Southeastern Pennsylvania was the nucleus of the colonial iron industry. There is much written information, taken from the many extant Pennsylvania furnace account books, on different aspects of the iron plantations. Few, Joseph E. Walker's study of Hopewell Village being the exception, have centered on a single iron community and even fewer have given any attention to the production of cast iron articles intended for domestic use, namely pots and kettles. Two reasons have strongly contributed to this situation. Double entry Italian bookkeeping of the eighteenth century is not easy reading and it is indeed a tedious endeavor to trace one or two items throughout a series of account books. Little technological interest, aside from descriptive accounts, has been generated in an industry characterized by Peter Temin as "operating almost exclusively on the basis of traditional technology." Temin's statement refers to the production of pig iron and the method of manufacture in charcoal-fired blast furnaces. Only recently have John D. Tyler's articles shed light on the interesting technological transformation in the process of casting pots and kettles perfected by Abraham Darby of Shropshire, England in 1707. This study demonstrates that on at least one colonial iron plantation, Colebrookdale in Berks County, Pennsylvania, the new technology took hold.

By concentrating on the Colebrookdale account books from 1735–1751 a comprehensive picture emerges of the interrelationships between manufacture of iron products, technological considerations and business practices. Colebrookdale was the first blast furnace erected in Pennsyl-
vania in 1720 by Thomas Rutter who supposedly named it after Abraham Darby's famous Coalbrookdale works. The furnace stood next to the Iron Stone Creek, a branch of the Manatawany (figure 1). Incorporation of the works in 1731 brought into partnership Philadelphians Thomas Potts Jr., Alexander Woodrup, Nathaniel French, George Mifflin, Samuel Preston, John Leacock and George Boon. Potts resided at and managed the iron plantation.

The account books which exist for Colebrookdale are Journals and Ledgers from the store, a central feature in the life of the iron community. "Here business records were kept, food, clothing and other supplies sold to the workers." The amount earned was simply credited to the worker's account with the furnace. "This credit could be used to make purchases at the store (entered in the debit side) to pay bills to the furnace, or to make payment for goods delivered at their homes." Accounts for outsiders who purchased pig iron and pots and kettles from Colebrookdale also appear.

Before continuing, we must realize how the nature of eighteenth century bookkeeping affects our understanding of technology and business during that time. First, no Colebrookdale accounts for 1739-40 exist, though pig iron was made. Recording for two years ceased because a war in the Spanish West Indies depleted much of the work force on the Pennsylvania iron plantations. Secondly, the Day Books, the initial volumes in which day-to-day transactions were spontaneously recorded have not survived. At Colebrookdale, it is possible such books were never kept by the clerks, Nathaniel Platt and Edward West. The Journals, posted after the Day Books, often make reference to a "Blast Book," possibly a type of Day Book containing information relevant to furnace operations and iron production. Thirdly, even though the Journal is the informal predecessor to the Ledger, both sets of books for Colebrookdale are fairly formal. The brevity of account book entries makes physical description of the furnace and technological processes difficult, but not impossible. Lastly, business methods of the day dictated the arrangement of accounts by individuals and not by goods. Writing in 1750, John Mair described the easiest way for a bookkeeper to post his accounts.

To save writing no accounts of goods is kept ... The ledger contains only personal accounts ... When goods are sold, neither Cash nor Buyers are charged Debter to any other account and that because no account of goods is kept ... In regard the Dealers or customers who frequent the stores do not usually begin and finish their Bargains all in one Day.
Such a practice warranted careful scrutiny of every account in order to compile and tabulate amounts of pots and kettles sold yearly. In short, it was possible to construct the "accounts of goods" John Mair advises the bookkeeper to omit.

These figures reveal that a fairly large amount of pots and kettles were sold at the Colebrookdale store. The highest total number of sales were in 1737, 1741, 1742, 1748, and 1751 (Table 1) with an average of 98 pots and kettles per year. This figure was derived from individual entries and in 1741, 1742, 1743, 1744 and 1748 large quantities of potterware (i.e. pots and kettles) were sold and their corresponding entries made only in weight. For example, on July 30, 1741, Henry Deeringer bought 10 cwt. 9 qtr. 13 lbs. or 1,385 pounds of pots and kettles and on November 2, 1743, Daniel Walker bought one-half ton of pots. Because the weight of single pieces of potterware varied from 16 to 52 pounds, it cannot be determined how many pieces constituted a large purchase. Nevertheless, consumers had a large selection of different size pots and kettles to choose from in making their purchases.

<table>
<thead>
<tr>
<th>Year</th>
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<th>Kettles</th>
<th>Total</th>
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<td>83</td>
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<td>7</td>
<td>57</td>
</tr>
<tr>
<td>1741*</td>
<td>71</td>
<td>26</td>
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<tr>
<td>1742*</td>
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<td>114</td>
</tr>
<tr>
<td>1743*</td>
<td>62</td>
<td>25</td>
<td>87</td>
</tr>
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<td>56</td>
<td>21</td>
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<tr>
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</tr>
<tr>
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<td>30</td>
</tr>
<tr>
<td>1751</td>
<td>99</td>
<td>399</td>
<td>138</td>
</tr>
</tbody>
</table>

*Large Purchases of Potterware Recorded in Weight
August 6, 1741 Henry Deeringer 10 cwt. 9 qtr. 19 lbs.
January 20, 1742 John Potts 20 cwt.
January 14, 1742 Thomas Yorke 3 cwt. 3 qtr. 10 lbs.
November 1, 1743 Daniel Dawson 3 cwt.
November 24, 1743 Daniel Walker 10 cwt.
November 7, 1744 John Potts 10 cwt.
May 3, 1744 John Potts 10 cwt. 1 qtr. 12 lbs.
July 4, 1748 John Potts 10 cwt.
MARKETING AND MANUFACTURING

The sale of five iron furnaces during the fifteen year period added to the diversity of products available at Colebrookdale. Furnaces are cast iron objects not mentioned in the sparse writing on the colonial iron industry. Arthur Raistrick in *The Darbys and Coalbrookdale* states,

These furnaces which became one of Darby's regular products, were like our 'set' pots or large copper boiling pans with a fire grate, bars, door, and door frame, varying in capacity but commonly containing twenty to thirty gallons.¹¹

At Colebrookdale, the largest furnace, 512 pounds, was sold to Casper Wistar in 1736. More commonly they weighed about 112 pounds. Scholars have often asserted that Colebrookdale in Pennsylvania was named after Coalbrookdale in England.¹² The iron furnaces cast at Colebrookdale represent one technological link between the two iron manufacturing firms. Individuals carrying the Darby technology to Colebrookdale have not been identified, but the casting of the iron furnaces suggests that Thomas Potts Jr. and the founders were aware of the English example.

Aside from the variety of pots and kettles sold at the Colebrookdale store, the sale of two additional items related to potterware, helped to encourage sales. Pothooks used for hanging iron vessels in the hearth, could be purchased. Timothy Burchell, in September 1737, received a 20½ pound iron pot. On November 17 he is debited to a pair of pothooks and also to a bale for the pot. A kettle and “a bale for the kettle” John Campbell bought was recorded on October 20, 1737. A bale is a “large bundle or package of merchandize more or less round in shape.”¹³ The bales mentioned in the Colebrookdale account books were packaging for the cast iron products. John Normand, a founder who came to work at the furnace in 1737 to make potterware, wove 55 large baskets and 19 small ones at that same time. Because Normand is so closely associated with the manufacturing of pots and kettles, the baskets he made are probably the bales. Both products are round in shape and so the bale, or basket, conformed to the shape of its contents. As early as 1722 Pierre Antoine Terchault wrote, “cast iron vessels break easily.”¹⁴ Those who travelled by wagon to Colebrookdale needed protective packaging for their purchases.

Sales were further insured because the price of potterware remained at 4 shillings per pound throughout the period and a high degree of flexibility characterized the handling of pots and kettles in their role as commercial products. For instance, special circumstances lowered the price. Peter Kuzer, a steady customer at Colebrookdale, was only
charged 2 shillings per pound for two iron pots he bought in December, 1737. Thomas Yorke, brother-in-law of Thomas Potts Jr., paid three shillings per pound for ten pots on September 27, 1741. No reason was given for discounting standard prices, but obviously family and business relationships were primary considerations. A second practice involved price agreements negotiated by the purchaser and Potts or the store clerk. The price disregarded an amount calculated on weight. Paul Tenchman was sold a kettle “per agreement” in 1747. It cost him 18 shillings, a real bargain considering most kettles cost about £1. Another type of agreement specified time of payment. On November 16, 1751 Henry Schoutz agreed with Potts that the kettle he purchased would “be paid for next harvest” and Jacob Frock’s kettle in 1746 was to be “paid for at the fall fair.” Finally, a large purchase of potterware was accompanied with complimentary pieces. On July 31, 1751 Henry Deeringer bought 31 potts and 16 kettles costing £18 13s. 6½d. and was given a kettle “debtor unto the bargain!”

Consumer preferences also influenced the different business arrangements made for the sale of pots and kettles at Colebrookdale. Pieces were returned because the product did not comply with a specified order. On May 3, 1737 William Farmer returned a 23¾ pound pot “being too small.” In cases like this, the item was returned shortly after purchase and the individual’s account was credited with the amount of the original purchase. Johnathan Henry Cooke bought his 30 pound pot on September 1, 1748 and it was returned within a week. A variation of this practice was the lending of pots and kettles which were to be returned after long periods of time. A person was debited as if the item was purchased and the status of the article was noted in the entry. When the piece was returned, the individual’s account was credited with the proper amount. Reuban Jennings borrowed an iron pot in December, 1746 and it was returned in one month. However in August, 1735, Joseph Reubans was lent an iron pot “which he took away with him,” and so the debit entry was permanent.

Commercial goods were often considered a form of currency in the eighteenth century, and the Colebrookdale account books make it clear that the clerks found this method quite valid. On more than one occasion, potterware was used to pay a person’s debt. Peter Yocum in January, 1742 placed an order at the store for an iron pot credited to Francis Hugh’s account. Yocum, now clear of his obligation to Hugh’s, still owed Colebrookdale for the pot. In turn, Hugh’s debt to Colebrookdale was reduced. Members of Potts’ family frequently paid debts by this method. For services rendered, the local doctor received a kettle worth £1 3s. in 1743 from Thomas Potts Jr. David Potts, his son, was
debtor to 4 pots in 1743. Each one went to a different person specified in his account.

The many commercial functions of potterware in the Colebrookdale account books plus the Italian system of credits and debits make it difficult to determine how or even if, payment for potterware was made. Debit amounts on the left side of the folio do not directly correspond to credit amounts on the opposite folio. Some direct examples were recorded showing the manner in which some potterware was paid for. Jacob Snyder paid £1 8d. in cash for his kettle in 1741. Cash payment was not as frequent as payment in goods. Willard Smith, on April 19, 1747, made an equal exchange of 118 pounds of butter and potatoes for two pots.

The majority of business transactions, recorded towards the end of the furnace blast in October, November, and December suggests that Thomas Potts Jr. chose to market the potterware after the everyday business of furnace affairs calmed. He may have needed time to deal directly with several customers who consistently purchased large quantities of pots and kettles from Colebrookdale. Undoubtedly these men transported the items elsewhere for sale. For example, Henry Deeringer was debited with £13 13s. 5d. for a furnace kettle and 10cwt. 13lbs. of pots and kettles on July 30, 1741. Several years later he purchased much pig iron. His last transaction in July of 1751 recorded the purchase of 31 pots and 16 kettles costing £18 12s. 6½d. On his many trips to Colebrookdale store Deeringer supplied the community with alcoholic beverages.

Thomas Potts Jr. permitted family relations to purchase the largest quantities of goods. Potts was a Quaker and members of the sect often depended upon each other in business affairs. Thomas Yorke, Potts' brother-in-law, became an agent for Colebrookdale. In 1737 Yorke moved from the furnace to Lancaster and in 1741 he moved to Germantown. His 1738 account is credited with the "neat proceeds of accounts of sales of 19 pots and kettles" for £4 13s. 3d. In 1742 Jonathan Potts, Thomas' son, was held responsible for 20cwt. or 2,240 pounds of pots and kettles worth £20. Again in January 1744, 10cwt. 1qtr. 12½ lbs. of wares were debited to his account. In November of that same year Jonathan Potts sent 1 cwt. or one-half ton of pots and kettles to Tulpehocken and was also debited for £11 20s. worth of additional potterware. Thomas Potts Jr.'s reliance on family members to market Colebrookdale goods and in turn, the willingness of Yorke and the younger Potts to be held accountable for large sums, exemplifies a carefully supervised method of distribution and sales.

Tulpehocken, where Jonathan Potts sent potterware in 1744, is one
of the several areas surrounding Colebrookdale from which customers came. If a person was not from the immediate area of the iron community, their location was noted next to their name in the Ledger. Maxatawany, Skippack, Durham, Douglas, Frederick, Oley and Maiden Creek (Figure 1) are settlements noted in the accounts. The proliferation of customers from these different areas, especially in the 1740’s, was simultaneous with the growth of Berks County in the second quarter of the eighteenth century. Of all locations listed, Maiden Creek and Oley appear most frequently. Morton L. Montgomery’s History of Berks County states that “Friends made early settlements in Oley” and “took up large tracks of land in Maiden Creek.” Richard Londey and Nathaniel Moulten, envoys from the Maiden Creek Meeting, appear in the Colebrookdale account books in 1747. Again, Potts’ desire to conduct business with Quakers may explain this situation. Nevertheless a marketing policy biased towards Quakers was not predominant. Tulpehocken was a German-dominated community, and Yorke’s residence in Germantown, another heavily populated German area, is evidence that marketability usually superseded religiosity.

![Figure 1. Map of Berks County, Pennsylvania](image_url)
In catering to the local markets, Potts was maintaining a balance in the supply of pots and kettles in the urban and hinterlands. John D. Tyler writes that “by 1730 wholesalers were buying Darby wares and it seems reasonable to assume that a large number of pots 20 found their way to America through exportation by wholesale merchants.” Familiar with Darby technology, Thomas Potts Jr. may also have known of the firm’s export shipments. Philadelphia, a leading colonial port city, may certainly have been the destination of some Darby pots. Rarely did domestic cast iron products from Colebrookdale reach Philadelphia. Samuel Michael of the city received two pots in 1736 and in 1751 Jehiel Nyce hauled 22 kettles and 19 pots there. It should be mentioned that much pig iron went to Philadelphia from Colebrookdale and so lack of transportation cannot explain this situation as adequately as lack of demand.

However the rarity of sales to the urban center is surprising because all of the Colebrookdale shareholders, except for Potts, were Philadelphia merchants. A letter of July 23, 1742 from Company members Alexander Woodress, William Atwood, Anthony Morris, Jonathan Hopkinson, Nathaniel French, and George Mifflin to Thomas Potts Jr. expresses their strong interest in cast iron articles and pig iron production. The men wrote:

Whereas we have at Sundry Times meet and Contracted with thee for Castings of the Iron work in our furness at Colebrookdale but as yet thee have never Comply'd wth any of the Colebrookdale Contracts So made with us . . . we order thee to Come down to us at Philad and then to render us an accoun' of all the utensils Delivered unto they possesion for Casting wears together with all them belonging to the Furness as likewise of all the pigg mettle and Casting wear thee have made During the whole time thee have had our in thy manedgment from blast to blast.

It is not known if Potts acquiesced to the demands made in the letter. The document depicts him as a domineering man whose advantageous isolation from Company members allowed him freedom in supervising iron production and distribution.

The 1742 letter directs attention to Potts’ handling of the Company’s possessions, particularly the “utensils for Casting wears.” While he probably did not report to his peers, Potts’ management of the furnace reflects his interest in casting. From 1735 to 1751 there were always two men present at the Colebrookdale furnace who had the ability to cast potterware and pig iron. In 1737 two men, who exclusively cast pots and
kettles during a blast, were added to the work force. The employment of extra skilled men indicates that pots and kettles were considered a significant component of overall output: the amount of potterware Potts sought to manufacture necessitated four men in the casting house at the base of the furnace (Figure 2). There was not a rigid division of labour, for potters like Arthur McGill and John Normand performed foundry duties. The fifteen year period witnessed a high turnover of several skilled men while others remained at Colebrookdale for long periods of time.22

John Potts and David Davies were the founders in 1735 and 1736. They taped the furnace hearth, filled ladles with molten metal, and poured it into molds for pots and kettles. In 1737 the same two men were founders, but James Dorney and John Normand were credited for casting the potterware. This meant the founders laded out metal to the potters. It required the stopping of the metal running from the hearth, a time consuming process. Potts’ two sons, John and David, did the casting in 1740, including potterware. Additional pots and kettles were made in that year by Angus McFadden, Joseph Gibson and his son, Francis. In 1742 David Davies and David Potts returned as founders with McFadden and James Dorney as potters. From 1740 on, both founders and potters cast potterware. Two new founders, Ralph Broomfield and Thomas Finlay came to work at Colebrookdale in 1744 and Angus McFadden alone added to the production of potterware cast by the founders. In 1745 Broomfield and another new founder, Stephen Doughten, presided over the blast and James Dorney made a small
quantity of pots and kettles. Again in 1746, Broomfield was accompanied by a new partner, Jonathan Duncklin with John Normand as potter. The same founders worked at the furnace in 1747 but John Fernandez and Arthur McGill were new potters. McGill assumed the responsibilities of founder along with Lewis Walker in 1748, while John Normand was credited for casting wares. In 1748 Jesse Ford itinerant potter, worked at Colebrookdale. Arthur C. Bining in Pennsylvania Iron Manufacture in the Eighteenth Century describes potters like Ford as “relatively highly specialized men working at the furnace only when small castings requiring a certain degree of skill were made ... they were needed infrequently for short periods of time, for this reason they often travelled from one furnace to another.”

Ford’s account, appearing only in 1748, is credited with making 64 pieces of “pottery ... vizt ... small pots, small kettles.” John Normand was the potter in 1749, and Jonathan Duncklin and Arthur McGill were founders. No potters worked in 1750, but Ralph Broomfield and Arthur McGill did all the casting. Seventeen fifty-one is a complicated year for there were three separate blasts. The founders included Arthur McGill, David Potts, and John Normand. Normand also cast pots and kettles with Patrick Koyle in 1751.
Little information can be obtained from the account books about the origins of each individual’s technical knowledge. Not all men who did casting at Colebrookdale went through a timely learning process, but it is evident that some had to ascend a hierarchy of furnace jobs to qualify for foundry work. Ralph Broomfield’s account began in the 1740-43 Ledger, but he is not a founder until 1744. His account for 1740 was credited with cutting wood. In 1742 and 1743 he was credited for various amounts by James Dorney and David Davies. Arthur McGill’s account from 1740 until 1745 includes digging lime, sand and clay; cutting wood and working in the mine, all duties related to furnace operations. Finally, in 1746/1747, the year before he began foundry work, he was credited by Jonathan Duncklin, Ralph Broomfield and John Fernandez. The men were paying Broomfield and McGill for performing furnace related activities from which they gained acquaintance with foundry and casting procedures.

It is not surprising that circulation and production of pots and kettles at Colebrookdale was closely supervised and structured, for this was a time of technological innovation in the casting process. The new casting method devised by Abraham Darby used “a wooden flask filled with fine dry sand of a certain cohesive type in which the form of the pot was impressed by a wooden pattern in three sections (bottom and two sides) so that the pot could be removed without disturbing the molding equipment.” Before this invention, pots and kettles were cast in molds of baked or fired dried loam. This method entailed building up a loam core through a series of bakings on a rope, wrapped around a spindle. “It was time consuming, involving the destruction of at least the core, if not other parts of the mold, in order to remove the finished pot.” Darby’s method, notes Richard D. Tyler, “eliminated this problem because now wooden molds were filled with sand rather than baked loam.” The wooden flask had to be a perfect replica of the item to be cast, carving the pattern required great skill. “One had to be informed of foundry methods, wood working, and joinery.” Founders and potters at Thomas Potts Jr’s. iron plantation possessed the high level of technical knowledge and skill needed to make moulds and cast pots and kettles. As the new technology was implemented, Potts probably compared the results of each method and found that the “sand casting process was more precise and produced smoother and lighter pots.” The iron master not only kept abreast of recent technology, but may have had an eye towards pleasing customers with the availability of a better quality product.

Tyler feels Darby techniques were used in the colonies by the second
quarter of the eighteenth century, and at Colebrookdale, experimentation began by about 1743. In that year, Angus McFadden constructed a new flask while performing foundry duties. Two years later accounts reveal both methods of casting were being used simultaneously. A crucial entry of November 29, 1745 credits James Dorney for casting 9cwt. 2qtr. 2lbs. or 1,066 pounds of “potts and kettles cast in sand at 20 shillings per hundred weight,” and 3cwt. 3qtr. 4lbs. or 424 pounds of “loomwork kettles at 33 shillings 4 pence per hundred weight.” Dorney was paid more for making a smaller quantity of kettles in the old way because of the time required in loam molding. He cast only “Loomwork kettles” because casting a pot presented more problems than casting a kettle. “The bulbous form of a pot meant that the mold had to be broken or split in half to remove the finished product. The body of a kettle could be cast in one piece simply using an existing kettle as a pattern.” Dorney’s work, in which he cast more wares in sand than loam, demonstrates the new replacing the old. After this transitional period, the sand casting method took hold at Colebrookdale. When Jesse Ford arrived in 1748 he made four new flasks and “mended Sundry old ones.” In September 1751, John Normand and Patrick Koyle spent “six days mending flasks and making new patterns.”

Although casting methods at Colebrookdale were technologically progressive, the furnace was not immune from problems plaguing eighteenth-century iron manufacturing apparatus. The dampness and splashing from the water wheel rotted the bellows quickly. The intense heat generated by the furnace rapidly deteriorated the hearth and inwalls. (Figure 3) Laborers aided in securing materials for new furnace parts, but founders and potters did the actual construction. Furnace maintenance and repair affected output. More often than not, Thomas Potts Jr. decided to limit pig iron production when furnace conditions necessitated production cuts. Even though a definite correlation between furnace repair and output cannot be cited between 1735–37, it seems that between periods of two blasts, 1740–42, pig iron production suffered while sales of domestic cast iron articles prospered. Waterwheels and bellows were mended in 1736 and a new hearth and boshes were built by John Normand, who also made new bellows in 1737. Pig iron output dropped 100 tons from the 1735 level in both 1736 and 1737 (Table 2). In contrast, potterware sales rose to 105 from 47 in 1735 and 33 in 1736. The jump occurred because potters were added to the work force. From 1737–38 Colebrookdale workers helped construct Thomas Potts Jr.’s new furnace, Mt. Pleasant in Berks County. Entries are confusing because accounts of the two furnaces are
Table 2
“Account of Pigg Mettle Made at Colebrookdale”:
Information from back folio, Ledger 1744-1749

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<td>August 11–November ?</td>
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<td>12</td>
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Blast Dates of Colebrookdale Furnace:
Information compiled from Ledger 1750–1751 and Journal 1750–1751

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<td>November 12–December 1</td>
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</tr>
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<td></td>
<td>November 12–December 1</td>
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</table>

combined. Records for 1739–40 do not exist. In October 1741, when accounts are clearer, Joseph Brackinridge “pulled out the hearth” and installed a new one with the help of David Potts. Two blasts occurred in that year, the first commencing May 17. Ledger book entries indicate these repairs were made after the first blast. The furnace blew the second time in November and in February John and David Potts made new bellows. Seventeen forty-one, the first year Colebrookdale experienced two blasts, was a time of high sales for potterware, 97 pieces total. Pig iron output was 148 tons compared to 160 in 1740. No major repairs were made in 1742 with two blasts extending from April 3rd until November 22nd. Again potterware sales climbed to 114 and even pig iron production was up to 262 tons. Alexander Harper and Jacob Beck installed a new hearth in 1743, though David Davies hewed the hearth stones. John Godfrey made 200 bricks for the top or tunnelhead of the furnace equipping the stack with a “cylindrical erection of brick over the tunnelhead for the protection of the workers from the heated gases and smoke rising from the furnace.”

Two blasts from May 19 to November 21 occurred in 1743. Sales were good at over 87 pieces of potterware while pig iron output was low at 166 tons.
Pig iron production and cast iron sales were extremely sensitive to furnace conditions between 1744–1747. There was only one blast in 1744, but severe problems with the furnace necessitated repair of the outer limestone block walls. Jacob Beke also “stopped the cracks about the inwalls.” Exactly what was done to the outer and inner walls is not stated in the account books. Some limestone was probably replaced on the outer walls. The inwalls were actually an inner lining of brick or other fire-resistant materials. A layer of clay, coarse mortar and fine grained sandstone between the lining and the outer wall allowed the inwalls to expand under the enormous heat produced by ‘smelting,’ the process of reducing ore.

Repeated entries of workers “getting clay” indicate that repairs to the inwalls ranged from patching the actual wall and lining to completely replacing the two. Ralph Broomfield replaced the hearth directly after the blast ended in March. Broomfield with Thomas Finlay did ten days work “about ye bellow.” However in this year pig iron production increased to 276 while sales of pots and kettles slightly declined to 71. The hearth was rebuilt in 1745 and 1746 by Stephen Doughten and Ralph Broomfield. New bellows were made by the latter in 1746. Pig iron output dropped from 244 tons in 1745 to 173 in 1746. Potterware sales went from 78 in 1745 to 58 in 1746. Overall output fell in 1746 because of furnace deterioration. After the blast the furnace underwent major renovation: a new hearth was installed, the inwalls were relined, and new boshes and arches were built. The time spent fixing the furnace shortened the duration of the 1747 blast and this explains the low pig iron production of 48 tons and potterware sales of only 54 pieces.

Production statistics of pig iron do not exist for 1748–1751. While variation more than consistency marked the effect of furnace life on sales of cast iron articles, purchases did increase following periods of major furnace alterations. In late summer 1748, Lewis Walker, Alexander Harper, Arthur McGill and Jesse Ford assisted in almost completely rebuilding the furnace due to the “lump in ye hearth.” Richard Shallenburg provides an accurate description of what probably happened to the Colebrookdale furnace:

The descending reaction mass is fairly nonfluid and sluggish due to the low temperature and pressures of the blast. Widely flaring walls and large diameter boshes tended to prevent the sluggish reaction mass from clogging or ‘hanging up’ the furnace which
could be dangerous since the mass of material, if suspended high up in the furnace could let go and come crashing down with explosive force.\textsuperscript{36}

The lump (a combination of molten ore, flux, and charcoal) mentioned in the account book was apparently the end result of this type of ruinous disaster. Jesse Ford and Arthur McGill took out the lump, wheeled stone out of the furnace hearth, hewed new stone and rebuilt the hearth, boshes and arches. Directly below the boshes, “Scuncheon Walls” were replaced. This particular part of the furnace was most susceptible to the problem described by Shallenberg because “Scuncheon Walls” sloped inward and downward to support the materials with which the furnace was charged and directed them towards the hearth.\textsuperscript{37} McGill and Harper replaced the inwalls and bellows. Harper also put in a new timp, “the part of the hearth’s innerwall which came down behind the damstone, through which workers inserted probing tools.”\textsuperscript{38} The damstone prevented the contents of the crucible from spilling out into the hearth. The 1748 repairs increased production capacity of the furnace for potterware sales jumped from 54 to 1747 to over 109 in 1748!

Few repairs were made between 1749–1750. New bellows were prepared by John Normand, and Matthias Ringer built new steps in the bridge house, where ore, limestone, and charcoal were stored. The tunnel head was connected to the bank of the hill, adjacent to the furnace, by a wooden bridge over which men who filled the furnace crossed. Despite the absence of furnace repairs at this time sales of potterware declined to 32 in 1749 and 30 in 1750. Three separate blasts were held in 1750, indicating the furnace was not operating smoothly. Quality of the iron may have been poor for Tim Mackey, manager of Spring Forge, “carried away 12 cwt. of broken pots” from Colebrookdale.

By 1751 Patrick Koyle and George Joseph reinforced the furnace inwalls with iron girders and three blasts were again held. While preparing for the second blast in July, Ralph Broomfield did not charge or fill the furnace with the proper amount of materials. “The burdening of the furnace—the determination of the proper proportions of ore, flux, and charcoal for the furnace charge—was considered a gift . . . the results obtained in view of lack of knowledge were remarkable.”\textsuperscript{39} Exactly what the ramifications of miscalculation were for the furnace cannot be learned from the pages of the account books. But in order to repair the damage, Arthur McGill “went over y^e Schulykill to bring y^e tools needed in cleaning and picking y^e hearth Ralph Broomfield left.” It
took McGill one-half of a day to take out the charge from the destroyed hearth and then Thomas Freeman installed a new hearth. McGill then spent three days putting in the new charge. He also repaired the portion of the tunnelhead through which charging materials passed. The repairs done on the Colebrookdale furnace in 1751 were advantageous for sales of pots and kettles which peaked at 138.

High sales for 1751 came at a time of decline in the life of Thomas Potts Jr. and Colebrookdale furnace. Linda McGurdy in *The Potts Family Iron Industry in The Schuylkill Valley* writes of the iron community: "by late 1751 local raw materials were being depleted, production declined and in 1752 it became necessary to abandon the furnace. Potts was 72 and died in 1752." Perhaps high sales reflect anticipation of shut down and a desire to unload stored goods. Yet, the year before Colebrookdale ceased operation was a year of increased activity in the production of pots and kettles. Attention given to mending old flasks and constructing new ones, combined with high sales figures does not fully coincide with Ms. McGurdy’s interpretation. Potts was simply concentrating manufacturing energies on items of technological fascination. The closing of Colebrookdale furnace may not have only been due to depleted raw materials, nor to the lack of interest in iron once generated by the old iron master, but also to the furnace’s endless debilitations.

Acknowledgment

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Notes


8. John Mair, Book-keeping Methodiz’d: or A Methodical Treatise of Merchant-Accounts According to the Italian Form wherein The Theory of the art is fully explained, and reduced to PRACTICE (Dublin, 1740), 253.
9. Ninety-eight may seem low but Potts was supplying a limited market. As late as 1760 the population, density of Berks County was only 10–19 persons per square mile. James T. Lemon, The Best Poor Man’s Company: A Geographical Study of Early Southeastern Pennsylvania (Baltimore, Maryland, 1972), 46.
14. From Reaumer’s, The Art of Converting Iron into Steel as quoted in Tyler, “Technological Development: Agent of Change in Style and Form of Domestic Iron Casting.”
15. Two excellent discussions about the intricacies of double-entry Italian bookkeeping can be found in John Mair, Book-keeping Methodiz’d and Thomas Dilworth, The Young Book-keepers Assistant, Shewing Him in the Most plain and easy Manner, The Italian way of Stating Debtor and Creditor (Philadelphia, 1794).
18. Ibid., 931.
19. Ibid., 73.
22. Account books do not provide information on the whereabouts of labor; where they came from or where they went upon leaving Colebrookdale.
24. Ibid., 120.
30. Ibid., 143.
32. Alfred D. Chandler Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, Massachusetts, 1979), 50. The author notes that until the 1840’s technological limitations constrained the growth of the enterprise. Adding to the labor force was the only way to increase output. In this regard, Colebrookdale iron plantation is a good example of what Chandler terms “the traditional enterprise in production.”
38. Ibid.