467.

217. Ibid. Vol. 6, 340; Vol.11, 39.

218. Ibid. Vol.11, 39 John Campbell to Meldrum and Company, 17 June 1858.

the Gartsherrie district.²¹⁹ Thereafter the sale of coal was of steadily growing importance in both absolute and percentage terms. This growth was especially rapid in the years up to the beginning of the 1880s- by 1883 the percentage of raw coal going for sale was 49.57²²⁰ Certainly, during the remainder of the 1880s, there is some indication that the company actively sought to extend coal sales while the market for pig iron remain depressed, and by 1890-91, sales accounted for 72.13% of output. From that date until 1914, although the absolute tonnage sold grew steadily with some fluctuation, sales as a percentage of output varied between 65% and 73%, apart from 1913-14 when it fell to 61.97%. In this latter period besides sales of raw coal coke sales were of growing importance.

Although local firms continued to be important customers, they could not account for the much larger quantity being sold by the company in the latter years of the century. Unfortunately, only isolated references to specific customers survive. Some went to the expanding domestic market, and to every kind of industrial enterprise in the West of Scotland, including foundries gasworks, forges, bottleworks, limeworks and breweries. Lists of railway rates show the areas to which coal was sent from the company's pits. In general the Monkland and Bothwell pits sent coal to the North Lanarkshire and Clydeside region, while the

219. Strathclyde, W.B. & Co. MSS, Gartsherrie Furnace Abstract 1861-2.

220. See Appendix. C Table 3.

Denny/Kilsyth pits distributed to customers throughout Scotland and parts of England, though this wider market was probably for coke rather than coal.²²¹ Another source gives a detailed breakdown of the destination of coal sold from Craighead in November 1878, and this is produced in table V:3²²²

TABLE V:3

Coal Sent from Craighead in November 1878

Destination	Tons	Destination	Tons
College Stn. (Glas.)	65.45	Maryhill	5.3
Alexandria	32.85	Milngavie	5.25
Cowlairs	254.2	Cardross	5.15
Partick	83.2	Hawick	5.2
Renton	10.7	Leith	5.15
Dalmuir	10.8	Total	483.25

Shipments were important, as is shown by the dispatch of 10,196.4 tons from Greenock alone in 1880.²²³ One market which the company attempted unsuccessfully to break into was that for naval contracts.²²⁴

To manage and develop the increasingly important coal marketing side of the business, special salesmen were appointed. Judging from their salaries such posts were considered very important indeed. A list of salaries at Gartsherrie for August 1883 placed J.K.Jarvie, coal salesman first with £37.50.²²⁵ Next came Robert Partick with a monthly salary of £12.50p - equal to that of W.J.Dunnachie the senior

221. Strathclyde, W.B. & Co.MSS, Railway Rates and Distances Book passim.

222. Coatbridge, W.B. & Co.MSS, GLB. Vol.31, 494 J.B.Macdonald to W. Findlay 24 December 1878.

223. Ibid.Vol.33, 391 W. Jardine to W. Laird 1 March 1881.

224. Iron and Coal Trades Review 22 November 1889.

225. Coatbridge, W.B. & Co.MSS, 'Salaries August 1883'.

Table V:4. Profit Margin on coal produced at Carlincroft No.1 pit, selected months, 1854-56 (in pence).

Date	Aug. 1854	Oct. 1854	Dec. 1854	Aug. 1855	Oct. 1855	Dec. 1855	Aug. 1856	Oct. 1856	Dec. 1856
Selling price	31.9	29.1	29.1	23.8	29.1	31.9	25	25	26.9
Production cost.	22.6	25.0	21.6	21.8	19.7	16.0	16.5	20.2	23.8
Profit margin.	9.3	4.1	7.5	2.0	9.4	15.9	8.5	4.8	3.1

Source: Strathclyde, W.B. & Co. MSS, Coal Abstract Book Gartsherrie 1854-1856.

joint manager of Gartsherrie works. In Ayrshire where shipments, especially to Ireland, were probably of considerable importance, the company had a full time agent, John Logan, with offices at the North Quay, Ayr and the Harbour Buildings, Ardrossan who arranged coal shipments to France, Spain and Norway.²²⁶

Attempts to assess the relationship between price and cost and thereby gain some impression of this side of the business are bedevilled not merely by the fragmentary nature of the surviving data. Equally serious problems are the frequent variations in prices and costs and the fact that different seams of coal in the same pit and even the same seam from different pits had different working costs. Furthermore, coal prices seem generally to have been governed by a fairly elementary demand/supply relationship so the difference between cost and price probably varied quite markedly.

The only early figures which allow a consideration of costs and profits are in an abstract for the period June 1854 to July 1857.²²⁷ This gives somewhat theoretical costs in the sense that they are based on certain assumptions - for example, that the cost rates of coal to dress working is the same as the ratio of their prices. The costs given are too low in modern accounting terms since they apparently make insufficient allowance for interest and depreciation. Representative of all the data is that for Carlincroft No.1 pit presented in table V:4. What emerges most clearly is the continuous and often considerable fluctuation in

226. Kelly's Directory of Shippers (1884) 'Eglinton Iron Company.

227. Strathclyde, W.B. & Co. MSS, Coal Abstract Book, 1854-56.

profit margin from month to month brought about for the most part by variations in costs. The largest item involved in costs was of course wages. For example in May 1885 the percentage of working costs accounted for by wages was as follows; Gartgill 62.6%; opencast 62.1%; Carlincroft 69.5%; Gartsherrie 60.1%, Sunnyside 71.4%. However a further analysis of the data shows clearly that the significant influence on profit margins was the nature of the working conditions in the pit. Whenever a loss was recorded, the most important cost increases occurred in connection with either wood, oncost working, or miscellaneous items proper to pit maintenance or some combination of these. For example, when opencast No.2 worked at a loss in December 1854, oncost charges at 4 p, were more than twice the average for all pits in the Gartsherrie estate. Likewise in August 1856 wood charges and miscellaneous charges at Gartgill No.2, then operating at a loss, were 2.92p and 4.89p respectively compared to an average for the estate of 1.15p and 1.38p.

It has not been possible to construct a long run table of output costs for the company. The furnace abstracts do, however, give details of the price of coal - both the company's own and purchased - as charged against the furnace account. Presumably the output price given for the company's own coal bore some relationship to production cost, but it has not been possible to discover exactly what the relationship was. The figures are presented in table V:5 together with comparative figures giving the U.K. average pithead price of coal over the same period.

Several interesting features emerge, notably the high price of Gartsherrie coal during the 1880s relative to the other two series, and the enduring reversal of the relationship from the early 1890s onwards. The explanation may lie in the high development costs experienced by the company at both Bothwell and Kilsyth. Secondly, there is almost complete correlation between the peaks and troughs for Gartsherrie and the U.K. with the single exception of 1890-91. The relationship with the purchased coal series, although strong, is not quite so marked. For purchased coal the upward movement of prices shows a tendency to be more marked than for the other two series reflecting the especially strong demand for such coal at times of vigorous economic activity.

Table: V:5

Average Pithead Price of Coal 1882-1913

Year	Gartsherrie	Purchased	U.K.
1882-3	32.4	24.5	26.7
3	35.1 P	26.2 P	28.3 P
4	34.0	22.1	27.0
5	29.5	21.7	25.9
6	26.5 T	23.3	24.1 T
7	28.4	20.3 T	24.1
8	30.5	25.6	25.4
1889-90	34.6	35.7	30.8
1890-91	38.2	38.2 P	41.2 P
1	38.3 P	36.2	40.0
2	29.7	28.6	36.3
3	30.3	30.3	34.2
4	28.9	29.2	32.9
5	25.6	26.8	30.0
6	25.1 T	25.1 T	29.2 T
7	26.3	27.1	29.6
8	33.1	38.5	31.7
9	35.7	50.4	37.9
1900	41.6 P	58.2 P	54.1 P
1	36.6	43.0	46.7
2	34.9	39.3	41.2
3	33.6	35.0	38.3
4	31.3	33.0 T	36.3
5	30.4 T	35.4	34.6 T
6	35.8	40.9	36.3
7	42.9 P	56.8 P	45.0 P
8	37.9	40.4	44.6
9	35.3 T	40.7	40.4 T
1910	37.6	37.7 T	40.8
1	37.3	42.0	40.8
2	43.3	56.1 P	45.4
3	54.2 P	54.3	50.8 P

Note: The U.K. price is for the calendar year 1882 and so on. All prices are pence per ton.

Source: The Gartsherrie and Purchased prices are from the Annual Furnace Abstracts. The U.K. prices are calculated from Taylor's article 'Labour Productivity...'

P = Peak T = Trough.

Purchases of Coal.

Despite their own extensive collieries William Baird and Company were on occasion compelled by circumstance to purchase coal from other firms. During the 1856 strike contracts were signed with three companies in Clackmannanshire- the Devonside Coal Company, the Alloa Coal Company, and the Clackmannan Colliery - for the supply of a total of 300 tons per day.²²⁸ In the event the contracts were too large. Some was sold to the Summerlee Iron Company, and some diverted to the Eglinton Ironworks, but eventually the outstanding quantity of 2,700 tons had to be resold to the companies concerned.²²⁹ Somewhat similar action was taken in the face of the restrictive policy of the miners in 1870-71, when despite strong demand for pig iron the output of the Scottish furnaces fell owing to a reduction in the output of raw materials. To alleviate the effects of restriction the company entered into contracts with salemasters for the supply of furnace coal. Agreements were signed with J. McAndrew and Company, the Provanhall Coal Company, the Stevenston Coal Company, and Robert Dick of Wyndedge Colliery.²³⁰ The Provanhall Coal Company alone supplied

228. Coatbridge, W.B. & Co. MSS, GLB. Vol. 9, 163 David Wallace to Walter Lunn, 19 April 1856; Ibid. Vol. 9, 241, John Campbell to Clackmannan Colliery Co. 16 May 1856.

229. Ibid. Vol. 9, 407 David Wallace to Clackmannan Colliery Co. 24 July 1856.

230. Ibid. Vol. 21, 905 W. Jardine to J. McAndrew and Co. 27 June 1870; Ibid. Vol. 21, 919 W. Jardine to Provanhall Coal Company 5 July 1870; Ibid. Vol. 21, 949 John Alexander to Stevenston Coal Company 28 July, 1870; Ibid. Vol. 22, 26 Robert Dick to William Baird and Company, 8 November 1870.

34,000 tons of coal between July 1870 and July 1871.²³¹

Of greater consequence than these temporary sallies into the market as coal buyers was the long term trend which led the company to become a regular and constant buyer of furnace coal to supplement its own resources. It is impossible to date precisely the beginning of this practice but from 1882 purchases never - except in strike years - fell below 19,000 tons. This was equivalent to not less than 10.2% of the supply from their own pits.²³² At their peak in 1905-6 purchases amounted to 88,488 tons - equivalent to 59.6% of the deliveries from their own pits. Attention has been drawn in the past to the declining proportion of Scottish coal output taken by pig iron production. As a corollary of this, emphasis has been laid on the tendency of the ironmasters to become 'sellers' of coal on a large scale and so become direct competitors with the salemasters. If, however, the experience of William Baird and Company was shared by other pig iron manufacturers, then some salemasters found a new and growing market for coal in the latter years of the century as a result of the entry into the market - as buyers - of the hitherto self-sufficient ironmasters.

Between 1861 and 1910 William Baird and Company increased its annual coal output in the Gartsherrie district by 463%. Even so it was forced to use large quantities of coke in the furnaces

231. Ibid.Vol.22,714 James McKinlay to Provanhall Coal Company 21 July 1871.

232. Strathclyde, W.B. & Co.MSS. Gartsherrie Furnace Abstracts 1882 on.

and buy furnace coal from other companies. Clearly, the shortage of Scottish splint coal which became all too obvious after the First World War was an important factor long before 1914. Indeed, the Bairds had been forced well before the turn of the century to use coal other than the famed Scottish Splint in the furnaces at Gartsherrie. A note of December 1869 reveals that 19% of the coal fed into the furnaces in that month came from the Kiltongue and Virtuewell seams,²³³ and an analysis of the furnace coals used in 1879 gives data for pyotshaw as well as splint.²³⁴ Thus, despite increasing economies in the consumption of furnace coal, the use of varieties other than splint, the substitution of coke for coal, and greatly expanded total output of coal, William Baird and Company became important consumers of purchased coal.

Organisation and Control.

Initially William Baird and Company was a small firm with one furnace located on the estate from which it obtained the necessary furnace coal. The brothers themselves were directly involved in the management of the pits, as with the ironworks. This was the particular task allotted to George Baird,²³⁵ with the more technical aspects of colliery control being the responsibility of William Cameron, originally a collier in the Baird's Rochsolloch pit.²³⁶

The company probably first introduced a contracting system

233. Coatbridge, W.B. & Co.MSS, 'Furnace Coal Gartsherrie December 1869'.

234. Coatbridge, W.B. & Co.Mss, 'Furnace Coal 1879'.

235. McGeorge, Bairds of Gartsherrie, 118.

236. Ibid. 76

as a method of control at their more widespread ironstone pits and adopted the system at their coal pits as these increased in number and became too far flung for any one brother to do more than supervise. Under the system as operated by the company a pit or group of pits was put in the charge of a contractor who sought the right to work the pit for an agreed price per ton of coal put out. William Baird and Company having opened up the pit handed it over to a contractor who became responsible for maintaining it, and paying the colliers. Various refinements were introduced over the years. For example in 1849 a new arrangement debited contractors with all rails received from William Baird and Company and credited them with all unbroken returns.²³⁷ At stocktaking on 31 May each year they paid for any deficiency. Although the system was fairly standard there do appear to have been variations. In some instances a section of the workforce - usually the oncost men - was paid directly by the company. At the original Gartsherrie pits no overall contractor was appointed although certain aspects of the work of the pit were put out on contract.²³⁸

The contract method of pit control was widespread in Scotland and in various parts of England, notably Staffordshire.²³⁹ The reasons for its adoption by William Baird and Company were no doubt the same as those which applied to other companies. The motivation provided by a payment-by-results system proved an appropriate way of ensuring effective management. It was especially suited to a situation in which the expansion in the number of pits and their widespread location made supervision difficult. Moreover at a time of rapid growth in the

237. Coatbridge, W.B. & Co. MSS, GLB.2, 281 David Wallace to J. & T. Wilson 15 January 1849.

238. Ibid. Vol. 5, 448 Contract by Andrew Bent, 13 April 1853.

239. A.J. Taylor, 'The Sub-contract System in the British Coal Industry' in Studies in the Industrial Revolution presented to T.S. Ashton ed. L.S. Presnell (1960).

coal industry generally there were not sufficient suitably qualified mineral overseers available and therefore reliance had to be placed on technically competent but often uneducated men who were in many instances ex-colliers. The limited scale of individual pits and the simplicity of the technology involved in actual working made such control effective. Also the nature of the labour-force, often transient, often inexperienced, and generally undisciplined, made constant below ground supervision essential.

When the company acquired the Blair Ironworks and associated pits, they introduced their control methods, even to the extent of bringing down contractors from Lanarkshire to do things the Baird way.²⁴⁰ It is probable that they used the same methods at their other Ayrshire pits.

Above the contractors, control was initially exercised directly from the ironworks in each district. As district mining centres developed at some distance from the works sub-offices were opened to take charge of day-to-day administration. Thus an office was opened at Twechar to supervise the pits in the Denny/Kilsyth district while in Ayrshire one was opened at Cumnock for the pits in that area.

It is as difficult to date the demise of the system as it is to date its introduction though a tentative date for the resumption of direct company control would be in the late 1860s. By that date improvements in communication made centralised control feasible. With the development of a supply of trained personnel it became possible to appoint salaried company officials. Such men were increasingly necessary as the scale and depth of individual collieries increased and the working methods and technology used became more sophisticated. Moreover, government legislation, especially concerning

240. Glasgow Herald 24 May 1852.

safety - notably the Mines Regulation Act of 1872 - increased the company's legal obligations and compelled them to appoint certificated managers. Originally the company had been primarily concerned simply to ensure the production of sufficient coal to feed the furnaces. Waste and inefficiency were tolerated during the early years when costs were low and reserves abundant. After 1870 the cheap extraction of all the coal became an important consideration and management of the pit by piece rate was no longer appropriate. Moreover, as the sales grew in importance, proper handling of the coal became vital - not just high output.

On the coming into effect of the 1872 Mines Act on 1 January 1873, the company did not have certificated managers to put in charge of all their collieries. On 3 February William Jardine wrote to the Inspector of Mines informing him that unqualified men would be appointed meantime.²⁴¹ How quickly qualified managers assumed responsibility at every colliery is unclear. Even when they had done so, contracting continued at a lower level. Particular jobs within the pit were still put in contract to certain workers who employed a squad to carry out the work.

Some indication of the growing control exercised by the company's managers is seen in the reduction on the number of pits supervised by each man. In February 1872 four men were responsible for the supervision of forty-four pits²⁴² in the Gartsherrie district. By 1888 there were seven managers for thirty-four pits.²⁴³ In addition by the latter date under-managers were also employed at almost every pit.

241. Coatbridge, W.B. & Co. MSS, GLB.24, 626 William Jardine to Inspector of Mines 3 February 1873.

242. List of Mines 1888.

243. List of Mines 1906.

The contracting system was appropriate given the conditions which faced the company in its early days. Under the changed conditions which the company faced at the end of the century legal obligation merely reinforced the pressure on the company to abandon a system which had outlived its usefulness.

CHAPTER VI

CHAPTER VI

Entrepreneurship and Management.

Among the owners of William Baird and Company in the period 1830-1914 were several individuals who were recognised in Scotland as national figures. If for no other reason, the wealth accumulated by William and James Baird entitles them to be ranked among leading Victorians.¹ The firm - the major one in what was for much of the century Scotland's most important industry - was controlled by men who played a leading role in the development of Scottish Railways and banking, as well as in religious and political life. That they have been widely ignored by modern economic historians is probably explained by the fact that they remained, in British terms, regional figures. To many contemporary Scots and to English industrial and political leaders they were familiar and highly respected men. Nevertheless, the history of the company does not provide support for the Schumpeterian view that great firms were generally led by a single pivot on which everything turns.² The classic entrepreneurial function of decision making was at no time exercised exclusively by one man. The pattern was one rather of collective leadership - albeit by a hierarchical group - and this apparently provided a pool within which were found all the principal elements of entrepreneurship, without giving rise to the disunity and factionalism to which group leadership systems are prone.

-
1. Their joint wealth at death was £2,169,653.18.3, plus \$741,473, plus estates whose purchase price exceeded £550,000. It might also be borne in mind that bequests during their lives, made mostly to the Church of Scotland, probably totalled some £750,000.
 2. Schumpeter's views are put forward in Joseph Schumpeter, The Theory of Economic Development (1934) and Business Cycles 2 vols. (1939).

T.S. Ashton has drawn attention to the need to consider the non-economic factors of social background, heredity, education and marriage which influenced businessmen.³ These features have also been examined and compared with the significance as assessed by Charlotte Erickson in the group of entrepreneurs in the steel industry studied by her.

The Baird Brothers.

The original partnership, formed in 1830, consisted of William, Alexander, James, Douglas and George Baird. In 1840 Robert and David Baird were admitted as partners. The remaining brother John, was never a member of the firm, but continued instead the family's traditional pursuit of farming. No record of the deed of co-partnership, or subsequent alterations has been traced, although it does seem probable, in spite of the fact that it was a family firm, that some legal record was made. Certainly by the date of the first death in the partnership (that of Douglas in 1854) a formal contract of co-partnership had been signed.⁴ The original partners all held an equal share, i.e., one-fifth, which was reduced when Robert and David joined since they were given one-twelfth each.⁵ When the brothers formed the Eglinton Iron Company in 1845 to erect their Ayrshire works they probably held equal shares. Robert and David, who died in 1856 and 1860 respectively, both held shares in the Eglinton Iron Company which exceeded in value their holdings in William Baird and Company, although the inventories of Douglas (d.1854)

3. C.Erickson, British Industrialists - Steel and Hosiery 1850-1950, (1959) XII.

4. Sheriff Court House, Dumfries, Inventory of Estate of Douglas Baird, recorded 7 December 1854.

5. McGeorge, Bairds of Gartsherrie, 109.

and Alexander (d.1862) make it clear that the latter company was the more valuable⁶.

The brothers owed their rise solely to their own inherent qualities as developed by their parents. They were little indebted to formal education and not at all to business or technical training. Nor did influential or wealthy associates, or advantageous marriage smooth their paths. Unquestionably their father's success eased their entry into business. Indeed some writers have described Alexander as of the first entrepreneurial generation.⁷ The Dalserf, Rochsolloch and Merryston colliery leases as well as the original Gartsherrie and Cairnhill leases prior to the erection of the works all include his name. With the exception of Dalserf, about which nothing can be established, the undertakings were all run exclusively by the sons. Alexander's importance lay in his local standing and sound financial reputation which made possible successful negotiation of the leases. He himself concentrated on farming, and latterly

-
6. Sheriff Court of Lanarkshire [Glasgow,] Inventory of Estate of Robert Baird, recorded 15 June 1857.
 Sheriff Court of Roxburgh and Berwick, Inventory of Estate of David Baird, recorded 29 March 1861.
 Sheriff Court House, Dumfries, Inventory of Estate of Douglas Baird.
 Sheriff Court of Lanarkshire [Glasgow,] Inventory of Estate of Alexander Baird, recorded 4 June 1862.
 Their shares were valued as follows:

	Robert 1857	David 1861	Douglas 1854	Alexander 1862
W.B. & Co.	£39,323.18.8	£46,331.2.4	£109,447.9.11	£ 104,245
E.I.C.	£46,387.19.10	£78,462.19.11	£ 30,113.3.1	£ 94,155.11.11

7. T.J. Byres, 'Entrepreneurship in the Scottish Heavy Industries 1870-1900', Studies in Scottish Business History, ed. P.L. Payne (1967), 268.

on the improvement of his estate of Lochwood. In 1829 his health began to fail and in the following year he made over all his leases to his sons who formed William Baird and Company. It is unlikely that he instigated a single initiative with regard to the firm with which the Bairds are so closely identified, and doubtful indeed if he made a significant 'entrepreneurial' contribution to the coalmining enterprises carried on earlier. While, therefore, he was unquestionably an important influence on his sons' early development, perhaps even to the extent of determining their future choice of career, it would seem more realistic to regard them as the first generation of entrepreneurs.

In her study of British industrialists Charlotte Erickson has assigned them to social class according ^{to} their father's status a) at the time of the sons birth or b) at the time they set up in business.⁸ Between the birth of his eldest son and the erection of the first Gartsherrie furnace Alexander advanced from small tenant farmer to landowner. Categorized even according to a) the Bairds cannot be described as of humble origin, although journalists tended in later years to imply this, perhaps because it made good copy. They sprang from a family which to all intents and purposes held a hereditary right to farm certain pieces of land in Old Monkland;⁹ it was an employing rather than an employee family,¹⁰ and in the local context would have been classified as middle class today.

8. Erickson, op.cit. 10.

9. McGeorge, op.cit. 16 refers to the great-great-grandfather of the Gartsherrie brothers (born c.1659) who was 'tenant in Kirkwood and Highcross'.

10. Ibid. 40.

The level of formal education varied. For William, Alexander, George and Douglas the three Rs, as imparted either at the Parish School or the school in the village of Langloan, were all that they received, and, apparently, all that they desired. McGeorge makes special mention of their lack of interest. William, 'was never an expert scholar'¹¹, Alexander 'was never a good scholar'¹², Douglas 'was not ready in learning his lessons',¹³ and George had 'a capacity for learning much like that of the others'.¹⁴ According to James's own account, he also received a basic education and left school at twelve years of age.¹⁵ Another source maintains that he attended Glasgow University for a time, where his jovial rollicking behaviour made him very popular among the other students but interfered with his studies, his stay consequently being of short duration.¹⁶ His name does not appear among the published list of matriculated students, though this is not definite proof of non-attendance. If he did attend, it seems certain that it made little contribution to his education. Robert showed decidedly atypical interest at school and was encouraged to go to University where he directed at least his later studies towards a legal career. His name appears in the prize lists on two occasions, but apparently he did not graduate, a far from unusual occurrence at the time. David also showed promise at school, but his studies were repeatedly interrupted until after his father's death. He then attended Glasgow and Edinburgh universities followed by a brief stay in Paris.

11. Ibid. 45.

12. Ibid. 47.

13. Ibid. 112.

14. Ibid. 117.

15. Ibid. 48.

16. Scotsman 21 June 1876.

Their educational deficiencies did prove restrictive in later life. Alexander's shortcomings made it necessary to bring Robert in to deal with all the correspondence of the Glasgow office. William and James were very poor public speakers and in the House of Commons they remained uncharacteristically silent. James wrote lengthy, one thousand word letters with highly individualistic punctuation.¹⁷ The brothers as a group had the reputation of being bluff, hard-headed, forceful men lacking in subtlety, refinement and culture. Yet James was typical of many highly intelligent men who received scant formal education. His deep interest in Burns and the Covenanters led to his becoming an expert on both subjects.

Apart from Robert's term of apprenticeship to a Glasgow writer, none of them were ever in outside employ. Any business training or technical expertise was acquired in the course of assisting their father on the farm or running the coal concern. Yet they did not run the firm in the style of modern directors, delegating the actual management to experienced employees. All the partners actively held administrative posts, and in the early years at least they worked with very few assistants.

William and James have emerged as the twin architects of the company's success. In some respects their prominence rests on fortuitous circumstances. As eldest brother, William gave his name to the firm, and gained public recognition thereby. James lived longer than any of the others and was still alive, and nominal head of the firm, when many of the popular accounts of the family were written in the 1870s. His gift of £500,000 to the Church of Scotland

17. E.g., University of Strathclyde, RB.MSS, James Baird to Robert Baird, 10 May 1847.

made him a household name; and it was his autobiographical sketch, as edited by McGeorge, which was published. Indeed James has frequently been described as the real leader of the firm.

The position of these two is based on very substantial evidence. James managed the works at Gartsherrie and supervised the building of the first Eglinton furnaces. During this time he introduced new developments in furnace design, hot blast systems, colliery equipment and plant layout, all of which earned for the works an international reputation, and directly influenced the development of the iron industry in Scotland and beyond. He was prominent too in extra-firm activities, more especially railways. He was at various times on the provisional committee, or board proper, of eight railway companies, being chairman of four.¹⁸ He is said to have played a key role in salvaging the fortunes of the Caledonian Company when it was apparently doomed to disaster in 1850.¹⁹ He was also a director of the Forth and Clyde Canal,²⁰ the Western Bank,²¹ The Glasgow Joint-stock Feuing Company²², and the Glasgow News.²³ At his death his moveable estate was valued at £1,190,868.14.5, plus \$564,473, to which must be added landed estates, purchased mainly in the 1850s for over £300,000.²⁵ His early determination to master

-
18. Glasgow Courier 18 October 1845, 21 October 1845 and Bradshaw's General Railway Directory, Shareholders Guide, Manual and Almanack (sic.) 1850 on, passim.
 19. J. Butt and J. J. Ward, 'The Promotion of the Caledonian Railway Company' Transport History, Vol. 3 (July 1970) 225-257, Vol. 3 (Nov. 1970) 164-192.
 20. McGeorge, op. cit., 105.
 21. SRO, Extracted Process 156, Closed record in the case of the Western Bank versus James Baird, 16 March 1865.
 22. Scotch Reformers Gazette 3 May 1845.
 23. Glasgow Herald 21 June 1876.
 24. Sheriff Court of Ayrshire, Inventory of the Estate of James Baird, recorded 18 August 1876.
 25. J. S. Jeans, Gallery of Western Worthies (1872), 79.

any task he was set continued throughout his life and he became knowledgeable in many branches of ironworks technology. His strength did not lie in original imaginative thinking but in finding the best way of applying the ideas of others. His forceful character made him an ideal chairman of committees where he pulled up lengthy speakers with the remark, 'Are you done? Let us get on with the business'.²⁶ Determination and fixity of purpose, often seen as narrowmindedness sprang from an unlimited self confidence. In many respects he closely resembled London society's image of the hard-headed but vulgar Scots businessman.

For all James's undeniable talent, he himself yields pride of place to William, of whom he wrote, 'In our greatest undertakings, it was always my brother William who gave the orders to advance. And I must here say that the success of the Company was in great measure owing to his great capacity, his almost unequalled business habits, his great power of utilizing to the best advantage the means within his power, by which he gained the confidence of all who dealt with him'.²⁷ He too played a prominent part in Scottish railway expansion as a member of the provisional committee or actual board of nine companies, though he was chairman of only one, the Caledonian.²⁸ This was not surprising since in contrast to James, William was of a quiet retiring disposition, preferring to act behind the scenes, and in consequence he 'never took the public place for which his talents and attainments fitted him'.²⁹ A good example of the high regard for his business acumen which his contemporaries had is provided

26. Edinburgh Evening Courant, 21 June 1876.

27. McGeorge, op.cit 73.

28. Glasgow Courier, 11 September 1845, 7 October 1845, 18 November 1845, Scotch Reformers Gazette 19 April, 1845; Bradshaw's General Railway Directory 1850 on, passim.

29. Coatbridge and Airdrie Advertiser, 12 March 1864.

by an incident during his directorship of the Western Bank. He first became a shareholder in December 1837 and was elected to the Board in June 1839. The other directors were apparently taken by surprise in June 1845 when he fell due for retirement, and the manager Donald Smith wrote to him, 'It is of the utmost importance to the bank to retain your services, and the Directors are of the opinion that the rules must be superseded to serve a case which (like me) they had not contemplated.'³⁰ Accordingly a new class of 'Honorary Director' was created and William duly elected. For the next year he acted as an additional ordinary director until he could be legally re-elected to the board in June 1846. Like James he made little general impact in the House of Commons, though his advice was often sought in private, as for instance when he was invited to sit in on a meeting between Peel and the Scottish peers on the proposed Bank Bill for Scotland in 1845.³¹ In so far as accumulation of wealth is an indication of ability William might be considered the more outstanding, bearing in mind that he died twelve years before James. The moveable estate was valued at £978,785.3.10, plus \$177,000.³² His landed estates were purchased in the early 1850s for almost £250,000.³³ The company was not only fortunate to have two exceptionally able men at the head of affairs but to have two whose personalities and abilities complemented each other rather than clashed.

-
30. SRO. Extracted Process 156 July 1873. Closed record in the case of Western Bank and Liquidator versus William Baird.
31. University of Strathclyde, RB. MSS. W.B. to R.B. 10 April 1845.
32. Sheriff Court of Ayrshire, Inventory of Estate of William Baird, recorded 4 June 1864.
33. Library of the Procurators Fiscal Glasgow Hills Biographical Notices of Glasgow Men, Vol.1, page 110.

Inevitably the other brothers were overshadowed by William and James, and in consequence contemporary references to them are brief and repetitive. With so few details it is difficult to be absolutely certain about their contribution to the firm. David seems to have been the least outstanding of the family. He was only fourteen when the partnership was formed and did not join the firm until towards the end of the 1830s, being made a partner in 1840. His connection with the firm lasted only about fifteen years, this entire period being spent in the Glasgow office where Robert and Alexander were in charge. No evidence has been found of outside business commitments - significantly, he was the only brother not to hold a single railway directorship. Douglas likewise had limited influence. An original member of the partnership, he held a post in the Gartsherrie office during the 1830s, which consisted of taking charge of wage payments and the works accounts. From about 1840 he was manager of the Thankerton Colliery, a particularly important source of furnace coal. In this latter post he may well have exercised some independent authority, but on the whole he does not appear to have had a major say in the overall running of the firm. He had, however, some external business connections, being on the board of three railway companies,³⁴ and the ill-fated West of Scotland Malleable Iron Company.³⁵ In this latter he was simply 'the Baird' spokesman and perhaps the choice of Douglas illustrates the reluctance of the Baird involvement. McGeorge damns with faint praise by describing him as 'a very expert clerk' who 'performed well a great amount of work'.³⁶

34. Glasgow Courier, 21 October 1845, 23 October 1845; Bradshaw's General Railway Directory 1850 on, passim.

35. R.H. Campbell, 'Early Malleable Iron Production in Scotland', Business History IV (1961), pp.22-33.

36. McGeorge, op.cit. 113.

There are many indications that Alexander was a much more important member of the firm, who, far from riding to fame and fortune on his brothers' coat-tails, contributed directly to the company's success. As a youth, he earned a reputation for being able to impose his will on the others, a considerable achievement among what must have been an exceptionally strong-minded group.³⁷ To succeed in Glasgow, at the Monkland canal basin, as a coal salesman, without any previous experience and aged only sixteen, indicates a high level of ability. He was on the board of four railway companies, being chairman of one,³⁸ a director of the Forth and Clyde Canal, a member of Glasgow Town Council, and Baillie of the river Clyde.³⁹ During the 1857 financial crisis he joined the Board of the Western Bank in a last gasp effort to save the Baird's sizeable financial interest as both shareholder and depositor.⁴⁰ For forty years, he was in charge of a key area of the company's business, the sale department, and his 'singular ability' in this sphere was of considerable importance. Although advised, often in forceful terms, by both William and James, he was no mere figurehead. When William wrote during 1845 advising him on the best sales policy to pursue, it is evident that for a time he chose to ignore his brother's opinions and act according to his own judgement.⁴¹

37. Ibid. 46.

38. Glasgow Courier 11 September 1845, 18 November 1845; Bradshaw's General Railway Directory 1850 on, passim.

39. McGeorge op.cit. 103.

40. SRO, Extracted Process 156. Closed record Western Bank versus Thomas Dunlop and others, 146 Statement of Facts for Alexander Baird. He said that he was 'induced to take office to assist the bank in the then existing monetary crisis... but was ignorant of the bank's difficulties'. His bitterness over the Western Bank fiasco is reflected in a clause of his will which empowered his trustees to invest in anything 'except banks of all descriptions'.

41. University of Strathclyde, RB MSS, WB to RB 26 April 1845, 28 April 1845.

George, the remaining member of the original partnership was involved in the coal business while still in his teens, and became a partner at twenty. He apparently took general charge of all above ground colliery work until the brothers' expansion of business into Ayrshire, when he assumed control there, of both raw material and pig iron production. It was he who made the decisions concerning the cessation and recommencement of operations in Ayrshire. He also seems to have had a special interest in dealing with all leases negotiated by the company. He was on the Board of directors of two railway companies, including the long period of fourteen years on the Board of the Edinburgh and Glasgow Railway.⁴² He too left an impressive legacy. His moveable estate amounted to £918,457.17.3 plus \$279,450⁴³, while his main landed estates of Stitchill and Strichen had been purchased for £295,000.⁴⁴ The weight of circumstantial evidence would seem to indicate that he had definite talent.

Although older than Douglas and George, Robert's connection with the firm did not commence until later because of his initial intention of going into legal practice. He first became involved with William as part leasee and manager of the Thankerton colliery, before joining and quickly taking charge of much of the business of the Glasgow office. Distinguished by that 'rare combination of practical intelligence with sound judgement',⁴⁵ his abilities were recognised by his fellow merchants who elected him to the leadership of the Merchant House. His personal

42. Bradshaw's General Railway Directory, 1850 on, passim.

43. Sheriff Court of Roxburgh and Berwick, Inventory of Estate of George Baird, recorded 14 September 1870.

44. J.S. Jeans, op.cit 79.

45. Glasgow Courier 9 August 1856.

influence was such that although he was only Dean of Guild from October 1854 until his death in August 1856, he enrolled more new members than any previous occupant of the office. He played an active part in the promotion of five railway companies,⁴⁶ and was a Deputy Governor of the Forth and Clyde canal.⁴⁷ His interest was apparently confined to the merchanting side of the business, but he appears to have been an important and influential figure among Scottish merchants.

An important element in the success of the company was clearly the deep family loyalty among the seven brothers. No hint survives of even the slightest dispute. That their interests and abilities covered the range of activities of the company and complemented one another was a source of strength. Indeed, it was probably an advantage that they were not all men of outstanding entrepreneurial ability, since the tension within such a partnership might well have proved a handicap.

All the brothers apparently shared a single motivating purpose - the desire to raise the family to a secure position of social prominence. This necessitated the acquisition of wealth, which, in the circumstances of the time, seemed most likely in the iron industry. There was no deep attachment to the Scottish iron industry or indeed to industry as such. So soon, therefore, as it became possible they began to disengage themselves from the firm and concentrate on their deeper aim of achieving social recognition. It was apparently for this reason that the brothers who had children brought them up to be cultivated gentlefolk.

46. Glasgow Courier 18 October 1845, 23 October 1845, 25 October 1845; Bradshaw's General Railway Directory 1850 on passim.

47. McGeorge op.cit. 110.

John George Alexander Baird, a son of William, after Eton and Christ Church, Oxford; a spell in the Dragoons and Lancers, became MP for Glasgow Central and a director on the Board of the North British Railway.⁴⁸ Another of William's sons, Edward William David was also educated at Eton, and also entered the army where he became Lieutenant Colonel commanding the County of Suffolk Hussars and a keen racehorse owner.⁴⁹ George's only son, George Alexander, after his education at Eton, devoted himself to racehorse owning and support of boxers, rapidly earning the reputation of black sheep of the family before dying in New Orleans where he had gone to act as second to his boxing protege in a championship fight.⁴⁹ Among the daughters Douglas's twins were typical. Jane Isabella married Fredrick Ernest Villers, son of the Bishop of Durham and nephew of Lord Clarendon, while her sister Charlotte Marion married Viscount Cole, eldest son of the Earl of Enniskillen.⁵⁰ Alexander, who died unmarried, left his estate of Urie to John and included a clause that after various bequests the residue of his estate should be invested and the income paid over to the holder of Urie, 'so that they may be able to live in a manner more becoming and suitable to their position and rank.'⁵¹

By the early 1850s the brothers were sufficiently confident that their fortunes were secure to hand the firm over to others, while they began seriously to put their wealth to good use in pursuing social advancement. In 1853 William bought the Ayrshire estate of Rosemount where he had lived since his retiral from the House of Commons in 1846,

48. T. Stothers, *Glasgow & Lanarkshire Illustrated* [Hamilton 1904-] part II, 18.

49. *Glasgow Weekly Mail*, 25 March 1893.

50. McGeorge, *op.cit.* 116.

51. Sheriff Court of Lanarkshire [Glasgow] Inventory of Estate of Alexander Baird, recorded 4 June 1862.

and in 1853 he purchased Elie, in Fife. The former cost £47,000 and the latter £155,000. James bought Greenfield, Ayrshire for £22,000 in 1853, renamed it Cambusdoon and commenced the building of a large mansion.⁵² In 1857 he bought Knoydart in the Western Highlands for £90,000. Douglas bought the Borders estate of Closeburn in two parts, the first in 1848, the second in 1851, for a total price of £225,000.⁵³ David acquired Stitchill, also a Borders estate, for £150,000 in 1853. In the following year Alexander bought Urie, Kincardineshire, for £120,000 and Robert bought Auchmedden, Aberdeenshire, for £60,000. A year later, George purchased Strichen, Aberdeenshire, for £145,000.⁵⁴ After carefully husbanding resources in the early years and ploughing back all profits into the firm, the brothers in a decade spent £1,115,000 on their main landed estates.

David, a keen hunter, chose his estate with sport in view and in order to take up residence immediately, he bought the mansion house complete with furniture.⁵⁵ His life as a country squire was cut short by a 'brain infection' in 1857, and after lingering for three months he died in 1860. Douglas, on acquiring the first part of Closeburn in 1848, spent much of his time there introducing large scale improvements. After purchasing the rest of the estate in 1851 he formally transferred his residence from Coats at Whitsun⁵⁶ in preparation for his marriage on 28 July to

52. A.H. Miller, Castles and Mansions of Ayr (1885), 47.

53. Memoirs & Portraits of One Hundred Glasgow Men (1886), Vol.1,13.

54. Library of the Society of Procurators Fiscal, Glasgow, Hills Biographical Notices of Glasgow Men, Vol.1, 110.

55. McGeorge, op.cit. 122.

56. Coatbridge Public Library, William Baird and Company, MSS, GLB. Vol.4, 73.

Charlotte, only daughter of Captain Henry Acton of the 12th Royal Lancers. Significantly, McGeorge thought it relevant to record that she was descended from Sir Edward Acton of Aldenham Hall, Shropshire, who was created a baronet in 1643. At Douglas's unexpected death in December 1854, his twin daughters became co-heiresses, he having died intestate.

Robert, although he frequently visited Auchmedden, continued to live at Cadder House, Bishopbriggs, not far from Glasgow and it would seem that he remained fairly active in the firm until his death in August 1856. His purchase of Auchmedden and the elaborate provisions of his will designed to ensure that it would remain in the Baird family reflect his desire to link the Gartsherrie Bairds with the ancient family of Baird who had held the land in the fifteenth century. McGeorge devotes the opening pages of his account to an attempt to provide this link, and mentions that the arms granted to the Gartsherrie brothers were based on those of the original Auchmedden family.

It is less certain when the other brothers withdrew from active management. McGeorge says that shortly after Alexander went to Urie his health began to fail, but he gives no indication of when he moved to his estate. If McGeorge is being precise, when he says that Alexander ran the sales department for forty years, then he would have given it up around 1856, possibly on Robert's death. This would, perhaps, correspond with the completion of the new mansion house at Urie.⁵⁷ In the same year he was appointed a Deputy-Lieutenant

57. Ordnance Gazetteer of Scotland, Groome, 6 vols. [1882-5], Vol. 6, p. 469. According to this source the large mock Elizabethan mansion was begun in 1855.

of Kincardineshire. Admittedly in 1857 he joined the Board of the Western Bank, but it is quite possible that he came to Glasgow specially for the purpose.

George was much attached to Stri~~ch~~chen, 'and lived a good deal there', but at first he still continued to run the Ayrshire side of the business. His last mention in the Blair papers occurs on 21st May 1857⁵⁸ and an agreement dated July 1858 between Blair and the company was signed by Alexander Whitelaw and William Weir. He apparently gave up his Glasgow house on purchasing Stritchen. In 1857 he stood unsuccessfully as Conservative candidate for the family seat of the Falkirk Burghs. In 1858 he married Cecelia, daughter of Admiral Hatton of Clonard, Wexford at St. George's, Hanover Square, London and thereafter threw himself into a determined campaign to become accepted by country society. The foundation stone of his 43-bedroomed Borders mansion, built at a cost of £34,000, was laid by the Duchess of Roxburghe in the presence of most of the leading Border families.⁵⁹ He was pressed to stand for Parliament, but having unexpectedly tasted defeat once, he declined. The circumstantial evidence would suggest that his fully active involvement in the firm ceased about 1857.

William, during the late forties and early fifties, lived mainly at Rosemount which was fairly conveniently situated about thirtyfive miles from Glasgow. In the early 1850s he came to the Glasgow office regularly but by July 1856 it had become necessary to send legal documents requiring his signature to Elie, rather than wait for his next visit.⁶⁰

58. SRO. Blair of Blair Muniments - box 4D, George Baird to Blair, 21 May 1857.

59. John M. Bulloch, The Last Baird of Auchmedden and Stritchen /Aberdeen 1934/ 7.

60. University of Strathclyde, William Baird & Co. MSS Leasebook No.1, 584. Robert Baird MSS, AW to RB 5 April 1850.

James was likewise beginning to withdraw from full time control at the beginning of the 1850s. Alexander Whitelaw in a letter to Robert Baird in April 1850 wrote, 'Now Uncle James is entangled with railways, especially the Caledonian, I suppose he'll give less attention to Gartsherrie.'⁶¹ The following year he entered Parliament remaining an MP till 1857. Even during the Parliamentary recess he did not always devote himself to the firm. On at least two occasions he spent the summer travelling on the continent. From about 1854 Cambusdoon became his principal residence, and on his retirement from Parliament he bought Knoydart where he spent the summer months hunting and yachting.

The conclusion must be drawn that during the 1850s the Baird brothers gradually relinquished active running of the firm to others. William, Alexander, James and George appear to have retained, in varying degree, a real if remote supervisory interest, while Robert remained an active partner until his death in 1856 and Douglas and David severed all but legal ties.

In twenty-five years the brothers had created one of the most important undertakings in Victorian Britain. Admittedly there was much in favour of anyone entering the Scottish iron industry in the early 1830s, but the fate of the highly talented Alexander Alison,⁶² as well as many lesser mortals serves as a clear indication that success was difficult to hold on to, and the outstanding success of the Bairds the result of more than simple good fortune. Specific examples, such as the

61. University of Strathclyde, Robert Baird MSS, AW to RB 5 April 1850.

62. Of Alison, Merry and Cunningham, who later branched out on his own but came to grief when his strenuous efforts to save himself failed with the collapse of the Ayrshire Iron Company.

doubling of the number of Gartsherrie furnaces, the timing of the purchase of Blair, the ability to exert effective pressure on railway companies, remain independent of speculators by avoiding overselling,, or create a premium for Gartsherrie iron on the highly lucrative American market, all indicate considerable business skill. Unfortunately, the absence of the appropriate type of family or business records makes it impossible to assess to what extent each of the brothers played a significant role in any particular event. The foregoing account goes far towards ranking the brothers in 'order of merit', but it is of more limited value as an indication of the quality of the entrepreneurial skill possessed by any one of them. The simple fact of the firm itself must stand as the sole measure of their collective ability.

The Second Generation.

The control of the firm now devolved upon Alexander Whitelaw, David Wallace and William Weir, three men who were in many respects different from the men they succeeded. They had come to play an increasingly influential role during the 1850s and the formal handover occurred around 1860 to 1862. Between 2 June 1859 and 5 September 1859 ten sasines were recorded detailing the transfer of numerous pieces of land by various brothers, mainly William, to all the partners in William Baird and Company.⁶³ This was followed by the admission of Whitelaw, Wallace and Weir as partners between 1860 and 1862 and then by a second series of sasines from May to October 1864 transferring the lands to the new partnership.

For Alexander Whitelaw and William Weir, Janet Baird's sons by her first and second marriage respectively, the path to the top was

63. SRO. General Register of Sasines, June to September 1859, passim.

opened by virtue of their being 'born to the purple'. Alexander born in 1823 and therefore only nine years younger than his uncle David, and William, born in 1835, were much closer to the Baird brothers, than their own sons. Moreover, they were brought up when the firm was still comparatively young and under circumstances more closely akin to the Bairds' own. Both Whitelaw and Weir senior were farmers in Old Monkland.

Alexander Whitelaw appears to have been made assistant manager almost immediately on joining his Uncle James at Gartsherrie in 1841. When James Baird entered Parliament in 1857 Whitelaw took over as manager but with the purchase of the Blair Works in Ayrshire in 1852 he became involved in wider Company affairs and was assumed as a partner in the Eglinton Iron Company. This deeper involvement was confirmed when he became a partner in William Baird and Company in 1860.

William Weir apparently entered the Glasgow office directly from school, but at all events he was a clerk there in 1852.⁶⁴ By 1856 he had moved to Blair Works⁶⁵ and as Uncle George withdrew, he assumed the principal charge of the Ayrshire end of the business. In 1862, at 27 years of age he became a partner.

David Wallace's family background and early years remain completely obscure. Born in 1822, he became an accountant in Glasgow before joining William Baird and Company, as head of the Gartsherrie office in 1846. That he was brought in from outside to take such an charge indicates that the Bairds thought highly of him. That he was

64. University of Strathclyde, William Baird and Company MSS. Railway Deeds Book, 198.

65. Coatbridge Public Library, William Baird and Company MSS. Gartsherrie Letter Book Vol.9,631.

given the post when aged only twentyfour is without parallel. Although his rise to a key managerial post at head office was probably achieved on his own merits, his actual assumption as a partner may well have been smoothed by his marriage to William Weir's twin sister Jane. By 1851 he was assistant manager and by 1859 manager at Gartsherrie.⁶⁶ Shortly afterwards he moved to the Glasgow office and in 1860 became a partner.

Not only did the Baird nephews, unlike the sons, actually enter the firm but they were educated with this in view. William Weir, his sister Jane, and their cousins, the children of the Bairds' second sister, Jane and Thomas Jackson, were educated at the expense of the Bairds, and it seems probable that the Whitelaws were too.

Douglas Baird, who paid for William Weir's education, issued instructions to his teacher that his studies should be aimed at preparing him for work in the counting house, which he had expressed a wish to enter.⁶⁷ Besides Arithmetic, Mathematics, Reading, French, Latin reading, and Pencil drawing, particular stress was laid on 'speaking English correctly, and for good style committing examples from the best authors to memory'. Douglas was, no doubt, very much aware of the Bairds own shortcomings in this respect. Alexander Whitelaw was educated at the Grange School, Sunderland, where he was taught by Dr. Cowan, son of Mr. Cowan who taught some of the Bairds, and considered a leading educationist. His instruction took a more practical turn with the emphasis on the technical side. He inherited the Bairds 'almost marvellous skill with figures', and possessed an astonishingly retentive memory. In his middle fifties

66. SRO.General Register of Sasines, 2 March 1859.

67. Coatbridge Public Library, William Baird and Company MSS. Gartsherrie Letter Book Vol.3,572. D. Wallace to Smeaton 17 October 1850.

he could repeat long sections of the sixth book of Euclid which he had not read since his school days.⁶⁸ On leaving school, he travelled on the Continent for a time, where he acquired some knowledge of German and Italian. Afterwards he studied mining before joining his Uncle James at Gartsherrie.

Alexander Whitelaw was clearly the leading figure of the trio. David Wallace was apparently an exceptionally able man, and his success against fierce opposition in getting the very important Bothwell Railway approved is clear indication of this.⁶⁹ Yet it would appear that on the whole he confined himself to straightforward internal administration, much in the way that he would have done had he not in fact been a partner. William Weir was very much the junior partner, being twelve years younger than his half brother, and resident in Ayrshire, away from the heart of the company's empire. Even there Alexander Whitelaw's predominance showed as for example when he took charge of the proceedings leading to the closure of the Blair Works.⁷⁰ Furthermore, Alexander was the special confidant of Uncle James, who although virtually retired, was still the controlling partner in the late sixties and early seventies.

Whitelaw's qualities were therefore, particularly important in considering the fortunes of the firm during this period. He was pre-eminently an administrator, who despite a weak heart, displayed a tremendous capacity for work. A phenomenal memory and dedication to detail ensured his grasp of any topic which he was required to handle. At the same time he knew well how to choose

68. Glasgow News 2 July 1879.

69. Glasgow News 17 August 1877.

70. SRO, Blair of Blair Muniments, Box 4E. Blair to AW 31 May 1871 and reply of 2 June 1871.

and handle men. He was responsible for bringing Robert Angus into the firm and probably J.T.Forgie also. It was this quality together with his organizational skills which won him the post of Chairman of the first Glasgow school board, where he welded together widely differing elements. In less than eight months a school census had been carried out, sites secured for fifteen of the thirty new schools required, 22,000 extra places made available, teachers selected, and buildings planned.⁷¹ Like his uncle James he was considered narrow minded and dogmatic. His views were of 'the strictest sect of Tories', and to him, 'when Lord Beaconsfield spoke it was wisdom, when he was silent it was wisdom'.⁷²

It is not surprising that from the mid-fifties to the mid-seventies the company showed definite signs of unimaginative though not incompetent leadership. The dynamism of the Baird brothers faded somewhat as they made their fortunes, became older and more secure, and gradually turned their interests elsewhere. The transfer of power was not sufficiently sharp and decisive. When finally brought about, it placed the company in the hands of three men, one of whom was as yet young and inexperienced and overshadowed by an accountant who was mainly preoccupied by internal matters and content to leave leadership to a man who, though possessed of many admirable qualities, lacked the vital spark of imagination and boldness, which had so distinguished his uncles.

71. Memoirs and Portraits of One Hundred Glasgow Men Vol.II, 339.

72. Glasgow Herald 2 July 1879.

William Weir remained unmarried, but rather significantly, David Wallace and Alexander Whitelaw pursued the same policy with regard to their families as had the Bairds. David's son John was educated at Harrow and Trinity College, Cambridge, prior to a life as a country gentleman.⁷³ The four Whitelaw sons likewise received their education at Harrow and Trinity though they went beyond being country gentlemen to include the equally acceptable pursuits of bank or railway directors, and in the case of Graeme and William membership of the House of Commons. The eldest son Alexander made a particularly acceptable match by marrying Disraeli's neice.⁷⁴ None of them became involved in the firm.

By the beginning of the 1870s the men who were to form the final partnership must already have been playing a significant role in the running of the firm. Whitelaw's involvement in local politics resulted in his becoming chairman of the Glasgow School board in 1873, while his concern with national politics culminated in his election as the first Tory MP to sit for Glasgow since the Reform Act of 1832. Presumably this restricted the time which he spent on Company affairs though probably not to the extent sometimes alleged. Instead of cutting down sharply on his company work the new tasks were simply added to existing commitments, a course which, in August 1876 led to his experiencing a stroke brought on by overwork. Nor were his sojourns in London entirely taken up with the House of Commons to which, like his uncles, he never became accustomed. In 1875 he was invited to join the original committee of the British Iron Trade Association⁷⁵ of which he was still a member in 1878. By November

73. Burke's Landed Gentry, 1896.

74. Burke's Landed Gentry, 1908.

75. Engineering 24 December 1875.

1878 he was virtually confined to his room at Gartsherrie House where he died the following July.

David Wallace also became less active in the firm during the early 1870s, partly through his involvement in local affairs, notably as chairman of two school boards, Old Monkland and Cumbernauld. More especially, however, his declining health forced long periods of absence on him. By 1876 he had to retire completely and he went to reside at his small Perthshire estate of Glassinghall bought in 1875.⁷⁶ He died there in August 1877, aged 55.

The Third Generation.

With Wallace's death and the incapacity of Alexander Whitelaw, the need for re-organization of the partnership became imperative. It would seem that, to some extent, pressure was exerted from below. Robert Angus threatened to leave the firm unless an attractive offer was made to hold him.⁷⁷ The fresh activity which followed their assumption as partners suggests that the new men were all eager for change. In February 1878 Alexander Whitelaw and William Weir were joined as partners by Alexander Fleming, James Baird Thorneycroft, William Laird, Robert Angus, John Alexander, and Andrew Kirkwood McCosh.⁷⁸ It was the most dramatic change to occur in the ownership of the firm, and consequently all the more regrettable that no detailed evidence has survived concerning it, particularly about such questions as whether the new partners paid for their shares, and if so, how. With the exception of J.B. Thorneycroft none of them were related to the Bairds. They represented

76. Glasgow Herald 17 August 1877.

77. Glasgow Herald 17 April 1923.

78. Engineering 4 February 1878.

the arrival in power of the professional bureaucrats who had been for some years past, gradually increasing the extent to which the running of the firm depended on them. Among them they had brought a wide range of talents to the service of the company. Differing markedly in family background, education, training and areas of interest these forceful influential men were bound together by a dedication to the interests of the firm, which might be said to have exceeded that of even the Bairds themselves.

They came from widely differing social backgrounds. James Baird Thorneycroft became involved with the firm presumably as a consequence of family ties, his mother being Alexander Whitelaw's sister Jane, a favourite of James Baird. On his father's side he came from a very distinguished family of finished iron manufacturers. His grandfather George B. Thorneycroft, first Mayor of Wolverhampton patented several inventions for the improved manufacture of iron.⁷⁹ As owner of the Shrubbery Works, he was a purchaser of Gartsherrie pig iron in the early days of the company and a personal friend of William and James. Andrew Kirkwood McCosh, although he did not go straight into the company's service, may well have been destined for the firm. He was not a blood relative but his family had close ties with the Bairds. His father, James McCosh, 'one of Scotland's most respected provincial lawyers',⁸⁰ acted for the Bairds right from the commencement of their Ayrshire involvement, and became a close personal friend. William Laird's father was a farmer at Crathies, Blairgowrie,⁸¹ but other than that

79. J.B.Owen, G.B.Thorneycroft of Wolverhampton (1856) passim.

80. The Baillie 13 March 1901.

81. Glasgow Herald 7 April 1899.

nothing is known, though the fact that he could provide his son with the necessary education, and then have him placed in a lawyer's office, would suggest that he was better off than the obviously poor father of Alexander Fleming. Nothing whatsoever has been unearthed about John Alexander's father, and it is not known what status of engineer Robert Angus's father was - a silence which usually suggests that in neither case was their parentage considered in any way distinguished. According to Erickson, the middle-class virtually monopolised power in the steel industry and American studies have tended to confirm the view that the number of leading industrialists who rose from humble origins has been exaggerated.⁸² The social composition of the third Baird group would suggest that the company considered ability above all else when choosing and promoting men.

In education and training they compare favourably with the Erickson norm in the supposedly more progressive steel industry. According to her study, fewer than 10% had a technical school training or University education in science before 1914.⁸³ While percentages are meaningless when dealing with only the Baird partnership, details of the individuals suggest that they were above the norm for the period in the extent to which they had either education or formal training appropriate to the industry. For those who specialized in the commercial side of the business formal vocational education did not exist. Thus Weir, Laird, Thorneycroft and Fleming acquired their expertise by the traditional method of occupying all the posts from junior clerk to manager. Criticism of late nineteenth

82. Erickson, op.cit.10

83. Ibid. 42.

century entrepreneurs in the iron industry has concentrated on the extent of education and training in science and technology and so it is the backgrounds of McCosh, Alexander and Angus which are of particular relevance.

A.K. McCosh studied science at the Universities of Glasgow and Edinburgh. His spell at Glasgow included a year under Professor McQuorn Rankine, at the end of which he took the prize in mechanical engineering.⁸⁴ He then served his articles with Ronald Johnston, a Glasgow civil and mining engineer, and immediately on completion of his training, he became civil and mining engineer with the Bairds. Robert Angus, the son of an engineer, was probably educated with a view to following in his father's footsteps. He qualified in the service of one of Scotland's foremost engineers of the time, Neil Robson,⁸⁵ and at least two of John Alexander's three brothers were engineers;⁸⁶ this lends strength to the impression that he received an appropriate education and training before gaining experience in the service of the Monkland Iron and Coal Company.

Nor was the company hostile to the use of appropriately educated personnel, nor to the fostering of scientific education among its own workforce. From 1853, if not earlier, the company made use of independent scientific experts, notably analytical chemists. By 1880 chemists were employed at the works. Far from being despised, as has been alleged was the case in the British iron and steel industry generally, the company's chemists were held in high regard. W.J.Dunnachie,

84. Journal of the West of Scotland Iron and Steel Institute Vol.23 (1916) 271.

85. Glasgow Herald 17 April 1923.

86. Sheriff Court of Lanarkshire [Airdrie] Trust Disposition and Deed Settlement of John Alexander, recorded 3 October 1895.

at Gartsherrie was made joint manager of the works. At Eglinton the works chemist, Stevenston, conflicted with all the company's normal standards being a rather eccentric atheist, vegetarian and esperantist, and yet he remained in the company's employ.

The Gartsherrie Academy Science and Art School had one of the finest equipped laboratories in the United Kingdom, surpassed it was claimed only by Macclesfield, Liverpool, Birmingham and Charterhouse. In 1878, it received the third largest payment-by-results grant of any school in Scotland. Subjects taught included mathematics, theoretical mechanics, applied mechanics, magnetism and electricity, inorganic chemistry, organic chemistry and steam. It had a class of sixty in mining at a time when only two other schools in Scotland, with eight students each, were listed as teaching the subject.

Immediately following the passage of the Technical Schools (Scotland) Act of 1887, A.K. McCosh, although not a member of the local School Board, wrote to the Government in an attempt to speed up the process involved in setting up a college. In 1890 Coatbridge Technical School, the only one created under the Act, was begun on ground given by William Weir.

With the special exception of Alexander Fleming the partners joined the firm when still young men, although, with the probable exception of J.B. Thorneycroft, all of them did have some experience with another firm. Thus Thorneycroft was 19, Robert Angus 23, William Laird 24, A.K. McCosh 24 and John Alexander 32. Of this group only Alexander had worked with a pig iron manufacturer, although Angus and McCosh had worked in related spheres. Broadly speaking therefore, they were, in the Baird fashion, trained within the firm.

Significantly, none of them started on the very bottom rung and their rise to a position of authority was very rapid. William Laird, on leaving Perthshire, stayed in Edinburgh for only a short time before going to Gartsherrie where he joined the Bairds in 1854 as 'the young man who looks after our house property.'⁸⁷ In 1858 he moved to the Glasgow office and established himself in the sphere of land ownership and leases besides apparently becoming investment and general financial supervisor for the partners in their private dealings. By the 1870s he was being described as an accountant in the Post Office Glasgow directory. By contrast, Robert Angus came in to the technical side of the business. He was in fact brought in to the firm by Alexander Whitelaw, who besides having close personal and business links with fellow Monklander Neil Robson, must presumably have known Angus's father who would also have been a contemporary of his in the Monklands. After a short spell at Gartsherrie and Kilsyth, on joining the company in 1858, Angus was made manager at Blair, and in 1860, his authority was extended to include Lugar and Muirkirk.

Angus may well have been brought in to provide technical skills in Ayrshire which could not be adequately provided by William Weir who was at that time moving to the forefront on the withdrawal of his uncle George. Similarly, John Alexander may have gone to Gartsherrie early in 1857 to fill the gap left by Alexander Whitelaw's involvement in wider company affairs. Probably by 1861 but definitely by July 1862 he had become joint

87. Coatbridge Public Library, William Baird and Company MSS. Gartsherrie Letter Book Vol.7, 8 June 1854.

manager of the works along with John Campbell,⁸⁸ hitherto chief cashier in the Gartsherrie office. By July of the following year, A.K. McCosh had joined the staff. His advancement was rapid and by 1871 he was assistant manager.⁸⁹ J.B. Thorneycroft seems to have come straight in to the Gartsherrie office in 1870 at the age of nineteen. By 1877 he had moved to Twechar to take charge of the company's expanding mineral activities in that area.⁹⁰

The entrepreneurial abilities of this group have been called into question in a recent study. Byres in his examination of Scottish Entrepreneurship 1870-1900 argued the general point that while no industry was uniformly unenterprising the Scottish pig-iron industry came close to it.⁹¹ This study reinforces the arguments presented by D.L. Burn and by Burnham and Hoskins in their studies of the British Iron and Steel industry. Illustrations drawn from these sources have been widely used in the general debate on the role of entrepreneurial inefficiency as a factor in the retardation of the United Kingdom economy during the period 1870-1914. Some recent works have laid greater emphasis on economic variables alleged to have been beyond the control of the Victorian businessman and although such arguments have not gone uncriticised entrepreneurial inefficiency has been reduced to but one factor among many. Indeed some attempts at quantitative analysis suggest that of all factors it may be the least important. Despite such new views the pioneer studies of the iron and steel industry remain

-
88. Coatbridge Public Library, William Baird and Company MSS. Gartsherrie Letter Book Vol.13, 11 July 1862.
89. University of Strathclyde, William Baird and Company MSS, Railways Deeds Book, Vol.1, 53. Minute of Agreement March 1871.
90. Coatbridge Public Library, William Baird and Company MSS. Gartsherrie Letter Book Vol.30, 113.
91. T.J. Byres, 'Entrepreneurship in the Scottish Heavy Industries 1870-1900' in Studies in Scottish Business History ed. Peter L. Payne (1967), 263.

as apparently conclusive evidence for the justification of the hypothesis at least so far as that industry is concerned.

Byres in his reference to William Baird and Company, maintained that the owners were pre-occupied with outside interests, unlike the original Baird brothers, whose other interests were limited, and who poured all their energies into the firm. As evidence of this outside involvement he cites examples of Alexander Whitelaw's educational and political activities, plus William Laird's leading role among Scottish Conservatives and chairmanship of the North British Railway Company. While it is undeniable that towards the close of the nineteenth century the international reputation of the Scottish pig iron industry and of William Baird and Company were eclipsed, the Byres thesis, presented as an explanation of this, requires serious modification in the case of William Baird and Company at least.

Alexander Whitelaw, his first example, was already relinquishing direction of the firm to others, and in any event was virtually irrelevant after his stroke in 1876, and obviously had no effect during two-thirds of the period, as he died in 1879. Admittedly Laird was chairman of the Scottish Unionists and of the Board of the North British Railway, though he held the former only in 1895 and assumed the latter in 1899 only two years before his death and after a lifetime of service to the company.

Byres also refers to his concern in the Glasgow and Bothwell Railway, the Glasgow City and District Railway, the Harbour Tunnel Company and the Glasgow Subway. Apart from the Glasgow Subway, these were in reality the very opposite of extra-firm activity. These concerns always had at least one, and frequently more than one,

member of William Baird and Company on the Board. Thus between 1875 and 1879 The Glasgow and Bothwell Railway, built to exploit the recently acquired mineral leases of the Bairds, had James Baird, David Wallace, John Alexander and William Laird on the Board, with James Baird as its first and David Wallace its second chairmen. Laird, like the others, was involved not on his own account but as the company's representative. In view of the extensive business interests of the Baird brothers detailed earlier it is difficult to sustain the view that the outside interests of the later group were in sharp contrast with the behaviour of the original partners. More important perhaps is the fact that Laird was only one of seven partners, none of the others being even mentioned by Byres though several of them were arguably more important in the firm than Laird.

On Whitelaw's death William Weir became the largest single shareholder owning 32.89% of the company while each of the others held 11.018%⁹² He remained a major force in company affairs, fully active in day-to-day administration until his death in 1913 at the age of 78. It was clearly imperative that any scheme have his approval. Thus, McCosh reluctantly abandoned a particular scheme because he and Angus were not agreed on it, and unless they could present a united front, 'there is no prospect of carrying Mr. Weir'.⁹³

It is difficult to place the others in any kind of order, in the absence of any minutes of partner/director meetings. The

92. Companies Registration Office, Edinburgh, Memorandum and Articles of Association of William Baird and Company 1893.

93. University of Strathclyde, William Baird and Company MSS. Gartsherrie Private Letter Book, A.K. McCosh to Robert Angus, 28 September 1888.

survival of some Gartsherrie letters gives McCosh and Alexander undue prominence. It may be because Alexander's handwriting was almost illegible that McCosh did most of the letter writing and consequently appears to be the more influential of the two. Alexander, who lived at Coatbridge and seldom travelled, 'shrank from public recognition'.⁹⁴ He would seem to have been almost exclusively concerned with Gartsherrie affairs, while McCosh became more involved in all aspects of the company policy. As the ultimate authority at the company's largest works his voice was a powerful one within the firm.

Robert Angus was described as 'a man of great ability, action and masterful mind, possessing the highest qualities of leadership', and as 'a typical Scot dedicated to hard unremitting work, possessing high business skill'.

Laird was throughout, a non-technical man, concerned primarily with financial and land affairs. The circumstances surrounding his election as chairman of the Board of the North British Railway Company illustrate his calibre. Opponents of the proposed future election of Lord Elgin defeated the opening efforts in the campaign on his behalf in March 1893. The following month the current chairman, the Marquis of Tweeddale, resigned in a fury on having his plans frustrated. No one, not even his opponents, questioned his behaviour until his letter attacking Laird appeared in the Glasgow Herald. Contrary to Tweeddale's expectation this had the effect of winning support for Laird who was immediately elected to the vacant seat on the Board and made chairman. Tweeddale's attack showed him to have been 'clay in the hands of the potter.'⁹⁵ The Board with him at its head decided

94. Coatbridge And Airdrie Advertiser 17 August 1895.

95. The Baillie 12 April 1899.

on one policy then he, at the bidding of Laird 'his terrible Glasgow mentor', changed it. One report, after referring to how well Laird had managed the financial interests of the Bairds, spoke of his 'enthusiasm, sound judgement and great business capacity'.⁹⁶ Obviously Laird was a powerful figure; yet the fact that he did not dominate the partners of William Baird and Company would imply that they too were forceful men.

Byres' suggestion that entrepreneurial ability was deficient must be questioned. The leaders of William Baird and Company, if anything, displayed greater initiative during the adverse years towards the close of the century than had been shown by their predecessors during the mid-Victorian Golden Age. The unprofitable works were closed down, and production concentrated at the remaining sites, where the furnaces were entirely replaced by new more efficient ones situated in replanned works with the latest ancillary plant. Many thousands of pounds were risked in introducing and perfecting by-product recovery plant. New products were made. The Bairds were among the first British companies to own ore mines in Northern Spain and the first to exploit supplies in the south of that country. On the coal mining side, they were pioneers in the development and use of coal-cutting machines; they sank many new, deeper mines; they were the first in Scotland to manufacture briquettes and led in the adoption of many of the new developments in coke manufacture. This does not mean that they cannot be faulted, but certainly they cannot be condemned as ineffectual. They raised output and, during difficult years for the whole of the British iron industry,

96. The Scottish Iron Merchant 13 April 1899.

they earned healthy profits, sufficiently large to allow impressive capital expenditure out of earnings. Clearly, the stature of any particular group of businessmen depends on the criteria by which they are judged. Of the company leaders during this period it can be said that their contemporaries held their abilities in high regard; when they chose to be involved in outside affairs they played leading roles; they made profits when others were struggling slowly towards dissolution of their companies; and they carried out a transformation which enabled their company to survive during the even more difficult period in the future.

This partnership group was responsible for the company's finally altering its structure, when they reformed it as a limited company. The significance of the precise timing of the changeover is unclear. The partners were taking advantage of the 1862 Companies Act. It is probably safe to say that prior to James Baird's death in 1876, and probably also before Alexander Whitelaw's in 1879, no serious thought would have been given to changing the structure. Any proposals after that date must have suffered as a result of the unhappy experience of those Scottish iron companies which had become public, for example Merry and Cunninghame.⁹⁷ By 1890 the trend towards limited liability was undeniable. For a firm like the Bairds, solvency had never been an issue; and therefore perhaps becoming a registered company was just one facet of the modernising trend of the period. There may have been a desire to end the upheaval created each time a partner died. Perhaps too, the artificial distinction between

97. Engineer 9 May 1875; Burn, Economic History of Steelmaking, 254.

William Baird and Company and the Eglinton Iron Company had outlived its usefulness. In addition, the rise of the sons of several of the partners made it necessary to evolve a system which would facilitate the transfer to them of an interest in the company.

The standard practice was followed of selling the assets of William Baird and Company and the Eglinton Iron Company to the new company through the medium of their law agent. Interestingly, Weir chose to give part of his share in the new company to William Baird of Elie, eldest son of the firm's founder, apparently simply in order to preserve the family link.⁹⁸ All the former partners became shareholders, but it was at no time envisaged that the company would become public. Immediately after the passage of the Companies Act of 1907 William Baird and Company registered as a private limited company - a category legally recognised for the first time. This action merely confirmed previous practice.⁹⁹

In the opening decade of the new century a number of new men joined the Board, but little requires to be done other than make brief mention of them. The previous group remained in effective control down to 1914, and the history of the new men really belongs to the period after the war.

The new directors fall into two distinct groups. On the one hand there were internal promotions. Thus, J.T. Forgie who was born at Coatbridge in 1855 and educated at Rothesay Academy, had served his apprenticeship with Simpson and Wilson, civil and

98. Companies Registration Office, Edinburgh. William Baird and Company file. Agreement between the partners and William Baird and Company 10 February 1893.

99. Companies Registration Office, Edinburgh. William Baird and Company file. Special Resolution registered 6 May 1908.

William Baird and Company and the Eglinton Iron Company had outlived its usefulness. In addition, the rise of the sons of several of the partners made it necessary to evolve a system which would facilitate the transfer to them of an interest in the company.

The standard practice was followed of selling the assets of William Baird and Company and the Eglinton Iron Company to the new company through the medium of their law agent. Interestingly, Weir chose to give part of his share in the new company to William Baird of Elie, eldest son of the firm's founder, apparently simply in order to preserve the family link.⁹⁸ All the former partners became shareholders, but it was at no time envisaged that the company would become public. Immediately after the passage of the Companies Act of 1907 William Baird and Company registered as a private limited company - a category legally recognised for the first time. This action merely confirmed previous practice.⁹⁹

In the opening decade of the new century a number of new men joined the Board, but little requires to be done other than make brief mention of them. The previous group remained in effective control down to 1914, and the history of the new men really belongs to the period after the war.

The new directors fall into two distinct groups. On the one hand there were internal promotions. Thus, J.T.Forgie who was born at Coatbridge in 1855 and educated at Rothesay Academy, had served his apprenticeship with Simpson and Wilson, civil and

98. Companies Registration Office, Edinburgh. William Baird and Company file. Agreement between the partners and William Baird and Company 10 February 1893.

99. Companies Registration Office, Edinburgh. William Baird and Company file. Special Resolution registered 6 May 1908.

mining engineers of Glasgow, before joining William Baird and Company in 1879.¹⁰⁰ He rose steadily until in July 1901 he became a shareholder with the transference of 590 shares from William Weir.¹⁰¹ In July 1905 he was elected to the board of directors.¹⁰² The other internal promotions were of a slightly different kind, exhibiting the tendency, noted by Erickson in the steel industry, for the development of bureaucratic dynasties. Andrew Kirkwood, McCosh II and his brother William W. McCosh were groomed for their future role. A.K. McCosh II after his education at Fettes went on to take the Mechanical Sciences Tripos at Trinity College, Cambridge,¹⁰³ while William trained as a mining engineer.¹⁰⁴ Andrew became a director in June 1910, and William in 1913. Robert Lawrence Angus, son of Robert Angus, was made a director at the same time as A.K. McCosh II. Of this group only J.T. Forgie had any impact before 1914. A highly regarded mining engineer, he was a founder member and first secretary and treasurer of the Mining Institute of Scotland and became President in 1898-1901.¹⁰⁵ Later he served on the council of the Federal Institute of Mining Engineers of Great Britain, represented Scotland on several government and industry committees, besides giving evidence, on behalf of the Scots, before the Royal

100. Glasgow Herald 19 October 1936.

101. Companies Registration Office Edinburgh, William Baird and Company file, Form E of 1901.

102. Companies Registration Office Edinburgh, William Baird and Company file, List of directors August 1905.

103. Who's Who 1947

104. JWSIST. 1913, List of Members.

105. Transactions of the Mining Institute of Scotland Vol. 19 [1897].

Commission on Coal Supplies ¹⁰⁶ /1903-4/ and the Royal Commission
¹⁰⁷ on Accidents in Mines. His 'ability energy and force of character'
 made him an important member of the board even before 1914. The
 others made their mark after the war. For example, A.K. McCosh II
 later became Deputy Controller of iron and steel at the Ministry
 of Supply (1939-42), President of the Mining Association of
 Great Britain (1944) and President of the British Employers
 Confederation /1945-6/.

From outwith the firm came Stuart Foulis, son of William
 Foulis, gas engineer of St. Andrews, and brother of William
 Foulis, the highly respected Gas manager for Glasgow.¹⁰⁸ Foulis
 was a lawyer who commenced his career in partnership with Cluny
 McPherson, a former Baird employee and close friend of the
 partners. He subsequently became partner in a firm which
 specialised in liability and compensation cases, on behalf of
 coalmasters. On becoming a director of William Baird and Company
 in 1903, he gave up his legal work. It seems probable that
 his influence was narrow, being largely restricted to legal matters,
 particularly liability cases which after the Compensation Act of
 1896 were of considerable importance. On Foulis' death in April
 1914, he was succeeded by James Morton, also drawn from outside the
 firm, who was allotted 1500 shares on 10 July 1914 and made a
 director on 14 July.¹⁰⁹ Clearly his influence was totally confined
 to the period after that dealt with in this thesis.

For our purposes, it is important to note that the later
 history of these new men indicates that a continuing supply of talent

106. Royal Commission appointed to inquire into the subject of the
 Coal Resources of the United Kingdom 1903-5.

107. Royal Commission on Mines 1907-11.

108. Glasgow Herald 3 April 1914.

109. Companies Registration Office Edinburgh, William Baird and
 Company file, List of Directors 14 July 1914.

was being groomed for future leadership. In this connection it is of particular significance to observe that company policy, owing largely to William Weir, made it possible for employees of ability, as for example, J.T. Forgie, to rise to director level. Weir ensured the continuation of this policy after his death by making provision in his will for the transfer, at the request of the board of shares to suitable employees, 'In consideration of the interest which I have in the continued prosperity of the business with which I have been long associated and with the view of promoting the same by encouraging capable and deserving employees engaged in the working thereof'.¹¹⁰

In reviewing the business careers of the twenty-two men who over a period of some eighty-five years created and guided one of Scotland's most important enterprises one point is clear. Not all of them rank alongside William and James Baird but they were all men of undeniable talent who collectively make an impressive entrepreneurial group.

Middle and Lower Management.

Studies of nineteenth century businessmen have been bedevilled by the problem of eliciting even the most elementary biographical details. Since this is true to an infinitely greater degree of those who never reached the ultimate status of partner/director, and since furthermore, the study of leaders is generally preferred to the study of followers, those who occupied the lower rungs of management have been widely ignored. Consequently there is a

110. Glasgow Herald 10 October 1913.

striking dearth of evidence on the subject of middle and lower management in nineteenth century Scottish history. In such circumstances an attempt to draw some tentative conclusions concerning the position in William Baird and Company is justified.

In its early years, the policy of the company was to train its personnel within the firm. There was of course no suitable institution to provide commercial education or even technical training of the kind required and training within the job was the norm. The Bairds however, preferred to train their own staff rather than recruit those who had been trained by other companies. This policy, although not rigid, endured throughout the century. As late as March 1882 A.K. McCosh replied to an applicant from England, 'As a rule our managers have all been trained from youth up at our own works.'¹¹¹ There are numerous examples of senior employees who spent their lives climbing the promotion ladder within the company. William McKinlay, who joined the company in 1861, aged 13, as a junior in the Muirkirk office, rose steadily to become chief cashier at the Twechar office, and died there still in the company's employ at the age of 68.¹¹² James Mitchell who joined the Gartsherrie office staff as a junior in 1832, died about July 1878 while holding the post of senior pay clerk at the Glasgow office.¹¹³ William Brand, who was a clerk at Glasgow in the early 1860s rose to become chief cashier, and on formation of the limited company he became Company Secretary, a post which he held until at or near his death in 1910.

-
111. Coatbridge Public Library, William Baird and Company MSS, Gartsherrie Letter Book vol.34,54. A.K.McCosh to T.Banton 22 March 1882.
112. According to newspaper extract in possession of his granddaughter M.A.Frood.
113. Coatbridge Public Library, William Baird and Company MSS, Gartsherrie Letter Book, Vol.31,460. 9 July 1878.

Of course, not all of the Baird employees remained their entire lives in the company's service. A significant number of those who left did so to set up in independent business, an indication of the calibre of the men employed. The best known example is probably that of James (later Sir James) Bain, Robert Blair, and John Paterson, who set up their own ironworks at Whitehaven.¹¹⁴ James Findlay, J.P., who held a senior post at Bothwell, left the Bairds after thirty years service to form a partnership with his brother as the West of Scotland agents of Nobel's Explosives.¹¹⁵ William Jardine a clerk at Gartsherrie in 1860 became chief cashier before leaving to form a partnership to carry on the nearby Coats Ironworks.¹¹⁶ Cluny McPherson clerk at Gartsherrie and later at the Glasgow office quit the Baird's employ to become a lawyer in Glasgow.¹¹⁷

There were also those whose service with the company was never expected to be anything but temporary. These were the sons of local businessmen and gentlemen who had them placed in one of the Baird offices as an ideal training centre. Thomas Jackson, junior, received some training in the Gartsherrie offices in the mid 1850s before moving to his father's works at Coats.¹¹⁸ James Brownlie, son of David Brownlie, veterinary surgeon, in Coatbridge, was a clerk at the Portland works for a short time before becoming an agent of some kind in Glasgow. J.T.Rankin, son

114. Glasgow Herald 26 March 1898.

115. Colliery Journal 15 June 1903.

116. Engineering 7 March 1886.

117. Memorial Volume on the Presentation of Alexander Whitelaw's Portrait to Glasgow Corporation /1880_/pamphlet in Baillie's Institution Library, Glasgow.

118. Coatbridge Public Library, William Baird and Company MSS, Gartsherrie Letter Book, vol.6, 420. 2 December 1853.

119. SRO. General Register of Sasines, 13 October 1894.

120. Glasgow Herald 4 May 1912.

of the Provost of Airdrie, William Service, stockbroker in Glasgow, and Andrew Thompson, iron and steel merchant were also trained in the company offices. It is not difficult to see why so many Scottish businessmen were eager to get their sons in to a Baird office. In an obituary of R.M.F. Watson, superintendent of the Western Division of the Caledonian Railway, the Glasgow Herald expressed the general view by referring to his 'excellent business training in the office of William Baird and Company.'¹²⁰

The need to seek out likely talent, bring it into the organisation and groom it in Baird ways was always before the partners. A.K. McCosh wrote Robert Angus that he should have 'developing in Ayrshire some able, well educated young man whom the firm could trust.'¹²¹ In choosing and promoting men, ability would seem to have been the only criterion at all levels. William Cameron, who began as a collier with the Bairds rose to become general underground manager for all the Lanarkshire pits.¹²² William Young also began as a collier, later became a contractor, before being made manager at Thankerton.¹²³

A notable feature seems to have been the widespread tendency for members of the same family to work for the company, often through several generations. James McKinlay the brother of William referred to above was a clerk at Gartsherrie while William's son Alexander was in the office at Lugar.¹²⁴ William Cameron's son Alexander succeeded his father as underground manager at Gartsherrie,¹²⁵

120. Glasgow Herald 4 May 1912.

121. University of Strathclyde, William Baird and Company MSS, Gartsherrie Private Letter Book 28 September 1888.

122. McGeorge, op.cit.76.

123. Coatbridge Public Library. William Baird and Company MSS. Gartsherrie Letter Book Vol.8, 290, 12 July 1855.

124. Coatbridge Public Library. William Baird and Company MSS. Gartsherrie Letter Book Vol.22, 350, 21 March 1871.

125. SRO. General Register of Sasines, 5 May 1874.

while Daniel Cameron was underground manager at Starid Colliery,¹²⁶ Daniel, junior, held a post at Auchinleck,¹²⁹ one William Cameron was a clerk at Gartsherrie,¹²⁸ and another William held a post at Palacecraig.¹²⁹ Frank Anderson clerk at the Eglinton office in 1900 was brother of Peter, then chief cashier at Gartsherrie.¹³⁰ George Borrowman, son of Daniel Borrowman, a contractor to the Biards, became manager of the pits at Lugar, and moved to Kilsyth where he died in 1893 still in the employ of the company.¹³¹ James Kennedy Jarvie a senior salesman with the company was brother of William Jarvie, general manager at Bothwell.¹³² Mark, the son of William Brand, already referred to, became a director of the company in 1932. James Nisbet, manager at Eglinton in 1901 was brother of John Nisbet works manager at Gartsherrie, both being sons of John Nisbet who was engineer at Gartsherrie works from 1835 until his death in 1867.¹³³ These are only a few examples of the numerous family groups found, and there are many other cases where, although definite proof is lacking, the occurrence of the same surnames appears to be more than mere coincidence. Thus,

-
126. Coatbridge Public Library. William Baird and Company MSS.Gartsherrie Letter Book Vol.23, 350, 21 March 1871.
127. Ibid. Vol.31, 175. 28 February 1878.
128. Ibid. Vol.29, 183. 4 May 1876.
129. Ibid. Vol.30, 380. 3 May 1877.
130. Information supplied by J.Alexander Henderson ex-employee of William Baird and Company.
131. Evidence supplied by George Borrowman.
132. Companies Registration Office Edinburgh. William Baird and Company, Form E 1903; Iron and Coal Trades Review 29 July 1910. The Jarvies may have been connected with Alexander Fleming who left £1,000 to the family of Nedric Jarvie.
133. Iron and Coal Trades Review, 20 March 1903.

four Johnstons, Andersons and Mitchells, three each of Crawfords and Jacks, all worked for the company between 1870 and 1910. McCosh pointed out in a letter to an applicant that not only were 'situations very difficult to find in the present state of trade', but that any post that might come up would readily be filled by 'our own people'.¹³⁴ It would seem that brothers, sons, cousins or nephews of existing employees had priority.

It might seem that the preference for training its own and employing relatives of existing employees would make the firm inward-looking and unresponsive to new trends in middle management. Set against this it is clear that unconnected young men could still enter the firm and rise without difficulty, not altogether surprising in view of the size of the staff in the last quarter of the century. One such was John Smith who became works manager at Eglinton in the late 1870s, and who was described as 'A gentleman whose scientific attainments are not a whit less than his great practical skill in managing mines and ironworks'.¹³⁵ In addition, the strong sense of identity with the firm's interests so apparent among the leaders was clearly likely to be stimulated in such a firm, where employees' sons could be confident of a fair chance, and merit and hard work opened any door. The records of lifelong service seem clear evidence of such loyalty.

In the absence of comparable data and owing to the survival of only a very few details regarding salaries, little more can be done than set out the information available. Office staff were

134. Coatbridge Public Library, William Baird and Company MSS. Gartsherrie Letter Book Vol.40, 457, A.K.McCosh to Robert Allen 1 May 1893.

135. The Colliery Guardian 18 June 1880.

apparently on a yearly salary paid monthly. In 1883 Alexander, who was in general charge at Gartsherrie, had under him two works managers, L.J.Dunnachie, a chemist who had special charge of by-product recovery, earning £150 p.a. and James Nisbet earning £100 p.a.¹³⁶ This evidence does not quite conform with the views of Carr and Taplin, or Burn, who concluded that ironworks chemists were generally of poor quality and low status.¹³⁷ An interesting point is that these men were both poorly paid in comparison with some other staff. The underground managers based at Gartsherrie received £400, £168 and £96 and the coal salesmen £450 and £150 each p.a. The two senior clerks in the Gartsherrie office were also highly paid at £150 and £138 p.a., while the remaining clerks received £96, £90, £84, £72, £60 £40 and £32.8s. p.a. respectively.

The widely dispersed nature of the company's physical organisation was counteracted by the closely knit administrative family which was created and maintained by the patriarchally-minded Bairds and their successors. The transference of employees from one works to another; the existence of family ties between employees at the different works; the fact that all lived in company houses in company villages; all this helped to create a devotion to the firm which the partners fostered by their example. It is a system without parallel in modern economic organisation.

136. Coatbridge Public Library, William Baird and Company MSS. Gartsherrie Salary details 1883.

137. D.L.Burn, Economic History of Steelmaking 1867-1939 (1940) 178; J.C.Carr, and W. Taplin, History of the British Steel Industry (1962), 218.

CHAPTER VII

CHAPTER VII

The Employees - Life and Work.

The completion of the Monkland Canal in 1791 heralded the beginning of a phase of rapid industrialisation in the parish of Old Monkland and the surrounding area. In 1793 there were 4 collieries in Old Monkland employing 435 miners; by 1862 there were 38 collieries, consisting of 70 pits, giving employment to 3190 men. Clyde Ironworks was begun in 1786. In 1862 there were 9 pig iron works with 68 furnaces in the vicinity of Coatbridge, and 10 malleable iron works.¹ The native - largely agricultural - community was quite incapable of satisfying the constantly rising demand for labour associated with such growth. Immigration to the Monklands was heavy and constant. Over the thirty years 1811 to 1841 during which the population of Scotland increased by 45.1 per cent from 1,805,864 to 2,620,184 the population of the Monklands increased by 265.7 per cent from 10,998 to 40,220.

The Bairds were just one of many in the region who offered employment to this astonishing influx of people. At first the numbers employed by the firm were small. According to William Cameron there were about 300 colliers at the beginning of the 1830s,² to which must be added about 100 ironstone miners and at the works themselves perhaps another 100 men, inclusive of carters and boatmen. The works expanded rapidly, till by 1844 there were sixteen furnaces. If the estimate of contemporaries

1. Miller, Rise and Progress of Coatbridge passim.

2. Tremenheere 1844 Report, 32.

is accepted that each furnace gave employment to from 200 to 250 men³ the labour force connected with Gartsherrie would have numbered approximately 3,200 to 4,000. One figure for 1848 puts the number of colliers alone at 800 in the immediate vicinity of Gartsherrie⁴ while a newspaper article gives 3,500 as the total labour force at the end of 1850.⁵ In the following year one of the Gartsherrie managers told S.H. Tremenheere that there were 1,800 to 2,000 men employed at the pits in the Gartsherrie district.⁶ For most of the period the company had no clear idea of how many employees it had. This was inevitable given the geographical spread of operations; the exercise of control through sub-contractors; the high rate of turnover in the labour force; absenteeism; seasonal fluctuations; and the continuous underlying trend of expansion. In 1853 it tentatively estimated that there were 2,880 men and boys associated with the Gartsherrie works.⁷ In the following year according to James Baird the total work force in Lanarkshire and Ayrshire was 5,000.⁸ By 1867 when the peak of expansion had been reached so far as number of ironworks owned is concerned, but before the

-
3. Engineering 3 May 1869.
 4. Tremenheere 1848 Report, 15.
 5. Mining Journal 3 August 1850.
 6. Tremenheere 1851 Report, 37.
 7. Coatbridge, W.B. & Co. MSS, GLB Vol.5, 541. David Wallace to James Bain 21 May 1853.
 8. SC on Payment of Wages Bill 1854, 136, evidence of James Baird.

great expansion of coalmining which came after 1870, Bremner gave the total of employees as 9,000 of whom 3,200 were in the vicinity of Gartsherrie.⁹ The company itself still did not have accurate statistics of the numbers employed and before the Truck Commission in 1871 Alexander Whitelaw could only give an estimate of between 8,000 and 10,000.¹⁰

From the early 1870s onwards the number of ironworks managed by the company declined, as first Blair was stopped (1870), and later Portland works was dismantled (1894). At the surviving works the total number of furnaces gradually declined but it is probable that the number of workers actually increased as the modernised works became increasingly sophisticated. Above all, the development of by-product recovery plant required the employment of additional labour.

While ironstone mining declined rapidly, after 1870, particularly in the Gartsherrie district, coalmining expanded. By 1894 there were 7,375 miners and colliers.¹¹ The number had risen to 9,618 in 1904 and 11,591 in 1911.¹² These figures do not include those working at the coke ovens - a major growth sector from the 1860s onwards, nor are there any figures available for the company's own transport system - by 1914 there were twenty locomotives in use in the Gartsherrie area alone.¹³ All in all,

9. D. Bremner, Industries of Scotland, 36.

10. Report of the Truck Commission 1871, Vol.II, 272, evidence of Alexander Whitelaw.

11. List of Mines 1894.

12. Ryland's Directory 1906, 1912.

13. Strathclyde, W.B. & Co.MSS, Valuation Book Gartsherrie Vol.7, 'Motive Power Account 1914'.

the labour force must have numbered some 15,000 just before the outbreak of war. In the period after 1850 the company was one of Scotland's major employers; indeed by some accounts it was the largest single employer.

Origins.

The labour force was of very diverse origin. The inability of the old mining population of Scotland to satisfy the industry's requirements had become apparent long before the entry into coal-mining of the Baird brothers. Indeed this was one of the factors behind the abolition of serfdom in 1799. Nevertheless, members of the traditional mining population must have been attracted to the Monklands in the first half of the nineteenth century, as well as other Scottish migrants both Lowlanders and Highlanders, and it seems probable that some found employment with William Baird and Company. A more definite statement is not possible. It was equally true of the labour employed at the works themselves. Given the rate of growth, not only of Gartsherrie, but of the total furnace capacity of Scotland much of the labour, even that required for skilled jobs, must have been drawn from among men with little or no previous experience.¹⁴ According to James Baird, the company had, 'to take what turned up, and I cannot say they were all of the best sort'. When the dam and tuyeres of the first furnace had to be put in, 'the two keepers were helpless. They stood like sheep and acknowledged that they could not do it'.¹⁵ Referring to the company's demand for hillmen and oversmen in the early days one

14. For a consideration of this problem as it affected industry generally at an earlier period of industrialisation, and also for a broader view of many of the aspects dealt with in this chapter, see Pollard, S. The Genesis of Modern Management, London, 1965, particularly chapter 5, 'The Adaptation of the Labour Force'.

15. MacGeorge, Bairds of Gartsherrie, 58.

of the Gartsherrie managers later remarked, 'we couldn't get such men. It was the greatest difficulty we had.'¹⁶ This was a powerful reason for the adoption of sub-contracting as an administrative technique. Fifteen years later shortage of skilled labour was still a problem. In spite of a deterioration in the quality of the iron during the week after pay day, 'in consequence of the men not being entirely masters of their own actions', Alexander Whitelaw wrote that 'the fuddlers cannot well be punished for want of hands to replace them'.¹⁷ Scots, whatever may have been their previous employment, naturally made up the bulk of the company's labour force. How many of these were Highlanders it is impossible to say although in 1891, long after the initial influx is likely to have occurred, all fourteen ^{company} villages listed in the census had at least two gaelic speakers and in all there were 53 in a total population of 9,700.¹⁸

England may have provided some of the early furnacemen, but the first definite evidence of the employment of Englishmen relates to the mid 1860s. The year 1866 was one of strong demand for both coal and pig iron. William Baird and Company, anxious to maintain output levels was pushing forward with the development of the Denny/Kilsyth mineral field while in Ayrshire expansion was particularly marked in the Cumnock district. It was however faced with a protracted period of industrial unrest. After adhering

16. Tremenheere 1851 Report, 37.

17. Strathclyde, R.B.Mss, Alexander Whitelaw to Robert Baird 15 July 1845.

18. Census Return for Scotland 1891, Vol.1, Population Tables III.

determinedly to a policy of restriction the colliers and miners finally struck work in June 1866. This encouraged the company, which required additional labour in any case, to bring men from outside the West of Scotland. Cornish miners, with their entire families were brought up to Lanarkshire and Ayrshire. The number involved is unknown but it was sufficient to encourage two Cornish schoolteachers to write to the company asking if teachers were needed for the Cornish schoolchildren.¹⁹

They were remarkably well treated. Coal already at their houses when they arrived, was not charged for,²⁰ and the cost of bedding, furniture and various other household items supplied through the store was written off.²¹ The cost of pick sharpening, a standard company offtake, was not levied.²² A group of Cornishmen sent to Gartcloss assembled in the schoolroom and held a meeting on their first day. Nevertheless the company paid them for a full shift.²³ Six months after their arrival the company was still anxious to show the Cornishmen, and no doubt others still considering the move north, that the firm was a good employer. When one of them, Robert Phillip, took ill, the cost of returning him and his family to Cornwall was borne by the firm.²⁴ Some other Cornishmen may have gone to Ayrshire in the 1880s, again as strikebreakers, but this possibility apart, there does not seem to have been any

-
19. Coatbridge, W.B. & Co. MSS, GLB. Vol.18, 839, A.K. McCosh to William Inglis 24 November 1866.
20. Strathclyde W.B. & Co. MSS, Manager's Notebook Gartsherrie, November 1866.
21. Ibid. March 1869.
22. Ibid. December 1866.
23. Ibid.
24. Ibid. April 1867.
25. T.S.A. Ayrshire, 470.

other organised movement of English into the company's employ, though individuals may have been attracted throughout the century. By 1907, according to J.T. Forgie there were few Englishmen among the employees.²⁶

The largest single group from outside Scotland was the Irish. Even before the famine they had been steadily immigrating to the Monklands, and some had found work with William Baird and Company. Prior to the company's first major strike in April 1837 Irish were present in the pits as roadsmen and they were sufficient to keep the pits going when some 200 colliers struck work.²⁷ Further strikes in 1842 and 1847 added to their number, and by 1848, James Baird stated that two-thirds of the miners and one quarter of the colliers were Irish.²⁸ Six years later he re-affirmed that, 'a very large number of the workforce was Irish'.²⁹ At the works, where the community was more stable and strike breakers less often required, the Irish were slower to make inroads. In 1848 only 70 out of 400 householders (17.5%) were Irish³⁰ and in 1852 only 44 out of 419 families (10.5%) were Roman Catholics.³¹ Although the influx of Irish was especially marked in the wake of the famine it was a constant feature of the entire period, and at times was actively encouraged by the company. During 1871 when the restrictive policy of the

26. RC on Mines 1907 Vol IV, 201, evidence of J.T. Forgie.

27. Tremenheere 1844 Report 37.

28. Tremenheere 1848 Report, 14.

29. SC on Payment of Wages Bill 1854, 139, evidence of James Baird.

30. Tremenheere 1848 Report, 15.

31. Tremenheere 1852 Report, 48.

miners remained particularly strong at a time of growing demand the Bairds advertised for hands in the Irish newspapers.³² A significant proportion of the Irish immigrants were Scotch-Irish and bore Scottish surnames. With this qualification, and bearing in mind also the limited validity of the methodology, it is interesting to note the proportion of fatally injured in the coal pits who had distinctively Irish names. In 1860-1864 and 1880-1884 respectively the proportion of Irish to others was 9 out of 29 and 18 out of 55, or almost 30% in both periods.³³ A list of employees in the Denny/Kilsyth area for 1879 is extant. On the same basis, 295 out of 1069, or 29%, were Irish.³⁴ The fatal accident data is for both Gartsherrie and Ayrshire and although no firm conclusion can be reached it would seem that upwards of 30% of the colliery labourforce was Irish in the second half of the nineteenth century. Handley has analysed the difficulties involved in calculating the number and proportion of Irish in Scotland at the middle of the century.³⁵ He was inclined to the view that in the heavily industrialised areas they could have been as much as one quarter of the population.³⁶ An estimate of 30% for the Irish miners in the Bairds' employ is therefore not unreasonable.

Following the acquisition by the company of mineral leases in Spain some Spanish workers came over to work in the Scottish pits.³⁷

32. T.S.A. Stirlingshire, 279.

33. Based on accident returns in Reports of H.M. Inspectors of Mines 1852-1914.

34. Strathclyde W.B. & Co. MSS, Manager's Notebook, Gartsherrie 1 October 1879.

35. Handley, J. The Irish in Scotland (Glasgow) 1964 edn., 197-8

36. *Ibid*, 265.

37. T.S.A. Ayrshire, 666.

The number, which was certainly small, is not known. They were confined to Ayrshire, and worked in the pits at Cumnock where one of them, José Blanco was killed in an accident at Burnockhill No. 1 pit in 1906.³⁸

The last significant ethnic group represented in the labour force started to arrive in the 1890s. Commonly described as Poles, they came in fact from Latvia, Lithuania and Germany, as well as Poland. First mention of them occurs at the time of the furnace-men's strike of 1890-91. In January 1891 about 100 of them visited Coatbridge at the height of the strike and rumour spread rapidly that the furnaces were to be relit using foreign labour.³⁹ Shortly afterwards some of the company's furnaces in Ayrshire were relit using non-union men, including Poles.⁴⁰ Twelve years later, Richard McPhee confirmed that this incident marked the arrival of Poles in the Scottish coal and iron district.⁴¹ The miners strike of 1894 accelerated their absorption into the ranks of the company's employees. By 1905 J.T.Forgie estimated that they made up about 10% of the labourforce.⁴² They were particularly strong in the expanding Bothwell field where Forgie put the proportion at 15% and Richard McPhee said that 30% of the men at Bothwellpark (180 out of

38. Report of H.M. Inspector of Mines 1906.

39. Engineering 23 January 1891.

40. *Ibid.* 20 February 1891.

41. R.C.on Mines 1907, Vol III, 90. evidence of Richard McPhee.

42. *Ibid.* Vol.II,236, evidence of J.T.Forgie.

600) were Poles.⁴³ Workers representatives maintained that at some pits the proportion was higher - from 50% to 75% in some cases.⁴⁴ At Craighead in 1910 about one-third of the occupants of the company's houses were Poles, according to the Medical Officer of the county.⁴⁵ Poles were present in Ayrshire as well as Lanarkshire but no figures are available.

Without some knowledge of the origins of the workforce it is impossible to appreciate fully the history of the communities which grew up around the work centres of the company. The formation of trade unionism and the evolution of housing conditions, education, social, spiritual, and cultural life were fundamentally affected by the origins of the labourforce, and the circumstances surrounding the arrival of the various groups.

Living Conditions.

Central to any consideration of the quality of life enjoyed by the company's employees was the standard of housing which they occupied. The development of ironworks and mineral fields on a scale previously unknown, and frequently in locations hitherto almost exclusively agricultural, meant that the company had no alternative but to provide accommodation for its workforce. Not all employees were housed in company property, especially in the Gartsherrie district where there was a considerable number of towns and villages near many of the pits. Although this was undoubtedly true, throughout the period precise details are not available until 1910 by which time

43. Ibid. Vol.III, evidence of Richard McPhee.

44. Ibid. Vol.III, 49, evidence of David Gilmour.

45. The Housing Conditions of Miners in Lanarkshire, Report of the Medical Officer of Health, 1910, 108.

the men's freedom of choice was greater. Of the 668 employees at Bothwell Park 1 and 2 pits, 332 lived in owners houses; 104 in rented houses at Bellshill; 93 at Muirpark; 21 at Ashley Grange; 45 at Bothwell; 42 at Uddingston; 9 at Blantyre; 10 at Wishaw and 12 at Glasgow.⁴⁶ Some employees owned their own homes. James Baird maintained that there were many such owner occupiers in Coatbridge in 1854.⁴⁷ In 1910, of the 690 men at Craighead colliery 15 owned their own home, while of the 434 employed at Bedlay mine 3 were homeowners.⁴⁸ For the majority, the company had to provide housing.

At Gartsherrie a village of some 300 houses had been built by the middle of the 1840s, and a further 150 in the vicinity.⁴⁹ In Ayrshire where the Eglinton works were in the course of construction a large number of houses were being built.⁵⁰ House building was continuous as the company's raw material requirements obliged it to lease and develop fresh mineral fields. By 1861 in the Gartsherrie district the company owned 914 houses. Its housebuilding rate was, however, insufficient to satisfy its requirements and it had been obliged to rent 205 houses.⁵¹

46. Ibid. 113.

47. S.C. on Payment of Wages Bill 1854, 54, evidence of S.H. Tremenheere.

48. MOH Report Lanarkshire (1910), 108, 221.

49. Tremenheere 1848 Report, 15.

50. Tremenheere 1847 Report, 20.

51. Strathclyde W.B. & Co.MSS, Valuation Book Vol.1 'House Property Account 1861'.

In Ayrshire the company added to the number of houses in its possession as it acquired the additional ironworks and leases. It also built more for example in 1857 when 50 were under construction at Gylinton and 109 at Blair.⁵²

During the 1860s the number of houses held on lease fell rapidly to 35, while a vigorous building programme in the Denny/Kilsyth area at Twechar, Croy, Smithstone, Drumglass, Tygetshaugh, Barrhill, Currymire and Kilsyth increased the number of houses owned by the company from 79 to 231, in that district.⁵³ Building continued during the 1870s raising the total to 395 in the Kilsyth district and establishing 287 in the new Bothwell field.⁵⁴ Despite this impressive building programme the total number owned by the company in the Gartsherrie district in 1879-80 was 1,089, only 175 greater than twenty years earlier.⁵⁵ The building programme in the new districts had been matched by the sale or demolition of a large number of the company's older houses in places where the minerals were worked out. Expansion of coalmining in the generation before 1914 was reflected in a continuation of the company's housebuilding programme. According to A.K.McCosh, it built 820 houses between 1875 and 1892.⁵⁶ New villages were begun after that date, for example Annathill where 127 houses were built, and by 1914 the company owned 1,606 houses in the Gartsherrie district.⁵⁷

52. Tremenheere 1859 Report, 38.

53. Strathclyde W.B. & Co. MSS. Valuation Book Vol.1, 'House Property Account 1869'.

54. Ibid. Vol.3, 'House Property Account 1879'.

55. Ibid. Vol.3, 'House Property Account 1880'.

56. RC on Labour 1892-4, evidence before Group A, Vol.11, 237. Evidence of A.K.McCosh.

57. Strathclyde W.B. & Co. MSS, Valuation Book Gartsherrie Vol.7, 'House Property Account 1914'.

In Ayrshire, apart from the ironworks villages attached to Kilwinning, Dalry, Lugar, Muirkirk and Hurlford, the company built villages for its miners at Birnieknowe, Bartonholm, Commondyke, Cronberry, Darnconner, Fergushill, Garrallan, Gas^swater, Glenburn, Glengyron, Highouse, Mossblown and Skares. The volume of house-building which this involved was considerable. By drawing on sources covering the period from 1871 to 1914 it is possible to obtain the number of houses built in thirteen of the eighteen villages listed above.⁵⁸ Some of the 2,082 houses in these villages - though only a very few - may not have been owned by the company. Moreover, many were demolished in some of the older villages before those in the newer were built. Nevertheless it is probable that the company had a larger number of houses in its possession in Ayrshire than in the Gartsherrie district.

Housebuilding on such a scale represented a very sizeable, albeit reluctant investment by the company. The earliest cost details refer to 8 workers houses built at Todsbuchts in 1855, which were £37.1p each.⁵⁹ By the middle of the following decade costs ranged from £39.10p at Smithstone and £40.17p at Twechar⁶⁰ to £63.24p for 50 two-apartment houses at Gartsherrie.⁶¹ Over the next decade costs rose very rapidly. In 1873 26 houses at Bothwellpark cost £113.31 while 22 at Cuihill cost £125.77p.⁶² A further 141 houses were put up at Bothwellpark in 1875 for £114.16,⁶³ although

-
58. Census Return 1871, Vol.1, Pop.table III; Ibid.1881; Ibid.1891; J. Strawhorn, Cumnock (1966), 114; H. Steven, Auchinleck (1898), 79; TSA (Ayrshire), 309, 570, 641, 673; RC on Scottish Housing, 1918, evidence Vol.II, 1132-1151.
59. Coatbridge W.B. & Co. MSS, GLB. Vol.8, 137. J. Campbell to J. Bain, 18 May 1855.
60. Strathclyde W.B. & Co. MSS. Valuation Book Gartsherrie, Vol.1 'House Property Account 1866'.
61. Coatbridge W.B. & Co. MSS, GLB. Vol.18, 419, A.K. McCosh to W. Laird 14 May 1866.
62. Strathclyde W.B. & Co. MSS. Valuation Book Gartsherrie, Vol.2 'House Property Account 1873'.
63. Ibid. 'House Property Account 1875'.

at Craighead two years later 108 two apartment houses were built in tenements for only £82.2 each.⁶⁴ Costs seem to have remained fairly static over the next thirty years despite the slightly higher standards which had to be observed as a result of legislation and the public attention which focussed on miners' housing. In the years 1890-92 60 two apartment houses were built at Queensyeburn at a cost of £117.71.⁶⁵ In 1903-4 it cost £129.54 per house for 23 two apartment houses at Drumgrew⁶⁶ and for 143 two apartment houses at Annathill built during 1905-8 the cost was £112.76.⁶⁷ Thereafter there was a sudden upward turn in building costs with the result that the erection of a further 52 houses at Annathill in 1910-12 cost £165.27 per house.⁶⁸

Taken together with the earlier details of the quantity of housing built by the company, the cost details clearly indicate a sizeable investment. According to A.K.McCosh, speaking in 1892, the company spent £90,448.21 in the 18 years prior to that date in erecting 820 houses of at least two apartments.⁶⁹ The book value of the firm's house property stood at £60,000 in 1891, £70,295 in 1907 and £84,573 in 1914, for the Gartsherrie district alone. The return on the book value of their Gartsherrie District houses was 4.6% in 1890-91, 6% in 1906-7 and -0.09% in 1913-14.⁷⁰

-
64. Coatbridge, W.B. & Co. MSS. GLB. Vol. 30, 448. A.K. McCosh to J and A. Waddell, 24 May 1877.
65. Strathclyde W.B. & Co. MSS, Valuation Book Gartsherrie, Vol. 5, 'House Property Account 1891'. Vol. 6 'House Property Account 1892'.
66. Ibid. Vol. 7, 'House Property Account 1904'.
67. Ibid. 'House Property Account 1908'.
68. Ibid. 'House Property Account 1912'.
69. RC on Labour 1892-4, evidence before Group A, Vol. 11, 237, evidence of A.K. McCosh.
70. Strathclyde W.B. & Co. MSS. Valuation Book Gartsherrie, Vol. 5 'House Property Account 1891'; Vol. 7 'House Property Account 1907'; 'House Property Account 1914'.

A.K. McCosh who took the cost of the properties as the basis of his calculation put the return to the company at 2.89% in 1892,⁷¹ while in 1912 J.T.Forgie, who allowed for depreciation put the return at 1.65%.⁷² Not surprisingly, the company was reluctant to invest more than was unavoidable in the housing sector.

In the period during which contracting played a large part in the system of management contractors were responsible for the housing allocated to their pit by the company.⁷³ Besides having direct control at several places, including Gartsherrie, the firm retained the ultimate authority of course. In particular, it insisted that occupants of company houses be given preference should contractors require workers.⁷⁴

Few details about rents have survived but there is no indication that housing was ever treated as a perquisite of the job in the sense that it was let rent free, although the company maintained that it charged rents well below the average for the district. In 1862-3 rents averaged about 37.8p per month⁷⁵ and by 1870-71 the average stood about 36.5p.⁷⁶ According to the information submitted by the Company to the Truck Commission in September 1870, rents ranged from 23p to 38p per month.⁷⁷

-
71. RC on Labour 1892-4, evidence before Group A, Vol.11, 237, evidence of A.K. McCosh.
72. RC on Scottish Housing, Minutes of Evidence Vol.11, 1086, evidence of J.T.Forgie.
73. Coatbridge W.B. & Co. MSS, GLB. Vol.15, 616. J.Shank to S.Anderson 29 February 1864.
74. Ibid. Vol.11, 349. J.Alexander to Contractor, Palacecraig No.7 pit, 7 March 1859.
75. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie. Vol.1, 'House Property Account 1862'.
76. Ibid. Vol.2, 'House Property Account 1871'.
77. Coatbridge, W.B. & Co. MSS 'Copy of Truck Commission Return September 1870'.

In 1875 rents were about 50p per month at Auchinstarry although at Kilsyth they ranged from 25.5p for one apartment to 35.5p for two apartment houses, and at Portland from 32.5p to 35 p.⁷⁸ By the middle of the 1880s the average rent had risen to 44.6p⁷⁹ and by 1893-4 it was 49.9p.⁸⁰ At about that time A.K. McCosh gave 46.08p⁸¹ as the average rent of the houses in his report. In 1901-2 the average was 57p.⁸² The 1910 report of the County Medical Officer recorded the rent of two apartment houses at Bothwell Castle as 61.75p; at Craighead as 43 to 50.33; at Bothwellpark as 58.3p to 60p; and at Annathill as 54.1p.⁸³

Although rents were much less volatile than wages, the evidence of Table VII:1 does suggest the existence of a more than chance relationship between the two.

Table: VII:1 The relationship between Rent and Wages, Gartsherrie District, 1870-1910.

Year	I	II	III	Notes
1870	23 to 38	20	1.15 to 1.9	I = weekly rent in pence.
1870-71	36.5 (av.)	20	1.82	
1875	50	25.13	1.98	II= Hewer's average day rate in pence.
"	25.5(s) to 35.5(d)	"	1.01 to 1.41	
1885-6	44.6 (av.)	15.4	2.89	III= Column I divided by Col.II
1892	46.08 (av.)	25.29	1.82	
1893-4	49.9 (av.)	"	1.97	s = single apt. d = double apt. av.= average
1901-2	57 (av)	31.03	1.83	
1910	61.75 (d)	30	2.05	
"	43 to 50.3	"	1.43 to 1.67	
"	58.3 to 60	"	1.94 to 2.0	
"	54.1	"	1.80	

Source: For figures in Column I see footnotes 77 to 81

For figures in Column II see, Strathclyde W.B. & Co. MSS, Manager's Notebook, Gartsherrie, passim.

-
78. Glasgow Herald January-March 1875 'Notes on Miners' Houses'.
79. Strathclyde W.B. & Co. MSS. Valuation Book, Gartsherrie Vol.4, 'House Property Account 1886'.
80. Ibid. Vol.6, 'House Property Account 1894'.
81. RC on Labour, 1892-4, evidence before Group A, Vol.11, 237 evidence of A.K. McCosh.
82. Strathclyde W.B. & Co. MSS, Valuation Book Gartsherrie. Vol.6. 'House Property Account 1902'.
83. M.O.H. Report Lanarkshire (1910) 108, 112, 113, 221.

Significantly, rents bore most heavily on wages at the trough of the depression of the 1880s when the hewer's day rate was below 15p for the first time in over thirty years. The impression that rents reflected wages payments to some extent is confirmed by the movement of Auchinstarry rents which were reduced from 47.9p per month in 1876-7 to 39.6 by 1885-6, rising again to 43.75p per month in 1891-2.⁸⁴

The company's houses were certainly rented at very favourable terms. In the centre of Glasgow in the early 1870s the average monthly rent for poor quality housing, which was demolished at the time, was 33.22p for one room and 48.02 for two rooms, while the better housing to which the tenants moved was 39.79, and 57.6p for one and two rooms respectively.⁸⁵ According to the Municipal Commission on Housing, average rents in the north of the city were as under.

Table VII:2 Monthly rent of tenements, Glasgow (pence)

<u>Year</u>	<u>Single</u>	<u>Double.</u>
1876	38.78	64.58
1891	43.75	70.83
1901	50	75

Source: see footnote 86.

In the Cowcaddens district of the city the average rent in 1911 was 53.12p for one room and 73.88 for two.⁸⁷ The housing of William Baird and Company was rented at well below the cost of even poor quality

-
84. Strathclyde, W.B. & Co. MSS, Valuation Book, Gartsherrie, Vol. 2, 'House Property Account 1877'; Vol. 3. 'House Property Account 1866', Vol. 6 'House Property Account 1892'.
85. Thomas Ferguson, Scottish Social Welfare 1864-1914 (1958), 96.
86. John Butt, 'Working-class housing in Glasgow 1851-1914' in The History of Working-class Housing, ed. by S.D. Chapman (1971), 81.
87. Ferguson, Scottish Social Welfare, 149.

Glasgow tenements and can therefore, to a degree, be regarded as a perquisite of the job.

The quality of the housing remained consistently poor throughout the period. The company's properties were rarely chosen by contemporaries as examples of either the best or worst in the coal and iron districts. For the most part they were considered as being above average.⁸⁸ The average, however, was very low.

Overcrowding was severe. In the nineteenth century very few of the company's houses had more than two rooms. Where they did occur they were generally occupied by pitheadmen or similar types of worker. The ironworkers were more fortunate than in the mining villages. At Eglinton in 1859 most of the 50 houses most recently erected had two bedrooms, and in some cases three. At Blair, 74 similar houses had been built as well as 35 smaller ones.⁸⁹ In 1862 only 26.5% of the houses in Gartsherrie village were of one room. At Faskine the figure was 57.7% while at Gartcloss it was 92.9%. Excluding the works village, 54.2% of all the houses in the Gartsherrie district had only one room.⁹⁰

By 1871 the position had changed little, indeed in the whole of the Gartsherrie district the number of single-roomed houses owned by the company had actually increased slightly from 44.9% to 45.3% of the total.⁹¹ Evidence from Ayrshire confirms the

88. Bremner, Industries of Scotland, 29; Glasgow Herald 26 January 1875.

89. Tremenheere Report 1859, 38.

90. Strathclyde, W.B. & Co. MSS, Valuation Book, Gartsherrie. Vol.1, 'House Property Account 1862'.

91. Ibid. Vol.2, 'House Property Account 1871'.

favourable position of the ironworkers. The average number of rooms per house was 2.45 at Eglinton and 2.28 at Lugar. Cronberry was well placed with 2.37 rooms per house but at Comondyke the figure was 1.29, with 1.62 at Darnconner, 1.72 at Fergushill and 1.41 at Gaswater.⁹²

During the 1870s there was a decisive change as most of the new housing was of two rooms, and by 1881 the percentage of single-roomed houses in the Gartsherrie district had fallen to 20.3%.⁹³ Among the new villages the average number of rooms per house was 2.0 at Smithston; 2.1 at Auchinstarry; 2.06 at Twechar; 2.0 at Blantyre and 2.02 at Bothwell Park.⁹⁴ Thereafter the fall in the proportion of single-roomed houses continued, though only slowly, and by 1911 they still made up 15.2% of the Gartsherrie district housing stock.⁹⁵ Although towards the close of the century the company virtually ceased to build single-roomed houses, it built very few of more than two rooms. In 1896 ten houses were built at Bothwell Castle of which two had 3 rooms.⁹⁶ At Bothwell Park in 1910 there were 2 single room houses; 157 with two rooms; 2 with three rooms; and 1 with 5 rooms.⁹⁷ At Annathill there were 127

92. Census Return 1871, Vol.1, Population Tables III.

93. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie Vol.3, 'House Property Account 1881'.

94. Census Return 1881, Vol.1, Population Tables III.

95. Strathclyde, W.B. & Co. MSS, Valuation Book Gartsherrie. Vol.7, 'House Property Account 1914'.

96. M.O.H. Report Lanarkshire (1910), 107.

97. Ibid. 112.

with two rooms, and 13 with three rooms.⁹⁸ Broadly speaking, the company's houses changed in the course of half a century from being almost equally divided between one and two roomed properties to being overwhelmingly two-roomed.

Early figures for the number of occupants in these houses are very scarce. At Gartsherrie in 1851 there were 5.2 persons per house, or approximately 2.6 persons per room for two apartment houses.⁹⁹ At Croy in 1864 the population was approximately 200, or 3.4 per room,¹⁰⁰ which compares with 1.82 for the county of Dunbarton at the 1861 census. Table VII: gives details for the latter years of the nineteenth century.

Table: VII:3 Number of Inhabitants per room in Company villages 1871, 1881, 1891.

Village	1871	1881	1891.
Blair	-	2.93	2.68 -
Old Carsehead	-	2.31	2.70
Bartonholm	4.08	-	-
Commondyke	4.71	3.34	3.03 -
Cronberry	2.81	2.20	2.18 -
Dernconner	3.90	4.1	3.36 -
Eglington	2.36	2.84	2.04 -
Fergushill	3.36	3.10	2.90
Gaswater	4.28	-	-
Lugar Ironworks	2.67	2.76	2.66 -
Gartsherrie	2.87	-	-
High Sunnyside	2.17	-	-
Cuilhill	4.42	-	-
Faskine & Palacecraig	3.73	3.47	3.35
Smithton	3.14	3.09	2.5
Auchinstarry	-	2.85	2.83
Twechar	-	2.78	2.79
Stonefield	-	3.52	2.45
Bothwell Park	-	3.10	2.67
Scotland	1.69	1.59	1.52
Ayrshire	1.90	1.78	1.66
Dunbartonshire	1.67	1.65	1.74
Lanarkshire (Glasgow excl.)	2.22	2.05	1.98

Source: Census Returns 1871, 1881 and 1891.

98. Ibid. 168.

99. Tremenheere 1852 Report, 48.

100. Coatbridge, W.B. & Co. MSS, GLB. Vol. 15, 500. Alexander Whitelaw to Rev. Hugh Park, 25 January 1864.

The more spacious ironworks villages were naturally less overcrowded than the mining villages and the improved situation in the more modern villages stands out clearly. On the other hand the company houses compare very unfavourably with the averages for Scotland and even the industrial counties of the west.

The early housing was laid out in long rows commonly, for reasons of building economy, in the form of squares.¹⁰¹ Even much later, when squares were abandoned, the houses were still erected in rows, usually arranged one behind the other.¹⁰² Those built prior to the 1870s were apparently single storey properties, though the company did acquire some two storey buildings at Portland.¹⁰³ Quite a few of the houses built before about 1860 were thatched. This was the case at Thankerton, Gartgill and Gartcross,¹⁰⁴ and as late as 1867 the Tygel'shaugh houses were re-thatched.¹⁰⁵ The cost of the earliest houses built in the Kilsyth area by the company was kept down by using prepared cotton cloth for roofing at one-third of the cost of ordinary roofing.¹⁰⁶ At Rowyards and Faskine and probably some other places, the houses had earthen floors¹⁰⁷ but stone floors were most common, either

101. Tremenheere 1852 Report, 48.

102. The Condition of Miners Housing S tirlingshire and Dunbartonshire. Report by the Medical Officer of Health (1911), 14.

103. Glasgow Herald, 28 January 1875.

104. *Ibid.* 16 January 1875, 26 January 1875.

105. Strathclyde, W.B. & Co.MSS, Valuation Book Gartsherrie.Vol.1, 'House Property Account 1867'.

106. Tremenheere 1859 Report, 38.

107. Glasgow Herald 13 January 1875, 3 March 1875.

flagstone or asphalt, with wooden floors in the bedroom of the two apartment houses. Ventilation was inhibited by the built-in bed recesses; small windows which generally did not open; and the absence of a back door. Plaster was usually applied straight to the walls, though the outside-facing walls were sometimes strapped as well. Water was not provided at Gartsherrie until 1849,¹⁰⁸ and at High Sunnyside until 1852.¹⁰⁹ In 1875 the water supply to other places was precarious. At Faskine it was taken from a small burn in a nearby field, and when this failed it was begged from neighbouring farmers.¹¹⁰ At Gartcloss the 'wee well' was dry from April till November when the people used what was pumped from the pit or what collected on the nearby moss.¹¹¹

The sanitary arrangements left much to be desired. While those at Gartsherrie were described as excellent,¹¹² at Gartgill ashes were deposited in two great heaps and an open drain running in front of the houses was cleaned once per week.¹¹³ At Portland ashpits and closets were situated fifteen feet from the houses, or in some cases against the gable end of the houses.¹¹⁴ At Thankerton the drains were open, and the closets and ashpits

108. Coatbridge, W.B. & Co. MSS, GLB. Vol.3, 31, David Wallace to Airdrie and Coatbridge Water Company 21 September 1849.

109. Ibid. Vol.4, 712. Note of 3 July 1852.

110. Glasgow Herald 13 January 1875.

111. Ibid.

112. Ibid.

113. Ibid. 26 January 1875.

114. Ibid. 28 January 1875

were built in the centre of the square.¹¹⁵ At Barrwood there were no drains, and the ashpits were located in the middle of the row.¹¹⁶

The houses erected after 1870 showed various improvements. At Twechar and Auchinstarry and Bothwellpark built in the mid 1870s the floors were of wood, with tarpaulin below, and in place of bed recesses there were free standing iron beds.¹¹⁷ The wash house, coal cellars, privies and ashpits were grouped in blocks between the rows about fifteen feet from the doors. Water was provided at pillar taps in front of the houses. Such new developments had pavements outside the doors but at the older villages as late as 1912 pavements were only being put down.¹¹⁸ Long unbroken rows set out in parrallel lines were still the commonest layout even at the close of the century, though in several places tenements took the place of the traditional cottages, for example at Bothwellpark and Annathill in Lanarkshire,¹¹⁹ and Glenburn in Ayrshire.¹²⁰ Internal lighting was commonly provided by paraffin, but street lighting was totally absent.

Apart from economising as much as possible on the construction of their early housing the company devoted little money to improvements at least in the mining villages whose existence was expected to be short. For many such villages this was indeed the case. Thankerton, built in the 1830s, was by 1875 'a deserted village', with the rows

115. Ibid. 16 January 1875.

116. Ibid. 30 January 1875.

117. Glasgow Herald 30 January 1875, MOH Report Lanarkshire (1910) 113; MOH Report Stirlingshire and Dunbartonshire (1911), 35.

118. RC on Scottish Housing 1918, Minutes of evidence Vol.11, 1092, evidence of J.T.Forgie.

119. MOH Report Lanarkshire (1910) 113, 168.

120. TSA Ayrshire 570.

on either side of the road mostly roofless and foresaken'.¹²¹
 Cronberry which had a population of less than 300 in 1861
 had 997 in 1871 and only 632 in 1891 when 41 of its 147 houses
 were uninhabited.¹²² The greater scale of the colliery develop-
 ments undertaken later in the century encouraged the company
 to build more substantial dwellings and introduce improvements.
 By the beginning of the twentieth century the ironworks villages
 also required renovation. At Craighead rows, built in the 1870s,
 waterclosets, one to every four tenants, were added just prior to
 1910, and others were built at some of the Bothwellpark houses.¹²³
 A major renovation scheme was undertaken at Gartsherrie where 103
 houses were converted into 9 four apartment, 20 three apartment,
 and 45 two apartment houses. Sixtyone were fitted with sculleries
 and glazed sinks and in all of them the windows were made to open.¹²⁴

The erection of better houses and the introduction of improvements
 unquestionably meant that the houses of 1914 were far superior to those
 of 1850. Yet in the eyes of contemporaries they still had serious
 shortcomings. Although conceding that the system of grouping the
 washhouse, cellar, midden and privy together on blocks was 'most
 ingenious', the Lanarkshire M.O.H. still concluded that 'the system
 must be condemned!'¹²⁵ At other places he criticised the absence of
 washhouses and sinks and the presence of open drains.¹²⁶ At Annathill

121. Glasgow Herald 16 January 1875.

122. Census Returns 1861, 1871, 1891, Population Tables III.

123. MOH Report Lanarkshire (1910), 108, 112.

124. Glasgow Herald 25 December 1913.

125. MOH Report Lanarkshire (1910), 31.

126. *Ibid.* 112.

which was only five years old he reported that the 'privy middens are of such construction that they cannot be used without creating a nuisance.'¹²⁷ These same houses were considered as among the best miners houses in Lanarkshire by the Royal Commission in 1912, though the commissioners criticised the absence of gardens, and the erection of too many houses per acre. At Craighead where the commissioners saw an infant being bathed in the kitchen of one of the houses they recorded that 'even this small performance was a severe test of the available space'. They also remarked on the complete absence of public lighting in any of the company's villages.

Such housing offered little encouragement to the occupants to seek high standards of domestic comfort and cleanliness. This was all the more true among the highly mobile tenants of the mining villages, especially those only recently arrived from either the black houses of the Western Isles or the equally primitive cottages of Donegal. In keeping with its general paternalistic philosophy the company sought to promote certain standards among its tenants. Leases specifically excluded the keeping of poultry and pigs in houses.¹²⁹ In 1845 at Gartsherrie a committee of inspection was established which fined those who kept untidy houses and distributed the money in prizes to those who set the best example.¹³⁰ By 1848 the firm employed four men whose^{sole} job it was to clear the rubbish away and keep the village clean.¹³¹ Tenants whose houses were particularly dirty were dismissed. Where gardens were provided, as at Gartsherrie and Eglinton, fines were levied if they were not cultivated. Later in the century the company policeman in the

127. Ibid. 32.

128. RC on Scottish Housing 1918, Report Vol.1, 127.

129. Coatbridge, W.B. & Co.MSS, GLB. Vol.6, 655 J Campbell to all contractors. 14 February 1854.

130. Tremenheere 1845 Report, 6.

131. Tremenheere 1848 Report, 15.

larger villages was also the house inspector. At Kilsyth the firm appointed 'an inspector to look after the behaviour and comfort of the tenants'.¹³² Just prior to 1914 a Mr. Dabth taught gardening at Gartsherrie and a flower show was sponsored.¹³³ According to J.T. Forgie, it was an uphill struggle to improve the condition of the workforce. Many did not want, or did not use the second room even when it was available. Of 536 two apartment houses in the Kilsyth district in 1912, 62 were unfurnished and 71 had only a bed. When the company offered to install sinks and water in some rows the tenants refused because the proposed rent increase of 2.9p was considered too great.¹³⁴ Not surprisingly, generations of inadequate housing had had an effect which it would require considerable time to eradicate.

Education and Social Life.

The company made provision for elementary education of its workforce. The first school, opened on 31 August 1844, may well have owed much to William's desire to promote a favourable political impression at a time of widespread criticism of the conditions prevailing in the mining districts. Gartsherrie Academy which cost £2,500 was in fact four separate schools under one roof with a capacity of 631 pupils.¹³⁵ Within little more than a decade the pressure of rising attendance at the Academy was such that a second school was built at the works in 1857 for 430 pupils.¹³⁶ Both

132. Glasgow Herald 30 January 1875.

133. Glasgow Herald 25 December 1913.

134. RC on Scottish Housing 1918, Minutes of evidence, Vol.11,1098, evidence of J.T.Forgie.

135. Miller, Rise and Progress, 46.

136. Coatbridge, W.B. & Co.MSS. GLB Vol.9, 448. 11 August 1856; Miller, Rise and Progress, 46.

Gartcross and Faskine already had schools by that date for 54 and 82 pupils respectively,¹³⁷ and as the company expanded into other areas, it built schools. Thus Drumglas school opened in January 1871¹³⁸ and Twechar later in the decade.¹³⁹ At Coatbridge a third school was built at Coats in 1872.¹⁴⁰ In Ayrshire the pattern was similar. Eglinton Works school was opened in 1851,¹⁴¹ and Lugar about 1858¹⁴² and each of the other works villages had a school, though these may have existed before the Bairds acquired the respective ironworks. Among the mining villages there were certainly schools at Cronberry, Gartallan and Skares. Where it did not erect its own schools it paid a portion of the salary of the teacher¹⁴³ or in some other way contributed to the upkeep of the school.¹⁴⁴ For a time the company also ran two schools of industry, one at Gartsherrie and the other at Eglinton¹⁴⁵ where the daughters of colliers and ironworkers could acquire some of the more refined domestic skills.

The company operated a scheme under which all workers paid a basic sum - 2.09p in 1870 - each month, with boys paying in proportion to earnings.¹⁴⁶ In addition fathers of one pupil paid a further 2.9p, of two pupils 5p and of three or more

137. Coatbridge, W.B. & Co. MSS, 'undated note regarding Company schools'.

138. Ibid.

139. Anderson, History of Kilsyth, 195.

140. Coatbridge, W.B. & Co. MSS, 'undated note regarding Company schools'.

141. Tremenhoe 1851 Report, 33.

142. H. Steven, Auchinleck, 80; Minutes and reports of the Committee of Council on Education, 1859-60, 820.

143. Coatbridge, W.B. & Co. MSS, GLB. Vol. 19, 837, note regarding payment of proportion of Denny schoolmasters salary.

144. Ibid. Vol. 20, 23, note regarding contribution to new school Bargeddie.

145. Tremenhoe 1859 Report, 51 and 54.

146. Coatbridge W.B. & Co. MSS, GLB. Vol. 21, 903. J. Alexander to R. Angus, Lugar, 25 June 1870.

6.25p per month. A charge was made for children between 5 and 10 years of age who did not attend school. In 1871 the monthly payment of 2.09p was reduced to 1.67p.¹⁴⁷ Alexander McDonald maintained that the Bairds levied additional fees to recoup the cost of building the schools.¹⁴⁸ The fees collected by the company were not paid directly to the teacher but formed a pool of money from which he was paid according to the number of pupils who attended his school. One estimate put the loss on the operation of Gartsherrie Academy for several years after 1857 at £157 per annum.¹⁴⁹ In 1871 Alexander Whitelaw maintained that the company's loss on education amounted to £3,000 over the previous ten years, not including the cost of new buildings.¹⁵⁰

The company schools were all associated with the Established church. To what extent children of other denominations did not attend the schools is unclear. At Drumglas where the population was 76.24% Roman Catholic the company^{school} had 142 Protestant pupils and 87 Roman Catholic. The separate Roman Catholic school had 150 pupils of whom 135 came from the company houses.¹⁵¹ In 1875 the Catholic workers in the Kilsyth district petitioned to be relieved of the payment of school fees. The company agreed to this on condition that written evidence from the teacher or priest was produced to prove the child's attendance at the Catholic school. The basic deduction of 1.67p per month had still to be paid however.¹⁵²

Following the Education (Scotland) Act of 1872 the company's

-
147. Strathclyde W.B & Co.MSS, Manager's notebook Gartsherrie, October 1871.
148. SC on Mines 1866, 209, evidence of Alexander McDonald.
149. Coatbridge, W.B.& Co.MSS, Report on Gartsherrie schools n.d.
150. Report of the Truck Commission 1871, Vol.II, 274, evidence of Alexander Whitelaw.
151. Coatbridge, W.B.& Co.MSS, Report on Gartsherrie schools n.d.
152. Coatbridge, W.B.& Co.MSS, GLB.Vol.27, 400. W.Jardine to W. McKinlay, 17 January 1875.

task of providing elementary school facilities was taken over by the local school boards. It did not immediately give up its own schools. In May 1878 Gartcross school was closed.¹⁵³ A major change seems to have occurred in 1887 when the company ceased to collect school fees at Faskine and Palacecraig and at Hallhill and Bargeddie.¹⁵⁴ In the same year Drumglass school was taken over by the local school board.¹⁵⁵ In the closing years of the century Eglinton was likewise taken over.¹⁵⁶ The company also made provision for senior and adult education. A secondary department for thirty pupils was begun at Gartsherrie in 1851, providing instruction in such subjects as Latin and geometry.¹⁵⁷ Evening classes were provided at Gartsherrie works school¹⁵⁸, at Drumglass¹⁵⁹ and at Eglinton.¹⁶⁰ The most important steps in this respect occurred after 1872 with the development of scientific and technical instruction. In that year there was a Science and Art school at both the Gartsherrie Works school and the Academy, the latter begun in May of that year.¹⁶¹

-
153. Ibid. Vol.31, 301, note on Gartcross School 3 May 1872.
 154. Ibid. Vol.38, 862, L. Crawford to W.J.Andrew.
 155. TSA Dunbartonshire, 309.
 156. W.L.Ker, Kilwinning (1900), 356.
 157. Tremenehere 1851 Report, 36.
 158. Minutes and Reports of the Committee of Council on Education, 1859-60, 839.
 159. Coatbridge, W.B. & Co.MSS, GLB.Vol.30, 120, note regarding Drumglass Evening School, 4 February 1877.
 160. Tremenehere 1859 Report, 53.
 161. Science and Art Department Report, 1872, 119, 162, 178, 191.

It boasted of the best equipped chemistry laboratory of the 322 in the United Kingdom, excepting only Macclesfield, Liverpool, Birmingham and Charterhouse.¹⁶² By 1876 there was a similar school at Eglinton¹⁶³ and by 1882 at Muirkirk.¹⁶⁴ Instruction was provided in theoretical mechanics, applied mechanics, mathematics, magnetism and electricity, organic and inorganic chemistry, geology, steam, physical geography and principles of mining. In 1872, Gartsherrie was the only school listed providing this latter subject and in 1878 it had 80 students in this class, while in the rest of Scotland two other schools had 8 students each. In that same year it received the third largest payment by results grant of any school in Scotland.

The firm sponsored the establishment of a Technical College at Coatbridge. As early as 1885 A.K. McCosh, although not then a member of the local board, wrote privately to the Science and Art Department in an effort to 'push on' the building of a specialist Science and Art School at Coatbridge.¹⁶⁵ Two years later the Technical Schools (Scotland) Act 1887 was passed giving local authorities the power to erect Technical Schools. In 1890 the Technical College Coatbridge, the only one erected under the act was begun on land given by William Weir, and it opened in 1892 with David Ross, ex-headmaster of the Gartsherrie Science and Art School as its first principal.¹⁶⁶

The motives underlying the company's long and firm commitment to the provision of educational facilities for its workforce can

162. Coatbridge, W.B. & Co. MSS, Report on Gartsherrie Schools, n.d.

163. Science and Art Department Report 1876, 45, 94, 110, 141.

164. Ibid. 1882, 108, 110, 183, 186, 292.

165. Coatbridge, W.B. & Co. MSS, GLB. Vol. 36, 718. A.K. McCosh to Charles Buckmaster 11 May 1885.

166. Engineering 20 January 1893.

only be inferred. To a certain extent of course such a policy was socially and politically advantageous. The promotion of education was widespread among Victorian businessmen and aristocrats, and the partners of the firm, who were politically active and eager to become socially accepted had to follow suit. Without doubt too, their acceptance of a responsibility to provide schools was a sincere expression of their paternalism. They believed in the virtues of a good basic Scottish education as provided through the parochial system and merely extended that system to cope with population developments. After all such an education had been the only help, outwith the family, which the Baird brothers had received to enable them to achieve success. There was too a compelling economic motive. The firm was in constant need of educated personnel at all levels from semi-skilled upwards as the firm, and the iron and coal industries, expanded and evolved. The building of schools played an important part in its policy of training its own. As early as 1851 one of the Gartsherrie managers spoke of their success in supplying, 'not only ourselves, but many neighbouring collieries and we/are frequently called upon to recommend young men for other iron district. The person in charge at Eglinton was brought up here as a collier, and twenty young men holding good positions on railways, etc., for example as drivers and enginemen, were bred here'.¹⁶⁷ Ten years later Tremenheere was told that, 'we always act on the principle of drawing from our schools when filling offices of trust connected with our works. Of such we have about fifty with salaries from £70 to £150 p.a. There are frequent changes, with many drafted off to other works on promotion as it were'. The company, at this date,

167. Tremenheere 1859, Report, 37.

still had difficulties, and the manager lamented that, 'despite all we offer few stay long enough to get a good education, therefore we don't always get the lads we need'.¹⁶⁸ Whatever the company's motives for providing it, the education they made available was highly regarded. When John Gordon was inquiring into the quality of education in the mining districts of Lanarkshire one teacher he visited warned him not to expect the same high standard as at Gartsherrie.¹⁶⁹

The influence of the company extended beyond the provision of formal education to the wider religious, social and recreational interests of its employees.

In 1836 religious services were begun at the works and in the following year the company took the major step of damping down the furnaces from 6 a.m. to 4.30 p.m. each Sunday.¹⁷⁰ A year later a preaching station, accommodating 200, with its own minister, was opened at the works. A proper church building was opened in 1839, and James Baird endowed it at a cost of £3,500, besides clearing its debt of £1,100, while George paid for the manse.¹⁷¹ This was the first of many church building schemes in which the company was involved. Robert Baird contributed to the cost of Holytown church used by the Thankerton workers,¹⁷² David Wallace paid for the building of Bargeddie church,¹⁷³ Alexander

168. Ibid. 1859 Report, 54.

169. Gordon, J. 'On the State of education among the mining population of Lanarkshire'. Transactions of the Nat.Assoc. for the Promotion of Social Science (1860), 361.

170. MacGeorge, Bairds of Gartsherrie, 70.

171. Ibid. 72.

172. Ibid. 73.

173. Glasgow News 17 August 1877.

Whitelaw for that of Twechar, George Baird for Coats - and A.K. McCosh was largely responsible for two others in Coatbridge.¹⁷⁴ Others were probably built by the firm but only Lugar is known for definite.¹⁷⁵

Towards the close of the century various partners bore the cost of the erection of Workers' Institutes at Eglinton, Lugar, Muirkirk, Gartsherrie and Twechar.¹⁷⁶ The Gartsherrie institute, built at a cost of £6,000 had both swimming and private baths, and a reading room. At Lugar there was a reading room, library, swimming pond and facilities for billiards, and skittles. In some of the smaller villages, for example Skares, the company provided a reading room and hall.

Various community societies and organisations were sponsored by the company. There was a Total Abstinence Society at Gartsherrie in 1859¹⁷⁸ and another at Muirkirk in the 1870s.¹⁷⁹ In 1852 the company supplied fifteen instruments for a band, employed a musician to teach them, and provided a hall for concerts.¹⁸⁰ In 1860 the company provided funds to buy instruments for a flute

174. Glasgow Herald 24 January 1916.

175. Steven, Auchinleck, 81.

176. TSA Ayrshire, 310, 677; TSA Dunbartonshire 291; Scotland's Industrial Souvenir (1905), 132; Steven Auchinleck, 79.

177. Strawhorn, Cumnock, 118.

178. Tremenheere, 1859 Report, 59.

179. Peter Mearns, Muirkirk and the Neighbourhood (1882), 73

180. Tremenheere 1852 Report, 49.

band¹⁸¹ and did likewise for the band begun at Bothwell in 1885.¹⁸² It also bought a flag for the Gartsherrie Hewers Society in 1867¹⁸³ and sponsored the formation of a Gartsherrie Yearly Society and Savings Bank whose funds it held.¹⁸⁴ The value of such schemes in promoting order and discipline in the community and the consequent good effects which these would have on work habits was fully realised. The company had to solve the problems of fashioning a modern industrial labour force against a community background almost as turbulent as that of the frontier towns of the American West. Robert Baird, speaking of the Monklands said in 1842, 'There is not a worse place out of Hell, than that neighbourhood. Murder may be committed every day and never heard of'.¹⁸⁵ Coatbridge had one public house for every twenty adult males about the middle of the century. As late as 1885, an American visitor described the public houses as 'filled to overflowing' and spoke of fighting as being the 'principal diversion of the place'.¹⁸⁶ 'Orange and Green' riots frequently resulting in fatalities, regularly necessitated the calling out of the yeomanry. According to J.E.Handley, 'for consistent trouble of that nature over many years Coatbridge, Motherwell and surrounding districts held pride of place'.¹⁸⁷

It was in the company's interests to support any proposal which might promote a more stable social structure.

-
181. Strathclyde, W.B.&Co.MSS, Manager's notebook Gartsherrie 2 July 1860.
 182. Coatbridge, W.B.& Co.MSS, GLB.Vol.36, 956,A.K.McCosh to J.Findlay 8 August 1885.
 183. Strathclyde W.B.& Co.MSS,Manager's notebook Gartsherrie, May 1867.
 184. Coatbridge, W.B.& Co.MSS, GLB Vol.21, 434, note regarding the society 6 November 1869.
 185. RC on Children in Mines 1842, Vol.II,362,evidence of Robert Baird.
 186. Porter, P. Breadwinners Abroad, New York,1885, 64.
 187. Handley, Irish in Scotland, 265.

A major scheme was the provision of medical facilities for the workforce and their dependants. As early as 1844¹⁸⁸ the services of a doctor were provided at Gartsherrie, and as the firm's activities expanded, more doctors were required, though to how many of them the company paid fees is unknown. In 1874 two were required in the Kilsyth area,¹⁸⁹ and in 1879 following demands from the Baillieston workers that area was divided between two doctors.¹⁹⁰ The fees were deducted from the men's wages. In 1856 the fee was 2.5p,¹⁹¹ in 1870¹⁹² 2.7p, and by 1879 it stood at 3.75p¹⁹³ per month which was still the rate fifteen years later.¹⁹⁴ There was also a dispensary at Gartsherrie, and annual subscriptions were taken up from the men for the nearest hospital.¹⁹⁵ Although the men had no say in the appointment of their doctor Alexander Whitelaw maintained that the firm investigated any complaints¹⁹⁶ and there is one case recorded of the firm having 'finally been forced to accept the demands of the men for a new doctor.'¹⁹⁷

188. Tremenheere 1844 Report 17.

189. Coatbridge W.B. & Co.MSS, GLB Vol.27, 98, A.K.McCosh to Dr. Fraser 19 October 1874.

190. Ibid. Vol.31, 1019, A.K.McCosh to Dr. Ferguson 5 March 1879.

191. Coatbridge W.B.& Co.MSS, GLB.Vol.8, 849 David Wallace to J. Hamilton, 19 January 1856.

192. Coatbridge W.B.& Co.MSS, Return to Truck Commission September 1870.

193. Coatbridge W.B.& Co.MSS, GLB.Vol.31, 1019.A.K.McCosh to Dr. Ferguson 5 March 1879.

194. RC on Labour,1892-4, evidence before Group A, Vol.II,238, evidence of A.K.McCosh.

195. Coatbridge W.B.& Co.MSS, GLB.Vol.19, 905,Vol.20, 784, Vol.21,555. Vol.II, 274.

196. Report of the Truck Commission 1871, Vol.II,274,evidence of Alexander Whitelaw.

197. Coatbridge W.B.&Co.MSS,GLB.Vol.3, 465.James Baird to Dr.Tennant 22 July 1850.

The Store System

In common with most other concerns in the coal and iron trade of the West of Scotland the company opened shops to provide food and other household provisions for its workforce. Initially the Gartsherrie firm's shops were fairly conventional Truck shops of the kind described by Hill Burton in 1853. Besides the store at the works there were shops at Faskine and Thankerton, ostensibly under the contractors' control but in fact regulated from Gartsherrie.¹⁹⁸ The system does seem to have been more enlightened than at some other works. Employees were free to spend their ordinary wages where they chose but were expected to spend advances in the shop. Tremenheere concluded that since only £4,357 out of £4,750.25 advanced in three months of 1844 were spent in the store this 'did not suggest a compulsory truck system'.¹⁹⁹ However, James Baird conceded that although advances might be spent where the men pleased, and no one was ever dismissed for not using the store, 'perhaps they might be remonstrated with a little by the clerk'. He had 'no hesitation in saying what the understanding is, that they do not get a daily advance unless it is to be spent in the shop to the extent of 80 or 90%'.²⁰⁰ At first the firm used some kind of ticketing system but following a number of prosecutions under the Truck Act, it adopted a system of paying in cash.

-
198. Coatbridge WB & CO MSS, G L B Vol2, 110, D. Wallace to Adams and McIntyre 30 July 1848.
199. Tremenheere 1844 Report 24
200. SC on Payment of Wages Bill 1854, 24, 140 evidence of James Baird

According to Douglas Baird the company had opened a store in the interests of the men, not least with regard to controlling the consumption of alcohol during working hours.²⁰¹ They provided 'every conceivable commodity necessary to existence.....of the best quality and at prices regulated by the public market' according to one reporter.²⁰² In 1848 David Wallace wrote to James Keith, in charge of the Thankerton store, criticising his poor buying policy and pointing out that, 'the colliers are complaining, with reason, at the price of your meal'.²⁰³ The firm also maintained that the stores were not operated for any reasons of profit. James Baird said that though profit had been as high as £2,000 it had also been as low as £300.²⁰⁴ By chance the figures on which he based this evidence have survived, and are presented in table VII:4.

Table VII:4 Gartsherrie Store Profits 1841-48

Year	Profit	Year	Profit
1841-2	£1919.68	1845-6	£2693.28
1842-3	£328.62	1846-7	£2163.08
1843-4	£680.70	1847-8	£2078.95
1844-5	£1852.23		

Source: Coatbridge, WB & CO MSS, GLB Vol.2, 403
'Store Profits 1841-1848'.

-
201. Tremenheere 1844 Report 24.
 202. Mining Journal 3 August 1850.
 203. Coatbridge, WB & CO MSS, GLB Vol.2 180, D.Wallace to J. Keith 15 August 1848.
 204. SC on Payment of Wages Bill, 1854, 138 evidence by James Baird.

The very low profit of 1842-3 was the result of setting against that year's true profit all bad debts since 1830. James Baird also provided an additional reason as to why the company ran stores. He explained that 'delegates urging a strike find the store a powerful agent against such' since 'the moment they stop work the store stops advancing'.²⁰⁵

In the mid 1850s the entire store system was significantly altered. Alexander Whitelaw maintained that the first store under the new system was opened at Eglinton in 1856 and that he was responsible for establishing it.²⁰⁶ According to another source, Alexander McDonald, the miners leader was instrumental in bringing about the change, a view which McDonald shared.²⁰⁷ At the time of the 1857 election when he campaigned against George Baird who was standing for the Falkirk Burghs 'he exposed the nefarious system of truck...A few days afterwards the practice was changed'.²⁰⁸

Co-operative stores were established. At Gartsherrie the company nominated three men - in practice the chief cashier and two of the principal managers - and the members of the society chose a further twelve men, to form a committee. Lenders could invest from £1 to £20 at 8% interest to provide the capital.²⁰⁹ Although anyone could make purchases in the store - and many outsiders did - only

205. SC on Payment of Wages Bill 1854, 137, evidence of James Baird.

206. Report of the Truck Commission, 1871, Vol.II, 273, evidence of Alexander Whitelaw.

207. SC on Mines 1866, evidence of Alexander McDonald.

208. Glasgow University Library, manuscript notes on Truck at end of volume of Parliamentary Papers entitled 'Mines Bills and Papers 1869 - 70'.

209. Report of the Truck Commission 1871, 273 evidence of Alexander Whitelaw.

employees could share in the dividend.²¹⁰ Shareholders received an annual dividend in proportion to their purchases and the dividend on all unregistered purchases was paid into a fund and used for charitable purposes.²¹¹

By 1887 Gartsherrie Ironworks Co-operative had four branches in the neighbouring colliery districts²¹² and by 1903 there were stores at Bothwell Park, Craighead, Twechar, Smithston, Auchenstarry, and Queenzieburn.²¹³ In Ayrshire there were stores at Eglinton,²¹⁴ Lugar (opened 1863)²¹⁵ and Muirkirk,²¹⁶ and branches in outlying villages - Lugar for example had branches at Cronberry and Skares.²¹⁷ The volume of business alone was considerable. At Eglinton in 1868 sales were £33,781.70 and the profit for the year amounted to £2,717.79p giving a dividend of 8.04%.²¹⁸ At Lugar and Muirkirk, which, according to Alexander Whitelaw, did the greatest business, the profit in 1870 was from £2,000 to £2,400 per annum.²¹⁹ At Gartsherrie sales expanded from £130.55p per week at the time of the establishment of the co-operative to £664.75 in 1886.²²⁰ By 1892 total annual sales were between £80,000 and £90,000 at all the works.²²¹

-
210. Redmayne's Report on Truck in Scotland 1887, 17, statements by AK McCosh (evidence before Group A, vol 11, 236.
211. RC on Labour 1892-4, evidence of A.K. McCosh.
212. Redmayne's Report 1887, 7, statement by A.K. McCosh.
213. Coatbridge, WB & CO MSS, "Co-operative Property 31 May 1903".
214. Report of the Truck Commission 1871, 273 evidence of Alexander Whitelaw.
215. Glasgow Herald 17 January 1863.
216. TSA, Ayrshire, 673.
217. Ibid, 666.
218. Report of the Truck Commission 1871, vol I, 113 evidence of William Robertson
219. Ibid, vol II, 275, evidence of Alexander Whitelaw
220. Redmayne's Report 1887, 7, Statement of A.K. McCosh.
221. RC on Labour, 1892-4, evidence before Group A, vol II, 236, evidence of A.K. McCosh.

The company acted as the stores banker, rented the store buildings to it and loaned it some capital in the early stages, as well as providing a minority of the committee. It insisted however, that the stores were genuinely independent bodies under the control of the employees themselves, and contemporaries, including Alexander McDonald, generally agreed that the system was a fair one.²²² The company did, however, further the interests of the stores. In 1864 it circulated a letter among its tenants on the Gartsherrie district forbidding the sale of goods in any of its premises.²²³ At Muirkirk it 'prevented the establishment of any kind of shop in opposition to its own general store.'²²⁴ In 1885 it solicited the support of local officials for Twechar stores application for a licence to sell spirits on the grounds that it would be on a property, 'under that proper control which we have the power to exercise'.²²⁵

Keir Hardie questioned the view that the division between company and store was clear cut.²²⁶ He maintained that his union's efforts to identify the true owners of the capital through the courts had been frustrated by the Society's paying even somewhat unjust claims rather than reveal the facts. He also claimed that men who were dismissed or quit the company's service forfeited their deposits and that as the trading year drew to a close, 'there was a considerable amount of terrorism

-
222. SC on Mines 1866, 210, evidence of Alexander McDonald; North British Daily Mail, 19 June 1869.
223. Airdrie and Coatbridge Advertiser 19 March 1864.
224. TSA Ayrshire, 673.
225. Coatbridge, WB & CO MSS, GLB Vol.36, 674, A.K. McCosh to P.B. Smollet, 30 April 1885.
226. RC on Labour, evidence before Group A, Vol II, 186, evidence of Keir Hardie.

with the dividend as the weapon', since only employees actually in employment at the annual settlement date could receive dividend. The store was still an instrument for use against unionism much as James Baird had used it forty years before. It was similar to the old Truck shops, also, in that it discouraged labour turnover.

Wage Rates and Earnings

Consideration of the nature of employment and the pattern of earnings must be prefaced by some reference to the variety of jobs within William Baird and Company. At the ironworks the range of occupations and hence of wages, was especially wide. In the early years it included furnace keepers, assistant keepers, fillers, blastenginemen, pig-breakers, weighers, moulders, boilermen, wrights, plumbers, slatelayers, joiners, blacksmiths, patternmakers, bricklayers, labourers, boatmen, waggoners, carters, engine-drivers, firemen, brakesmen, greasers, timekeepers, stablemen, scavengers and a policeman. Later were added elevator-enginemen, lid lifters, gasmen, sulphatemen, coopers, tubecleaners and electricians. At the pits, there were smiths, hammermen, wrights, hutchmakers, wood cutters, bricklayers, shankmen, coke-ovenmen, ashwheelers, riddlers, screemen, brasspickers, tinsmiths, waggonlifters, lampmen, pitheadmen and enginemen above ground. Below ground besides colliers and miners there were oversmen, foremen, bottomers, roadmen, brushers, ponydrivers, boggiemen, benchers, chain runners, couplers, trappers and pumpers.²²⁷ The duties involved under

227. Strathclyde, WB & CO MSS, Managers Notebook Gartsherrie, passim.

any particular category were not necessarily identical throughout the Scottish iron and coal district. At Gartsherrie the task of attending to the hotblast ovens was carried out by the assistant-keepers whereas at other Scottish works it was the job of a separate individual.²²⁸ Likewise the post of slag-filler existed at some Scottish works but at Gartsherrie the ordinary labourers did the job.²²⁹

In the early years there was a monthly pay settlement with one lying week, but the men were allowed advances daily to within a little of their earnings.²³⁰ At first men were allowed to draw on their succeeding pay ten days before their present pay was completed but by 1854 this had been abandoned. From 1857 the pay period was the calendar month with settlement on the 4th of the succeeding month.²³¹ In theory many of the men were paid by contractors, and not by the company, but in practice the contractors paid the amount, and in the manner, laid down by the company. Of course, the partners were always careful to stress that they could not actually speak with any authority about the behaviour of their contractors.²³² At both the works and the pits as many tasks as possible were paid for by piece rates based on the output of pig iron, ironstone, or coal. The rate paid to such workers was from a fairly early date considered in relation to a national shift wage. By 1864, and possibly much earlier a minimum

-
228. Coatbridge, WB & CO MSS, GLB vol.8, 549, J. Campbell to A.C.S.Clark, 15 October 1855.
229. Ibid vol.5, 186, D.Wallace to J.Eddie, 3 December 1852.
230. SC on Payment of Wages Bill 1854, 136, evidence of James Baird.
231. Coatbridge, WB & CO MSS, GLB Vol.9, 819, J. Campbell to all Contractors, 19 January 1857.
232. Report of the Truck Commission 1871, Vol.II 273, evidence of Alexander Whitelaw.

shift wage existed for piece workers at Gartsherrie, which was paid whenever it exceeded what the workers were entitled to on the basis of tonnage rates.²³³ The system, though not the actual rates was general throughout both the Gartsherrie district and Ayrshire.²³⁴

From the wages earned the company deducted a series of oftakes. In 1870 the oftakes per month were 2.7p for doctor's fees; 7.5p to 12.5p per cart for coal in the case of colliers and 16.25p for furnaceworkers; 22.9p to 38.3p for rent; 5.4p for pick sharpening; and 2.1p for education plus 2.9p for one child, 5p for two, and 6.25p for three or more.²³⁵ A collier working constantly late in 1870 would have earned approximately £4.95 pence. Assuming that he lived in a two-apartment house, burned four bags of coal per month, and had two children of school age his oftakes would amount to 53.2p or 10.75% of earnings. In 1899 workers at Bothwell paid the following oftakes per month; 5p for doctors fees; 43.75p for coal per ton, 54p for rent; 5p for pick sharpening and 9p for a lamp.²³⁶ On the basis of the same example as before earnings would amount to £6.87p and oftakes to 81.7p or 11.9% of earnings.

It is possible to construct a series showing furnace keepers' piece rates from 1844 onwards.²³⁷ However, there are numerous gaps prior to 1890 - in some cases of as much as two years. Differences

-
233. Strathclyde, WB & CO MSS, Manager's Notebook Gartsherrie May 1861.
 234. Ibid 20 February 1854; 22 May 1880; Departmental Committee on Checkweighing in Iron and Steel 1907; 57, evidence of William Estley
 235. Coatbridge, WB & CO MSS, Return to Truck Commission September 1870
 236. Strathclyde, WB & CO MSS, Manager's Notebook Gartsherrie February 1899.
 237. Taken mainly from Coatbridge, Gartsherrie Letter Books, and Strathclyde, Manager's Notebook Gartsherrie.

in the productivity of the furnaces and changes over time as deterioration or maintenance work affected performance, together with temporary stoppages on account of accidents, breakdowns or industrial disputes, all operated against a background of continuous minor technological advance which pushed productivity upwards. Furthermore, the need to provide a particular incentive to achieve quality as well as quantity caused the company to introduce a bonus to be paid whenever more than a stated percentage of the output of a furnace was No.1 iron. In the absence of detailed weekly output figures for each furnace calculation of actual earnings is impossible.

A much more fragmentary series of minimum shift rates can be constructed and by extrapolation it is possible to complete it in those cases where tonnage rates are known, the probability of error being no more than about 2%. Actual shift earnings normally exceeded these - by 17.5% in July 1871,²³⁸ and by 26% in July 1878.²³⁹ It is probable that the difference between minimum and actual shift earnings would be greatest in times of strong trade and least in depression. On the other hand, absenteeism was so much a part of the pattern of things that extra furnacemen were permanently employed to take the place of absentees.²⁴⁰ In periods of strong demand and high piece rates actual shift earnings would be significantly above the minimum, but absenteeism would be most prevalent, with the result that the gap between actual and minimum weekly earnings would not be so wide. Although the schedule of minimum shift rates does not show the absolute

238. Strathclyde, WB & CO MSS, Manager's Notebook Gartsherrie July 1871

239. Ibid. July 1878.

240. Engineering 10 October 1890.

level of earnings, it probably provides a good guide to the pattern of wage changes at the ironworks during the period.

The movement of wages shows a strong correlation with the fortunes of the pig iron trade with peaks for both occurring in 1845, 1856, 1866, 1873, 1880, 1889, 1900, and 1907; and troughs in 1851/2, 1861, 1868, 1878, 1886, 1893, 1903 and 1909.²⁴¹ From the late 1890s onwards the operation of a sliding scale made such a relationship inevitable. In the short term the wage rate was much more stable than the price of pig iron. For example, it was altered only three times in 1878 - from 26.67p to 25p in February; down to 23.75p in October; and down again to 22.92p in December. On the other hand the price of Garthserrie No.1 pig iron varied with almost every weekly quotation, occasionally rallied upwards but for the most part showed a steady fall from £3 in February to £2.50 in December.

In so far as the shift rate is indicative of actual earnings there was a long gradual drift downwards from the mid 1840s till the mid 1860s, followed by the brief spectacular boom of the early 1870s. Thereafter the rate fell back rapidly to the level ruling in the mid 1860s, remained sluggish into the mid 1880s and then began a steady climb upwards right through to 1910 to levels never before reached except for a few months in 1873.²⁴² If such is the case, then the Gartsherrie workers' earnings do not correspond very well with the existing general indices of nineteenth century wages.²⁴³

241. See Appendix D, Table 1 and Appendix B table 3.

242. See Appendix D, Table 1.

243. B.R. Mitchell & P. Deane, An Abstract of British Historical Statistics (1962), 343ff.

There are a few isolated figures for the tonnage rate paid to colliers in the 1840s and 1850s but unfortunately no details of the day worked; therefore, shift rates cannot be computed. From the 1860s on it is possible to construct fairly complete details of the hewer's nominal day rate. In the early years colliers wages moved in accordance with fluctuations in the pig iron market, but in the 1870s this relationship gradually weakened.²⁴⁴ By the time of the adoption of the first sliding scale in the Lanarkshire pits the company joined other coalowners in agreeing to a scale based on the market price of tripping.²⁴⁵ There were particular occasions when miners' wages were not altered in conjunction with those of collier's but for the most part the two sets not only moved together but were set at the same level - rather surprising in view of the more onerous work involved in ironstone mines. Each of the different categories of oncost worker was paid a shift wage rather than a piece rate. There is no evidence that the oncost shift rate was more stable than the hewer's nominal wage which suggests that oncost worker's actual earnings were not so volatile in boom periods but dropped just as low as hewer's rates in depression. For example, there were twenty-one recorded wage alterations between November 1868 and November 1878. The actual oncost rates were rarely mentioned but the percentage change in both the colliers' and oncost rates was in every instance the same.²⁴⁶

The hewer's nominal shift rate is, as Slaven has shown, subject to certain limitations,²⁴⁷ but in the absence of any better guide it

244. RC on Labour 1892-4, evidence before Group A, Vol.11,238, evidence of A.K. McCosh.

245. J.E.C. Munro, 'Sliding Scales in the Coal and Iron Industries from 1885 to 1889' Jnl. of the Manchester Statistical Society (1890),129-137.

246. Strathclyde, WB & CO MSS, Managers Notebook Gartsherrie 1868-1878 passim.

247. A. Slaven, 'Coal Mining in the West of Scotland', 154.

must be made to serve. The Gartsherrie series,²⁴⁸ shows clearly the impact of the boom of the early seventies and the wage decline of the consequent depression. Not until the minor recovery of 1880 did wage rates reach the levels of the late 1860s, only to collapse again into the trough of the long depression of the 1880s. There were short-lived recoveries in 1890 and again in 1893 but on each occasion the rate slipped back again to the level of the 1868/9. Not until the late 1890s did the wage rate really begin to move forward and even in depression it was never less than 37.5% above the level of 1869. This is in broad agreement with the movement established by Slaven for Govan and also the coalmining index of A.L. Bowley.²⁴⁹

Industrial Relations

It would be a serious over simplification to discuss the company's labour force as though it were a homogeneous entity. Apart from the racial mixture and geographical spread already indicated, the workforce was divided between ironworkers and mineral workers - and within each of these categories there were many subdivisions. Cohesion was provided on a local basis by mutual dependence on a place of work and reinforced by the fact that many of the workers lived in the company villages. In the early years the influence of even these factors was weakened by the short life of many of the pits, the often temporary nature of employment, and the consequent migratory habits of many of the employees, as well as the regular arrival of strangers often as strike breakers, into the expanding labour force. In such circumstances

248. See Appendix. D, table 2.

249. A.L. Bowley, Wages and Income in the United Kingdom since 1860 (1938).

sustained common action was difficult to achieve even discounting the opposition of the company. Attempts at unionisation seem to have been particularly weak and sporadic among the company's labourforce and it is interesting in view of the company's importance as an employer in the coal and iron industries that none of the nineteenth century trade union leaders came from among its employees.

The partners combined enlightened paternalism with implacable hostility to trade unionism. At the time of the 1837 strike the company ordered all unionists in its employ to quit either the union or the company's houses,²⁵⁰ and in 1842 Robert Baird stated that no known unionist was allowed down any company pit.²⁵¹ In 1847 William Baird expressed 'a very strong opinion as to the permanent injury which the combination was inflicting on the iron trade of Ayrshire'.²⁵² James Baird summed up the corrolary to the firms anti-unionism when, in a reference to truck, he said it was the responsibility of the firm towards its employees to see that, 'they are well fed, well-housed, and their children well educated. I think far more good can be done in that way, than by the workmen spending their wages to provide provisions for themselves'.²⁵³

The firm remained consistent in its attitude throughout the century. In 1887 A.K. McCosh wrote to a workers' spokesman, 'We cannot allow you to come between us and our employees. If they

250. Glasgow Herald 21 April 1837.

251. RC on Children in Mines 1842, Vol.II, 362 evidence of Robert Baird

252. Tremenheere 1847, Report, 20

253. SC on Payment of Wages Bill 1854, 139 evidence of James Baird.

have any grievance, real or imaginary or any request we are always ready and pleased to discuss the matter with them.....We need not point out that we or our employees are free to make or cancel any legal contract between us in a regular manner now and henceforth.'²⁵⁴ Keir Hardie confirmed that in the same year the Ayrshire union was refused recognition.²⁵⁵ In 1892 A.K. McCosh diplomatically conceded that the company 'would be pleased to see a union on moderate and reasonable lines'. However, the firm had 'discouraged unions principally because we objected to their organisation and their methods'.²⁵⁶ As late as 1907 J.T. Forgie and Robert Smillie became involved in a heated discussion over the firms attitude to unionism, in the course of which Smillie accused Forgie of having dismissed men because they were active in the union movement.²⁵⁷

In several spheres changes in the relationship between the company and its employees were brought about as a result of the passing of legislation, and in this respect also the company vigorously defended its interests. Much of the early legislation was designed to reduce the number of fatal accidents in the pits. The company had no truly major disasters, on the scale of the great Blantyre explosion, but in 1878 an explosion killed 17 men at Barrwood No.2 pit,²⁵⁸ and at nearby Quarter No.1 in 1895 another explosion killed 13 men.²⁵⁹ These two incidents apart, each year witnessed a steady number of individual tragedies. The figures do not permit any straightforward longterm analysis

-
254. Coatbridge, WB & CO MSS, GLB Vol.38,869, A.K. McCosh to A. Thomson, 17 December 1887.
255. RC on Labour 1892-4, evidence before Group A, vol 11, 205, evidence of Keir Hardie.
256. Ibid, 241, evidence of A.K. McCosh.
257. RC on Mines 1907, vol.IV, 199, evidence of J.T. Forgie.
258. Report of H.M. Inspector of Mines, 1878.
259. Ibid, 1895.

of the relative safety of the company's pits but a number of interesting points emerge. Firstly, the proportion of fatal accidents at the company's ironstone pits seems remarkably high, as table VII₅ indicates, not only in relation to the total for Scotland, but even when compared with the fatalities in the company's coal pits which employed far more men.

Table VII: Fatal accidents at coal and ironstone pits
5 in selected years - WB & CO and Scotland

Year	Company		Scotland		Year	Company		Scotland	
	C	I	C	I		C	I	C	I
1861	8	10	89	13	1871	15	5	103	15
1862	4	7	87	24	1872	7	6	84	15
1863	4	8	68	30	1873	5	6	113	22

Year	Company		Scotland	
	C	I	C	I
1881	6	8 (W)	100	14 (W)
1882	16	6 (W)	103	18 (W)
1883	8 (W)	5 (W)	34 (W)	9 (W)

Source: Reports of HM Inspectors of Mines.

NB: The figures marked (W) refer to the Western division of Scotland only.

C = Coal I = Iron.

On a number of occasions the inspector for the Western division referred to persons prosecuted for non compliance with the law. For the years 1882-1885 he also indicated the company involved and this information is set out in Table VII:6

Table - Prosecutions for non compliance with
VII:6 Mining Regulations

Year	I	II
1882	3	1
1883	6	1
1884	0	9
1885	4	3

Column I - Prosecutions involving
WB & CO.

Column II - Prosecutions involving
all other Scottish firms

Source: Reports of HM Inspector of Mines 1882-5.

The firm's record certainly seems very poor. In 1865 following an accident at Espieside No.3 pit, William Alexander, the inspector of mines wrote to the company about his visit to the pit, 'the only person seemingly in charge was an 18 or 19 year old and although age is no proof of ability still pit management requires experience not normally acquired by eighteen year olds. In addition to being manager he was also foreman. The area involved in the explosion was not fenced as required by rule two.' William Laird merely noted that no reply should be sent since the inspector had been told that the work was contracted for.²⁶⁰

The firm viewed the involvement of the legislature as suspiciously as it did that of the union agent. When the Mines Regulation Act of 1855 was passed requiring the framing of general and special rules, James Baird attempted to oppose the adoption of the rules favoured by the Inspector of Mines, because 'they introduced several points which (he was) most anxious to avoid'.²⁶¹ In 1872 A.K. McCosh

260. Coatbridge, WB & CO MSS, William Alexander to John Alexander 22 April 1865.

261. Coatbridge, WB & CO MSS, GLB Vol.8, 736, David Wallace to James Baird 10 December 1855.

severely criticised the Mines Regulation Act of that year and concluded that at least one provision would be 'impossible to carry out without shutting up half the mines in the Kingdom'.²⁶² Again in 1888 A.K. McCosh wrote to the Solicitor General criticising the Home Secretary's proposed alterations in the special rules. He closed his letter, "I regret to trouble you in this matter but practically the whole mining employers of Scotland feel aggrieved that for no good reason difficulties are being created between us and our employees".²⁶³

The partners were especially critical of the 1894 Compensation Act. There are numerous references to the assistance given by the company to employees and their dependents, such as the granting of a free house to the widow of a collier killed in a company pit,²⁶⁴ or the payment of 25p per week to an injured collier.²⁶⁵ It also established a mutual insurance society into which employees paid 3.75p to 5p per month to which the company added 10% as a gift. The fund which was used for sickness or injury benefit and the payment of funeral expenses was managed by a committee of workmen plus one company official.²⁶⁶ The government's proposals met with a hostile reception. Sir William Laird chaired a meeting of opposition held at Glasgow and condemned the act as 'an experiment in Socialistic Legislation.'²⁶⁷

262. Ibid. Vol.23, 377 note by A.K. McCosh, 4 March 1872.

263. Strathclyde, WB & CO MSS, Gartsherrie Private Letter Book, A.K. McCosh to Solicitor General 31 May 1888.

264. Strathclyde, WB & CO MSS, Manager's Notebook Gartsherrie, 13 March 1890.

265. Ibid. April 1867.

266. RC on Labour 1892-4, evidence before Group A, Vol.11, 238, evidence of A.K. McCosh.

267. Glasgow Herald 30 June 1897.

A.K. McCosh wrote to Lord Balfour of Burleigh pointing out that the results for, 'our party', at the polls would be 'absolutely disastrous'. He criticised 'this unfortunate measure' on the grounds that, it threw the whole burden of compensation on the employer; promised no effective safeguard against malingering; sacrificed existing mutual funds; and did nothing to prevent unwarrantable litigation.²⁶⁸

A constant source of friction between the firm and its employees arose over the issue of determining the actual weight of output for which workers were to receive payment. In the early years one hutch per day of each man's output was weighed and if found to be more than 13 lb. light it was forfeited.²⁶⁹ In addition excessive dirt in the coal resulted in fines. Particularly bad culprits could forfeit their whole day's work. The general principle of this system persisted down to the passing of the Mines Regulation Act of 1872 according to A.K. McCosh.²⁷⁰ It continued until much later according to Keir Hardie who gave as an example the forfeiting of a 10 cwt. hutch at Kilwinning on account of 26 lbs. of dirt.²⁷¹ McCosh maintained that in some cases the whole of the coal was picked, or only a representative sample and a certain amount of rubbish was allowed depending on the nature of the seam. The excess of dirt was penalised by a scale of fines and the whole of the remaining mineral was then paid for. J.T. Forgie in 1903, in describing essentially

-
268. Strathclyde, WB & CO MSS, Gartsherrie Private Letter Book, A.K. McCosh to Lord Balfour n.d. 1897.
269. Tremenheere 1844, Report, 22.
270. RC on Labour, 1892-4, evidence before Group A, vol.11, 236, evidence of A.K. McCosh.
271. Ibid. 203, evidence of Keir Hardie.

the same system, alleged that the situation had deteriorated on account of the greater rush following the introduction of the eight hour day.²⁷² The workers' desire to have check weighmen was finally acceded to though not without a struggle. A.K. McCosh insisted that the company preferred to employ checkweighmen because it saved trouble - he objected only to their interfering in the work of the colliery by acting as union agents.²⁷³ At Knockterra pit in Ayrshire the manager refused to accept Keir Hardie's notification of the election of a checkweighter and demanded a second election in his presence. Despite the re-election of the same man with near unanimity he was still not allowed to go to the pit head, and the mines inspector declined to act on the technical point, that the men themselves had not formally notified their choice to the employers. The workmen said that they had not done so because they feared dismissal. On Hardie's advice two representatives notified the manager whereupon they, together with twelve others, were dismissed.²⁷⁴ On at least one occasion the company was prosecuted for using false weights to determine their colliers' wages.²⁷⁵ In 1893 Hardie maintained that the position was even worse at the ironworks and in 1907 an employee at Eglinton explained before a Departmental Committee that the men were dissatisfied because they were not allowed 'inside the big weights' where the iron lifted from the pig beds was weighed.²⁷⁶

-
272. RC on Coal Supplies 1903, 2nd Rep.vol.11, 5, evidence of J.T.Forgie
 273. RC on Labour, 1892-4, evidence before Group A, vol,11, 237, evidence of A.K. McCosh.
 274. Ibid. 187, evidence of Keir Hardie.
 275. I.C.T.R. 23 September 1887.
 276. Departmental Committee on Checkweighing in Iron and Steel 1907, 157, evidence of William Estley.

The major issue in disputes between the workers and William Baird and Company was of course wages and it was the attempts made to defend their interests in this regard which witnessed the efforts at common action out of which stable unionism eventually emerged. Although the situation varied with time and place it was generally the case that the company's work force was drawn into disputes begun by others. They do not at any time appear to have either instigated action or been the mainstay of such action, although a minority of them exhibited a grim and usually hopeless determination in the face of the considerable power and influence of the company.

It is hardly surprising in view of the relatively good rates of pay, the smallness of the different groups of workers, and the particularly powerful influence of the company in the works villages, that industrial action among the ironworks labour force is almost unknown. The company showed at an early date that it was not prepared to tolerate any development of militancy. On Saturday, 23 September 1843 the furnace workers at Gartsherrie received their previous month's pay calculated on the basis of 2.5p per ton although they had hitherto been paid at 3.3p per ton and had received no notice of a reduction. Several of the furnace keepers decided to take the matter to court, but on Sunday 24 September James Baird had a warrant sworn out, and at one a.m. on Monday morning three keepers were arrested in their beds and taken to Airdrie. Three others were arrested the following morning when they went to Airdrie to make inquiries about their colleagues and all six were charged with breach of contract, which company witnesses testified required one months notice of intention to quit work. The workers maintained that only a short time previously the company had successfully

held in court that no such contract existed but they were not allowed to bring witnesses, and other employees were denied entry to the trial which was not held in court but behind closed doors in the Burgh Hall. All six were found guilty and sentenced to sixty days imprisonment.²⁷⁷

Not surprisingly there is no other recorded incident until the great strike of almost fifty years later. In 1890 the National Association of Blastfurnacemen won recruits at many of the Scottish Works and the men decided to press for payment at time-and-a-half for Sunday work.²⁷⁸ At that time furnacemen worked in 12 hour shifts and some activists urged the union to demand an 8 hour day with payment at time-and-a-half for the additional four hours on every day of the week.²⁷⁹ The employers, who resented the involvement of English union agents in the affair, decided to crush the union before its grip became too strong. They therefore refused the men's demands and insisted that they would be locked out unless they accepted a 10% reduction. After the lockout had begun at the end of September the masters declared that the reduction would be 20% and that the men would not be allowed to return until they left the union.²⁸⁰ In the course of a long and bitter dispute the Englinton Iron Company served eviction notices on its furnacemen.²⁸¹ By mid-February the men's resolve was beginning to weaken. At Lugar, where there were no

277. Strathclyde, RB MSS, 'Papers regarding dispute between Gartsherrie Furnacemen and WB & CO. 1843'

278. Engineer 26 September 1890.

279. Engineering 22 August 1890.

280. Engineer 13 February 1891.

281. Ibid. 6 February 1891.

unionists, the furnaces were relit,²⁸² and at Gartsherrie, and the other Ayrshire works, non-union Scotsmen and some Poles were used to restart the furnaces.²⁸³ In early March the strike rapidly collapsed, and the men returned on the masters' terms. Although defeated, the men were not totally disorganised nationally, and they were able to act together at a Conference in 1899 following which an agreement to establish a sliding scale was signed at Gartsherrie on 26 October 1899.²⁸⁴

Among the company's miners the history of attempts at combination is much more confused but the same general impression emerges of an early militant phase followed by a long period of weakness before the revival of the closing decades of the century.

Following the repeal of the Combination Acts, the miners employed by the Bairds were caught up in the widespread formation of organisations which occurred in the Scottish coalfields. This activity endured into the 1830s when men at some of the company's pits were involved in the Lanarkshire Union.²⁸⁵ When this body attempted to co-ordinate resistance to the wage cuts which came with the downturn of prices following the collapse of the 1836 boom, the company faced its first major strike. It dealt with it by evicting

282. Ibid. 13 February 1891.

283. Engineering 20 February 1891.

284. Strathclyde, WB & CO. MSS, Manager's Notebook Gartsherrie, 26 October 1899.

285. Tremenheere 1844 Report, 32.

the strikers from their houses and bringing in strike breakers. Despite this setback, the men retained a high degree of organisation in both Lanarkshire and Ayrshire during the 1840s and even won some limited successes following the introduction of restriction.²⁸⁶ In the Gartsherrie district perhaps as many as half the company's miners worked in unionised pits. However, in the strike of 1847, the company again vigorously attacked unionists among its employees and seems virtually to have destroyed the influence of the union in the Gartsherrie district.²⁸⁷

For many years thereafter attempts at unionism were sporadic and short-lived, and usually very local in scale. Strikes, when they did occur, were generally marked by evidence of weak organisation. In 1850 there was some evidence of unrest at Kilwinning, though even there the strikers could not achieve united action.²⁸⁸ In Lanarkshire the company were, 'rewarded in the general steadiness and good conduct of their work people, who rarely give them any trouble by going on strikes, or by any other form of insubordination'.²⁸⁹ They worked on through the strike with police protection from intimidation.²⁹⁰ In 1856 the company, 'had cause to be satisfied with the conduct of their Gartsherrie workers'.²⁹¹ A few company pits in Lanarkshire and Ayrshire

286. National Library of Scotland, William Cloughan 'A Series of Letters on the Restriction of Labour and its effects on the Mines of Lanarkshire' (1846)

287. Tremenheere 1849, Report, 18.

288. Tremenheere 1851, Report, 34.

289. Ibid.

290. Coatbridge, WB & CO MSS, GLB Vol.3, 323, D. Wallace to J. Johnstone 3 May 1850.

291. Tremenheere 1856, Report, 36.

did go on strike eventually, long after most other pits had struck, but they were the first to resume, and again worked under police protection.²⁹² The dissatisfaction and frustration of some of the workers was expressed through vandalism against company property.²⁹³

In the boom of the early 1870s there was renewed activity, the colliers at Kilsyth and the ironstone miners in Ayrshire each organising a union.²⁹⁴ Strikes broke out in both districts at the end of 1872 and in January 1873, 200 families living in the company's houses at Galston were evicted and at Portland works the heads of families prepared to leave before they were ejected.²⁹⁵ But there was 'little or no unanimity with each pit left to its own, and some have returned to work'. The strikes of the following year which sought to resist the massive wage cuts of the masters had no hope of success. At Lugar the men accepted a 45% reduction without striking²⁹⁶ and at Gartsherrie the men soon returned on the company's terms.²⁹⁷ At Dalry and more especially Hurlford, resistance was strong, but defeat was nevertheless inevitable, and with it the short-lived unions died.²⁹⁸

292. Coatbridge, WB & CO MSS, GLB vol.9, 243, D. Wallace to Captain Miller, 16 May 1856.

293. Ibid. Vol.9, 121. 4 April 1856, reference to vandalism at Faskine and Palacecraig pits.

294. Engineer 2 August 1872, 23 August 1872.

295. Engineer 17 January 1873.

296. Ibid. 15 May 1874.

297. Engineering 29 May 1874.

298. Engineer 18 December 1874, 26 February 1875, 21 April 1876.

Efforts to revive them proved unsuccessful until Keir Hardie succeeded, after some difficulty in forming the Ayrshire Union of 1886.²⁹⁹ Lanarkshire remained unorganised except on a local basis and among the Baird employees only Kilsyth seems to have had a union.³⁰⁰ When a strike occurred in 1887 the absence of organisation resulted in riots at Blantyre in which the company's employees looted the store and eight men arrested for their involvement in the affair were rescued by the mob.³⁰¹ In a test case the company served complaints against thirty men for breach of contract through failing to serve notice. An award of one pound was made against each of the thirty.³⁰²

As the miners' unions gathered strength the company was reluctantly compelled to adjust to the new situation. In March 1887 the first ever conference between mineowners and workers in Lanarkshire came to an abrupt end when A.K. McCosh, making his statement on behalf of the owners 'let fall some injudicious and impolitic remarks' following which the miners' representatives withdrew.³⁰³ Despite a decisive defeat in the strike of 1894 the Lanarkshire Federation survived and evolved into the Lanarkshire County Union, and the owners after repeated refusals once more agreed to a Conference. A.K. McCosh, who was again chairman, adopted a more temperate position. He became chairman of the Conciliation Board which finally emerged from the discussions and as such was the spokesman for the Scottish coalowners

299. R. Page Arnot, A History of the Scottish Miners (1955), 67.

300. Ibid. 92.

301. Scotsman 21 January 1887.

302. Ibid. 17 February 1887.

303. Engineering 18 March 1887.

for the next twelve years.³⁰⁴ The representatives of the men with whom he negotiated during that time did not come from among his own labour force. Company employees were steadily drawn into the rank-and-file of the union movement but did not at that time contribute to its leadership.

The period 1830-1914 was one during which the way of life of the labouring classes throughout Great Britain underwent profound changes. For those employed by William Baird and Company the degree of change was in many cases more extreme even than the general experience. For thousands it meant not just changing from agriculture to industry but from one country to another, from one society differing decisively in culture, rhythms, and often language, to another itself in the throws of rapid change. For the Highland Scot the change was probably no less traumatic. Many more were introduced into the labour force to break attempts at militant behaviour, or simply to hold down wages, and the divisions so created were slow to heal. The company was faced with the still largely novel problems of how to organise and control large work groups and in addition the necessity to provide and administer the entire community framework. It responded by the widespread introduction of piece-rates and the creation of a network of sub-contractors. At the same time it built houses, schools, shops, churches and recreation centres, provided elementary medical and insurance facilities and encouraged anything which promoted order and stability. External disruptive interference, whether by Government or unions was resented and obstructed.

The pattern of change in the standard of living is hard to determine. In its broad sense it comprises many variables none of which

304. Arnot, Scottish Miners, 98.

have proved easily measurable. Of course at the extremes of the 1900s compared with the 1830s, it is apparent that the company's employees lived in superior houses enjoyed more amenities and had higher real wages for fewer hours worked per day. They had too, won significant advances regarding the right to organise, besides greater freedom from company dominance in such spheres as truck, the provision of medical assistance, or compensation for industrial injuries. About the detailed timing and course of many of these changes it is impossible to be precise. This is particularly true with regard to earnings although it is clear that the changes in this respect were much more closely associated with the fortunes of the Scottish iron industry before the 1870s and the coal industry thereafter, than with general movements in the economy of the United Kingdom. Their condition relative to other groups in society or even in relation to similar groups elsewhere in Britain at different points throughout the period is again both uncertain and complex. Wages rates were generally attractive but subject to abrupt and sizeable fluctuations. Rents were low and social welfare services, in the later years at least, were advantageous. On the other hand, the quality of even the best housing was poor in comparison with that occupied by workers in regular employment in the cities. The all-pervading paternalism of the company welcomed self-help ideas, and itself promoted schemes, which helped mould the character of numerous villages throughout the West of Scotland. In large measure such schemes were intended to promote ideas of order, discipline, sobriety and stability in an effort to create a suitable work force. Accordingly therefore the one form of self-help which it vigorously opposed was the formation of trade unions and it does seem to have successfully retarded their development - a point of some importance to the wider field of the growth

of unionism among Scottish miners. On the other hand unadulterated provisions were provided, without, it would seem, any exploitation; besides good educational facilities and reliable medical services. Starvation was unlikely, utter deprivation in old age avoided and a respectable burial assured. If William Baird and Company cannot lay claim to being one of the pioneers of enlightenment in employer/employee relations equally it was very far from being an example of the worst which the nineteenth century had to offer.

Epilogue 1914 - 1974

During the First World War the company, like the remainder of Scottish heavy industry found its fortunes determined by the wider national interest. There had been signs of mounting difficulties for the Scottish iron industry before war broke out and these were exacerbated in the course of the hostilities.⁽¹⁾ Transport shortages were added to rising costs to interfere with the flow of imported ore on which the company had come to depend, and within Scotland the traditional ironstone fields proved incapable of responding to the demands made on them, despite generous Government incentives. The company was fortunate in that it had already done much preliminary work in preparing the Raasay ore field and it was able accordingly to bring it into production fairly early in the war. The ore was of low quality and relatively expensive to supply at the furnaces but in the circumstances of the time these disadvantages were eliminated. German prisoners of war were sent north to work on Raasay and by 1917 there were 300 of them employed at the mines which in that year supplied 65,985 tons out of a total Scottish ironstone production of 437,409 tons.⁽²⁾

The war also disrupted the normal pattern of the coal market and as enlistment for the army drew men from the company's pits output declined. Shortage of labour together with increased difficulty in winning coal from the narrowing seams of the Gartsherrie region kept the company, as it kept virtually the whole of the Scottish industry, in the vanguard as regards the adoption of machine mining. Even

-
1. F. Hatch, The Iron and Steel Industry of the United Kingdom Under War Conditions (1920), passim.
 2. W.R. Scott, and J. Cumison, The Industries of the Clyde Valley during the War (1924), 53.

so production remained below the pre-war level throughout the years 1914-18. In Ayrshire coalmining was less troubled except in one vital respect, the supplying of coal suitable for use in the blast furnaces was becoming rapidly exhausted.

Following the brief post-war boom the pig iron industry, now tied more closely than ever to the fate of the steel, shipbuilding and heavy engineering industries collapsed into severe depression. Closures were widespread and even those works which kept going operated at only 25% to 30% of capacity.⁽³⁾ The 1921 coal strike proved to be the death knell for the company's Muirkirk furnaces which were blown out at that time and never re-lit.

The industry was in continuous difficulty throughout the 1920s. In 1924 the Eglinton Iron Works ceased production and in 1928 Lugar also, thus ending 82 years of pig iron smelting by the Bairds in Ayrshire. The firm's coal interests in the county remained viable. Although the centre of gravity of the Scottish coalmining industry gradually shifted away from the company's territory to the East of Scotland, Ayrshire showed a very slight growth of production in the interwar period.⁽⁴⁾ Mechanisation continued, pits were modernized and fresh sinkings planned. As part of a logical process of rationalisation the company in 1931 merged its Ayrshire colliery interests with those of the second largest firm in the county, the Dalmellington Iron Company,⁽⁵⁾ which, like Bairds had been compelled to give up pig iron smelting.

3. Ibid, 72.

4. A.K. Cairncross (ed), The Scottish Economy (1954) 110.

5. R.H. Campbell, "The Iron Industry in Ayrshire", Ayrshire Archaeological and Natural History Collections 2nd series vol. VII (1961-66), 102.

The new company, Bairds and Dalmellington, with a capital of £1,750,000 dominated coalmining in Ayrshire, and held in lease virtually the whole of what had become the main part of the coalfield in the central district.⁽⁶⁾ Included in the new company were the pits of Sanquhar and Kirkconnell Collieries Ltd. Mauchline Colliery was acquired in 1934: Littlemill Colliery and Brickwork in 1936; and in the same year the minerals of Rankinston estate together with the surface plant at Rankinston colliery were taken over.⁽⁷⁾ The company thus controlled over 70% of the output of the county and the lions share of the exports to Ireland and the continent, which in the mid 1930s were running at two million tons per annum. Besides coal the firm also developed important interests in the manufacture of composition bricks and road slag.⁽⁸⁾

In the Gartsherrie region the coalmining side of the business did less well than in Ayrshire. The Lanarkshire field was steadily becoming exhausted and flooded in the interwar period, and especially so in the Baird heartland where pit closures became commonplace. However, the once great Lanarkshire coalfield remained of considerable importance owing to its being Scotland's major supplier of coking coal. With the exhaustion of the remaining supplies of splint coal on which the Scottish pig iron industry had hitherto depended, the availability of coking coal became critical. Lack of it in Ayrshire played a major part in the decision to close the company's works there, while its presence at Kilsyth ensured the survival of Gartsherrie. In 1933 plans were set in motion to erect a new modern set of furnaces and

6. T.S.A. Ayrshire, 80.

7. The Stock Exchange Official Year Book, 1940, 2764.

8. C.A. Oakley, Scottish Industry Today (1937) 188.

coke ovens.⁽⁹⁾ For a time the scheme was held up by difficulties in securing an outlet for the considerable quantity of gas produced as a by-product of the coke ovens.⁽¹⁰⁾ Glasgow Corporation declined to take gas offered to them at a price guaranteed for several years ahead at a figure below their own production costs. Suitable arrangements were finally made and the plant was completed in time to see the company through the Second World War.

By the mid 1930s all but one of the steel producing firms still active in Scotland had passed into the hands of Colvilles as the result of a process of merger and takeover begun in 1915. William Baird and Company which, as part of its new initiative had been reconstructed as a public company in 1936, had notably failed to develop steel producing facilities of its own. To remedy this an amalgamation was proposed with one of its main customers - the remaining independent steel concern.⁽¹¹⁾ This firm, the Scottish Iron and Steel Company, was itself a combine formed by the amalgamation in 1912 of 13 firms in the finished iron industry in Lanarkshire. The new firm of Bairds and Scottish Steel controlled the Gartsherrie works and associated collieries together with the Northburn Steel Works, and five steel re-rolling works - Waverley, Coats, Woodside, Victoria, and Rochsolloch - all in the Coatbridge area.⁽¹²⁾

In September 1933, the year when the modernisation scheme had first been announced the arrival at Glasgow of a shipment of 8,000 tons of ore from Sierra Leone provided tangible proof that

9. T.S.A. Lanarkshire, 54.

10. Iron and Coal Trades Review 28 August 1936.

11. Glasgow Herald 31 May 1939.

12. T.S.A. Lanarkshire, 54.

supplies of high grade ore would continue to be available.⁽¹³⁾

The ore had first been discovered by the geological survey of Sierra Leone in 1927, and in November of that year the company sent its own representatives to assess the commercial value of the deposits. This survey, together with one for a railway from the ore field to the coast, was satisfactorily completed three years later and in September 1930 the Sierra Leone Development Company, a subsidiary of William Baird and Company, was registered to exploit the deposits.⁽¹⁴⁾ Senior officials from Scotland, and from the company's Spanish mining subsidiary went out to develop the field and the Spanish mines were sold to a French company.⁽¹⁵⁾ By 1938 the African open-cast mines were producing 861,955 tons of ore valued at £646,421 which were exported to Britain and Europe. Plans were already in hand to extend the railway to enormous deposits further inland. The company had also made some tests of chrome ore in the colony and acquired an exclusive licence to prospect for deposits of the ore.⁽¹⁶⁾

With the creation of Bairds and Scottish Steel, the firm of William Baird and Company went into voluntary liquidation and was re-formed as a holding company of the same name. It owned £1,177,177 of the £1,750,000 capital of Bairds and Dalmellington; £1,200,000 ordinary shares and £750,000 preference shares of the £1,680,000 ordinary shares and £1,050,000 preference shares of Bairds and Scottish Steel. Its other subsidiaries were Bairds Mining, the Sierra Leone Development Company and the Ayrshire Navigation

13. Iron and Coal Trades Review, 17 January 1936.

14. Ibid, 29 September 1933.

15. Written communication of Mr. C.P. McConnachie, C.B.E. former employee of Bairds and Dalmellington.

16. Iron and Coal Trades Review, 1 December 1939.

Company.⁽¹⁷⁾ After the war the nationalisation of the coalmines resulted in the vesting of Bairds and Dalmellington's 21 pits in the National Coal Board and the company went into voluntary liquidation. Bairds and Scottish Steel were shorn of their collieries and had their remaining assets taken over in 1949 when the Steel Industry was nationalised, and then restored following denationalisation in 1953. The compensation received from the Government - over £3 million for the Ayrshire pits alone - was used to diversify the interests of William Baird and Company but its iron and steel activities still continued to be important. The shortage of scrap which had been one of the reasons behind the decision to build new furnaces in the 1930s had by the mid 1950s become a virtual famine. The Scottish Steel industry which at one time consumed 70% scrap to 30% pig iron was obliged to increase the proportion of pig iron used, as foreign steel industries took an increasing share of the world's scrap. Bairds and Scottish Steel embarked on a major modernisation programme in 1956, the initial phase of which was to cost £6 million. Two new furnaces each with 20 ft. diameter hearths were proposed in a scheme designed to double pig iron production from 150,000 tons to 300,000 tons per annum.⁽¹⁸⁾ Work on the new plant began in 1958 but only one furnace was actually built and the modernisation of the works had scarcely been completed when the decision was taken to cease production of both iron and steel. The closure of Gartsherrie in 1967 marked the end of a notable chapter in Scottish economic history. Gartsherrie was no longer an appropriate location for a major iron and steel complex but the use to which the site

17. Stock Exchange Official Year Book, 1940, 2764.

18. T.S.A. Lanarkshire, 56.

was put underlined the original foresight of the Baird brothers and their influence on Scottish transport developments. Its ideal situation and excellent railway links led to its being made into an inland port and freightliner terminal.

William Baird and Company continued in being and has diversified into a number of spheres. Its original capital was increased from £4 million to £6½ million in 1961, to £15 million in 1964 and to £20 million in 1969.⁽¹⁹⁾ Under its four divisions; textiles; industrial; investment; and mining; it has interests in over sixty companies in eleven countries⁽²⁰⁾ and according to the Times 1,000 it was ranked 183rd by capital, 297th by turnover and 321st by profit during 1972-73.⁽²¹⁾ The detailed study of the process whereby the Scottish iron and coal firm of 1914 became the international holding company of 1974 will prove a fascinating task for some future historian.

19. Stock Exchange Official Year Book, 1973-4, 1275.

20. Who Owns Whom 1972-3, passim.

21. The Times 1,000, 1973-4, 24.

Appendices

- A. Table 1. Period as a partner and value of share in William Baird and Company and Eglinton Iron Company.
- Table 2. Scottish Railway Involvement of the Partners.
- Table 3. Estates purchased by the Partners.
- B. Table 1. Furnaces Built and In Blast William Baird and Company, and Scotland 1830-1914.
- Table 2. Pig Iron output, William Baird and Company, Scotland, and the United Kingdom 1830-1914.
- Table 3. Production Cost and Selling Price of Gartsherrie Pig Iron 1830-1914.
- Table 4. By-products output and profits, Gartsherrie 1900-1914.
- C. Table 1. Collieries and Ironstone Pits operated by William Baird and Company c.1850-1914.
- Table 2. Coal Output and consumption Gartsherrie Region 1860-1914.
- Table 3. Coal Sales and Purchases Gartsherrie Region 1861, 1878, 1882-1914.
- Table 4. Coke Production, Gartsherrie Region, 1869-1914. Output, sales ironworks consumption and coal required per ton of coke.
- Table 5. Ironstone Output and Consumption Gartsherrie Region 1861-1914.
- Table 6. Cumberland Iron ore output, consumption and sales 1868-1914
- Table 7. Spanish ore consumed at Gartsherrie 1882-1914.

- D. Table 1. Gartsherrie Furnace Keepers Earnings 1844-1914.
- Table 2. Coalface workers earnings, Gartsherrie Region
1867-1914.
- Table 3. Wages and Salaries Gartsherrie and their relation
to production costs 1878-1914.
- E. Comparative rate of growth of coal production, Gartsherrie,
Scotland, and the United Kingdom 1861-1914.

APPENDIX A

Table 1: Period as partner and value of share in William Baird and Company and Eglinton from Company

Name	Period as Partner/Director	Proportion or Number of Shares		Value	Date of Valuation
Douglas Baird	1830 - 1854	1	1/6	£109,447 - 50	May 1854
		2		30,113 - 15	May 1854
Robert Baird	1840 - 1856	1	1/12	39,323 - 43	May 1856
		2		46,398 - 99	May 1856
David Baird	1840 - 1861	1	1/12	46,331 - 12	March 1861
		2		78,462 - 99	March 1861
Alexander Baird	1830 - 1862	1		£104,245 - 00	March 1862
		2		94,155 - 60	March 1862
William Baird	1830 - 1864	1		115,827 - 50	March 1864
		2		104,066 - 71	March 1864
George Baird	1830 - 1870	1		152,892 - 30	August 1870
		2		182,000 - 00	August 1870
James Baird	1830 - 1876	1		300,000 - 00	May 1876
		2		180,000 - 00	May 1876
David Wallace	1860 - 1877	1		192,000 - 00	May 1877
		2		110,000 - 00	December 1876

Name	Period as Partner/Director	Proportion or Number of Shares	Value	Date of Valuation
Alexander Whitelaw	1860 - 1879	1	£210,000 - 00	May 1879
	1852 for EIC	2	198,000 - 00	December 1878
John Alexander	1878 - 1895	a) 7,830 ord £10 shares	78,300	May 1895
		b) 1,120 ord £10 shares	11,200	
		c) £44,700 redeemable debenture stock	44,700	
		d) £11,200 redeemable debenture stock	11,000	
William Laird	1878 - 1909	a) 12,600 ord £10 shares	126,000	May 1901
		b) £24,400 redeemable debenture stock	24,400	
Alexander Fleming	1878 - 1909	a) 15,120 ord £10 shares	151,200	May 1909
		b) 2,520 cumulative preference shares of £10	25,200	May 1909
Stuart Foulis	1903 - 1914	a) 1,800 ord £10 shares	18,000	May 1913
		b) 505 5% cumulative preference shares	5,050	May 1913
		c) £5,000 redeemable debenture stock	5,000	
Andrew Kirkwood McCosh	1878 - 1916	a) 13,820 ord £10 shares	138,200	May 1915
		b) 2,520 5% cumulative preference shares	25,200	
		c) £63,000 redeemable debenture stock	50,400	
James Baird Thomeycroft	1878 - 1918	a) 16,364 ord £10 shares	163,640	May 1917
		b) 3,780 5% cumulative preference shares	31,500	
		c) 63,000 redeemable debenture stock	45,832 - 50	

Name	Period as Partner/Director	Proportion or Number of shares	Value	Date of Valuation
Robert Angus	1878 - 1923	a) 13,820 ord £10 shares b) 3,672 cumulative preference shares c) 3,000 redeemable debenture stock	£138,200 33,048 2,400	May 1923
James Tennant Forgie	1905 - 1936	a) 1,590 ord £10 shares	15,900	July 1905
Andrew Kirkwood McCosh II	1910 -	2,000 ord £10 shares	20,000	June 1910
Robert L. Angus	1910 -	2,000 ord £10 shares	20,000	June 1910
William W. McCosh	1913 -	2,000 ord £10 shares	20,000	October 1913
James Morton	1914 -	1,500 ord £10 shares	15,000	July 1914

NOTE

1 = William Baird and Company

2 = Eglinton Iron Company

SOURCES

1. The Wills of the Partners

2. Coatbridge, WB & CO. MSS, passim.

APPENDIX A

Table 2: Scottish Railway Involvement of the partners

Name	Company	Value of Holding (in pounds)	Date of Valuation	Period as Director	Period as Chairman	
John Alexander	GBH & CR	-	May 1895	1877 - 9		
	GS	8,375-00				
Robert Angus	CR	441-60	May 1922			
	GS	1,137-50				
Alexander Baird	F & CC	30,162-50	March 1862	Deputy Governor	1849 - 54	
	SNER	1,020-00	"			
	CR	78,736-00	"			
	P & AR		"			
	EP & DR	25,038-00	"			
	GG & CR	15,973-29	"			1845
	MR	424-00	"			
	W & CR	9,502-50	"			1850 - 53
David Baird	E & GR	7,035-60	"			
	F & CC	9,943-00	March 1861			
Douglas Baird	F & CC	14,943-50	May 1854	1850 - 51		
	GT & GHR		"			
	CJCTR	6,000-00	"			
	SMJCTR	6,251-00	"			

Name	Company	£ Value of Holding	Date of Valuation	Period as Director	Period as Chairman
George Baird	CJCTR	7,467-50	August 1870		
	W & CR	5,940-00	" "		
	GB & NR	5,415-18	"		
	CR	11,775-99	"		
	SCR	883-20	"		
	DP & AR	9,572-50	"		
	G & SWR	17,090-00	"		
	GNSR	1,352-65	"		
	G & AR	1,500-00	"		
	HR	14,832-00	"		
	NBR	26,524-12	"		
	EP & DR	1,394-70	"		
	E & BR		"	1852 - 4	
	E & GR	30,090-00	"	1851 - 64	
BR	400-00	"			
James Baird	C & DR		June 1876	1850	1851 - 62
	CJCTR	7,595-00		1852 - 3	1852 - 4
	DP & AR	5,113-72			
	GB & NR	12,604-37			
	GG & CR	12,853-80			
	G & AR	10,615-43			
	LR	9,947-50			
	W & CR	19,177-83			
	F & CC	3,020-00			
	CR	53,345-09		1850	
	G & SWR	18,852-50			
	NBR	266,883-63			
	GBH & CR	138,750-00		1875	1876
	C & OR	750-00			

Name	Company	£ Value of Holding	Date of Valuation	Period as Director	Period as Chairman
Robert Baird	F & CC	19,040-00		Date unknown	
	SMJCTR	7,177-50			
	LR	5,000-00			
	NB	7,655-00			
	AR	1,162-00			
William Baird	CR	86,247-87	March 1864	1851 - 55	1852 - 4
	CJCTR	33,080-00			
	DP & AR	15,591-00			
	E & GR	52,293-35			
	EFR	17,487-50		1856 - 62	
	GB & NR	4,100-00			
	GG & CR	16,219-69		1845, 1851 - 54	
	G & SWR	500-00			
	GNSR	10,000-00			
	G & AR	25,581-25			
	LR	20,152-50			
	MR	8,798-87			
	NBR	32,747-93			
	P & DR	3,150-00			
	SMJCTR	15,200-50			
	S & DR	5,150-00			
	SCR	9,258-12			
	SNER	4,296-00			
W & CR	77,400-00				
F & CC	57,070-00				

Name	Company	£ Value of Holding	Date of Valuation	Period as Director	Period as Chairman
Alexander Fleming	GS	2,906-25	May 1909		
	NBR	35,412-50			
	CR	33,050-00			
	HR	22,950-00			
	G & SWR	5,775-00			
William Laird	K & BR	60-00	May 1901	1899-1901	1899 - 1901
	NBR	13,827-50			
	G & SWR	7,000-00			
	GS	10,200-00			
	FBR	253-50			
	GBH & CR				
	GC & DR				
	WHR	7,807-48			
	HR	8,000-00			
	C & OR	1,912-50			
	L & DR	3,084-80			
				1900 - 01	
				1878 - 9	
				1882 - 9	
				1900 - 01	
				1	
Andrew Kirkwood McCosh	GS	3,725-00		1905	
	NBR	70,000-00			
	G & SWR	20,000-00			
	CR	52,500-00			
James Baird Thomeycroft	G & SWR	15,724-75			
	CR	10,642-50			
	NBR	6,050-00			
	PP & WR	5,220-00			
	HR	1,093-75			
	GS	387-37			

Name	Company	£ Value of Holding	Date of Valuation	Period as Director	Period as Chairman
David Wallace	GBH & CR	70,655-25		1876	1877
William Weir	CR	97,916-50			
	C & OR	63,000-00			
	F & CJCTR	9,432-44			
	G & SWR	73,297-50			
	GC & DR			1882 - 9 1905 - 13	1882
	GS	21,162-50			
	GNSR	82,541-95			
	HR	84,136-00			
	K & BR	3,637-50			
	L & AR	2,970-05			
NBR	191,874-47				
Alexander Whitelaw	GBH & CR	132,000-00			
	NBR	38,400-00			
	G & SWR	1,728-75			

ABBREVIATIONS

AR - Aberdeen Railway
BR - Berwickshire Railway
CR - Caledonian Railway
C & DR - Caledonian and Dumbartonshire Railway
C & OR - Callendar and Oban Railway
C JCT R - Clydesdale Junction Railway
DP & AR - Dundee, Perth and Aberdeen Railway
E & BR - Edinburgh and Bathgate Railway
E & GR - Edinburgh and Glasgow Railway
EP & DR - Edinburgh, Perth and Dundee Railway
EFR - East of Fife Railway
FBR - Forth Bridge Railway
F & CC - Forth and Clyde Canal
F & C JCT R - Forth and Clyde Junction Railway
GB & NR - Glasgow, Barrhead and Neilston Railway
GBH & CR - Glasgow, Bothwell, Hamilton and Coatbridge Railway
GC & DR - Glasgow City and District Railway
GG & CR - Glasgow, Garnkirk and Coatbridge Railway
GPK & AR - Glasgow, Paisley, Kilmarnock and Ayr Railway
G & SWR - Glasgow and South Western Railway
GS - Glasgow Subway
GT & GHR - General Terminus and Glasgow Harbour Railway
GNSR - Great North of Scotland Railway
G & AR - Greenock and Ayrshire Railway
K & BR - Kilsyth and Bonnybridge Railway
L & AR - Lanarkshire and Ayrshire Railway

ABBREVIATIONS - Continued

L & DR - Lanarkshire and Dunbartonshire Railway
LR - Lesmahagow Railway
MR - Monkland Railways
NBR - North British Railway
P & AR - Perth and Aberdeen Railway
P & DR - Perth and Dundee Railway
PP & WR - Port Patrick and Wigtonshire Railway
SM JCT R - Stirlingshire Midland Junction Railway
SCR - Scottish Central Railway
S & DR - Stirling and Dunfermline Railway
SNER - Scottish North Eastern Railway
WHR - West Highland Railway
W & CR - Wishaw and Coltness Railway

NOTE

The dates given for periods as director/chairman are not necessarily exhaustive. Nor is the list of companies with which the partners, especially the Baird Brothers, were involved.

GENERAL

Sources

1. Strathclyde, WB & CO MSS, passim
2. Coatbridge, WB & CO MSS, passim
3. Bradshaw's General Railway Directory 1850 - 1914
4. Glasgow Herald

APPENDIX A

Table 3: Estates purchased by the partners.

Name	Estate	Date of Purchase	Price
Robert Angus	Ladykirk (Ayr)		
	Foulton (Ayr)		
Alexander Baird	Urie (Kincardine)	1854	£120,000
David Baird	Stitchill(Roxburgh)	1853	150,000
Douglas Baird	Closeburn ₁ (Dumfries)	1848	
	2	1852	225,000
George Baird	Stritchen (Aberdeen)	1855	145,000
	Hadden	1860	
	Cairnflath		
	Stonefold		
	Cuningholm		
James Baird	Cambusdoon (Ayr)	1853	22,000
	Knoydart (Inverness)	1857	90,000
	Auchendrane (Ayr)	1862	
	Muirkirk (Ayr)	1863	135,000
	Drumellan (Ayr)		
Robert Baird	Auchmedden (Aberdeen)	1854	60,000
William Baird	Rosemount (Ayr)	1853	47,000
	Elie (Fife)	1853	155,000
	Dumbarnie		
	Whiteside		
Alexander Fleming	Oatfield (Kintyre)		
	Kilmaho (Kintyre)		
	Craigendmuir (Lanarks)		
James Baird Thorneycroft	Hillhouse (Ayr)	c1908	
David Wallace	Glassingall (Perth)	1875	
	Wester Daldowie (Lanark)		

Name	Estate	Date of Purchase	Price
William Weir	Kildonan (Argyll)	c.1875	
	Armsheen "		
	Glenduisck "		
	Adamton (Ayr)	1903	
	Dunbeth (Lanarks)	1876	
	Coats "	1876	
	Greenhill "	1876	
	Sunnyside "	1876	
	Drumbathie "	1876	
Alexander Whitelaw	Gartshore (Dunbarton)	1870	
	Woodhall (Lanark)	1873	
	Faskine "	1876	
	Palacecraig "	1876	

Sources

1. MacGeorge, Bairds of Gartsherrie
2. Memoirs and Portraits of One Hundred Glasgow Men
3. Glasgow Herald
4. The Scotsman

APPENDIX B

Table 1: Furnaces built in blast William Baird
and Company and Scotland, 1830 - 1914.

Year	Gartsherrie		Eglinton		Blair		Muirkirk		Lugar		Portland		Baird Total		Scotland		Sources
	B	I	B	I	B	I	B	I	B	I	B	I	B	I	B	I	
1830	1	1											1	1		27	2
1831	1	1											1	1			2
1832	1 + 1	1, 2											1 + 1=	1, 2			2
1833	2	2											2	2		31	2, 6
1834	2 + 1=	2, 3											2 + 1	2, 3			2
1835	3	3											3	3			2
1836	3 + 4	3, 7											3 + 4	3, 7			2
1837	7 - 1	7, 6											7 - 1	7, 6			2
1838	6	6											6	6			2
1839	6 + 2	6, 8											6 + 2	6, 8		54	2, 4
1840	8 + 4	8, 12											8 + 4	8, 12	60	54	2, 14
1841	12 + 3	12, 15											12 + 3	12, 15			2
1842	15 + 1	15, 16											15 + 1	15, 16			2
1843	16	11											16	11	104	62	7
1844																	
1845	16	15											16	15	135	92	6, 11, 12
1846	16	14	3	3									19	17, 14	122	95	3, 6, 13
1847	16	16	3	0									19	16	137	89	3, 6
1848	16	16	4	2									20	18	138	93	3, 6, 14
1849	16	16	4	3									20	19	139	109	3, 6
1850	16	16, 8	4	3, 0									20	19, 8	144	92	3, 6
1851	16	16	4	4									20	20		110	6
1852	16	16	4	4	5	2							25	22	144	109	6, 14

Year	Gartsherrie		Eglinton		Blair		Muirkirk		Lugar		Portland		Baird Total		Scotland		Sources
	B	I	B	I	B	I	B	I	B	I	B	I	B	I	B	I	
1853	16				5	2										112	6
1854	16	16	5	5	5	2							26	23	156	115	1, 6, 14
1855	16	15	5	5	5	2							26	22	160	117	1, 6, 14
1856	16	15	5	5	5	3	3	1	4	2			33	26	161	117	11, 6, 14
1857	16						3	1	4	0					165	128	6, 8, 14
1858	16	14	5	5	5	4	3	1, 2	4	0			33	24, 25	177	129	6, 14
1859	16	13	7	7	5	4	3	2	4	0			35	26	175	124	1, 6, 14
1860	16	14	8	8	5	4	3	0, 3	4	0			36	26, 29	175	121	1, 6
1861	16	13	8	8	5	4	3	3	4	0			36	28	169	123	1, 6, 14
1862	16	14	8	8	5	2	3	3	4	0			36	27	171	120	1, 6, 8, 14
1863	16	13	6	6	5	4	3	3	4	0			34	26	169	127	1, 6, 14, 16
1864	16	13	8	8	5	4	3	3	4	0	5	1	41	29	170	134	1, 14, 16
1865	16	14	6	6	5	4	3	3	3	2	6	5	39	34	180	133	1, 14, 16
1866	16	10	8	5	5	3	3	3	3	1	6	3	41	25	165	112	1, 14, 16
1867	16	13	8	6	5	3	3	3	3	2	6	3	41	30	167	108	1, 6, 9, 14, 16
1868	16	13	8	6	5	3	3	3	3	3	6	3	41	31	167	114	1, 14, 16
1869	16	14	8	7	5	3	3	3	4	4	6	3	42	34	165	124	1, 14, 16
1870	16	13	8	7	5	2	3	2	4	4	6	4	42	32	156	130	1, 5, 14, 16
1871	16	12	8	7	5	2,0	3	3	4	4	6	3	42	29	156	127	1, 14, 16
1872	16	11	8	6			3	3	4	4	6	4	37	28	154	127	1, 6, 10, 14, 16
1873	16	12	8	7			3	3	4	4	6	3	37	29	156	119	1, 14, 16
1874	16	10	8	6			3	3	4	4	6	3	27	26	163	96	1, 14, 16
1875	16														159	117	14, 16
1876	16	13	8	6			3	3	4	4	6	3	37	27	156	116	1, 14, 16
1877	16	11	7	4			3	3	4	4	6	3,2	36	25,24	152	103	1, 14, 16
1878	16	10	7	5, 6			3	3	4	4	6	0	36	22,23	152	90	1,14, 16
1879	14	10	7	6			3	3	4	4	6	0, 2	34	23,25	151	88	1, 14, 16
1880	14	12	7	5½			3	3	5	4, 5	6	4	35	28½, 29½	149	106	1, 14, 16
1881	14	13	7	5½			3	2½	5	4½	6	3½	35	28¾	151	116	1
1882	14	13	7	4½			3	2	5	4	6	2	35	25½	149	108	1
1883	14	12	7	6			3	2½	5	5	6	2	35	27½	127	110	1
1884	14	11	7	3			3	3	5	5	6	2½	35	24½	144	95	1
1885	14	10	7	3			3	3	5	5	6	3	35	24	144	90	1, 15
1886	14	11	7	3			3	3	5	4¾	6	3	35	24¾	141	83	1, 15
1887	14	12	7	4			3	3	5	5	6	2½	35	26½	141	80	1, 15

Year	Gartsherrie		Eglinton		Blair		Muirkirk		Lugar		Portland		Baird Total		Scotland		Sources			
	B	I	B	I	B	I	B	I	B	I	B	I	B	I	B	I				
1888	14	13	7	4½			3	3	5	5	6	2	35	27½	141	83	9, 15			
1889	14	13	7	3			3	3	5	4½	6	2	35	25½	134	84	9, 15			
1890	14	8½	7	2.1/3			3	2	5	3¾	6	1.1/3	35	17	126	66	9, 15			
1891	14	8	7	3			3	2½	5	5	6		35	16½	122	51	9, 15			
1892	14	12	7	4			3	3	5	4.1/3	6	0	35	23.1/3	125	77½	9, 15			
1893	14	10	7	1½			3	2½	5	4½	4	0	33	18½	116	53	9, 15			
1894	14	9	7	1½			3	1½	5	3¾	0	0	29	15½	114	45	15			
1895	14	9¾	7	2			3	3	5	5	0	0	29	19¾	108	74	15			
1896	14	11¾	6	2½			3	3	5	4¾	0	0	28	22	105	80	15			
1897	14	12	5	3			3	2½	5	4½	0	0	27	22	103	80	5, 15			
1898	12	10½	5	3¾			3	3	5	5	0	0	25	22	100	82	15			
1899	12	12	5	4			3	3	5	4½	0	0	25	23½	100	83	15			
1900	12	11¾	6	5¾			3	2½	5	5	0	0	26	25	101	83	15			
1901	12	12	6	5½			3	2½	5	4½	0	0	26	24½	102	80	15			
1902	12	11¾	6	6			3	3	5	4¾	0	0	26	25½	103	85	15			
1903	12	12	6	6			3	3	5	4¾	0	0	26	25¾	102	86	15			
1904	12	12	6	6			3	3	5	4¾	0	0	26	25¾	102	85	15			
1905	12	12	6	5½			3	3	5	5	0	0	26	25½	102	87	15			
1906	12	12	6	6			3	2½	5	4¾	0	0	26	25½	102	90	15			
1907	12	11¾	6	6			3	3	5	5	0	0	26	25¾	103	90	15			
1908	12	11½	6	6			3	3	5	4½	0	0	26	25	104	74	15			
1909	12	11	6	5¾			3	3	5	4⅞	0	0	26	24⅞	105	82	15			
1910	12	12	6	5			3	2¾	5	5	0	0	26	24¾	103	85	15			
1911	12	11½	6	5¾			3	3	5	5	0	0	26	25½	102	85	15			
1912	12	11¾	6	5¾			3	2¾	5	4	0	0	26	23	102	71	15			
1913	12	12	6	5½			3	3	5	5	0	0	26	25½	102	86	15			
1914	12	9¾											26	21	102	70	15			
					Ayr Total = 11½ in blast															

NOTES

1. B = Number of Furnaces Built . . . I = Number of Furnaces in blast.
2. For the company, the number of furnaces in blast prior to 1880 is usually the actual number at a particular date in the year - generally 31 December. After 1880 the figure given is an average of the number in blast at four points in the year. For Scotland the number of furnaces in blast from 1845 on is an average for the year.

SOURCES

1. Mineral Statistics
2. MacGeorge, Bairds of Gartsherrie
3. Barclay, Statistics of the Scotch Iron Trade
4. Mushet, Papers on Iron
5. Engineer
6. Mining Journal
7. Strathclyde, WB & CO MSS, Printed Circular 1846
8. Coatbridge WB & CO MSS, Gartsherries Letter Books
9. Colliery Guardian
10. North British Daily Mail
11. Scottish Reformer's Gazette
12. Glasgow Chronicle
13. Pagan, Sketches from the History of Glasgow
14. Birch, The Economic History of the British Iron and Steel Industry
15. Iron Trade Circular
16. Rowan, 'On the Iron Trade of Scotland' JISI 1885

APPENDIX B

Table 2: Pig iron output, William Baird and Company,
Scotland, and the United Kingdom 1830 - 1914

Year	Gartsherrie	Ayrshire	Total Baird	Scotland	United Kingdom
1830	1,900	-	1,900	37,500	653,417
1	3,050	-	3,050	-	-
2	4,600	-	4,600	-	-
3	7,000	-	7,000	44,000	700,000
4	9,400	-	9,400	-	-
5	10,000	-	10,000	-	1,000,000
6	18,000	-	18,000	75,000	1,200,000
7	26,500	-	26,500	-	-
8	25,000	-	25,000	-	-
9	32,450	-	32,450	196,960	1,343,000
1840	39,750	-	39,750	241,000	1,396,400
1	60,000	-	60,000	250,000	1,500,000
2	75,000	-	75,000	271,000	1,347,790
3	55,000	-	55,000	480,000	1,214,550
4	75,000	-	75,000	413,000	1,999,608
5	90,000	-	90,000	475,000	1,512,500
6	85,000	= 300	85,300	580,000	2,214,000
7	95,000	-	-	540,000	1,998,808
8	101,225	12,900	114,125	600,000	2,093,736
9	106,387	19,045	125,432	692,000	-
1850	90,000	20,500	110,500	630,000	2,500,000
1	100,000	28,200	128,200	775,000	-
2	100,000	41,000	141,000	780,000	2,701,000
3	100,000	-	-	720,000	-
4	100,000	47,175	147,175	780,000	3,027,884
5	92,000	49,179	141,179	820,000	3,200,580
6	95,000	77,093	172,093	820,000	3,586,377
7	95,000	-	-	900,000	3,658,147
8	90,000	80,500	175,500	950,000	3,454,024
9	100,000	100,600	200,600	980,000	3,709,374
1860	105,000	115,700	220,700	1,000,000	3,802,920
1	96,567	126,800	223,367	1,040,000	3,695,060
2	98,684	117,000	215,684	1,080,000	3,946,469
3	98,093	117,700	215,793	1,150,000	4,510,760
4	97,429	138,500	235,929	1,160,000	4,767,951
5	106,256	175,000	281,256	1,164,000	4,825,254
6	95,000	133,000	228,000	994,000	4,523,897
7	105,000	162,200	267,200	1,031,000	4,761,023
8	105,000	168,000	273,000	1,068,000	4,970,206
9	110,000	185,000	295,000	1,150,000	5,445,757
1870	105,000	176,200	281,200	1,206,000	5,963,515
1	99,000	155,000	254,000	1,160,000	6,627,179
2	90,000	146,000	236,000	1,090,000	6,741,929
3	95,000	142,000	237,000	993,000	6,566,451
4	81,000	134,000	215,000	806,000	5,991,408
5	-	-	-	1,050,000	6,365,462
6	108,000	133,000	241,000	1,003,000	6,555,997
7	104,000	128,600	232,600	982,000	6,608,664
8	89,999	125,000	214,999	902,000	6,381,057
9	90,000	148,000	238,000	932,000	5,995,337

Year	Gartsherrie	Ayrshire	Total Baird	Scotland	United Kingdom
1880	89,522	165,750	255,272	1,049,000	7,749,233
1	-	159,650	-	1,176,000	8,140,000
2	120,298	130,310	250,608	1,126,000	8,590,000
3	103,253	159,080	262,333	1,129,000	8,530,000
4	98,098	140,400	238,498	988,000	7,810,000
5	97,654	156,020	253,674	1,004,000	7,420,000
6	98,903	155,060	253,963	936,000	7,010,000
7	106,259	168,920	275,179	932,000	7,560,000
8	114,702	179,590	294,292	1,028,000	8,000,000
9	109,134	148,660	257,794	999,000	8,320,000
1890	78,911	115,950	194,861	798,000	7,900,000
1	74,606	112,330	186,936	674,000	7,410,000
2	119,711	145,690	265,401	977,000	6,710,000
3	112,439	125,730	238,169	784,000	6,980,000
4	98,878	90,970	189,848	655,000	7,430,000
5	129,685	148,240	277,925	1,097,000	7,700,000
6	155,167	151,190	306,357	1,180,000	8,660,000
7	164,107	148,500	312,607	1,188,000	8,800,000
8	156,918	163,260	320,178	1,190,000	8,610,000
9	166,001	161,690	327,691	1,167,000	9,420,000
1900	167,651	184,220	351,871	1,154,000	8,960,000
1	165,084	174,060	339,144	1,114,000	7,930,000
2	165,092	209,480	374,572	1,295,000	8,680,000
3	162,677	205,930	368,607	1,288,000	8,940,000
4	160,707	216,760	377,467	1,340,000	9,610,000
5	164,827	213,830	378,657	1,378,000	10,180,000
6	178,976	213,620	392,596	1,451,000	10,110,000
7	162,623	218,240	381,043	1,403,000	19,060,000
8	165,118	218,490	383,608	1,230,000	9,530,000
9	157,951	226,220	384,171	1,362,000	10,101,000
1910	165,870	212,100	377,970	1,414,000	9,530,000
1	135,815	226,630	362,445	1,401,000	8,750,000
2	168,742	212,430	381,172	1,198,000	10,260,000
3	167,177	216,310	383,487	1,378,000	8,920,000
4	-	182,340	-	1,140,000	-

NOTES

1. The Gartsherrie output for the years listed below is for the year from 1 June to 31 May following. All other figures are for the calendar year.

1849 - 50; 1861 - 65; 1878 - 79; 1882 - 83; 1889 - 1914

2. For the following years the Gartsherrie figures are estimates:

1830 - 47; 1851 - 60; 1866 - 77; 1880 - 81

These figures were arrived at using details of the number of furnaces in blast together with scattered references to daily, weekly, or monthly output throughout the WB & Company MSS. For the early years output figures from Report of the trial Neilson v Baird were also used

3. For the Ayrshire works the figures were estimated using details of the number of furnaces in blast together with calculations of Scottish output per furnace made using data from:

- a. Mining Journal
- b. Rowan, 'On the Iron Trade of Scotland'
- c. Iron Trade Circular
- d. British Iron Trade Association, Reports

APPENDIX B

Table 3: Production Cost and Selling Price of Gartsherrie Pig Iron 1830 - 1914.

Year	Production Cost per Ton		Av. Selling Price No.1 Gartsherrie Pig Iron	
	£	p.	£	p.
1830	2.	25		
1831	2.	09		
1832	1.	70		
1833	1.	54		
1834	1.	62		
1835	1.	48	4.	62
1836	1.	59	6.	50
1837	1.	63	5.	50
1838	1.	76		
1839	1.	70		
1840				
1841				
1842				
1843				
1844				
1845			2.	10
1846			3.	76
1847			3.	38
1848			2.	37
1849			2.	45
1850			2.	10
1851			2.	08
1852			2.	45
1853			3.	33
1854			4.	20
1855			3.	77
1856			3.	85
1857			3.	80
1858			2.	94
1859	1.	99	2.	68
1860			2.	84
1861	2.	24	2.	79
1862			2.	92
1863			2.	97
1864			3.	10
1865			3.	09
1866			3.	38
1867			3.	18
1868			2.	87
1869			2.	98
1870			3.	13
1871			3.	43
1872			6.	25
1873			6.	64
1874			5.	37
1875			3.	81
1876			3.	38
1877			3.	13
1878	2.	38	2.	82

Year	Production Cost per Ton		Av. Selling Price No.1 Gartsherrie Pig Iron	
	£	p.	£	p.
1879			2.	60
1880			3.	20
1881			2.	89
1882	2.	54	3.	06
1883	2.	70	2.	97
1884	2.	38	2.	66
1885	2.	28	2.	43
1886	2.	30	2.	21
1887	2.	25	2.	44
1888	2.	32	2.	30
1889	2.	58	2.	92
1890	2.	14	3.	31
1891	2.	51	2.	91
1892			2.	54
1893	2.	11	2.	45
1894	2.	06	2.	64
1895	1.	91	2.	55
1896	1.	96	2.	54
1897	1.	98	2.	58
1898	2.	17	2.	64
1899	2.	45	3.	66
1900	2.	57	4.	40
1901	2.	38	3.	37
1902	2.	35	3.	32
1903	2.	37	3.	15
1904	2.	37	2.	87
1905	2.	41	3.	02
1906	2.	63	3.	39
1907	2.	93	3.	74
1908	2.	61	3.	16
1909	2.	63	3.	06
1910	2.	59	3.	15
1911	2.	75	3.	09
1912	3.	19	3.	71
1913	2.	25	3.	86
1914			3.	44

Notes

1. The production costs from 1882 - 1914 are for the year from 1 June to 31 May following.

Sources

1. Strathclyde, WB & CO MSS, Production Abstracts Gartsherrie
2. Coatbridge, WB & CO MSS, 'Cost of Production of Gartsherrie Pig Iron 1830-1840'
3. Mitchell Library, Glasgow, Connal & Co. Monthly Circulars
4. Engineer
5. Engineering

APPENDIX B

Table 4: By-products output and profits, Gartsherrie 1900 - 1914

	Sulphate of Ammonia			Lbs. Per Ton	Pitch			Lbs. Per Ton	Creosote Gallons	Galls. Per Ton	Cresylic Galls. Gallons	Galls. Per Ton	Dehydrated Galls. Gallons	Galls. Per Ton	Total Profit	Profit per ton of Pig Iron
	Tons	Cwts	Qrs	of Coal	Tons	Cwts	Qrs	of Coal	Gallons	of Coal	Gallons	of Coal	Gallons	of Coal	Profit	
1900-9	2097	7	0	20.19	7796	13	2	75.06	1,113,768	4.79	6,708	0.03	94,665	0.41	£29,770.70	17.75p
1901-2	1969	4	2	19.85	7025	17	2	70.84	991,858	4.46	770		9,750	0.04	22,164.37	13.42
1902-3	1900	19	2	19.15	7719	6	2	77.76	1,103,998	4.96			3,360	0.01	29,476.29	17.85
1903-4	1974	15	3	19.76	7928	8	0	79.34	1,095,650	4.89	10		3,100	0.01	33,014.40	20.32
1904-5	2095	16	0	20.22	8070	18	3	77.87	1,083,524	4.67			2,390	0.01	27,366.99	17.02
1905-6	2109	13	1	19.93	10014	18	3	94.63	1,208,080	5.10	2,604	0.01	2,624	0.01	30,799.98	18.68
1906-7	2096	18	3	19.8	9222	11	1	87.10	1,130,954	4.77	3,432	0.015	3,445	0.015	26,775.17	14.95
1907-8	1935	3	0	20.35	8310	12	3	87.34	1,041,583	4.89			3,350	0.01	23,828.54	14.65
1908-9	1938	7	1	20.91	8516	16	2	90.88	988,092	4.76			2,060	0.01	25,200.18	15.29
1909-10	2115	4	3	20.97	8430	9	3	83.57	969,748	4.29			158,091	0.7	25,471.28	16.16
1910-11	2268	7	1	21.31	9569	18	1	89.9	1,291,065	5.41	3,403	0.01	20,540	0.09	33,193.99	19.99
1911-12	1717	4	0	20.86	9486	17	0	115.24	944,785	5.12	2,185	0.01	4,570	0.02	30,537.78	22.49
1912-13	2045	6	2	19.9	9215	18	3	89.69	1,118,969	4.86	240		2,355	0.01	41,342.87	24.50
1913-14	1901	11	1	20.72	7986	19	3	87.04	922,984	4.49	240		2,328	0.01	33,457.60	20.01

Source

Strathclyde, WB & CO MSS, Production Abstracts Gartsherrie

APPENDIX C

Table 1: Collieries and Ironstone pits operated by
William Baird and Company c1850 - 1914.

A - GARTSHERRIE REGION

Colliery	Pit	Coal		Iron		
		Number	Started	Stopped	Started	Stopped
1) <u>Central District</u>						
1	Aitkenson	2	1878	1886		
2	Bartonshill	1	1872	1897		
		2	1879	1897		
3	Burnbrae	2	1854 (e)	1866		
4	Cairnhill	5	1868	1895	?	1860
		6	1870	1904		
		7	1872	1891		
		8	1873	1875		
		9	1887	1904		
5	Carlincroft	1	-	1911		
6	Cliftonhill	3			-	1856
		4	-	1864		
		5			-	1856
		8				1856
		9			1860	1862
7	Coats	3	1861	1871		1854
		4				1853
8	Cottonmill	1	1887	1895	-	1865
9	Craigmauken				?	?
10	Drumbathie	1				1858
		2				1863
		3				1862
11	Espieside	1				
		2				
		3		1880		
		4		1861		
		5		1880		
		6	1870	1876		
12	Faskine	7		1887		
		8	1862	1882	1873	1878
		9		1861		

Colliery	Pit	Coal		Iron	
		Number	Started	Stopped	Started
13 Faskine Hillhead	2	1866	1906	?	1866
	5	1887	1906		1887
	6				1862
	10				1858 1862
14 Gartcloss	2	1866	1880		
15 Gartgill	2	1854(e)	1871		
	4		1858		
	6		1867		
	7	1871			
16 Gartsherrie	1	1826	1880		
17 Garturk		?	?		
18 Greenhill	1	1868	1880	-	1858
	2	-	1862		
19 Gunnie	1	1854(e)	1881		
	3	-	1871		
	4	-	1865		
20 Hallhall	1	1885	1897		
21 Hollandhurst	1	-	1858		
22 Kipps		?	?		
23 Kippsbyre	1			1854(e)	1859
	3	1860	1866	-	1859
	4	1860	1866	-	1859
24 Lochwood	1	1871	1880		
25 Maid o'the Mill	1	1872	1881		
26 Mainhill	2	1872	1897		
27 Opencast	1	-	1851		
	2	-	1880		
28 Palacecraig	1	-	1858		
	2	-	1908		
	3	-	1887		
	4	-	1859		
	5			-	1866
	6	-	1882		
	7			-	1866
29 Raw	1		1861		
	2	1859	1880		
	3	1872	1888	1878	1881

Colliery	Pit Number	Coal		Iron	
		Started	Stopped	Started	Stopped
30 Rawyards	2				1858
	4			1848	1858
	5				1866
31 Riggend	1				1858
32 Springhill	1	1870	1899		
	2	1871	1899		
33 Stand	4			1876	1879
34 Stanrigg			-	1858	
35 Thankerton			1854		
36 Thrashbush	1				1861
	2				1858
37 Whinhall				?	?
2) <u>NORTHERN DISTRICT</u>					
38 Auchinbees	1			1858	1870
39 Auchinreoch	1	1896			
	2	1896			
40 Auchinvale	1				1858
	3				1858
41 Balgrochan	1			1872	1877
42 Barrwood	1	1872	1913	1871	1872
	2	1886	1913	1871	1886
43 Bedlay	1	1904			
	2	1904			
44 Broomhill	5	1874	1879	1858	1865
45 Currymire	1			1859	1866
	2			1860	1865
46 Drumellier	1				1877
47 Dumbreck	1	1872	1876	1885	-
	2	1884	1889	1890	-
	3	1890			
48 Gartshore	1	1898	-	1859	1898
	2	1893	-	1860	1893
	3	1861	-		
	4	1862	-		
	5	1863	-		
	6	1873	1893	1863	1873
	7	1863	1870	1870	1886

Colliery	Pit	Coal		Iron	
		Number	Started	Stopped	Started
48 Gartshore (con't)	8			1867	1874
	9			1872	1889
	10	1872	-		
	11	1887	-		
49 Haugh	1	1877	-	1868	1877
	2	1877	-	1868	1871
	3			1868	1871
50 Inglestone	1	1861	1887	1887	1910
51 Neilston	1			1858	1871
	2			1858	1865
52 Overcroy	1			1861	1871
53 Quarter	1	1879	1910	1863	1879
	2	1867	1910	1865	1866
54 Risk	3			1858	1861
55 Riskend	1			1859	1902
	2	1885	-	1861	1885
56 St. Flannans	1	1900	-		
	2	1900	-		
57 Townhead	1			1862	1864
	2			1862	1862
	3			1862	1863
	4			1862	1864
58 Twechar	1	1895	-	1861	1895
	2	1896	1910	1863	1896
59 Tygetshaugh				1859	1877
3) <u>SOUTHERN DISTRICT</u>					
60 Bothwell Castle	1	1874	-		
	2	1875	-		
	3	1893	-		
	4	1893	-		
61 Bothwellpark	1	1871	-		
	2	1871	-		
62 Craighead	1	1875	-		
	2	1875	-		
4) <u>EASTERN DISTRICT</u>					
63 Balbardie Mine				1906	1911
	1	1906	-		
	2	1906	-		
64 Easton	1	1906	-		

B. AYRSHIRE REGION

Colliery	Earliest	Latest	Coal = C Iron = I
<u>1) NORTHERN DISTRICT</u>			
1 Auchingree	1864	1869	C
	1854	1889	I
2 Bartonholm	1904	1912	C
3 Barrhill	1873	1882	I
4 Blair	1854	1914	C & I
5 Bogside	1888	1908	C
6 Carsehead	1873	1907	C & I
7 Clonbeith	1887		C
8 Davidshill	1873		I
9 Eglinton	1854	1914	C
10 Ha'hill	1852	1854	C
11 Misk	1876	1907	C
12 Mount Curr	1855	1873	C
13 Merklands	1856	1857	C
14 Moncur	1906	1914	C
15 Redburn	1855	1910	C
16 Ryefield	1866		C
17 Pitcon	1873		I
18 Stepends	1873	1890	C & I
19 Stonebriggs	1879	1888	C & I
20 Stoopshill	1852	1854	C
21 Todhills	1873	1887	I
<u>2) CENTRAL DISTRICT</u>			
22 Bankhead	1864	1890	C
23 Craig	1906	1914	C
24 Dykehead	1864	1877	C
25 Grougar	1864	1895	C

Colliery	Earliest	Latest	Coal = C Iron = I
26 Loudon	1864	1914	C
27 Maxwood	1888	1911	C
28 Portland	1864	1914	C
29 Skerrington	1859	1867	C
3) <u>SOUTHERN DISTRICT</u>			
30 Airdsgreen	1859	1873	
31 Auchincruive	1909	1914	C
32 Barglachan	1889	1914	C
33 Barony	1906	1914	C
34 Berryhill	1876	1881	C
"	1900	1914	C & I
35 Blackstone	1873	1881	I
36 Braehead	1888	1897	C & I
37 Burnockhill	1906	1914	C
38 Burnieknow	1856	1865	C
39 Cumnock	1864	1874	C
40 Carbello	1873	1906	C & I
41 Common	1864	1914	C & I
42 Commondyke	1873	1881	I
43 Cronberry	1864	1893	C & I
44 Craigstone	1878	1881	I
45 Crossflatt	1867	1872	C
46 Dykes	1876	1888	C & I
47 Glenlogan	1864	1881	C & I
48 Gaswater	1856	1861	C
49 Gilminscroft	1906	1914	C
50 Glengyron	1873	1906	C & I
51 Grasshill	1876	1914	C & I
52 Glenbuck	1856	1852	C

<u>Colliery</u>		<u>Earliest</u>	<u>Latest</u>	Coal = C Iron = I
53	Highhouse	1894	1914	C
54	Hindsward	1877	1914	C
55	Kaimes	1870	1914	C
56	Knockterra	1876	1914	C
57	Lightshaw	1860	1914	C & I
58	Lugar	1856	1880	C
59	Muirkirk	1856	1872	C
60	Mossblown	1909	1914	C
61	Mosshouse	1873	1877	I
62	Maidenbank	1857	1881	C
63	Shankstone	1873	1881	I
64	Stottencleugh	1867	1881	C
65	Templand	1873	1878	I
66	Welltrees	1856	1867	C & I
67	Wellwood	1856	1898	C
68	Whitehill	1894	1914	C
4) <u>EASTERN DISTRICT</u>				
69	Pollock	1905	1914	I
70	Victoria	1882	1914	C & I

Notes

1. For the Gartsherrie Region list e = the earliest definite mention. The starting date is the year when sinking commenced and the stopping date the year in which the machinery was removed.
2. For the Ayrshire region the dates given are those of the earliest reference and latest reference to Baird activity.

Sources

1. Strathclyde, WB & CO MSS, Valuation Books Gartsherrie; Managers Notebook Gartsherrie; Muirkirk papers.
2. Coatbridge, WB & CO MSS, Gartsherrie Letter Books.
3. Mineral Statistics
4. Lists of Abandoned Mines. HMSO, various dates
5. Ryland's Directory

APPENDIX C

Table 2: Coal Output and consumption Gartsherrie Region, 1860 - 1914.

Year	Output	Sent to Gartsherrie	Sent to Coke Ovens	Stock at Pits
1860-61	-	-	0	116,221
61-62	375,089	276,256	0	116,638
62	399,125	-	-	117,103
63	419,717	-	-	123,483
64	445,727	-	-	132,691
65	475,130	-	-	121,439
66	445,614	-	-	-
67	462,768	-	-	-
68	431,149	-	-	-
69	439,779	-	-	-
1870-71	404,979	-	-	-
71	402,836	-	-	-
72	358,609	-	-	-
73	365,329	-	-	-
74	430,349	-	-	-
75	440,937	-	-	-
76	398,561	-	-	-
77	457,632	-	-	40,162
78	479,401	186,045	51,170	54,578
79	555,885	-	-	-
1880-81	617,299	-	-	-
81	672,905	-	-	56,863
82	617,014	219,296	115,333	47,138
83	583,147	194,124	117,821	29,279
84	613,649	166,183	110,786	46,990
85	627,709	166,757	106,546	61,293
86	544,499	150,687	103,029	18,079
87	707,993	190,976	110,297	35,690
88	752,103	168,670	102,863	33,035
89	881,996	165,137	131,544	26,078
1890-91	891,438	91,723	150,510	32,851
91	1,041,580	205,624	134,704	34,139
92	1,058,599	206,593	145,775	45,429
93	1,076,090	170,023	139,824	24,761
94	875,385	166,531	101,707	54,659
95	1,149,374	198,870	136,435	71,990
96	1,204,716	187,742	151,499	69,759
97	1,219,723	173,447	159,302	58,171
98	1,291,375	165,089	190,490	56,843
99	1,267,472	191,238	211,416	53,979
1900	1,292,676	191,316	250,662	21,955
01	1,253,526	181,642	229,767	23,883
1902-03	1,277,576	185,185	239,243	31,530
1903-04	1,356,432	174,729	241,399	48,091
1904-05	1,367,737	169,174	243,705	51,656
1905-06	1,383,230	148,446	262,154	49,373
1906-07	1,569,460	176,488	310,878	28,841
1907-08	1,617,677	169,304	329,563	14,589

Year	Output	Sent to Gartsherrie	Sent to Coke Ovens	Stock at Pits
1908-09	1,671,254	188,926	337,209	29,558
1909-10	1,687,889	196,743	352,107	18,333
1910-11	1,737,584	197,860	415,345	21,525
1911-12	1,557,865	166,062	362,778	22,873
1912-13		171,429		6,890
1913-14	1,577,140	186,975	391,933	27,844

Sources

Calculated from data in:

- 1) Strathclyde, WB & CO MSS, Valuation Books Gartsherrie
- 2) Strathclyde, WB & CO MSS, Production Abstracts Gartsherrie

APPENDIX C

Table 3: Coal Sales and Purchases, Gartsherrie Region
1861, 1878, 1882 - 1914

Year	Sales	Purchases	Sales as a % of Total Output
1861-2	98,416	0	26.24
1878-9	227,771	0	47.51
1882-3	292,111	21,847	47.34
83	289,050	22,052	49.57
84	318,969	30,388	51.98
85	340,103	26,715	54.18
86	333,997	31,355	61.34
87	389,109	25,387	54.96
88	483,225	47,286	64.25
89	592,272	42,814	67.15
1890-91	642,991	3,865	72.13
91	699,964	4,080	67.20
92		19,788	
93	786,911	23,655	73.13
94	577,249	10,229	65.94
95	796,739	31,069	69.32
96	867,706	73,306	72.03
97	898,562	77,417	73.67
98	937,123	80,305	72.57
1899-1900	967,681	67,948	68.46
1900-01	882,723	44,240	68.29
01-02	850,699	45,192	67.86
02-03	845,501	37,731	66.18
03-04	923,743	52,232	68.10
04	951,394	63,912	67.56
05	974,912	88,489	70.48
06	1,128,626	62,977	71.91
07	1,133,061	44,883	70.04
08	1,130,151	19,180	67.62
09	1,150,264	29,948	68.14
1910-11	1,122,187	42,105	64.58
11	1,027,676	21,785	65.96
12		58,281	
1913-14	977,278	28,209	61.97

Source

Strathclyde, WB & CO MSS; Production Abstracts Gartsherrie

APPENDIX C

Table 4: Coke Production, Gartsherrie Region, 1869 - 1914
Output, Sales, Ironworks Consumption and Coal
required per ton of Coke.

Year	Output	Sent to Gartsherrie	Sales	Cwt. of Coal required per ton of Coke
1869-70	5,983	-		
1878-79	31,011	1,426		33
1882-83	73,792	2,092	69,646	32.85
83	74,356	1,538	71,500	32.20
84	69,766	955	65,407	32.54
85	66,505	724	67,547	32.71
86	62,670	795	62,100	33.27
87	67,687	3,746	63,760	32.92
88	62,514	3,305	64,115	32.70
89	83,119	4,241	76,645	33.04
1890-91	92,841	4,977	84,624	32.71
91	89,623	5,201	86,840	32.32
92	90,215	4,103	82,010	
93	84,403	5,814	80,541	33.40
94	64,096	3,810	59,734	31.90
95	85,146	5,670	80,093	32.34
96	93,454	8,543	86,006	32.29
97	99,233	12,055	96,163	31.67
98	127,131	16,645	108,537	33.41
99	140,605	12,561	129,727	30.75
1900-01	171,778	31,216	141,742	31.85
01	158,832	30,220	129,079	31.10
02	165,107	31,913	130,860	32.97
03	165,761	31,520	132,913	32.17
04	166,789	31,402	134,730	31.80
05	179,150	32,993	144,543	32.30
06	211,636	50,905	163,539	30.27
07	226,273	56,576	155,290	34.56
08	236,998	62,746	174,807	34.64
09	251,137	45,993	210,461	29.79
1910-11	302,273	41,429	251,758	30.05
11	260,199	46,378	217,164	28.43
12	-	66,365		
1913-14	287,075	74,890	206,476	28.87

Sources

- 1) Coatbridge, WB & CO MSS, Unsorted papers; passim
- 2) Strathclyde, WB & CO MSS, Production Abstracts, Gartsherrie

APPENDIX C

Table 5: Ironstone Output and consumption
Gartsherrie Region, 1861 - 1914

Year	Output	Sent to Gartsherrie	End of Year Stock
1861-2	153,334	146,329	87,272
62	137,462	143,428	81,306
63	138,968	145,803	72,771
64	161,182	139,861	95,092
65	142,657	149,706	88,043
66	127,009	95,677	119,375
67	137,194	132,953	123,616
68	122,117	138,286	107,447
69	123,547	139,821	90,853
1870-71	121,971	138,987	73,837
71	113,908	108,864	78,881
72	82,421	109,768	51,534
73	72,191	100,771	22,954
74	-	-	27,087
75	147,065	142,839	31,313
76	162,673	136,853	57,133
77	147,327	105,320	99,140
78	118,190	115,262	102,068
79	118,928	113,336	107,660
1880-81	107,810	120,645	94,825
81-82	114,168	119,902	89,091
82	102,084	128,271	62,904
83	94,464	104,979	52,389
84	86,840	93,590	45,639
85	87,309	78,860	54,088
86	65,772	61,333	58,527
87	65,692	85,809	38,410
88	68,972	75,027	32,355
89	65,038	63,849	33,544
1890-91	46,906	36,987	43,463
91	40,727	52,797	31,393
92	31,089	32,343	30,139
93	9,912	23,307	16,744
94	12,777	19,733	9,788
95	14,493	16,853	7,428
96	13,718	16,058	5,088
97	8,332	9,102	4,378
98	0	3,117	1,201
99	0	1,201	0
1900-01	0	0	0
01	6,696	3,900	2,796
02	6,955	7,383	2,368
03	9,305	8,144	3,529
04	11,098	12,261	2,366
1905-06	18,316	16,284	4,398
1906-07	33,259	34,669	6,087
1907-08	28,718	29,856	4,848

Year	Output	Sent to Gartsherrie	End of Year Stock
1908-09	27,666	27,779	4,735
1909-10	23,957	23,834	4,858
1910-11	23,250	24,118	3,991
1911-12	18,466	19,374	3,083
1912-13	-	-	4,731
1913-14	18,533	19,417	3,847

Sources

Calculated from data in:

- 1) Strathclyde, WB & CO MSS, Valuation Books Gartsherrie
- 2) Strathclyde, WB & CO MSS, Production Abstracts Gartsherrie

APPENDIX C

Table 6: Cumberland Iron Ore output,
consumption and sales 1868 - 1914

Year	Stock		Output		Total Deliveries		of which To Gartsherrie		Profit On Sales
	Tons	Cwt	Tons	Cwt	Tons	Cwt	Tons	Cwt	
1869-9			1,462	-1					
1869-70			6,667	-11					
1870-71					5,002	-14			
1871-2	12,052	-11							
1872-3									£2,504.84
1873-4									1,318.31
1874-5									6,117.86
1875-6									4,522.06
1876-7			19,441	-6					446.89
1877-8	26,097	-7	13,884	-13					2,606.16
1878-9	19,528	-15	14,735	-18	9,928	-13	9,598	-6	
1879-80	24,336		31,189	-3					
1880-81	20,421	-9	50,914	-0					14,439-35
1881-82	19,112	-11	57,140	-0					20,428-82
1882-83	164	-8	65,090	-0	61,089	-15	9,360	-5	10,174.20
1883-84	4,164	-13	60,277		58,958	-8	360	-14	13,486-42
1884-85	5,491	-5	55,240		50,875	-4	0		7,822.01
1885-86	9,856	-1	46,300		41,019	-17	0		5,339-93
1886-87	15,136	-4	43,800		38,786	-10	0		2,840.03
1887-88	20,149	-14	46,250		47,200	-4	0		
1888-89	19,199	-10	52,350		43,459				
1889-90	28,090	-10	50,500		60,057	-5	10	-4	
1890-91	18,533	-15	45,800		47,393	-12	0		
1891-92	16,939	-13	38,250		47,652	-19	0		
1892-93	7,536	-14	33,650		27,196	-1	0		
1893-94	13,990	-13	25,600		31,453	-5	0		
1894-95	8,137	-8	22,700		23,457	-14	0		
1895-96	7,379	-14	21,740		23,984	-17	0		
1896-97	5,134	-17	19,340		20,547		0		
1897-98	3,927	-17	15,565		15,388	-19	0		
1898-99	4,103	-18	19,095		21,922	-2	0		
1899-1900	1,276	-16	15,870		14,580	-4	0		
1900-01	2,566	-5	14,420		13,535		0		
1901-02	3,448	-5	26,580		28,102	-7	0		
1902-03	1,925	-18	35,300		28,567	-17	0		
1903-04	8,658	-1	34,150		34,296	-2	0		
1904-05	8,511	-19	31,625		27,979		106	-10	
1905-06	12,158		22,100		16,014	-10	199		
1906-07	18,243	-10	28,750		31,850	-7	24,189	-7	
1907-08	15,143	-3	28,900		26,360	-9	23,861	-7	
1908-09	17,682	-14	27,870		13,999	-4	5,526	-19	
1909-10	31,553	-10	25,760		35,282	-9	10,775	-19	
1910-11	22,031	-1	18,350		19,663	-9	0		
1911-12	20,717	-12	15,216		7,578	-15	0		
1912-13	28,354	-17	-				13,051		
1913-14	27,005		13,771	-10	9,782		6,334	-18	
1914	30,994	-16							

- Sources
1. Strathclyde, WB & CO MSS, Production Abstracts Gartsherrie
 2. Strathclyde, WB & CO MSS, Gartsherrie Valuation Books
 3. Coatbridge, WB & CO MSS, 'Profit on Cumberland Ore Sales 1872-1887'

APPENDIX C

Table 7: Spanish ore consumed at Gartsherrie 1882-1914

Year	Total Char in Furnaces	Baird's Own Spanish Ore	All Spanish Ore	Baird's Own as % of Total Char	All Spanish as % of Total Char
1882-3	216,184		7328-25		3.39
83-4	186,137-5		24,668-2		13.25
84-5	177,967-65		7,588-11		4.26
85-6	177,468-55		27,842-1		15.69
86-7	169,378-5		51,268-35		30.27
1887-8	210,142-65		45,842-7		22.00
88-9	205,899-85		29,706-1		14.43
1889-90	181,693-55		12,281-05		6.96
1890-91	83,918-15		6,647-5		7.92
1891-2	172,537-45		45,837-15		23.81
1893-4	200,420		83,505-85		41.67
1894-5	181,927-80		77,923-85		42.83
1895-6	242,207-35	132,353-99	149,366-85	54.64	61.67
1896-7	283,985-30	170,351-20	189812-75	59.99	66.84
1897-8	277,176-35	165,171-70	185,882-05	59.59	67.06
1898-9	287,250-40	184,940-90	206,964 -05	64-38	72.05
1899-1900	309,988-95	186,888-15	227,300-55	60.29	73.33
1900-01	315,612-95	214,086-60	254,123.95	67-83	80-52
1901-02	309,254-50	202,102-70	250,314-05	65.35	80.94
1902-03	319,316-85	183,934-65	249,858-85	57.60	78.25
1903-04	321,459-55	172,308-05	255,328-80	53.60	79.43
1904-05	311,319-60	162,558-3	247,921-95	52.22	79.64
1905-06	313,580-20	156,883-95	238,281-70	50-03	75.99
1906-07	337,790-9	137,408-98	201,960-30	40.68	59.79
1907-08	319,157-60	153,490-60	197,177-45	48.09	61.78
1908-09	319,891-15	155,012-65	240,401-85	48.46	75.15
1909-10	313,173-60	153,771-55	248,020-65	49.10	79.20
1910-11	324,341-95	199,148-45	254,316-95	61.40	78.41
1911-12	264,293-60	174,226-25	204,457-15	65.92	77.36
1912-13	335,141-35	154,498-70	253,554-65	46.10	75.66
1913-14	325,547-2	161,219-65	262,098-60	49.52	80.51
Total					
1895-1914	5,830,489-35	3,220,356-80	4,316,873-15	55.23	74.03

Note:

The figures for 'All Spanish Ore' 1882-1894 include some from the Bairds own Spanish mines bought through the Eglinton Office which was in charge of the Spanish mines. Gartsherrie did not record separate details until 1895.

Source

Calculated from figures in, Strathclyde, WB & CO MSS, Production Abstracts Gartsherrie

APPENDIX D

Table 1: Gartsherrie Furnace Keepers earnings 1844 - 1914

Date	Tonnage Rate	Shift Rate	Date	Tonnage Rate	Shift Rate
1 Jan 1884	2.5	20.83(e)	9 Oct 1879	2.5-2.71	24.58
Sep 1845	3.33	27.5 (e)	14 Jan 1880	2.76-2.92	25.83
13 Jun 1850	2.71	22.5 (e)	Apr 1880	2.55-2.71	24.58
22 Mar 1851	2.5 (e)	20.83	30 May 1880	2.34-2.5	24.17
5 May 1851	2.5	20.83(e)	31 Jan 1884	2.08-2.29	25.0
1 Oct 1852	2.5	20.83	5 Apr 1885	2.08-2.29	25.0
3 Dec 1852	2.5	20.83(e)	10 Apr 1885	1.93-1.98	24.17
Jan 1853	2.92	24.17(e)	Jul 1886	1.82-1.88	22.5
4 Nov 1854	3.33	27.5 (e)	1 Oct 1886	1.93-1.98	24.17
15 Sep 1855	3.33(e)	27.5	1 Dec 1888	1.98	24.17(e)
15 Oct 1855	3.33	27.5 (e)	Jan 1889	2.08-2.19	25 (e)
5 Nov 1856	3.33	27.5 (e)	Aug 1889		23.35
Jun 1858	2.92	24.17(e)	1 Sep 1889	2.24-2.34	26.67
4 Apr 1861	2.92	27.17(e)	Oct 1889	2.45-2.55	28.75
9 Apr 1861	2.5	20.83(e)	Nov 1889	2.66-2.76	30.83
19 Oct 1863	2.81	23.33(e)	Mar 1891	2.24-2.34	27.08
5 Nov 1863	2.81	23.33(e)	Feb 1893	2.24-2.34	27.08
May 1864	2.71(e)	22.5	Mar 1893	2.03-2.14	26.25
Aug 1864	2.92	24.17(e)	Jan 1894	1.46-1.88	
Jan 1866	'	32.21	Sep 1895	1.46-1.88	
Mar 1866	2.92	25.0	Oct 1895	1.61-2.14	27.5
12 Apr 1866	3.13	27.5	Aug 1898	1.61-2.14	27.5
24 Jun 1866	2.81	23.33(e)	Jan 1899	1.77	28.75
Aug 1866	2.81	23.33(e)	9 Jul 1899	2.19	35.83
Jan 1868	2.5	20.83(e)	1 Nov 1899	2.29	37.08
Oct 1868	2.5	20.83(e)	1 May 1900	2.37	38.33
Oct 1869	2.75	25.0	1 Aug 1900	2.21	35.83
Feb 1870	2.88	25.0	1 Jan 1901	2.05	33.33
Mar 1870	2.92-3.13	27.5	1 May 1901	1.98	32.08
Apr 1870		28.54	1 Feb 1902	1.90	30.83
May 1870		25.73	1 Aug 1902	1.98	32.08
Jun 1871		32.2	1 Aug 1903	1.90	30.83
Jul 1871	3.33	27.5	1 May 1905	1.98	32.08
1 Mar 1872	3.65	30.0	1 Aug 1905	1.90	30.83
17 Jun 1872	4.06	34.17	1 Nov 1905	2.05	33.33
Jul 1872	4.38	38.33	1 Aug 1906	1.98	32.08
12 Aug 1872	4.38	38.33	1 Nov 1906	2.05	33.33
1 Oct 1872	5.1	43.75	1 Feb 1907	2.19	35.42
Mar 1873	5.1	43.75	1 May 1907	2.14	35.0
Mar 1874	4.17	36.25	1 Aug 1907	2.19	35.42
25 Apr 1874	3.54	31.25	1 Nov 1907	2.14	35.0
Aug 1874	3.75	32.5	1 Feb 1908	2.05	33.33
24 Apr 1875	3.54	30.83	1 May 1908	2.03	32.92
6 May 1876	3.33	29.17	1 Feb 1909	1.98	32.08
Mar 1877	3.13	26.67	1 Nov 1909	2.03	32.92
Feb 1878	2.6-2.71	25.0			
Jul 1878	2.6-2.71	31.25			
Oct 1878	2.29-2.6	25.0			
Oct 1878	2.29-2.5	23.75			
10 Nov 1878	2.08-2.29	23.75			
Sep 1879	2.29-2.5	23.75			

Notes:

1. e = estimated
2. Where two figures appear in the column headed 'Tonnage Rate' these are the tonnage rates paid at the 'large' and 'small' furnaces respectively.

Sources:

1. Coatbridge, WB & CO MSS, Gartsherrie Letter Books, passim
2. Strathclyde, WB & CO MSS, Manager's Notebook, Gartsherrie, passim.

APPENDIX D

Table 2: Coalface workers earnings Gartsherrie Region 1867 - 1914

Date	Hewer's Nominal Day Rate (Pence)	Date	Hewer's Nominal Day Rate (Pence)
Dec 1867	23.75	Jan 1890	27.5
Jan 1868	20.00	Apr 1892	30
Nov 1868	22.5	May 1892	27.5
Feb 1869	20.0	Oct 1892	25
Jun 1870	22.5	Feb 1892	22.5
Oct 1871	25.0	May 1893	20
Dec 1871	27.5	Jul 1893	25
Apr 1872	30	Aug 1893	30
Jun 1872	32.5	May 1894	25
Aug 1872	37.5	Apr 1895	22.5
Sep 1872	42.5	Mar 1896	20
Oct 1872	47.5	Nov 1896	22.5
Dec 1872	37.5	Mar 1898	22.5
Mar 1873	42.5	Apr 1898	27.5
Apr 1873	47.5	Aug 1898	30
Mar 1874	37.5	Apr 1899	31.25
Apr 1874	27.5	Feb 1900	35
Apr 1875	22.5	Aug 1900	40
May 1876	20	Mar 1901	35
Mar 1877	17.5	Jun 1901	32.5
Sep 1878	20	Sep 1901	30
Oct 1878	17.5	Jul 1902	28.75
Nov 1878	15	Sep 1902	27.5
Apr 1879	15	Dec 1902	28.75
1 Oct 1879	20	Jun 1903	27.5
9 Oct 1879	22.5	Nov 1906	27.5
Dec 1879	20	Dec 1906	28.75
1 Jan 1880	22.5	Feb 1907	30
14 Jan 1880	25	Mar 1907	31.25
Apr 1880	20	Apr 1907	32.5
May 1880	17.5	Jul 1907	33.75
Jan 1884	17.5	Aug 1907	36.25
Feb 1884	16.67	Dec 1907	37.5
Mar 1885	16.67	Apr 1908	36.25
Apr 1885	15.42	Jun 1908	33.75
Jun 1886	15.42	Jul 1908	31.25
Jul 1886	14.17	Mar 1909	30
Oct 1886	15.42	May 1912	30
Mar 1887	16.67	Jun 1912	32.5
Jul 1887	15.42	Nov 1912	33.75
Jun 1888	15	Mar 1913	36.25
Oct 1888	15.42	Jul 1913	37.5
Mar 1888	15.83	Oct 1913	36.25
Nov 1888	16.67	Dec 1913	37.5
Dec 1888	17.5	Apr 1914	36.25
Jan 1889	18.33	Jun 1914	35
Apr 1889	17.92		
Jun 1889	18.33		
Jul 1889	17.92		
Aug 1889	20		
Sep 1889	22.5		
Oct 1889	25		
Nov 1889	27.5		

Sources

1. Coatbridge, WB & CO MSS, Gartsherrie Letter Books
2. Strathclyde, WB & CO MSS, Managers Notebook Gartsherrie

APPENDIX D

Table 3: Wages and Salaries Gartsherrie and their relation to production costs 1878 - 1914

a)

Year	WAGES		SALARIES			
	Total	Per Ton	Glasgow	Local	Total	Per Ton
1878-9	£10,810.51	12p	£1,583.33	412.34	1,995.67	2.2p
1882-3	15,562.35	12.9	1,543.33	382.80	1,926.13	1.6
1883-4	13,310.77	12.9	1,410.	447.67	1,857.67	1.8
1884-5	11,242.01	11	1,728.68	448.61	2,177.30	2.13
6	10,741.73	10.9	1,942.50	359.35	2,301.85	2.33
7	11,941.53	12.7	1,982.33	338.26	2,320.60	2.48
8	12,482.60	10.7	2,718.40	468.39	3,186.99	2.72
9	13,758.09	12.1	2,547.06	619.30	3,166.66	2.78
	18,288.92	17.3	2,524.43	686.68	3,211.61	3.03
1890-91	10,302.05	21.6	2,662.23	719.31	3,381.55	4.48
	17,450.58	15.9	2,924.05	809.30	3,733.66	3.41
1892-3	-	-	-	-	-	-
4	15,094.55	13.7	2,653.35	941.29	3,594.64	3.27
	13,714.22	13.5	2,615.	957.57	3,572.57	3.51
	18,342.01	13.4	2,110.	937.15	3,047.15	2.22
	20,533.18	13.1	2,165.	892.10	3,057.10	1.94
	19,950.07	12.7	2,227.50	962.56	3,190.06	2.03
	20,453.54	13	2,302.49	1,005.50	3,307.99	2.11
	27,179.61	16.4	2,390	1,003.12	3,393.12	2.05
1900-01	27,154.99	16.2	2,357.50	894.59	3,252.09	1.94
	24,330.25	14.7	2,079.50	935.07	3,014.56	1.83
	25,426.14	15.4	2,192.05	854.05	3,046.10	1.85
	24,590.68	15.1	2,106.35	1,032.38	3,138.73	1.93
	23,923.92	14.9	2,090.	945.80	3,035.80	1.89
	25,349.38	15.4	2,070	780.20	2,850.70	1.73
	26,925.13	15	2,598.77	784.14	3,382.91	1.89
	27,015.01	16.6	2,805	925.18	3,730.18	2.29
	27,226.48	16.5	2,857.50	764.66	3,622.16	2.19
	25,969.61	16.4	2,945.	798.30	3,743.30	2.37
1910-11	25,281.58	15.2	3,373.45	747.61	4,121.06	2.6
	21,790.34	16	3,285	1,019.99	4,304.99	3.17
	28,136.34	16.7	4,244.45	1,136.95	5,381.40	2.77
	26,336.99	15.8	5,004.65	1,224.25	6,228.90	4.14

b)

Year	I	II	III	IV
1878-9	5.059	0.926	100.0	100.0
1882-3	5.091	0.629	107.6	72.2
1883-4	4.797	0.667	107.6	81.2
1884-5	4.643	0.897	96.1	96.3
1885-6	4.744	1.018	90.4	105.
1886-7	5.531	1.078	105.9	111.6
1887-8	4.726	1.207	88.6	122.7
1888-9	5.208	1.198	100.6	125.6
1889-90	6.711	1.177	143.8	136.9
1890-91	6.892	1.428	179.9	201.0
1891-2	6.353	1.359	132.7	152.9
1892-3	-	-	-	-
1893-4	6.497	1.548	114.2	146.7
1894-5	6.533	1.702	112.1	158.2
1895-6	7.008	1.162	111.2	100.2
1896-7	6.686	0.999	108.7	87.6
1897-8	6.403	1.025	105.6	91.5
1898-9	6.006	0.972	108.5	95.1
1899-1900	6.689	0.837	136.2	92.3
1900-01	6.310	0.756	134.8	87.4
1901-02	6.042	0.768	122.7	82.3
1902-03	6.557	0.788	128.1	83.2
1903-04	6.339	0.814	125.8	87.1
1904-05	6.276	0.796	123.6	85.2
1905-06	6.393	0.719	127.9	78.0
1906-07	5.712	0.718	125.2	85.4
1907-08	5.674	0.782	138.2	103.4
1908-09	6.325	0.839	137.2	98.9
1909-10	6.250	0.901	136.9	106.9
1910-11	5.896	1.006	126.9	117.5
1911-12	5.826	1.153	133.6	143.1
1912-13	5.236	0.868	139.0	125.0
1913-14	7.011	1.842	131.1	186.8

Column

I = Wage per ton as a % of total cost per ton

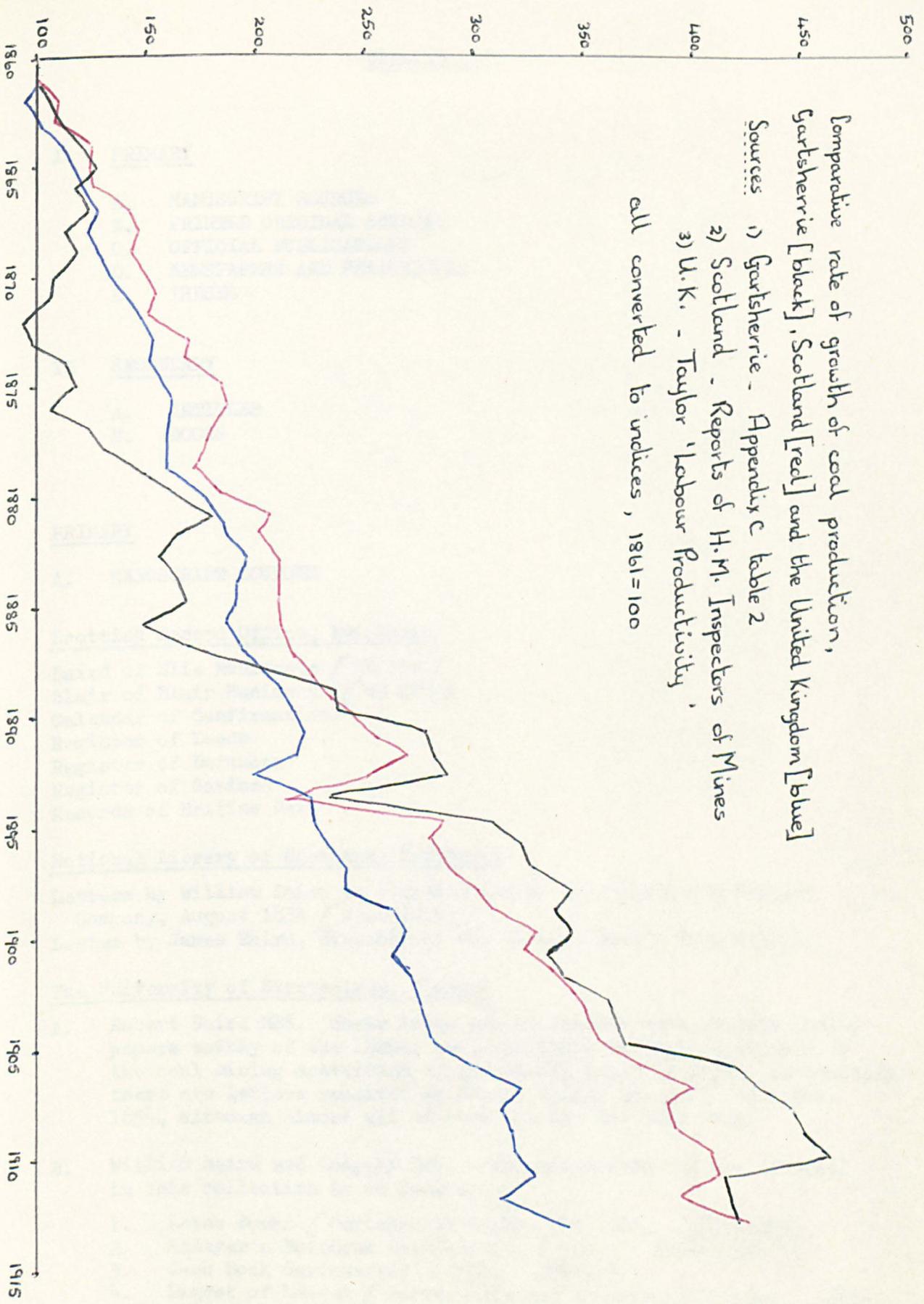
II = Salary per ton as a % of total cost per ton

III = Index of wage per ton data with 1878-9 = 100

IV = Index of Salary per ton data with 1878-9 = 100

Source

Calculated from Strathclyde, WB & CO MSS, Production Abstracts, Gartsherrie



Comparative rate of growth of coal production,
 Gartsheerie [black], Scotland [red] and the United Kingdom [blue]

Sources: 1) Gartsheerie - Appendix C table 2
 2) Scotland - Reports of H.M. Inspectors of Mines
 3) U.K. - Taylor 'Labour Productivity',
 all converted to indices, 1861=100

BIBLIOGRAPHY

I PRIMARY

- A. MANUSCRIPT SOURCES
- B. PRINTED ORIGINAL SOURCES
- C. OFFICIAL PUBLICATIONS
- D. NEWSPAPERS AND PERIODICALS
- E. THESES

II SECONDARY

- A. ARTICLES
- B. BOOKS

PRIMARY

A. MANUSCRIPT SOURCES

Scottish Record Office, Edinburgh

Baird of Elie Muniments [GD 147]
Blair of Blair Muniments [GD 167]
Calendar of Confirmations
Register of Deeds
Register of Defuncts
Register of Sasines
Records of British Rail

National Library of Scotland, Edinburgh

Letters by William Baird to shareholders of the Caledonian Railway
Company, August 1854 [N-6.678(4)]
Letter by James Baird, director of the Glasgow News [MSS. 4511]

The University of Strathclyde, Glasgow

- A. Robert Baird MSS. These loose papers include some private family papers mainly of the 1820s, and some business papers relative to the coal mining activities of the family prior to 1830. In addition there are letters received by Robert during the period c. 1842-1854, although almost all of them are for the year 1845.
- B. William Baird and Company MSS. - The nineteenth century material in this collection is as follows:-
 1. Lease Books [Gartsherrie Region] 9 vols. 1830-1914.
 2. Manager's Notebook Gartsherrie 2 vols. 1844-1910.
 3. Cash Book Gartsherrie 1 vol. 1845-46
 4. Digest of Leases [Gartsherrie and Ayrshire] 2 vols. 1845-1870.
 5. Lease Books [Ayrshire Region] 5 vols. 1857-1920.

6. Valuation Books [Gartsherrie Region] 7 vols. 1858-1914.
7. Railway Deeds Book [Gartsherrie Region] 1 vol. 1840-1870.
8. Production Abstracts Gartsherrie Ironworks 1861, 1879, 1882-1914.
9. Private Letter Book Gartsherrie (wet copy) 1 vol. 1876-1929.
10. General Conditions of Contract Gartsherrie 1 vol. 1880-1914.
11. Allocation of Minerals [Gartsherrie Region] 1 vol. 1882-1914.
12. Cast Iron Rails and Plates Book [Gartsherrie Region] 1 vol. 1897-1908.
13. Inventory Book Gartsherrie 1 vol. 1906-1914.
14. Rent Roll [Gartsherrie Region] 1 vol. 1907-1914.
15. Alterations on Colliers Wages [Gartsherrie Region] 1 vol. 1908-1915.
16. Lordship Book [Gartsherrie Region] 1 vol. 1908-1914.
17. Coal Output Book [Gartsherrie Region] 1 vol. 1910.
18. Weekly pay totals Gartsherrie Iron Works 1 vol. 1911.
19. Inventory of Raasay Estate 1 vol. 1911.
20. Gartsherrie Ironworks Wage Rates Book 1 vol. 1911-1914.
21. Private Journal [Gartsherrie Region] 1 vol. 1912.
22. Colliery Output and Delivery Book [Gartsherrie Region] 1 vol. 1912.
23. Allocation of Minerals Book [Gartsherrie Region] 1 vol. 1912.
24. Compensation Register and Ledger [Gartsherrie Region] 1 vol. 1913.
25. Inventory of Raasay Estate 1 vol. 1913-1921.

Carnegie Public Library, Coatbridge

William Baird and Company MSS. - Included are the following:-

1. Gartsherrie Ironworks Letter Books [wet copy] 40 vols. c. 1847-1894. (wanting volumes 1, 10, 16, 17, 25, 26, 32, 37, and 39).
2. Loose papers, letters, leases, official forms, concerning Gartsherrie Iron works c. 1846-1903.

The Mitchell Library, Glasgow
Bedlay Estate Papers

Hamilton Public Library, Hamilton
Hamilton Estate Papers

The Sheriff Court of Lanarkshire, Glasgow
Register of Deeds
Commissariat Records

The Sheriff Court of Lanarkshire, Hamilton
Commissariat Records

The Sheriff Court of Lanarkshire, Airdrie
Commissariat Records

The Sheriff Court of Ayr and Bute, Ayr
Commissariat Records

The Sheriff Court of Dumfries, Dumfries
Commissariat Records

The Sheriff Court of Kincardineshire, Stonehaven
Commissariat Records

The Sheriff Court of Perthshire, Dunblane
Commissariat Records

The Sheriff Court of Roxburgh, Roxburgh
Commissariat Records

Allan, Louson and Hood, SSC, Edinburgh
Gartsherrie Estate Papers 1821-1914

L. G. Cameron, Towers Road, Airdrie
Notebook c. 1860-1866 of Alexander Cameron, employee of
William Baird and Company

B. PRINTED ORIGINAL SOURCES

1. Deposited Items

The Mitchell Library, Glasgow

Young Scrapbook (newspaper cuttings)

Monthly Circulars of William Connal and Company 1845-1910

Report of the Trial J. B. Neilson and others versus William
Baird and others 1843

River Clyde Shipping Lists 1890-1910

The University of Glasgow

Report of the Trial J. B. Neilson and others versus William
Baird and others 1843 / Murray Collection 7

Report of the Trial J. B. Neilson and others versus Harford
1842 / Murray Collection 7

The Liquidators of the Western Bank versus William Baird's
Trustees 1873 / Murray Collection 7

Library of the Royal Society of Procurators Fiscal, Glasgow

Biographical Notices of Glasgow Men 1867-1918

20 vols. (newspaper cuttings) / Laurence Hill Collection 7

Hamilton Public Library

Reports of Mining Companies and History of Mining (newspaper
cuttings) c. 1870-1890

Mining Appliances (newspaper cuttings) 1872-1892

Miners and the Mining Industry (newspaper cuttings) 1872-1896

2. Miscellaneous Items / Dictionaries, directories, gazetteers,
legal digests etc. 7

Addison, W. J. (ed.), A Roll of Graduates of the University of
Glasgow, Glasgow, 1898.

Addison, W. J. (ed.), The Matriculation Album of the University
of Glasgow, Glasgow, 1913.

Bateman, J., The Acre-ocracy of England, London, 1876.

Bateman, J., The Great Landowners of Great Britain and Ireland,
London, 4th edn. 1883.

- Blair, G., Biographical and Descriptive Sketches of Glasgow Necropolis, Glasgow, 1857.
- Boase, F., Modern English Biography, London, 1965 edn.
- Bradshaw's General Railway Directory, Shareholders Guide, Manual and Almanack for 1850 / -1914 /, London, 1850 etc.
- British Iron Trade Association, Annual Reports 1877-1900.
- Bulmer, T & Co. (pub.), History, Topography, and Directory of Cumberland, Preston, 1901.
- Burke, Sir J. B., Vicissitudes of Families, series 1-3 London 2nd edn. 1883
- Burke, Sir J. B. (ed. by Burke, A. P.), A Genealogical and Heraldic History of the Landed Gentry of Great Britain and Ireland, London, 8th edn. 1894, 11th edn. 1906.
- Burke, A. P., Family Records, London, 1897.
- Cassell's Gazetteer of Great Britain and Ireland, 6 vols. London, 1893-8.
- Chronicle of the General Assembly, Edinburgh, 1870.
- Connolly, M. F., Biographical Dictionary of Eminent Men of Fife, Cupar Fife, 1866.
- Dawson, J. H., An Abridged Statistical History of the Scottish Counties, Edinburgh, 1853.
- Foster, J., Members of Parliament, Scotland 1357-1882, London, 1882.
- Fullarton's Topographical, Statistical, and Historical Gazetteer of Scotland, 2 vols. Glasgow, 1842.
- Gaskell, E., Renfrewshire and Ayrshire Leaders, London, 1908.
- Gibson, J. C., The Lands and Lairds of Larbert and Dunipace, Glasgow, 1908.
- Grant, W., Scottish Anecdotes and Tales, Edinburgh, 1891.
- Griffiths, M. W., Iron and Steel Manufactures of Great Britain, London, 1883.
- Groome, F. H. (ed.), Ordnance Gazetteer of Scotland, 6 vols. Edinburgh, 1882-5.
- Hogg, J., Merchants and Iron Trades Guide, London, 1858 edn., 1869 edn.
- Hunt, R., Mineral Statistics of the United Kingdom for 1854 / -1881 / London, 1855-82.
- Jeans, J. S., Western Worthies, Glasgow, 1872.
- Memoirs and Portraits of One Hundred Glasgow Men, 2 vols. Anon., Glasgow, 1886.
- Millar, A. H., Historical and Descriptive Accounts of the Castles and Mansions of Ayrshire, Edinburgh, 1885.
- The Old Country Houses of the Old Glasgow Gentry, Anon., Glasgow, 2nd edn., 1879.
- Post Office, Directory of Glasgow, 1800-1914.
- Ryland's Iron, Steel, Timplat, Colliery and Allied Trades Directory, Birmingham.
- Scotland's Industrial Souvenir, Glasgow 1905.
- The Scottish Jurist, vols. 1-45, 1829-1873.
- Scottish Law Reporter, vols. 1-52, 1865-1914.
- The Scottish Law Review and Sheriff Court Reports, vols. 1-30, 1885-1914.

- The Scots Law Times, vols. 1-22, 1893-1914.
Session Cases, 1829-1914.
Spon's Dictionary of Engineering, Civil Mechanical, Military, and Naval, 8 vols. London, 1871-74.
 Stothers, T., Historical, Biographical and Literary Sketches of Glasgow and Lanark, 1904.
 Stothers, T., Glasgow, Lanarkshire and Renfrewshire, Christmas and New Year Annual 1911-12, 1912.
 Thomson, G. (ed.), Directory to noblemen and gentlemen's seats, villages etc., in Scotland, Edinburgh, 3rd edn. 1857.
 Tweed, J., Lord Provosts of Glasgow, Glasgow 1883.
 Ure, A., Dictionary of Arts Manufactures and Mines, London, 1839.
Walford's County Families of the United Kingdom 1860 [-1914] London, 1860-1914.
Who's Who, 1890 on, London, 1890-1914.
Who's Who in Glasgow, Anan., Glasgow, 1909.
 Wilson, J. M. (ed.), The Imperial Gazetteer of Scotland, 2 vols. Edinburgh, 1854-7.

C. OFFICIAL PUBLICATIONS

1. Parliamentary

- BPP 1835 [30] XXIX.1 General Report of the Commission appointed to inquire into the state of Municipal Corporations in Scotland (and also 1836 [34] XXIII.1; 1835 [31] XXIX.101; 1835 [32] XXIII.103)
- BPP 1841, sess 2. (52) 11. Great Britain (1841 Census) Population Tables (and decennially thereafter till 1901)
- BPP 1842 [380] XV.1 Report of Commissioners for inquiring into the employment and condition of Children in Mines and Manufactories (and also 1842 [381] XVI.1; 1842 [382] XVII.1)
- BPP 1844 [592] XVI. Report of the Commissioner appointed to inquire into the state of the population in the mining districts (and annually thereafter till 1859)
- BPP 1846 [741] XXXII.209 Minutes of the Committee of Council on Education, with appendices, for 1845 (and also 1848, 1849, 1850, 1853, 1859)
- BPP 1851 [1422] XXIII.507 Report of Messrs. Dunn and Dickinson, Inspectors of Coal Mines (and annually thereafter till 1914)
- BPP 1852 (509) V.1. Report from the Select Committee on Coal Mines. 1852.
- BPP 1854 (0.3) LXIX.205. Report on the Arrestment of Wages ... the effect of Abolishing Imprisonment for small debts and the Practice of Truck in Scotland

BPP 1854 (382) XVI.1. Report from the Select Committee on Payment of Wages Bill, and Payment of Wages (Hosiery) Bill.

BPP 1860 (307) XXII.443. Report from the Select Committee appointed to take into consideration the best means of settling disputes between masters and operatives.

BPP 1865 (398) XII.605 Report from the Select Committee appointed to inquire into the operation of the Act for the regulation and inspection of mines, and into the complaints contained in petitions from miners of Great Britain with reference thereto (and also 1866 (431) XIV.1; 1867 (496) XIII.1.)

BPP 1865 (370) VIII.1 Report from the Select Committee appointed to inquire into the state of the law as regards contracts of service between master and servant, and as to the expediency of amending the same (and also 1866 (449) XIII.1)

BPP 1867-8 [3980 I-VI] Fifth to Tenth Reports of the Royal Commission appointed to inquire into the organisation and rules of trades unions and other associations.

BPP 1871 [c 435] XVIII.1. Report of the Royal Commission appointed to inquire into the several matters relating to coal in the United Kingdom (and also 1871 [c 435 - 1] XVIII.199; 1871 [c 435 - 11] XVIII.815)

BPP 1871 [c 326] XXXVI.1. Report of Commissioners appointed by the Truck Commission Act, 1870, for the purpose of inquiring into the operation of the Act 1 & 2 William 4. c 37, and upon the operation of all other Acts or provisions of Acts prohibiting the Truck System. (and also 1871 [c 327] XXXVI.127.)

BPP 1873 [c 313] X.1. Report of the Select Committee appointed to inquire into the present dearness and scarcity of coal.

BPP 1884 [c 3869] LXXXV.535. Mining and Mineral Statistics of the United Kingdom of Great Britain and Ireland, including lists of Mines and Mineral Works for 1882 [and annually until 1914]

BPP 1887 [c 4982] LXVI.361 Report by the Chief Inspector of Factories upon the Truck System in Scotland.

BPP 1890 [c 6195] XXXVI.1 Report of the Royal Commission appointed to inquire into the subject of Mining Royalties (and also 1890-91 [c 6351] XLI.375; 1890-91 [c 6529] XLI.817; 1893-4 [c 6979] XLII.1; 1893-4 [c 6980] XLII.341)

BPP 1892 [c 6708 - IV] XXXIV.313 The Royal Commission on Labour 1892-94, Evidence before Group A, Mining, Iron, Engineering, Hardware, Shipbuilding and Cognate Trades (and also 1892 [c 6795 -IV] XXXVI. parts 1-5; 1893-4 [c 6894 - VII] XXXII.5)

BPP 1903 [cd 1724] XVI.1 Report of the Royal Commission appointed to inquire into the subject of the Coal Resources of the United Kingdom (and also 1903 [cd 1725] XVI.9; 1903 [cd 1726] XVI.381; 1905 [cd 2359] XVI.139)

BPP 1907 [cd 3548] XIV.1. Report of the Royal Commission on Mines (and also 1907 [cd 3549] XIV.65; 1908 [cd 3873] XX.1.)

BPP 1908 [cd 3846] XI.691 Report of the Departmental Committee on Checkweighing in Iron and Steel (and also 1908 [cd 3847] XI.707)

BPP 1911 [cd 5498] XXXVII.1 Report of Departmental Committee on the working of the existing Special Rules for the use of Electricity in Mines. (and also 1911 [cd 5533] XXXVII.47)

BPP 1914 [cd 7476] XLII.27 Second Report of the Royal Commission on Metalliferous Mines and Quarries (and also 1914 [cd 7477] XLII.233)

BPP 1917-18 [cd 8731] XIV.345 Report of the Royal Commission on the Housing of the Industrial Population of Scotland, Rural and Urban.

2. Non-Parliamentary

Mineral Statistics of the United Kingdom for 1853 and 1854 [- 1881] 30 parts, London 1855-1882.

First Annual Report on the Health and Sanitary Condition of the County of Lanark, 1891 (and also 1892, 1893).

Report on Miners Houses Lanarkshire by Dr. John T. Wilson 1910.

Report on Miners Houses Stirlingshire and Dunbartonshire by Dr. J. McVail 1911.

Minutes of Evidence given before the Royal Commission on the Housing of the Industrial Population of Scotland, 4 vols (H.M.S.O.) 1921.

D. NEWSPAPERS AND PERIODICALS

1. Newspapers

Airdrie and Coatbridge Advertiser

Courier

Edinburgh Courant

Glasgow Argus

Glasgow Chronicle

Glasgow Herald

Glasgow News

North British Daily Mail

Scotch Reformers Gazette

The Scotsman

The Times

2. Periodicals

The Baillie (Glasgow) 1872-1908

Colliery Guardian (London) 1861-3, 1867, 1880-1905

Colliery Journal (Glasgow) 1902-3

The Economist (London) 1852 on, selected years

Engineer (London) 1856-1914

Engineering (London) 1866-1914

Engineering and Mining Journal (New York) 1876-1914

Iron Age (New York) 1901-1914

Iron and Coal Trades Review (London) 1884-1914

Iron and Steel Trades Journal (London) 1888-1909

Iron Trade Circular (Birmingham) 1893-1914

Mechanics Magazine (London) 1830-1836

Mining Journal (London) 1847-8, 1850-63, 1865, 1867, 1871-3, 1877-1897

Practical Magazine (London) 1873

Practical Mechanic and Engineers Magazine (Glasgow) 1848-1870

Scottish Ironmerchant (Glasgow) 1899-1900

E. THESES

Brown, A. J. Y., 'The Scottish Coal Industry 1854-86' D. Litt. thesis, University of Aberdeen

Birch, A., 'The Economic History of the British Iron and Steel Industry 1784-1879' Ph.D. thesis, University of Manchester, 1952-3

Byres, T. J., 'The Scottish Economy during the Great Depression 1873-1896, with special reference to the Heavy Industries of the South-west', B. Litt. thesis, University of Glasgow, 1962

Campbell, R. H., 'The Growth and Fluctuation of the Scots Pig Iron Trade 1828-73', Ph.D. thesis, University of Aberdeen, 1956

Flinn, M. W., 'British Overseas Investment in Iron Ore Mining 1870-1914', M.A. thesis, University of Manchester, 1952-3

Gibson, I. F., 'The Economic History of the Scottish Iron and Steel Industry', Ph.D. thesis, University of London, 1955

Slaven, A., 'Coalmining in the West of Scotland in the Nineteenth Century - The Dixon Enterprises', B. Litt. thesis, University of Glasgow, 1967

II SECONDARY

A. ARTICLES

Aldcroft, D. H., 'The Entrepreneur and the British Economy, 1870-1914' Economic History Review, 2nd series, vol. XVII (1964), 113-34

Aldcroft, D. H., 'Technical Progress and British Enterprise' Business History VIII (1966), 122-139

Allen, A., 'On the Utilization of Blast Furnace Creosote' Report of the British Association for the Advancement of Science (1887), 640

Beaver, S. H., 'Coke Manufacture in Great Britain: A Study in Industrial Geography' Transactions and Papers, Institute of British Geographers, No. 17 (1951), 131-148

Bell, I. L., 'On the Use of Raw Coal in the Blast Furnace' Journal of the Iron and Steel Institute (1884 part I), 13-59

Bell, I. L., 'On the Manufacture of Iron in Relation to Agriculture' Journal of the Iron and Steel Institute (1892 part II), 11-32

Blackwell, S. H., 'On the arrangement of the materials in the blast furnace and the application of the waste gases' Proceedings of the Institution of Mechanical Engineers (1852), 191-206

Brand, M., 'Calcination of Blackband Ironstone at Dumbreck' Transactions of the Institution of Mining Engineers, vol. XXV (1902-3), 253-58

Brown, A. J. Y., 'Trade Union Policy in the Scots Coalfields 1855-1885' Economic History Review 2nd series vol. VI (1953), 35-50

Bumby, H., Wylie, W. and Archibald, H., 'On the Iron and Steel Industries of the West of Scotland' Journal of the West of Scotland Iron and Steel Institute vol. IX (1901-2), 203-220

Butt, J. and Ward, J. T., 'The Promotion of the Caledonian Railway Company' Transport History vol. III (1970), 164-192, 225-257

Byres, T. J., 'Entrepreneurship in the Scottish Heavy Industries 1870-1900' in Studies in Scottish Business History ed. by P. L. Payne, London, 1967, 250-298

Campbell, R. H., 'Statistics of the Scottish Pig Iron Trade 1830-1865' Journal of the West of Scotland Iron and Steel Institute vol. LXIV (1956-57), 282-289

Campbell, R. H., 'The Development of the Scots Pig Iron Trade 1844-48' Journal of Economic History vol. XV (1955), 209-226

Campbell, R. H., 'Edinburgh Bankers and the Western Bank of Scotland' Scottish Journal of Political Economy vol. II (1955), 133-148

Campbell, R. H., 'The Industrial Revolution in Scotland' Scottish Historical Review vol. XLVI (1967), 37-55

Campbell, R. H., 'Investment in the Scots Pig Iron Trade 1830-43' Scottish Journal of Political Economy vol. I (1954), 233-49

Campbell, R. H., 'The Iron Industry in Ayrshire' Ayrshire Archaeological and Natural History Collections 2nd series vol. VII (1961-66), 90-102

Campbell, R. H., 'Fluctuations in Stocks, A Nineteenth Century Case Study' Oxford Economic Papers new series 9 (1957), 41-55

Campbell, R. H., 'Early Malleable Iron Production in Scotland' Business History vol. IV (1961), 22-33

Clark, T., 'On the Application of the Hot Blast, in the Manufacture of Cast-Iron' Edinburgh Philosophical Transactions vol. XIII (1836), 373-382

Cockey, W., 'Bessemer's Process for Manufacturing Iron' Proceedings of the Philosophical Society of Glasgow vol. IV (1855-6), 81-2

Crapster, B., 'Scotland and the Conservative Party in 1876' Journal of Modern History vol. XXIX (1957), 355-360

Day, S.V., 'The Present State of Iron Metallurgy' Proceedings of the Philosophical Society of Glasgow vol. VI (1865-68), 311-37

Day, S.V., 'On the Past and Present of Iron Smelting' Proceedings of the Philosophical Society of Glasgow vol. VIII (1871-73), 464-480

Dron, R. W., 'Some Notes on the Output of Coal from the Scottish Coalfields' Report of the British Association for the Advancement of Science (1901), 741-42

Fairbairn, W., 'On the Strength and other Properties of Cast Iron obtained from the Hot and Cold Blast' Report of the British Association for the Advancement of Science (1837), 377-415

Flinn, M.W., 'British Steel and Spanish Ore, 1871-1914' Economic History Review 2nd series, vol. VIII (1955), 84-90

Forge, J. T., 'Electric Power Plant at Dumbreck Colliery Kilsyth' Transactions of the Federated Institution of Mining Engineers vol. VII (1893-4), 121-134

Forrest, B. J., 'The Bilbao Iron Ore District' Transactions of the North of England Institution of Mining and Mechanical Engineers vol XXXIII (1883-4), 213-35

Gibson, F. F., 'The Establishment of the Scottish Steel Industry' Scottish Journal of Political Economy vol. V (1958), 22-39

Gill, W., 'The Iron Ore District of Bilbao' Journal of the Iron and Steel Institute (1882 part 1), 63-95

Gill, W., 'The Present Position of the Iron Ore Industry of Biscay-Santander' Journal of the Iron and Steel Institute (1896 part II), 37-103

Gillespie, J., 'Notes on the Evolution of Blast Furnace Recovery Plant' Journal of the West of Scotland Iron and Steel Institute, vol. XII (1904-5), 49-81

Gillespie, A., 'The Recovery of Tar and Ammonia from Blast Furnace Gases' Transactions of the Institution of Engineers and Shipbuilders in Scotland vol. XXXIX (1895-6), 187-94

Gordon, J., 'On the State of Education among the mining population of Lanarkshire' Transactions of the National Association for the Promotion of Social Science (1860), 370-379

German, W., 'On producing cast steel or Ingot Iron from crude or pig iron' Proceedings of the Philosophical Society of Glasgow vol. XVI (1884-5), 289-296

Gorman, W., 'On the heat restoring Gas Furnace and heating by radiation' Proceedings of the Philosophical Society of Glasgow vol. XVI (1884-5), 297-304

Griener, A., 'Presidential Address' Journal of the Iron and Steel Institute (1914 part I), 29-50

Hall, B.J., 'On the Ford and Moncur Hot-Blast Stove' Journal of the Iron and Steel Institute (1896 part I), 20-33

Hamilton, H., 'Combination in the West of Scotland Coal Trade 1790-1817' Economic History Supplement to the Economic Journal vol. II (1930), 125-136

Hamilton, R., 'On the recovery of bye-products from blast furnace gases' Journal of the West of Scotland Iron and Steel Institute vol. IX (1902), 125-138

Head, J., 'Iron Mines of Bilbao' Report of the British Association for the Advancement of Science (1887), 861-64

Hodgkinson, E., 'On the Relative Strength and Other Properties of Cast Iron obtained from Hot and Cold Blast' Report of the British Association for the Advancement of Science (1837), 337-377

Hume, J. and Butt J., 'Muirkirk 1786-1802: the Creation of a Scottish Industrial Community' Scottish Historical Review vol. XLV (1966), 161-83

Jeans, J. S., 'The Pig Iron Trade of Scotland' Practical Magazine vol I (1873), 241-8

Jenkins, J. G., 'Some Account of the Iron Ore Industry of the North of Spain' Proceedings of the Philosophical Society of Glasgow vol. XIV (1882-3), 161-72

Jones, W., 'The Present Position and Prospects of Processes for the Recovery of Tar and Ammonia from Blast Furnaces' Journal of the Iron and Steel Institute (1885 part II), 410-447

Kellas, J., 'The Mid-Lanark By-election of 1888 and the Scottish Labour Party 1888-1894' Parliamentary Affairs vol. XVIII (1965), 318-29

Kendall, J. D., 'The Iron Ores of Spain' Transactions of the Federated Institution of Mining Engineers vol. III (1871-2), 604-616

Labon, J. H. G., 'The Development of the Ayrshire Coalfields' Scottish Geographical Magazine vol. XLIX (1933), 138-54

Lindert, P. H. and Trace, K., 'Yardsticks for Victorians' in Essays in a Mature Economy: Britain after 1840 ed. McClaskey, D.N. London, 1971, 239-284

Lloyd, S., 'On taking off waste gases from open topped furnaces' Proceedings of the Institution of Mechanical Engineers (1860) 251-76

McClaskey, D. N., 'International Differences in Productivity? Coal and Steel in America and Britain before World War I' in Essays in a Mature Economy: Britain after 1840 ed. McClaskey, D.N., London, 1971, 285-309

McCloskey, D.N., and Sandberg, L. G., 'From Damnation to Redemption: Judgements on the Late-Victorian Entrepreneur' Explorations in Entrepreneurial History 2nd series vol. IX (1971), 89-108

Macrosty, H. W., 'Prices and Speculation in the Iron Market' Economic Journal vol. XV (1905), 340-60

Marten, H., 'On the Construction of Hot-Blast Ovens for Iron Furnaces' Proceedings of the Institution of Mechanical Engineers (1859), 62-91

Mayer, J., 'On the Rise and Progress of the Iron Manufacture in Scotland' Journal of the Iron and Steel Institute (1872), 29-44

Moore, R., 'Recent Developments in the Hamilton Coalfield' Proceedings of the Philosophical Society of Glasgow vol. XXIV (1892-3)

Moore, W., 'On the Principal Seams of Coal and Ironstone in the Glasgow Coalfield' Proceedings of the Institution of Mechanical Engineers (1864), 229-48

Moore, R., 'On the Blackband Ironstones of the Edinburgh and East Lothian Coalfields' Transactions of the Royal Scottish Society of Arts vol VI (1864), 11-24

Moore, W., 'Observations on the supply of coal and ironstone from the mineral fields of Scotland' Proceedings of the Philosophical Society of Glasgow vol. IV (1855-6), 292-306

Murray, W., 'A Section of the Lanarkshire Coalfield' Proceedings of the Philosophical Society of Glasgow vol I (1841-44), 113

Murray, W., 'Who invented the Hot-blast' Steel Times (1965), 597-8

Napier, J., 'Black and Clayband Ironstone: their composition and valuation' Proceedings of the Philosophical Society of Glasgow vol. V (1860-64), 210-217

Neilson, J. B., 'On the Hot Air Blast' Transactions of the Institution of Civil Engineers vol. I (1836), 81-83

Orsagh, J. S., 'Progress in Iron and Steel, 1870-1913' Comparative Studies in Society and History vol. III (1960-61), 216-30

Paterson, B. E., 'The Social and Working Conditions of the Ayrshire Mining Population 1840-1875' Ayrshire Archaeological and Natural History Collections 2nd series, vol. X (1970-72), 201-60

Payne, P.L., 'The Emergence of the large scale Company in Britain 1870-1914' Economic History Review 2nd series, vol. XX (1967), 519-42

Payne, P. L., 'The Govan Collieries 1804-5' Business History vol. III (1960-61), 75-96

Payne, P. L., 'Iron and Steel Manufactures' in The Development of British Industry and Foreign Competition 1875-1914 ed. Aldcroft, D.H. London, 1968, 71-99

Porter, G. R., 'On the Progress, Present and Probable Future Condition of the Iron Manufacture of Great Britain' Report of the British Association for the Advancement of Science (1846), 99-119

Porter, J. H., 'Management, Competition, and Industrial Relations: the Midland Manufactured Iron Trade 1873-1914' Business History vol. XI (1969), 37-47

Prentice, J., 'Mineral Seams of New Monkland' Transactions of the Federated Institution of Mining Engineers vol. XII (1896-7), 435-450

Richardson, H. W. and Bass, J. B., 'The Profitability of Consett Iron Company before 1914' Business History vol. VII (1965), 71-93

Riley, J., 'On the Rise and Progress of the Scotch Steel Trade' Journal of the Iron and Steel Institute (1885 part II), 394-409

Rogerson, T. B. and Buchanan, W., 'Progress of the Manufacture of Pig Iron' Journal of the West of Scotland Iron and Steel Institute vol. XXI (1913), 15-26

Rogerson, T. B., 'Comparison of American and British Blast-Furnace Practice' Journal of the West of Scotland Iron and Steel Institute vol. VII (1899-1900), 153-167

Rowan, F. J., 'On the Iron Trade of Scotland' Journal of the Iron and Steel Institute (1885 part II), 376-93

Sexton, A. H., 'On the Evolution of the Blast Furnace' Proceedings of the Philosophical Society of Glasgow vol. XXX (1898-9), 284-93

Sexton, A. H., 'Bye-Products of Blast Furnaces' Proceedings of the Philosophical Society of Glasgow vol. XXVII (1895-6), 122-35

Simpson, M. L., 'Steelworks - a 21 year review' Journal of the West of Scotland Iron and Steel Institute XXI (1913), 45-60

Slaven, A., 'Earnings and Productivity in the Scottish Coal-mining Industry during the Nineteenth Century: the Dixon Enterprises' in Studies in Scottish Business History, ed. Payne, P.L., London, 1967, 217-249

Sleight, G. E., 'Ayrshire Coalmining and Ancillary Industries' Ayrshire Archaeological and Natural History Collections 2nd series, vol. VII (1961-66), 103-119

Smith, W., 'The recovery of bye-products from coal, with special reference to the Coke and Iron Industries' Journal of the Iron and Steel Institute (1884 part II), 486-516

Strang, J., 'On the Progress, Extent and Value of the Coal and Iron Trade of the West of Scotland' Report of the British Association for the Advancement of Science (1855), 193-5

Strang, J., 'On the money rate of wages of labour in Glasgow and the West of Scotland' Report of the British Association for the Advancement of Science (1856), 155-59

Sutherland, W. S., 'On the most recent results obtained in the application and utilization of Gaseous Fuel' Journal of the Iron and Steel Institute (1884 part I), 72-87

Tatlock, R. R., 'On By-product Recovery' Proceedings of the Philosophical Society of Glasgow vol. XV (1883-4), 1-17

Taylor, A. J., 'The Miners' Association of Great Britain and Ireland, 1842-8: A Study in the Problem of Integration' Economica new series, vol. XXII (1955), 45-60

Taylor, A. J., 'Labour Productivity and Technological Innovation in the British Coal Industry 1850-1914' Economic History Review 2nd series, vol. XIV (1961), 48-70

Taylor, A. J., 'The Coal Industry' in The Development of British Industry and Foreign Competition 1875-1914, ed. Aldcroft, D. H., London, 1968, 37-70

Thomson, G., 'Practical Remarks on Blast Furnaces' Proceedings of the Philosophical Society of Glasgow vol. I (1841-4), 84-92

Thomson, G., 'James Watt and the Monkland Canal' Scottish Historical Review vol. XXIX (1950), 121-133

Thomson, T., 'On the difference between the composition of cast iron produced by Hot and Cold Blast' Report of the British Association for the Advancement of Science (1838), 117-26

Urwin, D., 'The Development of Conservative Party Organisation in Scotland until 1912' Scottish Historical Review vol. XLIV (1965), 89-111

Urwin, D., 'Scottish Conservatism: A Party Organisation in Transition' Political Studies vol. XIV (1966), 145-162

Vamplew, W., 'Banks and Railway Finance, a Note on the Scottish Experience' Transport History vol. IV (1971), 166-82

Vamplew, W., 'The Financing of Scottish Railways before 1860: a Reply' Scottish Journal of Political Economy vol. XVIII (1971), 221-3

Vamplew, W., 'Railways and the Transformation of the Scottish Economy' Economic History Review 2nd series, vol. XXIV (1971), 37-54

Ward, J. T., 'Ayrshire Landed Estates in the Nineteenth Century' Ayrshire Archaeological and Natural History Collections 2nd series, vol. VIII (1967-69), 93-143

Warren, K., 'The Location of the Scottish Iron and Steel Industry' Scottish Geographical Magazine vol. LXXXI (1965), 18-37, 87-103

Watt, A., 'On the Iron Trade of Scotland' Report of the British Association for the Advancement of Science (1845), 90-91

Wilson, A., 'On the Generation and Application of Heating Gas and the Recovery of By-products' Journal of the Society of the Chemical Industry vol. II (1883), 453-461

B. BOOKS

Aberconway, Lord, The Basic Industries of Great Britain: Coal, Iron, Steel, Engineering, Ships: An Historic and Economic Survey, London, 1927

Ackermann, A. S. E., Coal Cutting by Machinery in the United States of America, London, 1902

Allison, A., The Outline of Iron and Steel, London, 1936

Alison, Sir A., History of Europe from the Fall of Napoleon in 1815 to the Accession of Louis Napoleon in 1852, 8 vols., Edinburgh and London, 1853-9

Anderson, R., A History of Kilsyth, and a Memorial of Two Lives 1793-1901, Kilsyth, 1901

Anton, Rev. P., Kilsyth: A Parish History, Glasgow, 1893

Arnot, R. P., The Miners: A History of the Miners' Federation of Great Britain 1889-1914, London, 1949

Arnot, R. P., A History of the Scottish Miners from the Earliest Times, London, 1955

Bain, J., Spiritualism - Narrative of Facts Observed, Glasgow, 1864

Bain, J., Spirit Rapping in Glasgow, Glasgow, 1864

- Baird, A. F., Annals of a Scots Family 1691-1936, Glasgow, 1936
- Balloch, J. M., The Last Baird of Auchmedden and Strichen, Aberdeen, 1934
- Barclay, J., Statistics of the Scotch Iron Trade, Glasgow, 1850
- Barrowman, J., A History of Scotch Mining and Miners, Hamilton, 1889
- Bauerman, H., A Treatise on the Metallurgy of Iron, London, 1868
- Bell, J. L., Principles of the Manufacture of Iron and Steel, London, 1884
- Bell, Sir J. L., The Iron Trade of the United Kingdom compared with that of the other Chief Ironmaking Nations, London, 1886
- Bernal, J. D., Science and Industry in the Nineteenth Century, London, 1953
- Bevan, G. P. (ed.), British Manufacturing Industries, 13 vols. London, 1876
- Birch, A., The Economic History of the British Iron and Steel Industry 1784-1879, London, 1967
- Blackwell, S. H., The Ironmaking Resources of the United Kingdom, London, 1852
- Bowley, A. L., Wages and Income in the United Kingdom since 1860, Cambridge, 1937
- Boyd, W., Education in Ayr Through Seven Centuries, London, 1961
- Bremner, D., The Industries of Scotland: Their Rise, Progress, and Present Condition, Edinburgh, 1869
- British Association, Notices of Some Principal Manufactures of the West of Scotland, Glasgow, 1876
- British Association, Handbook on the Local Industries of Glasgow and the West of Scotland, McLean, A. (ed.), Glasgow, 1901
- Buchanan, G., Account of the Glasgow and Carnkirk Railway, Edinburgh, 1832
- Burn, D. L., The Economic History of Steelmaking 1867-1939: a Study in Competition, Cambridge, 1940
- Burnham, T. H. and Hoskins, G. O., Iron and Steel in Britain 1870-1930, London, 1943
- Butt, J., Industrial Archaeology of Scotland, Plymouth, 1967

- Caine, C., The Iron Mines of Cleator, Whitehaven, 1911
- Caine, C., Cleator and Cleator Moor Past and Present, Kendal, 1916
- Cameron, J., Parish of Campsie, Kirkintilloch, 1892
- Campbell, R. H., Carron Iron Company, Edinburgh, 1961
- Campbell, R. H., Scotland since 1707, Oxford, 1965
- Carr, J. C. and Taplin, W., A History of the British Steel Industry, Oxford, 1962
- Carter, E. F., An Historical Geography of the Railways of the British Isles, London, 1959
- Carvel, J. L., The New Cumnock Coalfield, Edinburgh, 1946
- Carvel, J. L., The Coltness Iron Company, Edinburgh, 1948
- Carvel, J. L., Fifty Years of Machine Mining, Glasgow, 1949
- Challinor, R. and Ripley, B., The Miners' Association - A Trade Union in the Age of the Chartists, London, 1968
- Checkland, G. K., The Mines of Tharsis; Roman, French, and British Enterprise in Spain, London, 1967
- Church, S. R., Analysis of Pig Iron, 2 vols., San Francisco, 1900, 1903
- Cleghorn, T. (ed.), Journal of Henry Cockburn, 2 vols., Edinburgh, 1874
- Cleland, J., Enumeration of the Inhabitants of the City of Glasgow and County of Lanark, 2nd edn., Glasgow, 1832
- Cleland, J., Statistical facts descriptive of the former and present state of Glasgow, Glasgow, 1837
- Cleland, J., Account of the Minerals in the Public Green belonging to the Corporation of Glasgow, Glasgow, 1856
- Cloughan, W., A series of letters on the restriction of labour and its effects on the mines of Lanarkshire, Coatbridge, 1846
- Colt, G. R. F., The History and Genealogy of the Colts of that Ilk and Gartsherrie, Edinburgh, 1887
- Cormack, J. (publ.), Lanarkshire [County History Series], Edinburgh, 1912

Craig, J., Remarks on the Mineral Resources of Lanarkshire, Glasgow, 1836

Cree, T. S., Evils of Collective Bargaining in Trade Unions, Glasgow, 1898

Crookes, W. and Rohrig, E., A Practical Treatise on Metallurgy, London, 1869

Dilke, M. S. and Templeton, A. A., The County of Dumbarton, The Third Statistical Account of Scotland, vol. VI., Glasgow, 1959

Douglas, W. S., In Ayrshire-Cunningham, Kilmarnock, 1874

Dron, R. W., Coalfields of Scotland, Edinburgh, 1902

Dron, R. W., The Economics of Coal Mining, London, 1928

Durland, K., Among the Fife Miners, London, 1904

Erickson, C., British Industrialists: Steel and Hosiery 1850-1950, Cambridge, 1959

Evans, D. E., The Commercial Crisis 1847-8, 2nd edn., London, 1849

Evans, D. E., The History of the Commercial Crisis 1854-8 and the Stock Exchange Panic of 1859, London, 1859

Ferguson, T., Dawn of Scottish Social Welfare, London, 1948

Ferguson, T., Scottish Social Welfare 1864-1914, Edinburgh, 1958

Fordyce, W., A History of the Coal, Coke, Coalfields, Iron of Great Britain, London, 1860

Fraser, W. N., Account of the Surname of Baird, Edinburgh, 1857, (2nd Ed. 1870)

Galloway, R. L., Annals of Coal Mining and the Coal Trade: First Series, 1898: Second Series, 1904, London, 1898, 1904

Greenwell, A. and Elsdon, J. V., Analysis of British Coals and Coke, London, 1907 edn.

Griffiths, H. W., The Iron and Steel Manufactures of Great Britain, London, 1883

Griffiths, S., Guide to the Iron Trade of Great Britain, London, 1873.

Guthrie, A., Ardrossan, Ardrossan, 1869

Hamilton, H., The Industrial Revolution in Scotland, Oxford, 1932

- Hamilton, W., Work and Prayer, Coatbridge, 1937
- Handley, J. E., The Irish in Scotland 1783-1845, Cork, 1943
- Handley, J. E., The Irish in Modern Scotland, Cork, 1947
- Hatch, F. H., The Iron and Steel Industry of the United Kingdom under War Conditions, London, 1920
- Hiorns, A. H., Iron and Steel Manufacture, London and Glasgow, 1889
- Hodge, J. M., Through the Parish, Ardrossan, 1900
- Hodge, J., Workman's Cottage to Windsor Castle, London, 1931
- Horne, J. (ed.), Kirkintilloch, Kirkintilloch, 1910
- House, J., Lochrins Hundred Years, Glasgow, 1959
- Hull, E., Our Coal Resources at the Close of the Nineteenth Century, London, 1897
- Hyslop, J., Colliery Management, Edinburgh, 1870, 2nd edn. London, 1876
- An Inquiry into the Present System of Storing Scotch Pig Iron in Glasgow / by a member of the Iron Trade /, Liverpool, 1859 (?)
- Ireland, J. A., A Legacy from a Scottish Manse - a series of parish papers, London, 1918
- Irving, J., The History of Dumbartonshire, 2nd edn. Dumbarton, 1860
- Irving J., The Book of Dumbartonshire, 3 vols., Edinburgh, 1874
- Jears, J. S., The Iron Trade of Great Britain, London, 1906
- Jevons, H. S., The British Coal Trade, London, 1915
- Johnston, T., History of the Working Classes in Scotland, Glasgow, 1912
- Johnston, T., Old Kirkintilloch, Kirkintilloch, 1937
- Keddie, H., Three Generations: The Story of a Middle-Class Scottish Family, London, 1911
- Kendall, J. D., Iron Ores of Great Britain and Ireland, London, 1893
- Ker, W. L., History of Kilwinning, Kilwinning, 1900
- Knox, J., Airdrie, Airdrie, 1921
- Kohn, F., Iron and Steel Manufacture, London, 1869

The Late Alexander Whitelaw, Esqr., Glasgow. Report of Proceedings at the Presentation of his Portrait to the Corporation of Glasgow, Glasgow, 1881

Legge, B., Catechism of Iron: Guide to the Iron Trade, Tipton, 1860

Lindsay, J., The Canals of Scotland, Newton Abbot, 1968

Lumsden, R., Chemical Report on, and Examination of the Rankinston Ironstone and Coalfield, the Property of Robert Salmond, Airdrie, 1863

Macarthur, J., New Monkland Parish: its History Industries and People, Glasgow, 1890

Macegeorge, A., The Bairds of Gartsherrie, Glasgow, 1875.

McHutchison, W., History of Airdrie, Airdrie, 1877

Macintosh, J., Historical Review of Galston and Loudon Parishes, Newmilns, 1890

Mackenzie, T. B., Life of J. B. Neilson, Glasgow, 1929

Mackinnon, J., Social and Industrial History of Scotland, 2 vols. London, 1920-21

MacLeod, W. H., The Houldsworths of Coltness, Glasgow, 1937

Macrosty, H. W., The Trust Movement in British Industry, London, 1907

Malloch, D. M., The Book of Glasgow Anecdote, London and Edinburgh, 1913

Marwick, W. H., Economic Developments in Victorian Scotland, London, 1936

Marwick, W. H., A Short History of Labour in Scotland, Edinburgh, 1967

Matthews, R. C., A Study in Trade Cycle History 1833-42, Cambridge, 1954

Marwick, W. H., Scotland in Modern Times, London, 1964

Maxwell, General E. H., Griffen Ahoy, London, 1882

Maxwell, Sir W., History of Co-operation in Scotland, Glasgow, 1910

Meade, R., The Coal and Iron Industries of the United Kingdom, London, 1883

- Mearns, P., Muirkirk and its Neighbourhood, 1883
- Miller, A., The Rise and Progress of Coatbridge and Surrounding Neighbourhood, Glasgow, 1864
- Miller, T. R., The Monkland Tradition, Edinburgh, 1958
- The Mining Association of Great Britain, Historical Review of Coalmining, London, 1924
- Mitchell, B. R. and Deane, P. M., British Historical Statistics, Cambridge, 1962
- Mort, F., Lanarkshire, Cambridge, 1910
- Muir, A., The Story of Shotts: A Short History of the Shotts Iron Company Ltd., Cambridge, 1954
- Munro, R., An Autobiographical Sketch, Glasgow, 1921
- Mushet, D., Papers on Iron and Steel, London, 1840
- N.C.B. (Scottish Division), A Short History of the Scottish Coal Mining Industry, Edinburgh and Glasgow, 1958
- Nisbet, Hill and Carnegie, S., Cairnhill, Edinburgh, 1949
- Pagan, J., Sketches from the History of Glasgow, Glasgow, 1847
- Pagan, J., Glasgow Past and Present, 3 vols., Glasgow, 1851-6
- Paterson, J., History of the County of Ayr, 2 vols., Ayr, 1847
- Paterson, J., History of the Counties of Ayr and Wigton, 3 vols., Edinburgh, 1863-4
- Pechar, J., Coal and Iron in all Countries of the World, Manchester, 1878
- Percy, C. M., Mining in the Victorian Era, London, 1897
- Percy, C. M., The Mechanical Equipment of Collieries, London, 1905
- Percy, J., Metallurgy, 4 vols., London, 1861-80
- Percy, J., Refractory Materials and Fuel, (a revised and greatly enlarged edition) London, 1875
- Porter, G. R., The Progress of the Nation in its Various Social and Economical Relations, London, 1847

- Porter, P., Breadwinners Abroad, New York, 1885
- Pounds, N. J., The Geography of Iron and Steel, London, 1959
- Rankin, J. T., History and Statistics of East Monkland, Airdrie, 1855
- Raynes, J. R., Coal and its Conflicts, London, 1928
- Redmayne, R. A. S., Modern Practice in Mining, 5 vols., London, 1908-32
- Reed, M. C. (ed.), Railways in the Victorian Economy, Newton Abbot, 1969
- Rennie, R. C. (ed.), The County of Stirling, The Third Statistical Account of Scotland, vol. XVIII, Glasgow, 1966
- Rhead, E. L. and Sexton, A. H., Assaying and Metallurgical Analysis, London, 1902
- Robertson, R. H. S. and Clement, A. G., Scotland's Scientific Heritage, Edinburgh, 1961
- Roepke, H. G., Movements of the British Iron and Steel Industry 1720-1951, Urbana, 1956
- Rose, J., A New Guide to the Iron Trade, London, 1874
- Salt, S., Facts and Figures principally Relating to Railways and Commerce, London, 1848
- Scobie, G. K. (ed.), Book of Airdrie, Glasgow, 1954
- Scrivenor, H., The Railways of the United Kingdom Statistically Considered, London, 1849
- Scrivenor, H., A Comprehensive History of the Iron Trade, 2nd edn., London, 1854
- Sexton, A. H., An Outline of Quantitative Analysis, London, 1887
- Sexton, A. H., Outline of Qualitative Analysis, London, 1888
- Sexton, A. H., An Elementary Textbook of Metallurgy, London, 1895
- Sexton, A. H., Fuel and Refractory Materials, London, 1897
- Sexton, A. H., The Chemistry of the Materials of Engineering, Manchester, 1900
- Sexton, A. H., Metallurgy of Iron and Steel, Manchester, 1902

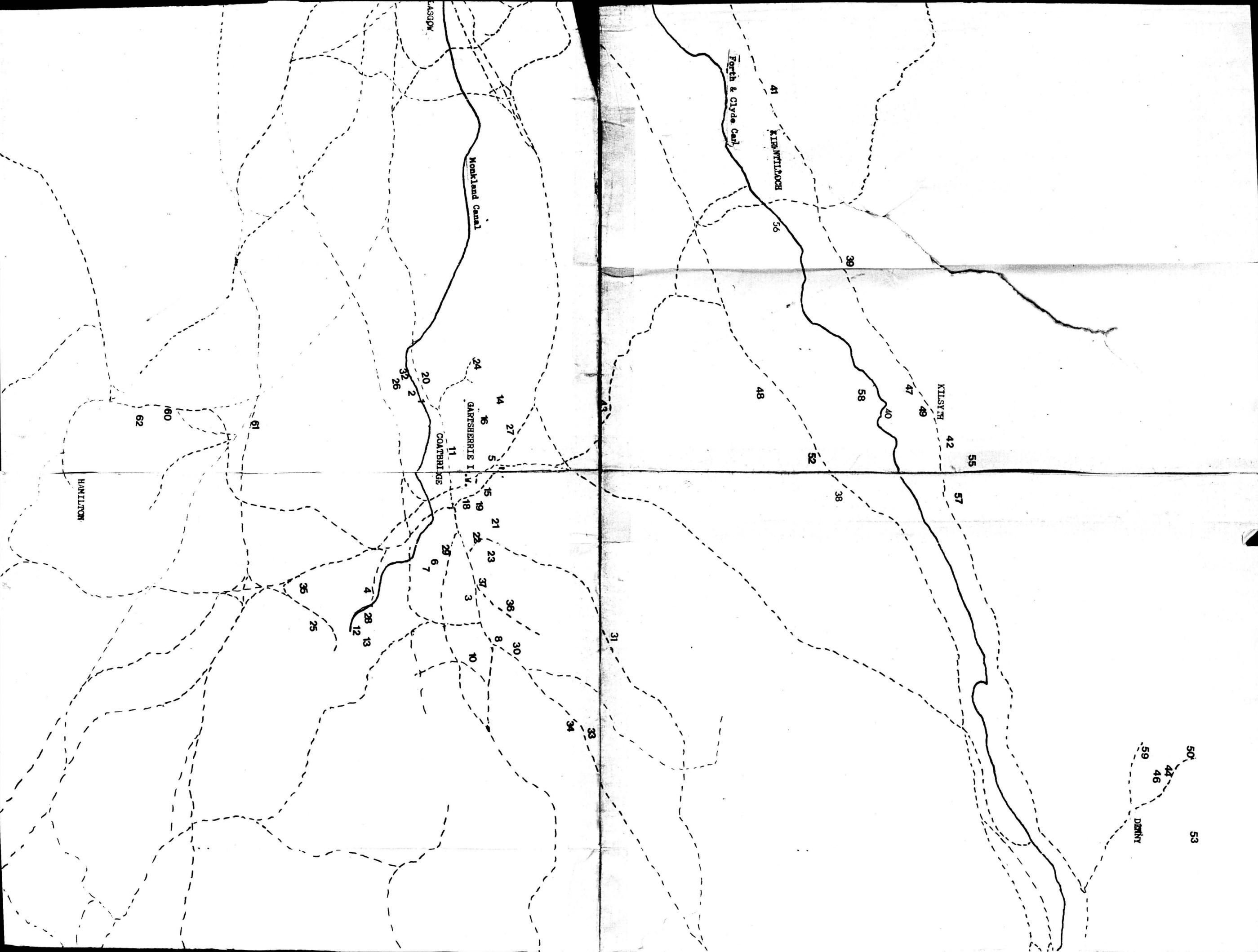
- Shaw, J. E., Ayrshire 1745-1950, Edinburgh and London, 1953
- Smiles, S., Industrial Biography, Ironworker and Tool Makers, London, 1863
- Smith, D. L., The Dalmellington Iron Company, Its Engines and Men, Newton Abbot, 1967
- Smith, J., Grievances of the Working Classes, Glasgow, 1846
- Stansbie, J. H., Iron and Steel, London, 1907
- Steven, H. J., Auchinleck, its History and Associations, Kilmarnock, 1898
- Steven, H. J., Sorn Parish, its History and Associations, Kilmarnock, 1898
- Steven, H. J., New Cumnock, its History and Associations, Kilmarnock, 1899
- Steven, H. J., Old Cumnock, its History and Associations, Kilmarnock, 1899
- Stewart, G., Curiosities of Glasgow Citizenship, Glasgow, 1881
- Stewart, G., Progress of Glasgow, Glasgow, 1883
- Story, R. H. (ed.), The Church of Scotland Past and Present, 5 vols., London, 1890-91
- Stoughton, B., Metallurgy of Iron and Steel, New York, 1908
- Strawhorn, J. and Boyd, W., Ayrshire, The Third Statistical Account of Scotland, vol. I, Edinburgh, 1951
- Strawhorn, J., The New History of Cumnock, Cumnock, 1966
- Tancred, G., Annals of a Border Club, Jedburgh, 1899
- Tariff Commission [a private body], Report of the Tariff Commission, vol I., The Iron And Steel Trades, London, 1904
- Taylor, R. C., Statistics of Coal, Philadelphia, 1848
- Temin, P., Iron and Steel in Nineteenth Century America: an Economic Enquiry, Cambridge (U.S.A.) 1964
- Thompson, F. M. L., English Landed Society in the Nineteenth Century, London, 1963
- Thomson, G., The Growth of the Monklands, Airdrie, 1947

- Thomson, G. (ed.), The County of Lanark, The Third Statistical Account of Scotland, vol. VIII, Glasgow, 1960
- Tiemann, H. P., Iron and Steel, 2nd edn., New York, 1910
- Truran, W., The Iron Manufacture of Great Britain Theoretically and Practically Considered, London, 1855
- Turner, T., The Metallurgy of Iron, London, 1895
- Walker, S. F., Coal Cutting by Machinery in the United Kingdom, London, 1902
- Wallace, W., Analyses of Ironstone, Coal, Limestone, Fireclay, Pig Irons and Furnace Slags Illustrative of Scotch Ironmanufacture, Glasgow, 1877
- Warrick, J., The History of Old Cumnock, Paisley, 1899
- Watson, T., Kirkintilloch, Town and Parish: a History, Glasgow, 1894
- Whitelaw, H. W., The House of Whitelaw 1400-1900, Glasgow, 1928
- Wilkie, G., The Manufacture of Iron in Great Britain, Edinburgh, 1857

MAP ONE

GARTSHERRIE REGION

THE NUMBERS REFER TO THE
COLLIERIES AS LISTED IN
APPENDIX C TABLE I.A.



GLASGOW

Monkland Canal

Forth & Clyde Canal

KIRKINTILLOCH

KILSYTH

DENMY

HAMILTON

GARTSHERRIE I.
&
COATBRIDGE

62

60

61

35

25

4

28

12

13

20

2

32

26

11

7

29

6

7

3

37

10

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

18

15

5

14

27

24

16

21

22

23

37

3

8

30

36

23

21

19

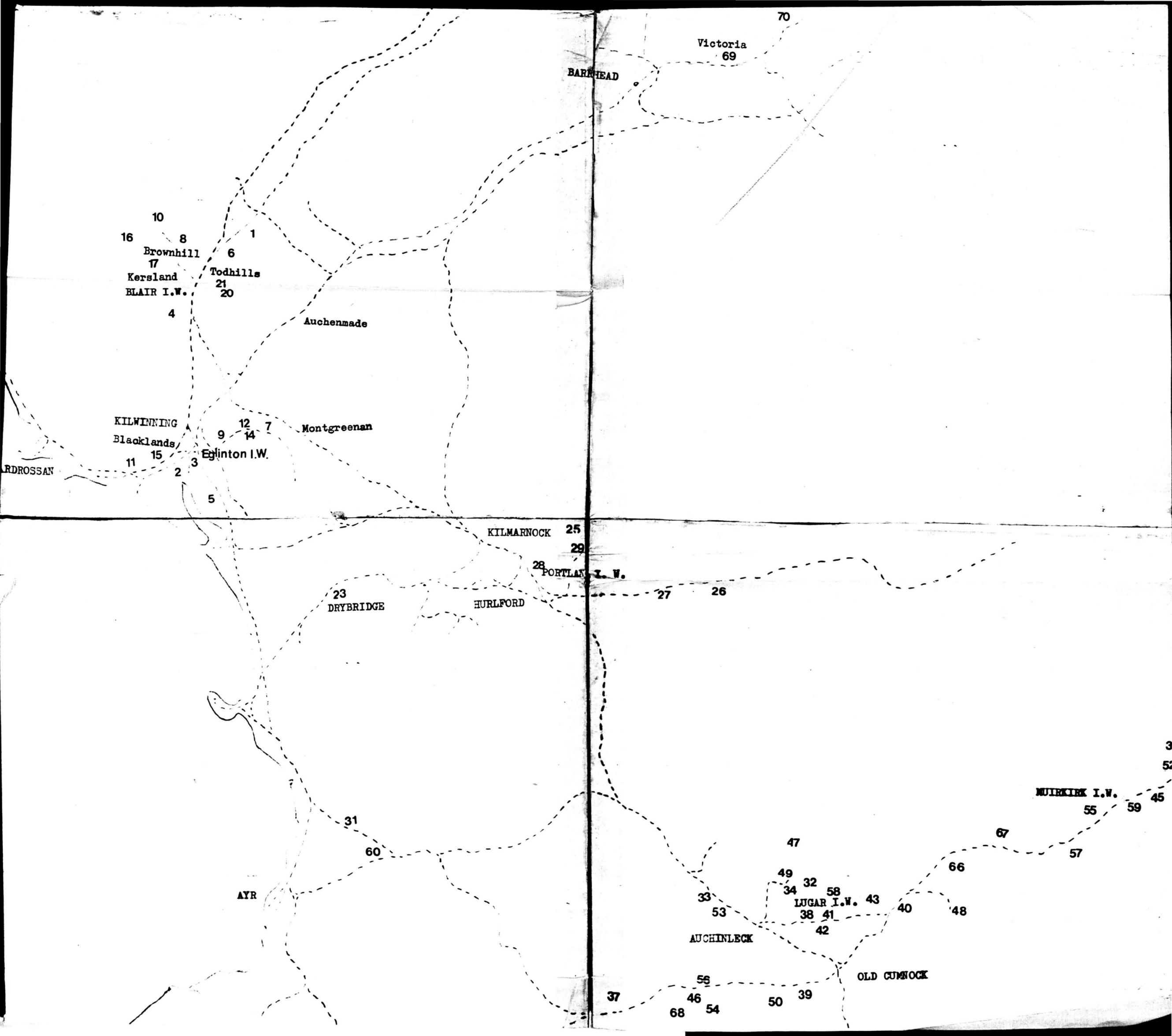
MAP TWO

AYRSHIRE REGION

THE NUMBERS REFER TO

THE COLLIERIES AS LISTED IN

APPENDIX C TABLE I B.



Victoria
69

BARRHEAD

10
16
8
Brownhill
17
Kersland
BLAIR I.W.
4

1
6
Todhills
21
20

Auchennade

KILWINNING
Blacklands
11
15
2
3
Eglinton I.W.

Montgreenan

9
12
14
7
5

KILMARNOCK
25
29

28
PORTLAN I.W.

23
DRYBRIDGE

HURLFORD

27
26

AYR

31
60

33
53
AUCHINLECK

49
34
32
58
LUGAR I.W.
38
41
42
43

OLD CUMNOCK

MUIRKIRK I.W.
55
59

37
68
46
54
50
39

66
48

67
57

3
52
45