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James Watt and the Delftfield Pottery, Glasgow

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ABSTRACT

The recent acquisition of the James Watt Papers by Birmingham Central Library has brought into the public domain virtually all the personal archives of this famous Scottish engineer. They reveal not only his role as technical adviser to the Delftfield Pottery while he lived in Glasgow but also the fortunes of the concern for many years afterwards, because he remained a partner in the Company until his death in 1819. The paper describes how the pottery was founded in 1748 and covers the technical contributions Watt made, such as suggesting appropriate clays, experimenting with new glazes, designing new kilns, assisting with employing suitable workmen and advising on new production methods. After he moved to Birmingham in 1774, Watt continued to correspond with his brother-in-law, Gilbert Hamilton, who became the managing partner. Their letters show how Watt gave technical advice and suggested improvements in design as well as sales outlets. In return, Hamilton sent Watt details of the annual accounts and Watt's remuneration. After Hamilton's death in 1808, his sons and Watt's cousin, Robert Muirhead, ran the Company and continued to keep Watt informed about progress until Watt's death in 1819. The Company ceased trading in 1826.

ORIGINS

> I have now a small share in the Delft work along with a new company. We intend carrying on a Stone manufactory likewise, and are getting proper people for that purpose.[1]

James Watt had borrowed money from his relatives to invest in the Delftfield Pottery in Glasgow and this letter of 15 February 1768 to Joseph Black is the earliest reference that has survived confirming Watt's involvement. He was then acting as a sort of technical adviser and, through his position as a partner, we can trace the varying fortunes of this concern from that time until his death in 1819. His involvement in this partnership is not as well known as others which he formed, particularly to develop his steam engine, with John Roebuck and Matthew Boulton. With these people, and indeed Black, their shared interests in chemistry developed into a series of close friendships. The Delftfield partnership remained on a business level but nevertheless may have been important in the story of the steam engine; it provided Watt with a regular income at a time when he was running down his scientific instrument and merchanting businesses to start his career as a civil engineer, and also after he had moved to Birmingham and was struggling to launch his steam engine.

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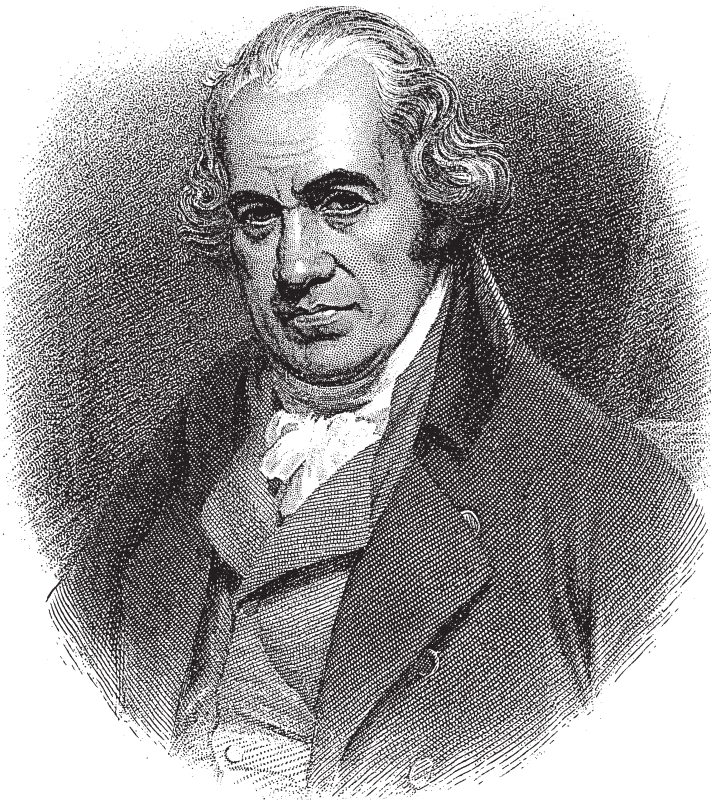
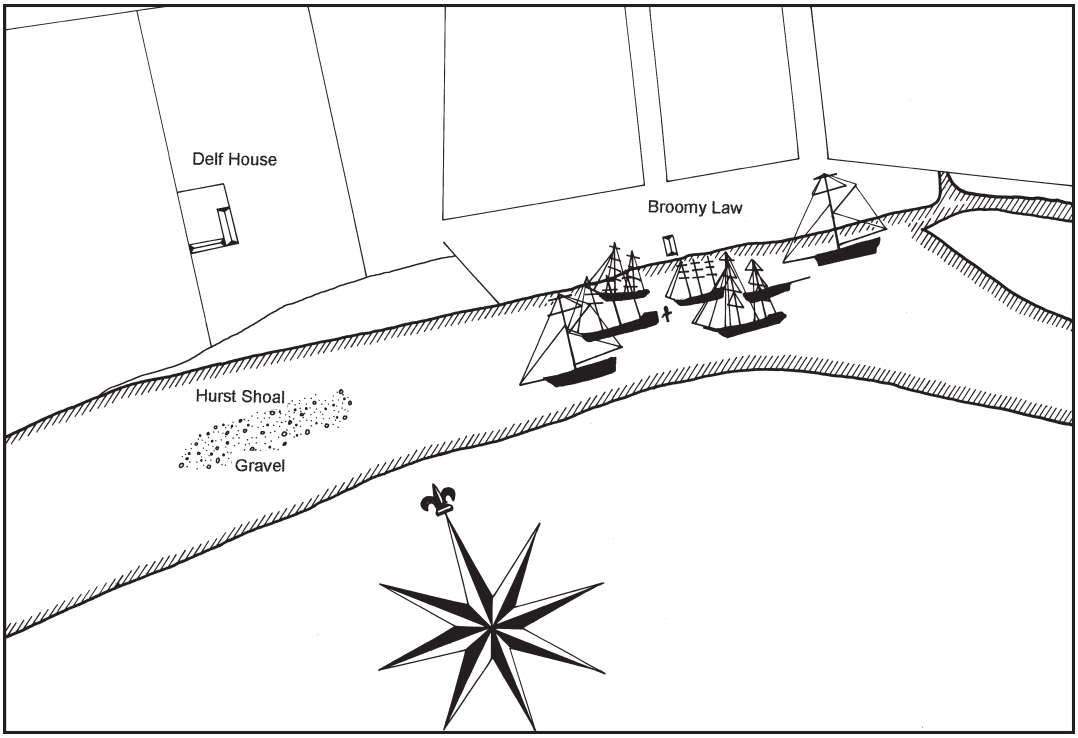


ILLUS 1 James Watt, FRS, 1736–1819 (frontispiece of S Smiles 1865 *Lives of Boulton and Watt*, London)

The Delftfield Pottery (often referred to by Watt as Delfthouse) was established in 1748 when Laurence Dinwiddie, who was one of Glasgow's leading tobacco merchants, invited his elder brother, Robert, to join him. Robert had been trading as a merchant in London until 1751 when he became Governor and Commander-in-Chief of His Majesty's Colony and Dominion of Virginia. He retired in 1757 through ill-health and went to live at Clifton, near Bristol. Robert Finlay, a cordiner (shoemaker), tanner and merchant, was the third partner; Patrick Nisbet, of whom little is known, the fourth.[2] In the original agreement, Laurence and Robert Dinwiddie between them had three-fifths of the land on which the pottery was built and Robert Finlay and Patrick Nisbet one-fifth each. This reflected their financial investment in the concern.[3]

None of these investors had any knowledge of pottery manufacture and, throughout its history, the partners who provided the bulk of the capital were businessmen whose main interests lay in other enterprises. Therefore, they had to employ a manager who had some knowledge of the industry to run the company for them. This person might be offered a share in the partnership but was never the leading figure. This may be a significant point when their success is compared with that of Josiah Wedgwood, who was trained as a potter and was passionately interested in the development of his works.

Laurence Dinwiddie owned land at Germiston, where there was clay, to the east of Glasgow and there was more clay on the site where they decided to erect the pottery. The intention was to produce from the local clay deposits tin-glazed delftware in the English and Dutch manner which,



ILLUS 2 Part of 'A Plan of the River Clyde' by James Barry and Alexander Wilson in 1758, which is probably the earliest map showing the Delftfield Pottery. (*from Smeaton's* Designs; *reproduced by courtesy of The Royal Society of London*)

at that time, were in demand both at home and overseas. Delftware held an intermediate position between expensive porcelain and cheap earthenware; the growing prosperity of a middle-class in Glasgow might be expected to provide one market while Laurence Dinwiddie's trading links across the Atlantic would have provided another.

The site chosen was situated on the west side of Glasgow close to the River Clyde, just down-stream from the main quay, the Broomielaw. The land was purchased from the Merchants' House of Glasgow. A point that was stressed in the sale and which was to have repercussions later was that 'they have no right or interest by virtue hereof to the waterside ground or Grass thereof upon the South of the lands but only free access to their said lands by the waterside ground'. Between their land and the river itself, there was to be left a strip free to act as a highway.[4] The map of the Clyde, drawn by James Barry and Alexander Wilson in 1758 for Smeaton, shows the pottery as an L-shaped building at the southern end of the plot. There is a space between it and the river bank which appears to slope down to the river. Opposite the 'Delf House' in the river is the Hirst shoal of hard gravel while, up-stream, ships are anchored off the Broomielaw quay. The quay itself stops short before it reaches the Delftfield plot.[5] Therefore, while the pottery was situated in a good position close to the head of the navigable part of the Clyde, it did not have direct access to the water, so that goods would still have to have been transhipped from the Broomielaw.

The partners appointed a young man, John Bird, who was a painter at the Lambeth pottery, to act as manager. He drew up plans, but apparently the buildings were not constructed according

to them. The local clay proved to be unsatisfactory and therefore more had to be imported from Carrickfergus in Ireland. There were many disputes. The initial firing of the kiln went badly wrong, which was only one of several misfortunes. Bird was soon replaced, leading to a lengthy lawsuit. However, after this, the Company seems to have settled down to reasonably successful production.

On the death of Laurence Dinwiddie on 3 May 1764, his shares passed to his son, Robert. It has been suggested that he might not have had the same interest in the concern as his father. With his Uncle Robert living in Bristol and perhaps owing to trading difficulties, the pottery was advertised for sale in August and September 1765.[6] As there was no response, there was a further advertisement in May 1766.[7] However, we shall see that Robert Dinwiddie, the son, was still a partner in 1783 (see below) and therefore it seems more likely that the proposed sale was caused by Nisbet, who seems to have got into financial difficulties in 1765 and transferred his share in the business to four merchants: James Buchanan, James Coulter, John Shortridge and David Niven (or Nivien). There is no mention of Watt as a partner at this time.[8] The new partners were Freemasons, members of the Glasgow Kilwinning Lodge, to which Robert Finlay's brother, John, as well as the lawyer who handled the proposed sale of the works also belonged. Watt was already a Mason in a different lodge. James Coulter's brother was Robert Dinwiddie's uncle.

THE PRODUCT

When it was established, the Delftfield Pottery was in competition both with rival manufacturers (particularly in London, Bristol and Liverpool) and with the development of newer products such as cream-coloured earthenware.[9] The newer types appealed to a wider market, challenging the older delftware and imported porcelain;[10] this no doubt added to the Glasgow Company's difficulties. In England, the name 'delftware' came to be given to earthenware glazed with a mixture of tin (at first up to 25% but later only 5%) and lead through its similarity to the products of the Dutch town of Delft, which were at the height of their popularity up to the middle of the 18th century. English delftware was made in much the same way as earlier Italian maiolica or faience. The clay was first thrown on a wheel or pressed into a mould to produce the required shape. This was then fired in a kiln for the first time. When it was cool, the resulting 'biscuit' body was dipped into the glaze which was allowed to dry. This absorbent surface was then ready to be painted, the painters taking care not to make any mistakes, as these were impossible to correct. The piece was fired a second time in order to fuse the glaze to the body and to fix the decoration. However delftware had a soft but thick and heavy body which was quite fragile and therefore easily chipped or broken. The glaze did not fit closely and might craze. Often the glaze had to be thick to be sufficiently opaque to conceal the colour of the body, because coloured clays, which otherwise might show through the glaze, were frequently used. Although delftware was easily cracked by boiling water, it cost much less than imported porcelain and was very popular.

Because delftware was so fragile, it was the dream of every ambitious potter to develop either true porcelain itself or a fine white earthenware that could imitate its appearance without involving highly expensive methods and destructive losses in production. True or hard-paste porcelain was first made in China in the eighth century AD. It was composed of a mixture of china clay (kaolin, a pure white clay formed by the decay of felspar, the chief constituent of granite) with china stone (petuntse, less fully decomposed felspar). After the vessel had been formed, these constituents were fused together by firing in a kiln, first at about 900°C, then dipped in glaze and refired at about 1300°C. The blue decoration of cobalt was particularly admired.

Many Europeans tried to discover the secrets of Chinese porcelain during the early part of the 18th century. The discovery of kaolin near Limoges in 1768 enabled French factories to make true hard-paste porcelain. Investigations into the method of making porcelain in England began in the 1740s but these used a mixture of china clay and ground glass which resulted in a soft-paste variety. This type had a white translucent body but easily warped in the kiln; hot water was likely to make it crack; the glaze surface was easily scratched and absorbed stains. The major advance came with the discovery that Cornish stone and china clay would form a true hard-paste porcelain body. William Cookworthy, a native of Kingsbridge in Devon, after training in London, set up as a chemist and druggist in Plymouth. He started experimenting around 1747 but it was not until 1768 that he took out a patent for his porcelain formula and set up a manufactory in Plymouth. Some time before he gained his patent, he sent to Black in Edinburgh samples of kaolin and petuntse which he had found in Cornwall in 'immense quantities'.[11] Black carried out tests and found that the kaolin burnt 'to a very pretty stone porcelain'.

In the meantime, during the early 1700s, most British potteries concentrated on improving existing ceramic types to produce stoneware. Clay was the raw material which most influenced the appearance of the pottery and it was this which underwent great changes before 1760. Improvements which resulted in pottery having paler, stronger bodies were associated with the introduction of white 'ball' clay together with ground flint. The principal advantage of ball clay was that it fired at temperatures up to 1300°C to produce white pottery, which meant that ware made with it could compete with expensive imported porcelain. It could also challenge the soft white-coloured delftware.[12] Ball clay was used in Staffordshire from about 1710 and flint about 10 years later. Ground flint was mixed with clay to make the body stronger and more able to withstand the high temperatures necessary in the firing of stoneware. Flint was also mixed with lead in the preparation of liquid glazes by at least 1760.[13]

These newly-imported materials of flint and ball clay allowed the increased manufacture of a completely cream-coloured body and, by 1740, this type was much in demand for popular domestic tableware. It is from this period that the growth of the Staffordshire potteries really began. Josiah Wedgwood's contribution was to discover reliable formulae for both body and glaze after conducting a series of experiments on a scientific basis, and suffering many disappointments and heavy losses before control of the firing was mastered. His reward came in 1766 when Queen Charlotte bought a service of Wedgwood's refined cream-coloured earthenware and allowed it to be called 'Queen's Ware'.[14] The Queen's acceptance of this improved earthenware or stoneware helped to persuade the greatest people in the land that, although much cheaper to produce, it was of such quality that it could be used instead of porcelain, and therefore it became fashionable.[15] This cream-coloured earthenware would decimate the manufacture of tin-glazed earthenware or delftware across the Western world.

WATT JOINS THE DELFTFIELD POTTERY

We have no clues about when or why Watt started to take an interest in the manufacture of pottery. The most likely reason would have been his interest in chemistry. I have described above how the startling advances in pottery techniques which occurred during the years up to 1760 were linked with the discovery of new raw materials and their chemical analysis. If others could make improvements through scientific experiments, perhaps he could as well, and create the fortune that he so much coveted. His knowledge about some of these changes may have come from seeing the latest examples of ceramic design when he travelled to London, Bristol and elsewhere for his scientific instrument business. Perhaps it was the brilliant colours in the best porcelain which

ILLUS 3 Tin-glazed earthenware bottle, attributed to the Delftfield Pottery, c 1760. (*Photo courtesy of Glasgow Museums*)

prompted him to try and emulate them by experimenting with different chemical compositions. We have no indication that he was involved at this early period with the design of either shape or style of the products, although later he did criticize some of the output.

I have noted that Cookworthy consulted Black about his discovery of kaolin and petuntse in Cornwall and this may indicate that Black's interest in the pottery industry was widely known. Perhaps Black influenced Watt. Black ventured to define chemistry in the following words:

> CHEMISTRY is the science or study of those effects and qualities of matter which are discovered by mixing bodies variously together or by applying them to one another with a view to mixture, and by exposing them to different degrees of heat, alone, or in mixture with one another, in order to enlarge our knowledge of nature, and to promote the useful arts.[16]

Surely it must have been unintentional that Black should have given such a fine description of the potter's art! Like William Cullen, his former tutor, Black was interested in the application of chemistry to improve industrial processes, a lesson quickly learnt by Watt. Black later described the manufacture of porcelain in his lectures, 'Porcelain is another production of art which has been invented upon principle by making chemical experiments upon the earthy and stony substances, and which derives to be admired for the elegance and usefulness of its productions'.[17] He outlined its history and described its production. He also commented that nobody had made so many experiments in the study of earthenware and porcelain as 'Mr. Wedgewood'. He must have kept himself well informed about progress in the pottery industry, and clearly knew the importance of scientific experiment in its improvement.

Black studied the quantitative science of heat which was at the heart of so many industries, for he realized that heat was the chief means of promoting chemical changes. Watt had manufactured Black's design of a furnace, which may have given him useful background knowledge about the pottery industry and its kilns. The earliest letters that have survived between these two scientists concern kilns and experiments using them on ceramics. It seems likely that Watt was seeking advice from Black because he knew Black had had experience, not only of furnaces, but of ceramic experiments as well.

At this point, the question must be raised of Watt's involvement in the Delftfield Pottery in the period before he wrote to Black on 15 February 1768 telling him that he had purchased a small share. It has been suggested that he was a partner much earlier. G Quail gives no reference other than H W Dickinson for his statement, 'Watt's association with the Delftfield pottery possibly started about 1760. At this time he may have sold some of their wares at his shops in the Saltmarket and Buchanans Land. He possibly did odd experiments for the company'.[18] There are no entries in Watt's accounts for his shops concerning purchases from Delftfield but in December 1762, his uncle John Muirhead sent to 'Greenoak Eight Hodgets [small barrels] of Delphware to go to Jamica'.[19] Likewise no evidence has been found to support Dickinson's claim that Watt acquired an interest in the Company in 1763.[20] J Kinghorn and G Quail say that Watt was a partner in 1764 with £244 42s invested.[21] This figure corresponds with one quoted in Watt's Journal for 1772 so may have been given an earlier date. When the Company was being offered for sale around 1765, Watt's name was not included among the partners. However, he could have been involved in some way, possibly doing odd jobs with his journeymen.

In Watt's association with the Company, the Masonic links may have been important.[22] With the Company up for sale in 1765, it is possible that production had ceased which, together with the Masonic links, may explain how tradition claims that Watt occupied the manager's house after his marriage to Margaret Muirhead. This must have been the building which William Martin occupied in 1760 when he became Managing Partner.[23] Martin was still involved with the concern in 1772 (see below) and died in January 1779 'at the Delftfield in the neighbourhood of this city'.[24] Presumably he must have vacated the building to allow Watt to move in.

We have seen that delftware was being eclipsed by other types of earthenware; if the Delftfield Company were to survive, it had to change its product. Fleming states that, at this period, Delftfield was experimenting with other types of pottery and in 1766 introduced white

stoneware which was harder in the 'paste' than delftware.[25] While white stoneware is unlikely, some improvement was made to the product because the *Glasgow Journal* for May 1766[26] carried an advertisement for a new ware from the Delftfield Company for which it claimed that 'by some new compositions luckily discovered ... [they had] brought it to a still greater degree of perfection as it now holds boiling water and is made stronger than formerly'. We do not know whether Watt was involved with this improvement, but he certainly was with others in 1768 and afterwards. Indeed, he was to claim in 1786 that he had laid the foundations of the Company's prosperity. The beginning of a letter to Robert Muirhead, his cousin, is quoted here in full:

> I certainly would not willingly relinquish my share in the Delftfield Company but cannot think of retaining it against the opinion of a majority of the company. I am sorry it has not been in my power to be of more service to the concern lately but on the other hand it should be considered that I took much more trouble upon me in laying the foundations of their present prosperity than the share I had required me to do and that I have hitherto run all risks along with them nevertheless if it is their will that I should resign, I shall comply without repining.[27]

He wrote in a similar vein to Gilbert Hamilton.[28] Hamilton had married the sister of Watt's second wife and acted as their Scottish agent after Watt moved to Birmingham. He became one of the leading Glasgow merchants and was associated with a wide range of businesses, among them becoming agent in Glasgow for the Bank of Scotland and the Carron Company. He was elected Provost of Glasgow in 1792 and 1793 and died on 30 November 1808. The background of this dispute will be examined later, but the important point to notice here is Watt's claim of setting the Delftfield Pottery on the road to prosperity which he achieved through his knowledge of chemistry.

WATT AS TECHNICAL ADVISER

The science of chemical analysis was in its infancy and all progress in the development of a ceramic body, or glaze or any other technique was, by necessity, empirical. Potters tried to conceal their secrets from their rivals and each person had therefore to discover anew the latest advances. Identification and isolation of materials was the first necessity before any work could begin on observing their behaviour. We have seen that experiments to improve the products of the Delftfield Pottery must have been carried out, possibly by Watt, before he joined the partnership, and indeed it could well be that he was admitted on the strength of them. However we have no details of any involvement before 1768. We will follow his association with the Company for the rest of his life, including the advice he would send after he had taken up residence in England. But what is not clear is whether he continued to try and improve delftware or whether his trials were for new types of pottery.

CLAY

Different types of clay were essential to make improvements to delftware. Watt must have experimented with clays soon after joining the Company in 1768, using some which his father had sent him that February. His father mentioned various types that he had seen or heard of in Scotland and where they were to be found.[29] A little later, Watt told Black:

> I shall be extremely happy to see you, and can communicate a great many particulars relating to earthenware. From an accidental experiment I found that p[ipe] clay may be burnt as white and hard as any porcelain. Nothing hitherto discovered can be wrought at the wheel with double the trouble it can. If, therefore, this could be made to succeed in practice, nothing would be necessary for china but stone body.[30]

This is the only clue we have that Watt was investigating porcelain manufacture at Delftfield. Pigott, an agent in Liverpool, had some clay ready for shipping in June 1768 and could send 30 tons.[31] Might this have been from Carrickfergus? Watt's father was forwarding a small cask from Liverpool for Delftfield a year later but failed to mention the contents.[32] Watt must have discovered a satisfactory composition.

Watt's interest in clays was renewed through erecting steam engines to drain the tin and copper mines in Cornwall. This county and Devon were the main sources for ball clay, kaolin, and petuntse, all crucial for cream coloured earthenwares and porcelain. In February 1779, he sent Dinwiddie three small casks of clay.[33] However two became lost en route at Bristol and were not traced for some time.[34] While delftware was still being produced in Glasgow at this time, it is not clear whether Delftfield was trying also to make porcelain, or only improving the body of their stoneware; however, a letter underlines their need for better clays. Young Duncan Nivien had just been appointed as manager of the Company and wrote to Watt:

> I observe that when in Cornwall you desired a Friend to ship p first vessell for Bristol 3 small Casks of Grawan Clay, of which the Bristol China is made, & also some of the stone to mix with it — every attention shall be paid to this matter when these materials come to hand — I purpose attending Mr Irvins Lectures on chemistry by which means I hope to attain to a little knowledge that way & be better able to assist in trying any Experiment which may be judged for the Improvement of the Work. In the mean time if you would be obliging enough to favour the Compy with your thoughts on the most proper plan to be adopted, in mixing & making up the Grawan clay & the disposing of it, or if you incline to communicate the process to Dr Irvin, it would be a great satisfaction. Wm Young who has been in the Compys service for many years & is exceedingly versant in every thing about the Work may be of service, he has hitherto acquitted himself much to the Company's satisfaction, & they find him so necessary a person, that they have made an Agreement with him for a term of years.
>
> The Company for this some time past have been supplyd with very indifferent Clay for the stoneware, the last parcell was very bad indeed & greatly affected this ware — we expect a vessell will soon sail for Pool to [hole] load of that article for the Coy as we have no House to apply to there, we purpose sending by the vessell a sample of clay, of the sort we mean to be procured, for there is still remaining on hand a small quantity of very fine, of a former parcell. do you know of any good House that could regularly supply us with the best sort, & where the principal Manufacturers in Staffordshire get theirs ? good clay being so very essential to the success of the work it behoves us to be extremely careful & attentive in the procuring of it.
>
> Being totally unacquainted with the nature of a Delph & stone manufactory, my knowledge must be learnt from information & attention to put in practice the information I may receive & as I am informed no person is better qualified than you, Sir, to instruct me in what experiments ought to be made for the Benefiting the Concern, & of course to the advantage of <u>you</u> & the other Partners — I can assure you of my assidious attention to follow any directions that you may be pleased to commit to my care.[35]

Here we see Watt's importance as technical adviser. He replied that he was seeking advice from Wedgwood in return for advising Wedgwood about steam engines but he warned Nivien, 'My knowledge of pottery is on the decline — I shall always take a pleasure in answering such questions as I can'.[36] In fact Watt continued to add to his knowledge of pottery. At this time, Watt was not only in an advantageous position as regards Cornwall with its supplies of clay, but he was also only 40 miles away from one centre of the pottery industry, Staffordshire, and, through the Lunar Society, had become a friend of Wedgwood. Watt was able to help Delftfield in many different ways over the following years and part of this help came through his contacts with Wedgwood.

Watt realized that he could assist Wedgwood by suggesting where good clay and other materials might be found in Cornwall at the same time as he was pursuing his own interests, which of course included the Delftfield.[37] In early 1782 Watt sent some barrels of killas which he had found at the Ale & Cakes mines to Falmouth for shipment to London and so to Wedgwood.[38] This must have interested Wedgwood because he proposed engaging a ship to bring back a few tons.[39] Watt also saw a quarry of white elvan stone near Truro which he thought might make fine porcelain.[40] Later in the year, he wrote to Wedgwood who was going to visit Cornwall and had asked if Watt could suggest a reliable agent as well as suitable sources:[41]

> About geological deposits in Cornwall [. . .] If you call upon Mr. Wilson [Boulton & Watt's agent there] and use my name, he will readily make the necessary enquiries for you concerning the Lord & Lessees and give his advice. Query whether a patent can be obtained for making china from elvan? Has it been done by anybody in England? Would it be worthwhile?[42]

Watt continued in a later letter which shows his continuing interest in pottery manufacture and experiments thereon:

> I wrote to you on Saturday and promised a sequel. What I have to say is, briefly this. You know that I have formerly made some improvements on China making: I have lately made some few more experiments and some useful observations on the materials; The only objection I have communicating these observations to you, is that I might thereby prevent myself from reaping any advantage from them when I might be disposed to apply them to practice, which I have not given up the thoughts of, though at present I have other pursuits before me.
>
> But as it would give me pleasure to be able to be of service to you; the field is wide enough for us both, even though I were ready to set about the business, and I believe I can facilitate your acquisition of materials, which I expect will be useful to you. I hope you will not think me too selfish in asking your promise to allow me to supply myself under your leases with such materials as I shall point out to you on my paying a part of the costs of getting and Lords dues proportioned to the quantities I shall take away, which will not probably be great for some time.[43]

It seems that Watt still retained some ambition to make pottery. Wedgwood was willing for Watt to have up to half the produce of any mine or vein.[44] There was a further letter that June about constructing mortars. Wedgwood's trials of this killas showed that it was 'very useful for making a compact body which will stand in all weathers in open air for pots & vases for gardens'.[45]

Possibly in return for this help, Wedgwood assisted Watt four years later with different types of clay for Delftfield. There had been considerable correspondence between Watt and Hamilton with Hamilton wanting to learn the secrets of how to improve manufacture at Delftfield. At one time the Delftfield Company was trading as Gilbert Hamilton & Co and he was the senior trading partner from 1781.[46] In 1782, it was announced in the *Glasgow Mercury* that he had begun to transact 'the business of the Company' when he took full control.[47] In 1786, Wedgwood must have told Watt that some varieties of clay could be used to replace flints, which he reported to Hamilton, 'He tells me that notwithstanding they add about as much China Stone as they used to do flints they still put in the same quantity of flint the china stone giving much fusibility hardness & clearness I would recommend to you to have a few tons of both sorts'.[48]

In the meantime, Watt had asked Wedgwood for his prices of china stone and china clay which he sold at various ports because he wanted two tons of Growan clay sent to Delftfield.[49] This must have been despatched because Wedgwood sent an account for £6 9s 7d.[50] Then Watt wrote to Wedgwood early in 1788 asking him to send some more, 'My friend Mr. Gilbert Hamilton Mercht Glasgow desires you would send him as speedily as possibly two tons of the washt China Clay & four tons of the china Stone via Liverpool as before'.[51] While Wedgwood did send this, he told Watt, 'If he [Hamilton] continues to make use of these materials in any great quantity I think he had better give me leave to order them directly from Cornwall to Liverpool; they would be considerably cheaper'.[52] Possibly Wedgwood was becoming a little tired of helping a rival. But Hamilton's experiments must have been successful, for Watt offered to help him obtain clay from Cornwall even though he did not dare go there himself 'lest I should be robbed & matters [over steam engines] grow worse & worse there every day'.[53] Perhaps this explains why Watt made a further request for more clay from Wedgwood that autumn![54]

This was really the end of Watt's dealings in clay but on a Welsh holiday in the summer of 1794, he noted:

> At Conway there is a very large vein or mass of whitish or yellowish Jasper forming the greatest part of the mountains Penmaenbach, which seems a good substance for pottery I have brought some bits for trial it is granite earth pretty ?...? it is carried to the Staffordshire potteries to grind their flints with.[55]

It was with good reason that Watt chose the motto 'Observare'!

GRINDING FLINTS AND COLOURS

Part of the toughness of stoneware was achieved through the addition of ground flint to the clay. The Delftfield Company had taken possession of the North Woodside Mills on the river Kelvin in June 1758 when they were offered for sale.[56] At this period, the mills were used to prepare colours. Then an advertisement appeared in the *Glasgow Journal* in June 1768:

> A MILL TO BE SET
>
> That the Delft Colour Mill at Woodside which is fit for a Snuff or a Waulk Mill is presently to be set. For further particulars enquire at the Delph House or at Mr. Watts shop in Buchanans land.[57]

The Company still retained possession much later when another business was threatening to build another mill on the same fall in the river and Watt was asked for his advice in his capacity as a civil engineer, together with Martin their manager.[58] At a meeting of the Company at Woodside in September 1772 to see the situation of this other mill, Watt's opinion was, 'They should be allowed to proceed upon binding themselves to do nothing to hinder our milne'.[59]

The Delftfield Company must have retained the Woodside Mills in order to grind flint there. Later correspondence with Hamilton in 1786 reveals that it may have been Watt who designed some machinery. In 1726, Thomas Benson had patented a method of grinding calcined flints immersed in water in a large iron pan in which iron balls were driven round by arms attached to a central rotating shaft. In a further patent of 1732, he proposed using granite balls on a similar bed which avoided iron particles discolouring the pottery.[60] This would have been the type of mill installed by Watt for Delftfield, but just when this was done is unknown. The lease on the Woodside Mill had expired in August 1783 and Hamilton asked Watt about driving the grinding pans with one of his steam engines on the Delftfield site. This would have brought all the processes under one roof instead of having them three miles apart. Not only would this make easier supervision under Mr Young, the manager who succeeded Martin, but it would save the expense of carriage.[61] This was before Watt had perfected his rotative steam engine with the parallel motion but, although we have some calculations for a four horse engine, we have no record of what he finally suggested. The watermill could not work in the spring of 1784 through being first frozen up and then flooded,[62] but, a little later, Hamilton decided to retain it.[63] Then a lease was taken on another watermill, but he would have preferred to try a steam engine had Watt been present to give advice. It was for this mill that Hamilton enquired about flint grinding pans.[64] In the meantime, Wedgwood had asked Watt about using a steam engine to drive a flint mill[65] and Watt worked out the size of one needed to replace a 16-foot diameter waterwheel.[66] Hamilton had asked what was the best size for the flint grinding tubs and Watt replied:

> The small round tubs for grinding flints were originally used in Staffordshire but are now entirely laid aside, & they have even got to tubs of 20 or more feet in diam. I erected one of 8 feet in diam. at Delft mill, but proof was brought by Martin and his men that the small tubs did infinitely better & it was laid aside, & I am afraid condemned unheard all I can say is that it holds with reason that the large tubs should do best, as having superfluous friction. I have not seen one these many years but if you will send me the quantity of flints wanted to be ground pr week & the power of your waterwheel I shall endeavour to give you good advice meanwhile I think it should not be under 12 feet in diam. they have commonly 4, 6, or 8 large stones and they take out or put in according to the quantity of water they have to drive them.[67]

This letter shows both how Watt based his designs on first principles and also that he kept abreast of technical developments in fields other than steam engines. He continued his interest in the Delftfield flint mill as is shown in another letter sent in April 1786:

> Our principal Engineer in Cornwall, Mr Wm. Murdock is now on a visit to his friends in Ayrshire. I desired him to call on you & to look at the flint mill he is a very ingenious man & has consumate skill in Fire Engines any civilities shown to him I shall consider as a favour.[68]

Unfortunately Hamilton failed to recognize Murdock when he called.[69]

GLAZES

On joining the Delftfield Company, Watt experimented with glazes. He told Black:

> I have contrived a glazing for stone-ware that will bear the ware to be burnt with it on it; for if that were not the case the trouble of putting the glazing on a hard-burnt close body would raise the price too high, but this can be sucked in upon a bisket and, when burnt, is very little if any inferior in beauty to your china, which appears to me to be made of pipe-clay and petunse, and glazed with an opaque white glazing. What that glazing is I have not discovered; my glazing is a glass of lead and tin without salts, which in great heats are apt to render the tin transparent, and at same time they prevent the glazing from running smooth on the ware without it be made very fusible, in which case it runs about. But I have by no means acquired all the knowledge I must have in this article, having just now little time to spare on it.[70]

While salt glazed earthenware had been popular during the earlier part of the 18th century, towards the 1760s, lead again became significant as a glaze. Lead ore, mixed with flint or ball clay and water, was normally applied in liquid form to the already fired 'biscuit' body. But the lead tended to give the glaze a yellow colour, varying in shade according to its thickness and the whiteness of the underlying fired clay;[71] hence possibly Wegdwood's cream ware. After about 1770, Wedgwood was able to make it appear whiter by adding minute quantities of cobalt, so he called the resultant product 'pearl ware'. One of the challenges was to produce a true white glaze in imitation of porcelain, something to which Watt would return later.

COBALT

The work of painters on delftware had been dominated by the blue and white porcelain imported from China. Cobalt was the most satisfactory blue colouring agent because the colour produced was much less susceptible to changes in firing conditions in the kilns, and because it could be counted on to produce true blue colours, varying in intensity with the concentration of cobalt in the glaze. But the high price of cobalt was a continuing problem. It was imported from Saxony, which kept supplies small and prices unnaturally high through regulation of its export. Smuggling was punishable by death. It was claimed that around 1760 '£200,000 Sterling goes out annually for that Article of Commerce'.[72]

Just before 1759, in a glen above Alva on the Ochils, a vein of cobalt was discovered. Sir Charles Erskine sent samples of ore to a number of people for testing and appears to have received encouraging reports. Black was one of the respondents and wrote, 'I shall compare some trials to be made by painting some delftware and comparing the colour with saffer used here'.[73] (Saffer or zaffer was an impure oxide of cobalt.) In our first surviving letter from Black to Watt, written on 10 January 1768, Black asked Watt to send the 'Manganese and Cobalt'.[74] Manganese might be used to produce black and, in conjunction with cobalt, mulberry ceramic colours. This again demonstrates Black's interest in the pottery industry.

However the veins of cobalt at Alva proved to be elusive and mining may have ceased in 1766 although a stockpile of ore remained available, and samples were sent to interested people. Among them was the Delftfield Company and, at the beginning of 1769, Watt was able to carry out experiments. He reported his results in a letter to Lord Barjarg, so giving our earliest account of any of his chemical experiments:

> I took out at random 12 lb of Cobalt. This I separated by picking into two parcells of which the best weigh'd 6 lb. 10½ oz. The other 5 lb. 5½ oz. These were carefully roasted & pounded. The best then weigh'd 5 lb. 5 3/4 oz. The second weigh'd 4. 11 oz. both together 10 lb. 10 lb. of Ground Flints was added to them & they were levegated seperately by the Mill the best gave on the ware a very good blue but not so deep as the Dutch Zaffre tho superior in Colour. The second was very light & not so good a Colour. From this Experiment it appears that the best roasted Cobalt will take no more than 3/4 of its weight of Flint the other none at all. On the whole 18 oz. to the pound will make it about as deep as the lightest Dutch Zaffre. 12 lb of Cobalt unroasted then is equal to 15 lb. of Zaffre These 15 lb. of Zaffre wou'd cost us about 30/–.[75]

Watt may well have visited the mine, because it was situated quite close to where he was surveying to make the River Devon navigable. However production had declined to nothing in 1768 and the lease was forfeited.[76]

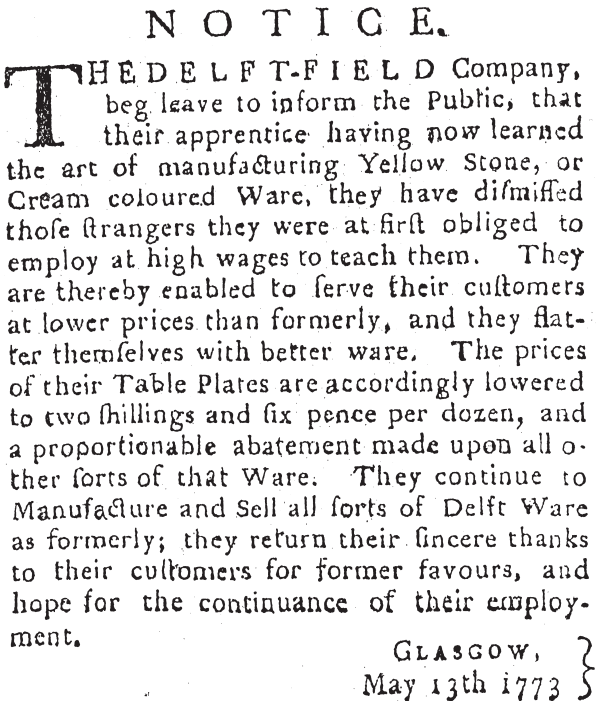
But this did not end Watt's involvement with cobalt, because another source was discovered while he was in Cornwall at the end of 1781. At the back of his Journal for this period is a note on chemical tests he carried out on 'Mr. Beauchamps Cobalt'[77] and probably about the same time he entered into his Common Place Book notes on how to make royal blue from impure cobalt based on the method of Gehard Abbe Rozier.[78] In February 1782, Watt told Wedgwood about this new mine and that, while samples showed it contained cobalt and nickel, he doubted if there were sufficient to make it pay.[79] When he had returned to Birmingham, he again told Wedgwood about his tests on cobalt,[80] presumably more of which he had made at home, and Wedgwood, who was intending to visit Cornwall himself, asked Watt about the sources of cobalt and other materials there.[81] At the end of 1782, Wedgwood again enquired about cobalt and whether the mine was being carried on.[82] The mine was a failure, and this was the end of Watt's involvement with cobalt, excepting that he told Hamilton in 1789 how to purify it and obtain it from smalt.[83]

OTHER GLAZES

In his Journal he wrote in August 1770, 'Visited the Delfthouse in the evening think they are improved in manufacturing their plates but still deficient in glazing the man Austin is come but not begun work gave directions for building a new house for part side of square'.[84] This also shows other ways in which Watt was involved, and we will look at the personnel aspects below. On the first of September, Watt went again to 'the Delfthouse saw Austin's glaze which is very bad — I imagine the greeness of our glazing is owing to the want of manganese'.[85] This was followed by another visit on the 17th:

> Went to Delfthouse — their last kiln had been pretty hard burnt & was of a tolerable colour the glazing is however still deficient in not being uniformly smooth having misty spots upon it, being too transparent & of a greenish colour. I imagine that the addition of a little mang.e & arsenic might remedy these.[86]

He must have continued with experiments to produce a white glaze, for in the autumn he tried mixing bone ashes with clay or window glass, bone ashes and something else and heating them violently but discovered that they did not produce the same whitening effect that they once had.[87]



NOTICE.

THE DELFT-FIELD Company, beg leave to inform the Public, that their apprentice having now learned the art of manufacturing Yellow Stone, or Cream coloured Ware, they have diſmiſſed thoſe ſtrangers they were at firſt obliged to employ at high wages to teach them. They are thereby enabled to ſerve their cuſtomers at lower prices than formerly, and they flatter themſelves with better ware. The prices of their Table Plates are accordingly lowered to two ſhillings and ſix pence per dozen, and a proportionable abatement made upon all other ſorts of that Ware. They continue to Manufacture and Sell all ſorts of Delft Ware as formerly; they return their ſincere thanks to their cuſtomers for former favours, and hope for the continuance of their employment.

GLASGOW,
May 13th 1773

ILLUS 4 Advertisement for the Delftfield Pottery, probably written by James Watt, in the *Glasgow Journal* of 6–13 May, 1773

In spite of some failures, these notes show Watt's knowledge of the chemistry involved, which must have helped put the Company's products on a firm footing. In 1772, the concern, advertising as Dinwiddie, Martin and Company, claimed that 'having brought the STONE and DELFT Ware to the greatest perfection are determined to serve the Public on as low terms as possible and have already reduced the price of several of their articles'.[88] Part of their success was due to Watt's investigations and part due to recruiting men from a rival company in Glasgow, which had imported men from Staffordshire,[89] so that in 1773 they placed an advertisement, probably written by Watt,[90] in the *Glasgow Journal*:

> THE DELFTFIELD Company beg leave to inform the Public, that their apprentice having now learned the art of manufacturing Yellow Stone or Cream Coloured Ware, they have dismissed those strangers they were at first obliged to employ at high wages to teach them. They are thereby enabled to serve their customers at lower prices than formerly, and they flatter themselves with better ware.[91]

We know that Watt had improved their cream ware through a letter from Robert Muirhead:

> At the time you was paying so much attention to the bettering of the cream colour'd ware you found out a method of giving it as fine a glaze as China & perfectly white We think as our buildings are sufficient for such an undertaking that upon your describing to us that secret it will be worth our

> applying for a patent for making such Ware, and that you shall have such annuity during the continuance of such patent for your trouble & Expence and ingenuity as we can agree upon with you — If you like this proposal let me know as also when you'll be down in Scotland.[92]

Watt could not have answered because Muirhead asked again about it in March 1778 when he described it as 'perfectly white ... and an enamel as fine as any China'. Watt had apparently lost the recipe but then found it again. Muirhead therefore asked whether Watt was willing to reveal the secret only to himself and Mr Dinwiddie, and what would be Watt's terms, as he supposed that this was 'an entire new art and has not been discovered & practised by any other persons in Britain'.[93] This leads to us speculate about what Watt could have achieved if he had concentrated fully on the pottery industry. Again there could have been no reply because Muirhead wrote once more in February 1779 wondering whether Watt could do some more experiments.[94] That July, Hamilton passed on a request from Duncan Nivien to Watt to see if he could 'learn if possible the proportions of clay & flint used in the ware made by Mr. Wedgewood or any other eminent potter in Staffordshire — Also the composition of his glaze & whether Mr Watt thinks a small proportion of clay any service in the mixture'.[95]

At last Watt replied and it is from this that we derive most of our knowledge about his work on glazes:

> I know not the composition of the cream Coloured body as used in Staffordshire but was formerly told they used 3 parts clay and one of flints for it and for the white stone ware 2 ps clay & one flint — The flints give whiteness but encrease the tendency to ring crack in the ?...? I should imagine the first composition a good one — all whitish or opake whitish flints should be rejected they contain calcarious crust which is highly prejudicial, all calcarious crust should be rubbed off the flints before calcination — The utmost care should be used to prevent dirt entering the clay or flints, or smoking the biscuit as to the Glazing I cannot readily find my memorandums but think it was 12 lbs white lead from Bristol 20 lb flints and 10 lb clay The clay gives hardness & prevents crazing, but if too much is used, causes dryness & want of glass. If the glazing is wanted to be paler may add to the whole ?mass? of the above composition 10 lb best flint glass ground to very fine powder but let this be tryed only on a parcel of ware dispersed in various parts of the kiln — If the growan clay has not reached you from Cornwall I should expect it to be a good succedareum in place of part of the flints in the body — neutral salt in small proportions whiten clay Alum or vitriolated tartar are I believe the best the latter can be had here very cheap may try in small batches — Above all things a strict attention to cleanliness adds the most to the beauty of the ware but could never be obtained at the Delftwork — no ware which is not clean & white in the biscuit will look well in the glaze Care should be taken to eradicate all ?dran? clay out of the sagar clay the smell of it makes brown our sagar clay not being white should be slipt with white clay ?...? or have some gypsum mixed in their glazing.[96]

We have no record of the outcome of any industrial espionage against Wedgwood in 1779 but Hamilton tried to pursue this trail in 1782 and 1783.[97] Presumably he had been unable to make a white glaze from Watt's notes and he wanted to know how Wedgwood made his which he, Hamilton, thought might replace the Queen's ware.[98] He was willing to purchase the secret or hire a person who thoroughly understood it.[99] He hoped Watt himself might be able to help with the secret by turning out his old notes on pottery and sending him excerpts so their ware might be improved.[100] Hamilton was still wanting a better white glaze in 1787[101] when Watt told him:

> You took memorandums of the experiments we made together from which I should think you might make a better glaze to make the glaze whiter you should diminish or take away altogether the pipe clay which is put in it. make a frit of equal quantities of purified pearl ashes & flints cleaned from calcarious earth by boiling them in spirit of salt & water.[102]

This seems to conflict with Watt's original discoveries about pipe clay! At that same time, Hamilton asked Watt his views about blue printed ware[103] and Watt replied with a long description, showing once again his breadth of knowledge:

> We are as much out of the pottery here and as ignorant of their improvements as you can be in Glasgow, however everything I can learn I will transmit you with my opinions on bodies etc— as to improvements for shortening labour in painting I know of nothing equal to copper plate printing which I think might be carried further than it is by the adopting prints done in the ?Bartologgio? manner or in Aqua tinta which from their softness admit of colouring much better than graving.
>
> I am not sure whether you know the art of transferring copperplates on enamel. I have heard of two ways one of which I have tried— The enamel is varnished over with a turpentine varnish & suffered to dry till it is just sticky The plate is printed in enamel colours on a soft pliable thin paper & while wet from the press is applied to the ware Something is laid behind it & it is gently rubbed or rolled with a hand roller such as a table castor the wet paper is then taken away & leaves the impression on the varnish. In the other way thin paper is painted over evenly with a coat of weak common glue & suffered to dry in the shade then made damp enough to print upon with the enamel colours on the glued side & is immediately applied to the ware & rubbed down. it is then suffered to dry long enough for the colours to fasten themselves to the ware which is then put into water & the paper glue etc washed off. The colours must be mixed up with strong oil such as copper plate printers use which of these ways is best I cannot determine but perhaps a mixture of the two ways are best but for neat goods nothing will equal the pencil.[104]

To what extent advice of this type proved to be of any value to Hamilton cannot be determined but it would have given him some leads. At Worcester, early pieces were printed in black on top of the glaze by 1760 but underglaze blue printing on pottery was not introduced until around 1780. Wedgwood was using a variety of colours on his cream ware soon after that date and Hamilton was therefore trying to introduce these new techniques at Delftfield quite quickly.

Chevalier Landriani from Austria hoped to exchange news of latest scientific discoveries with Watt and in 1789 Watt sent him a brief description of transfer printing.[105] In return, Landriani told Watt about silvering on pottery, which Watt passed on to Hamilton:

> Mix with the precipitate of platinum obtained by Sal ammoniac (does he mean sal Alki) a small portion of gold (fine) melt & pulverise the mixture use it as you do the gold ?powder? ?burn? in & burnish as the powder seems to be in a metallic state perhaps fine platinum would do which you can get from Mr Willis chemist somewhere about Tanner hill London. which is obtained by ?pollatiers? process of making the grains of platinum with glass of phosphorous & charcoal dust. then purifying from phd by long cuppellation but as the phosphorus of platinum is very brittle it would answer you better in yt state & would readily unite with the gold and become pure in your kiln.[106]

This silvering was meant to be proof against tarnishing or acids.

In March 1799, Watt told Hamilton about some enamel, which withstood heat and cold well. He thought this might be useful for cooking utensils and would have a good sale.[107] A couple of years later, he passed adverse comments on the glazing of a beehive sent him by Hamilton:

> The white is too much of the chalk kind, too blue, & the glazing too vitrious or glassy, otherwise the china was excellent when glazings are composed of matters already vitrified they never look well since part of the vitrification shd be performed upon the body in firing the glazing & shd contain matters which at that heat will act a little on the body. moreover it should not of itself be perfectly transparent but milky Query what wd a small proportion of arsenick do to use it it must be first mixed with ?potash? or soda & there must be some lead in the glaze.[108]

Hamilton's son, Robert, set up his own pottery at Stoke-on-Trent and Watt gave him advice on glazes in 1802 and later, but, as they do not concern Delftfield, they will not be included here.[109]

EQUIPMENT

We have seen that Watt helped install flint grinding tubs. He would also help with different equipment such as lathes for turning the bodies. Once again it would seem that Delftfield was later than potteries in Staffordshire in adopting the lathe. Watt had owned some in his scientific instrument business and could have been aware of their possibilities. The ordinary lathe had been introduced to Staffordshire, according to tradition, by John Phillip Elers at the end of the 17th century. In 1763, Wedgwood introduced the more complex engine-turning lathe which was capable of giving an eccentric movement, so that geometric and fluted patterns could be produced. In 1767, while on a visit to the Soho Manufactory in Birmingham, he saw the even more refined rose-turning engine and was able to buy one from Boulton. These employed rotary cutting tools so that further exciting possibilities became available for decorating pottery.[110] At Etruria, the turning room rapidly became one of Wedgwood's most important workshops.

It was not until September 1778 that Robert Dinwiddie wrote to Watt asking for an engine lathe to turn fluted cream earthenware with five or six different movements to give the latest patterns. He had been recommended as the best maker one John Badly at Handly Green near 'Newcastle under Line'. It was wanted as soon as possible.[111] Watt undertook to send one[112] but he seems to have done nothing about it until being reminded by Hamilton in July 1779.[113] Watt immediately asked Wedgwood if he could arrange for one to be sent,[114] followed by a further reminder that September.[115] One must have been despatched because we find Hamilton asking for another lathe in the summer of 1783. This time he wanted to be able to do oval turning.[116] The last we hear is that he was still waiting to receive one in the following March![117]

Of much greater importance were Watt's improvements to kiln design.[118] Soon after he set up his scientific instrument business in Glasgow in 1757, he made some parts for Black's furnaces and around 1764 he tried to improve the design of small steam boilers. In view of Watt's later patenting in 1780 of a steam engine boiler with fire grate for consuming smoke, his improvements to pottery kilns must have given him good experience. Watt's letter to Black in February 1768 shows that the Delftfield Pottery was still employing the traditional square type of kiln fired with wood. These needed a great deal of skill to achieve successful results, partly because different

types of wood had to be used at different stages and care had to be taken to prevent ash settling on the pieces being fired (which caused black spots on the glazing). Watt pointed out that, 'This way of firing is not only expensive, but inconvenient' and that a great deal of the ware was spoilt.[119] He commented on the route of the gases passing through the kiln, realizing that some parts heated more than others. It is surprising that coal, readily available in Glasgow, does not seem to have been tried because Henry Delamain, a delftware potter in Dublin, had spent more than £1,000 in the 1750s on designing new kilns for coal.[120] Perhaps the Delftfield partners were unwilling to invest such capital without being certain of success.

However Watt was willing to carry out experiments, but no mention is made at whose expense, probably his own! He sent Black a description of a new small kiln he intended to construct and fire with coke, and sought Black's advice on its suitability. It was cylindrical, four feet in diameter and four feet high, closed at the top with an arch, terminating in a two foot high chimney.[121] We can see that his experiments were on quite a large scale. He must have been pleased with his results for he later told Black, 'I have tried the cokes for burning our Delft; they answer very well'.[122] But it was only after alterations to the grate that he made the kiln heat equally, although ash still settled on the ware, which he proposed to prevent by closing the chimney when the fire was stoked and sealing the saggars better.

Watt also described how the type of kiln for stoneware was like that of common potters. Pit coal was used and the firing lasted for 48 hours. The advantage for the Delftfield Company would have been cheaper fuel than wood. Watt experimented in a different small furnace that he had but found difficulty in raising more than 'a bold red heat'. He then tried coke, which soon had the furnace up to a 'bright white' heat.[123] The delftware fired in it was equal in colour to any. Watt was surprised at this difference in heat from the two types of fuel and so once again sought advice from Black. Watt doubted whether the heat from coke would spread as far as that from flames. Black replied, 'A kiln which is heated with flaming fuel may be said to be heated by means of a torrent of liquid fire which flows through it, but I am persuaded that cokes act mostly by a radiation like that of the sun'.[124] Watt carried on with his experiments and told Black, 'I have strange and incredible things to tell you about stone kilns, which, if true, cokes will beat pit-coal even as to quantity or cheapness'.[125] There was still much to be discovered about the nature of heat!

Watt was experimenting on kilns for over a year from February 1768 until at least May 1769. It may have been of great significance that he announced to his father that December, 'I have fired a kiln with coals which has succeeded',[126] because coals would be the fuel generally used. He must have been proud of this because that May he recommended Boulton to consider a china factory as a good trade and that he, Watt, thought: 'I almost understand how to make a furnace for it'.[127] We may note that bottle ovens were first recorded at the Delftfield on MacArthur's map of Glasgow, published in 1773.[128] The extent to which Watt's own discoveries contributed any improvement to pottery is impossible to determine, but it is reasonable to assume that his knowledge of the chemical processes enabled him to assess improvements by others and to recommend to his partners whether such innovations were worth copying. What is surprising is how Watt found the time to carry out all the experiments to explore the constitution of glazes, methods of kiln firing and much more.

PERSONNEL

We do not have any idea of the extent to which Watt was responsible for employment of personnel at Delftfield. When he went to London in the summer of 1768 to apply for his steam engine

patent, he took with him £30 in cash from 'Delfhouse' and returned through Litchfield, Newcastle and Stone as well as Sandon. He paid 10/9 for 'pottery & horse' and £1 11s 6d for 'Cream Coloured Ware'. Then he 'agreed John Hinton for the Delft work at £50 pr annum gave him 7 guinneas to engage other hands'.[129] Later he noted that the 'man Austin will not answer'[130] and in 1771 recorded, 'Called at Delfthouse with Mr Dinwidder & desired Mr. Martin to provide for a proper assistant for himself found the business there going on very well'.[131] More than 10 years after he had moved to Birmingham, he was still actively involved in the Delftfield management and wrote in 1784 to a Mr John Widows:

> Being informed by Mr. John Baddeley that you understand the China glaze and are a good potter and as a hand in that way is wanted at an established pottery I am concerned in near Glasgow I will be obliged to you to inform me what branches of the pottery business you have generally wrought at and also what wages you would demand. (The Company allowing you a reasonable sum for travelling charges thither) and also what term you would chuse to engage for.
>
> When I receive your answer, I will write to my partners and will immediately on receiving their answer communicate with you.[132]

A little later, Hamilton told Watt he was pleased with the painter Watt had sent.[133]

TRADE PROMOTION

Possibly when Watt had decided to live in Birmingham, he must have made a promise that he would send to Glasgow patterns and samples of the latest improvements and fashions. Muirhead reminded him about this in March 1778.[134] As the Delftfield pottery was so remotely situated, Watt, through his visits to London and his many contacts, was able to give advice about the wares their rivals were producing and at what prices. Ten years later, Watt passed the comment to Wedgwood, 'The potters in Scotland are following your countrymen as fast as they can, but keep too far behind. An insulated manufactory has much to struggle with'.[135] In spite of the advantages of its site in Glasgow being close to good shipping facilities and supplies of coal, the Delftfield Pottery was isolated from both the latest technical advances and fashions. Any information which Watt could supply must have been very valuable and later he passed some on to Hamilton:

> I wrote to you lately about the pottery since which I have obtained the Staffordshire list of prices from Mr. Chas. Austin which not knowing if you have got & being necessary for your regulation in foreign Markets I send you [. . .]
>
> I fear the Staffordshire prices are low for you but without some marked superiority or beauty in your ware you cannot hope to go beyond them in price. I have lately seen some ware printed with blue in imitation of ?Nankeen? which looks very well & I dare say will take abroad have you attempted anything in that way yet ? Annie complains much that she has never yet got a set of ware she ordered when she was down.
>
> On that head I must comment that a speedy execution of orders is the soul of the trade & that in a country so fluctuating in taste as France things may be out of fashion before they arrive if this is not attended to.[136]

Watt must have kept sharp eyes and ears open to keep abreast of what was happening in the mercantile world and his warnings about the need to keep up with fashion did not go unheeded.

Another way of promoting sales was to use Delftfield products himself, so that they could be seen by his friends. A box of patterns, and possibly Annie's set of china, were despatched at the end of April 1787[137] only to be received with some criticism:

> Yours ... came to hand also a box of patterns but no list of prices there should also have been some cups & saucers, some desert plates, & some plates with painted edges. The ware looks well, the gilding is very neatly done & the coat of arms well printed the plate of the conversation piece is very badly engraved The handle & spouts clumsy & badly finished The common tea pot is a very clumsy one & I do not much admire the forms of the better ones. The milk pot in particular bears the Birmingham stamp as we say here. The glaze also is much too yellow for the present mode.[138]

With such comments, it is surprising anything was sold! In order to improve their products, Watt recommended sending William Young to London to obtain the latest patterns. However he was not to show his real purpose and definitely not to enter Wedgwood's warehouse but to buy only one thing from one shop and something else from another. When Watt himself was in London later in the year:

> I saw some blue & white stoneware in imitation of ?Nankeen? that I thought worthy of imitation from the transient view I had of it in passing a shop window... I nevertheless bought a ?...? set of it as patterns ... In another shop I bought a tea set of coloured stoneware, which however is nothing to compare with Wedgwoods ... I bought an odd cup & saucer of another pattern ... & ordered them to be sent to the Glasgow wharf. The prices are as under ... The prices are high ... I hope the patterns will be of some use to you.[139]

In 1788, the Delftfield Company advertised, 'Sets of particular pieces made to any pattern, plain or with coloured edges, and ornamental with coats of arms, crests, initials, or other devices'. Andrew Brown, who wrote in 1795, stated that they made 'all kinds of Queens china, plain and ornamental, and table-ware sets with crests and coats of arms of as high a value as thirty shillings sterling'.[140] Therefore it is evident that some of Watt's advice was accepted and helped to keep the Delftfield pottery in the forefront of competition with its rivals further south.

But markets had to be found where the products could be sold. Exports were very important to Delftfield and these certainly started from an early date, but it has not been possible to determine what proportion of sales derived from overseas markets.[141] Wedgwood told Sir William Meredith in 1765 that the bulk of his manufacture was exported, principally to 'the Continent and islands of North America'.[142] In the early 1770s, Arthur Young reported that large quantities were sent from Staffordshire to Germany, Ireland, Holland, Russia, Spain, the East Indies as well as a great deal to America. By the 1780s, it has been estimated that Wedgwood was selling 80% of his output abroad. He recognized that such sales spread the fame and prestige of his name, his factory and his product as well as increasing sales and, possibly as important, provided useful outlets for goods that were no longer fashionable at home.[143] He was able to clear stocks of ware which had become outmoded in England in the Leeward Islands, Barbados and Bermuda.

While exports may not have been as important in Delftfield's trade, they were certainly significant. In 1786, the American market had collapsed and Hamilton realized that he must look elsewhere and turned towards Russia and the Continent.[144] He must have known about Wedgwood's successful trade in Queen's Ware to Russia but his contacts there had not been involved in the pottery trade and he found difficulty gaining entry.[145] Boulton of course had traded successfully with Russia so that Watt may have consulted him and suggested:

> In relation to the Russia trade for pottery, I have yet had no late information only I know in general that trade is far from being so good as it was, and all the trade to the continent in the same way. You must lay your account in case of any ?expansion? to come in competition with the Staffordshire ware both in quality & price & the surest way of doing which will be to send me an order for an assortment such as you make that may seem like an order in business & I will get Mr. B[oulton]s house or some other factor to order it for you to Liverpool so that you may compare qualities & prices and I conceive your best way of doing business in Russia would be to apply to some of the houses here who have factors there and to send samples of your goods & prices here or ship them to their orders.[146]

Here we see Watt recommending the ancient practice of obtaining rival products and trying to undercut them. Watt approached some of his contacts, although he could not find out as much about the Continental trade as he wished:

> I applied to Capper Palmer & Perkins who promised to give me the address of some of their foreign agents to send patterns to which they have not done & I can not properly trouble them again — I think however you might send a small box of patterns with wholesale prices of some of your most current useful articles to Mr. Capper marked St. Petersburgh mentioning your connection with me.[147]

This met with some success because in the autumn of 1786 he announced two potential export outlets, 'I am authorized by Messrs Capper Palmer & Perkins of this place to desire you to send patterns of your ware with prices to their correspondents, Mr. Peter Capper at Petersburgh & to Mr Charles ?Startin? at New York'.[148]

Watt took advantage of the impending peace with France to visit Paris at the end of 1786 and his trip there shows that he was able to use his position not only to help gain orders but to compare production with continental products and to recommend improvements. (Wedgwood was trying to gain entry for his products at the same time.) Hamilton would have liked to have accompanied him to learn more about continental manufacturers.[149] Watt informed Hamilton about his trip in February 1787:

> I did not forget the pottery when in France where I am of opinion it will sell very well but I had not time to go into any of their potteries nor pig merchants, but in general they are in a very coarse Delft ware or china of their own making which is quite good. They also do some very fine and beautiful Delft but that I suspect is dear, the common Delft is dirt cheap but has neither ?..? nor colour They may require that their pottery ?...? feu that is can bear to stew things in over their charcoal stove holes or be set in the wood ashes near the fire to warm water or broth but that can only relate to

> their casserolles, coffee pots, acuelles and such like vessels & not to plates & dishes, however the means of giving that property must be studied. As many of their utensils are different in form from ours, I would advise having patterns of them as soon as the ports are open & immediately sending a ?...? or two of patterns of your ware to Paris, i.e. to have it ready at London to send off as soon as the treaty takes effect. Indeed I believe I could procure the admission of it now but it will be of no use if the treaty does not take place — I endeavoured to find a correspondent at Paris for you but it was not in the line. However spoke to a Monsr. Prodeaux, Rue Richelieu No 129 who is a kind of merchant or factor to assist you.[150]

Prodeaux replied in March that he was willing to act for the Delftfield and asked for samples because he thought he could find customers. Watt recommended Hamilton to prepare a cask or two because:

> There is now no doubt that the treaty will pass through both houses so that I think you shd be taking your steps so as not to be behind others Wedgwood has had patterns & even goods there long ago by permission of the Controller General from whom I fancy I could also obtain it.[151]

Hamilton prepared a couple of casks that April and also said that the American trade was at an end and that other outlets were therefore essential.[152] Later letters show that the samples were sent but there is nothing to indicate how successful this trade was.[153]

Watt certainly acted in a very broad capacity as technical adviser to Delftfield, covering so many different aspects of the business. We have seen how Watt's assistance to the Delftfield pottery covered almost every aspect of its management and went far beyond merely being a sort of technical adviser. The range of his chemical knowledge must have been extensive, far greater than has generally been accorded to him previously. We can also see that he participated in running the business. It has always been thought that Boulton provided the managerial expertise in the famous partnership with Watt but, in the case of the Delftfield pottery, Watt was also involved in managerial decisions, something which must have provided useful experience for developing the steam engine business.

THE PARTNERSHIP

While Watt remained in Scotland, we have few details about the partnership because he could deal with his colleagues face to face. We learn more about the business only after he had taken up residence in Birmingham in 1774. At first it would seem that he did not hold a high opinion of his partners, for he wrote to William Small at Birmingham in 1769:

> Our pottery is doing tolerably, tho' not as I wish. I am sick of the people I have to do with, tho' not of the business, which I expect will turn out a very good one. I have a fine scheme for doing it all by fire or water mills, but not in this country, nor with the present people. I have tryed no chemical experiments this winter.[154]

He was right about the concern doing well for he recorded in his Journal for 10 June 1771:

> Dined with the Delftfield company, found on Ballc. our books and throwing out the bad debts that our stock had increased £1700 since we entered into partnership. We agreed that the interest of our capital should be paid up from the time we begun viz £100 to each full share.[155]

Watt's later comments to Small show that, while he was pleased with the financial result, he was not satisfied with the products, 'Our pottery does very well tho we make damned bad ware & my 8th part worth £70 p annum clear to me. I am still f[seal] the china scheme & am certain it may be made to answer'.[156] Watt's investment of apparently an eighth part of one of the shares was paying a good return in 1771. During his civil engineering career he was often not paid promptly for his surveys and it would be interesting to know how much he relied on the income from Delftfield to support his other ventures. In 1772, the pottery was to do even better, and this is the possible source of the quotation used by Dickinson and others about Watt's capital in 1764:

> 13 June — At meeting of Delftfield Compy found the encrease of our stock since last year to be £833 from which deducting bad and dubious debts £195.1 remains our true profit 637.13.7 and we ordained Mr Martine to place the same to credit in proportion having paid to each one years interest of our capital being our proportion part of the whole interest of £3320.14.8 or £41.10 to each full share.
>
> 14 June — My capital in the Delfthouse is now £474.4.2 besides £20 of interest to be speedily paid me I owe of that to Mr Moreheid £120 & to Nancy Millar £110 both with one years interest my free capital there being £244.4.2.[157]

Therefore it looks as if Watt borrowed £230 from his relations to finance the purchase of an eighth share. There is no indication of the interest he paid them but, with returns of around £70 per annum, he must have made a handsome profit. The £3320 14s 8d appears to have been the total capital invested in the Company at this date.

Business continued to do well and there was a possible payment of £20 on 2 March 1773.[158] Then we find another entry in his Journal for July 1773:

> Delfthouse Company our clear profit this year are much the same as last year but we ordered only so much to be carried to our capital as made it £4000 in all & ordered payt. of interest at £40 to each full share. I recd. my £20 and paid Miss Millar interest upon bill £5.10.[159]

From this we may deduce that Watt had increased his holding to a half of one of the shares. Profits must have continued to come in because that August Watt wrote, 'Received from Delfthouse (of the £72 lent them) £32'.[160] As well as his capital investment in the part share, Watt had money loaned to the Company on interest at various times. Fortune continued to smile and in April 1774, Watt dined 'with the Delftfield Company', presumably to discuss the results before the annual meeting which was held that 5 May.[161] He wrote about that meeting, 'we resolved to continue the partnership for one year more'.[162] For Watt, this was to be the last of such dinners

for many a year because at the end of that month he arrived in Birmingham to erect his new type of steam engine at the Soho Manufactory.

Watt probably intended only to finish making his engine work properly at Birmingham and then return home to Scotland but, in the spring of 1775, with Boulton's help, he managed to secure the passage of an Act through Parliament extending the 1769 patent for the separate condenser until 1800. This seems to have convinced Watt that he should remain in Birmingham and thus the famous partnership with Boulton was formed. At the same time, Watt was discussing selling part of his share in the Delftfield to Robert Muirhead. The first intimation we have of this occurs in the February of that year, when Muirhead also asked Watt what he was doing in London with Parliament.[163] It could have been that Muirhead wished to invest in a prosperous company or that they wished to keep some family connection with the concern since Watt was away so much. It may have been that Watt needed cash, for he used some or all of the money he received from Muirhead to pay off part of his debts to Black. Watt may have thought of selling his entire holding from a comment by Muirhead, 'I have lately had a conversation with Mr Dinwiddie about our Delfthouse concern & mentioned to him your intention of selling out there which he is sorry for & desired me to write you our sentiments on that Head'.[164] In the end, Watt sold only a fifth of his share for which he received £118 2s 6d,[165] suggesting that his capital investment had risen to nearly £600. He received £12 10s 0d as balance of profits that year.[166] At this period, William Martin was ill with gravel in his kidneys and suspected consumption.[167]

In 1776, the profits for the preceding year were £150 after paying interest out of which Watt received £22 10s 0d.[168] Hamilton wrote to him about the balance in 1777, which is the first time that Hamilton can be demonstrated to have any connection with the Company, 'The Delftfield Compy. say that they have £22.10 to pay you for interest'.[169] The balance for 1 June 1778 is the only set of accounts surviving at Birmingham.[170] It shows four partners with £900 capital each, Robert Dinwiddie, Robert Muirhead, Duncan Nivien and William Martin and two with £450, Laurence Dinwiddie and James Watt. In addition there were loans totalling £1356 from five others, James Coulter and Sarah Dinwiddie, Agnes Dinwiddie, Robert Dinwiddie and Mr Robert Dinwiddie. The house, mill and kiln were valued at £2009 0s 5½d. Stocks of materials such as clay, white lead, flint, wood, moulds, etc, were about £300. Valuation of made-up goods was £1520 for delft ware and £200 for stone ware. The list of outstanding debts came to £2642 14s 11½d. Overseas customers, where a place is mentioned, were situated in St Kitts, Virginia, Philadelphia and Jamaica. At home, sales to people at Irvine, Fort William, Aberdeen, Inverary, Port Glasgow, Greenock, and Bo'ness, can be identified. The proportion of export to home sales cannot be determined from this list. Thus the Company had a share capital of £4500; money on interest or further loans, £1,356; buildings, materials and stock, £4,031 5s 6½d; debts due, £2,642 14s 11½d and what is entered as 'Profit & Loss' £750 8s 6d but with no indication as to which! As Hamilton pointed out, no attempt had been made to determine the actual financial situation.

Through the death of Martin around 1778, it became necessary to find another manager. Watt supported the appointment of Duncan Nivien's son, also Duncan, who was duly grateful. But Nivien junior had no knowledge of the pottery business, although he expressed himself willing to learn and hoped that 'the Company will have no reason to think their trust misplaced'.[171] The lad's inexperience may have been a reason why Hamilton wanted the connection with an experienced person like Watt to continue, although some of the other partners still thought that Watt was too far away to be of much help.[172]

From a letter to Watt in May 1779, we can see that Hamilton was beginning to have a much greater involvement with the Company:

> I dined with the Delftfield Company & looked over their last Ballance, a copy of which you have inclosed for your perusal— They all of them disclaim the least idea of wishing you not to continue a partner & that it proceeded entirely from Bob Muirheads misunderstanding something that had been said — they therefore wished me to write to you that they will be exceedingly happy if you will continue a partner with them, as so far from thinking you may be a useless load upon the business you may be of great service to it — from what they said I am fully convinced this is their real opinion You must therefore judge for yourself entirely — They propose a new contract for 9 years & Mr Rob Dunmoor & Rob Donaldson have been spoke of as new partners — They have made offer to Mrs Martin of payment of her Husbands stock & interest from last Ballance, which I believe she is to accept of. If you were to leave the concern, you would draw out in the same manner — What the Profits are for the year I cannot say — I find the sales for ready money are at present about £90 p month — The other sales are but triffling untill America open again. They are to ballance upon the 1st. of June next & therefore it will be right you determine this matter as soon as you can conveniently — In the state enclosed I have marked with red ink those I think are bad part of which may be recovered — Then I have marked thus x I dont know but from their being mostly abroad I have not a good opinion & therefore included them in the list —should you chuse to continue I shall give any attention in my power upon your account.[173]

We shall see that Watt offered to resign and sell out his holding many times in later years. It could be that this was a ploy to make the other partners assent to him continuing. Martin's capital must have been repaid on his death at the beginning of 1779.[174] While Watt did offer to sell his share,[175] in fact he remained a partner and signed the co-partnery deeds in August 1779.[176] It was almost certainly Hamilton who persuaded him to continue.[177] Hamilton became a partner at this time, which pleased Watt.[178] The partners were Robert Dinwiddie, Robert Muirhead, both with two-twelfths, Duncan Nivien, gent, and Duncan Nivien junior, Robert Dunmore, Robert Donaldson, Laurence Dinwiddie, Gilbert Hamilton and James Watt all with one-twelfth which left one-twelfth vacant.[179]

In the second half of 1778, export trade remained bad but income was sufficient to meet current needs and pay off some debts.[180] But then our surviving archives fail and even Hamilton does not mention the Delftfield in his letters until the beginning of 1781, when he began to take direct charge through a double crisis in the Company. The first was that the original product, the heavy delftware, had become unfashionable and they had accumulated considerable stocks. Hamilton explained how they were dealing with this situation in a letter to Watt in February 1781, essentially by reducing prices in distant markets:

> With regards to Delftfield, it is going on better than it has done for some years — Last year we put back the profits to make up for bad debts which are afterwards to be divided among the Partners as received the rest of the Profits we put to the credit of Delftware of which there was a very considerable stock on hand & little probablity of lessening it — We at same time resolved to send out quantities of that ware to New York –Charlestown etc. by running ships & to insure the value — This plan has been carried into execution — Part have been taken & the rest will at least we hope bring prime cost so that by this means the stock of Delft ware is considerably diminished— we are still pursuing the same plan so that in another year I hope all our Delftware will be gone. We propose however at this ballance to sink this years profits upon the Delftware, which I hope it will nearly extinguish & whatever is drawn from it afterwards to be divided at the end of each year among the partners.[181]

Hamilton had hoped that they would have cleared off the delftware by that March, had his plans been followed 'with the same vigour that was intended'[182] and Watt thought he had 'acted very prudently with respect to the delftware and hope we shall see the end of it'.[183] They had changed their production just in time because, by 1786, the manufacture of English creamware had all but extinguished the production of British delftware.[184]

The other problem was that Nivien junior had proved to be a failure. In the letter quoted above, Hamilton told Watt of his dismissal and his replacement with Robert Finlay whom Hamilton hoped would assist in the sales.[185] All this was revealed partly through the elder Nivien getting into some kind of financial difficulties.[186] Watt was sorry to hear about Nivien's misfortunes.[187] Nivien junior, although in debt, managed to retain his share until it was sold in August 1783.[188] Hamilton intended to purchase it and divide it among any other partners who wished to increase their holdings.[189]

It had become obvious to Hamilton and probably to the other partners that the Company needed better management. Accordingly, when Nivien's failure was announced, it was resolved that two of the partners should 'attend at the Delftfield once a fortnight to enquire into the business' and to report back to the other partners.[190] Hamilton's report to Watt after the annual meeting in the summer of 1781was much more optimistic:

> I think we are now coming upon a better plan than we have been before — the Committee attended regularly once a fortnight which I think will be of great use & we are erecting another kiln by which we will be enabled to do near double the quantity we used to do & at very little more expence than we are at present, so that I would flatter myself it will at last turn out profitably— The profits last year were above £700 from which we placed about £400 to the credit of the Buildings as by investigating the cost & value we found they had been charged nearly that sum more than they ought — We made a dividend of 3½ p Cent besides one Interest & the remainder entered into a stock Account to serve as a sinking fund for making good any debts that may prove bad or which may appear at present a little dubious Delftware is greatly decreased from the quantities we have exported, part of which has been taken & we have recovered by Insurance & part which has gone safe has come to a tolerable good market —What remains is at present rated at 50 pr cent under the selling price — The stone ware on hand is rated in the Inventory 25 pr cent under the selling price which are lower valuations than ever were used before, so that I think all things being taken into account, there is a prospect of making something handsome in future — Indeed for these 3 years past we have been working like moles, all that was gained going to make good parts which had been too highly valued.[191]

The new kiln was finished towards the end of August and replaced the earlier one for delftware so that Hamilton hoped that this would be reflected in increased profits the following year.[192] Manufacture of delftware must have entirely ceased. Watt approved of Hamilton's actions in revaluing the buildings and, especially, the stock because he had often objected that this was costed too highly.[193]

While the Delftfield was beginning to take a turn for the better under the capable guidance of Hamilton, who was hopeful 'it will turn out profitable in a year or two',[194] Watt found himself in a financial crisis at Birmingham. Boulton's partnership with John Fothergill in the Soho Manufactory had proved unsuccessful, incurring a loss of upwards of £11,000 up to 1780.[195] Boulton had supported this business partly by the profits of his partnership with Watt and the steam engine. Watt had entered into some financial security over the engine patent dues and feared that he might be drawn into bankruptcy should Boulton's affairs collapse. If this were to

happen, Watt wanted to see that those who had put up the money to purchase his original part share in the Delftfield would not suffer, and wrote to Hamilton in July 1782:

> I have ever since I was obliged to enter into this security been a prey to the most cutting anxiety. I have been able to enjoy no pleasure [...] I have not been able to attend with perspicuity to any business — As sinister accidents may happen I think it my duty to provide for my creditors in Scotland which are a few and therefore wish to assign to you in trust my property in the Delfthouse for the purpose of paying such debts as I owe in Scotland.[196]

Hamilton sent the deed in August and from it we learn that the Delftfield capital was valued at £4,800 and Watt also had 'free stock' at £420.[197] There is no mention of any money involved in the transaction, possibly because some of the Delftfield assets were tied up in land and buildings.[198] Watt was still indebted to Agnes and Betty Millar for £210, about £100 to William Craig and 'a sum to Mr Muirhead'. He wanted the Miss Millars to be paid first should the worst happen.[199] From Watt's point of view, it was fortunate that Fothergill died in 1782 and a settlement reached with Boulton in July 1783.[200] In the meantime, Watt was reinstated as a partner at Delfthouse because Watt 'apprehend[ed] my great danger of my affairs is over'[201] but there is no mention of his debts being paid off. The partners at this time were given as 'Robert Dinwiddie, Robert Muirhead, David Nivien jnr., Robert Dunmore, Robert Donaldson, Laurence Dinwiddie, Gilbert Hamilton and James Watt'.[202]

Hamilton expected a favourable result for 1781:

> The Delftfield goes on pretty well & I am hopefull this Year will turn a pretty good Balance, of which I shall advise you in my next, with anything that occurs about that Business at our General meeting — I believe I shall next year take the charge of the Books & the correspondence — The Manufacture I think cannot be in better hands than Wm Youngs.[203]

Hamilton meant that he would act as the accountant and secretary from the meeting in May 1782. He regretted he had not done so earlier, because he found the business 'has been much neglected' and the balance turned out 'very trifling'.[204] In the next few years, Hamilton sought as much assistance as possible from Watt, which must have helped to turn the business round and make it profitable. William Young had also turned out to be a good manager at the beginning.

Prospects looked brighter at the start of 1783, because there was peace after the American War of Independence and, as James McGrigor, Watt's second father-in-law, put it, 'the Company has made some very considerable improvements' and he therefore expected that it would do better.[205] He was correct, because Hamilton told Watt in about 1782:

> As to the Delftfield it has turned out much better than I expected, having this year besides paying our interest divided 17½ pr ct. There is a sum too large to expect will be always the case & indeed I should be content with the half of it — We do not draw out that money from the concern but it is added to our stock, & am happy that you still hold your share with us & continue a partner.[206]

1783 proved to be even better and Hamilton could inform Watt:

> Though the former year was very good this has still turned out better as we have encreased our stock acct 25 pr cent so that your stock there now stands at £612.10.– & a sufficient allowance made for bad debts. — We have given Mr Young a small share of £200 He has been very attentive & careful & deserves it very well & have no doubt of its being for the advantage of the Company — We must however keep our profits entirely to ourselves as if they were known it would only serve to raise up rivals to us who might spoil the business to both.[207]

Giving employees a share in the business has a long history! Also we may note the desire for secrecy but, through Hamilton's letters to Watt, we have some knowledge about the financial state of Delftfield over many years. We have no news of what happened in 1784, but 1785 was not so good as some earlier ones, through failure of the American market. After 'setting aside a sum to answer for bad debts, we added £60 to each share from the Profits so that your share now is £800, so that on the whole it has turned out tolerably well'.[208] This was when the steam engine business of Boulton and Watt was beginning to make a profit and it is possible that Watt relied on the income he received for Delftfield up to this time.

But at the annual meeting in 1786, terms for a new partnership agreement must have been discussed, and a majority of the partners thought that Watt would decline further involvement because his interests in England would allow him little time to help Delftfield.[209] It is from Watt's response to Hamilton that we again learn about the role Watt played in the early development of the Company:

> In relation to the Delftfield Company I am certainly very far from wishing to get out of the concern, particularly now when I have money to spare, and have a rising family to come of whom a share in an established business might be usefull. I have this last week a letter from Bobb Muirhead in which he says that the majority of the company were for my going out, on account of my distant residence & my being able to be of no service to them in the management of the business all of which is true and reasonable; but on the other hand, In the beginning of the business & while it was in my power I took much more pains with it than my share in it demanded & I have run all manner of risques while it was in an unprosperous situation. I do not wish to magnify these matters, nor will I continue in the concern if the majority of the Partners wish to the contrary. You will please therefore to lett them know that it depends entirely on their pleasure whether I continue longer in the concern or not, & that I should not complain if they determine in the negative.[210]

Presumably the concept of a sleeping partner had not developed at this time when all partners were liable to meet any debts incurred by the others. Once again we see Watt putting the onus of the decision onto the other partners. We do not know what discussions took place behind the scenes between June 1786 and April 1787 but, during that time, Watt endeavoured to suggest markets in Russia and on the Continent. This may have helped persuade some of the partners in Glasgow that he could provide valuable contacts. Hamilton dropped the hint to Watt that, in spite of his other business commitments, he ought to find time to help Delftfield. Watt replied:

> In relation to the new partnership I know not what to say as our business rather increases than diminishes — my health does not mend & I feel very sensibly that I grow old I should be wrong to

> promise that I should be able to bestow any great share of attention on the business but partner or not I shall certainly lend any assistance in what concerns sales & if furnished with several sets of patterns some customers might be had here. I thank you & the Company for your kind attention & shall leave the matter entirely to you & them & if a more desirable partner should occur I shall very willingly go out otherwise shall continue on the terms you mention so long as they chuse.[211]

This must have convinced the other partners and Watt was included by an 'Act of Sederunt' in the new co-partnery with the same one-twelfth part of a share as he had had in the former one.[212] Hamilton sent Watt the deed to sign in April 1787 when: 'The Truth is there is now none of the Company but wish you to remain & think you might be of great service'.[213] This contract was to run for 19 years but Watt was assumed onto it only for two, after which he might renew.[214] In fact, Watt was to remain a partner for the rest of his life.

Although Watt's letters to Hamilton are preserved in his out-going letter books, they contain little about Delftfield over the next few years, while those from Hamilton have not survived. Possibly Hamilton had no problems or difficulties to report. In July 1789, Hamilton had not balanced the books but hoped the figures would turn out tolerable. Also Young had been busy with some considerable orders that summer.[215] Watt executed another bond during the summer of 1789, perhaps confirming him as a partner.[216] The younger Robert Dinwiddie died in September 1789 but the archives make no mention of his being replaced.[217] In December 1793, there was some correspondence about Watt lending Robert Muirhead £1,000, partly on the security of the Delftfield or buying his share, but we do not know the details.[218] Robert Donaldson may have sold his share at the same time but the name in the record is illegible.

Hamilton must have sent Watt some information about progress at Delftfield but we have only Watt's comment in January 1796, 'I thank you for your information about the Delftfield which I hope will do still better upon peace'.[219] That April, the company had been doing well and Watt hoped that it would improve its profits.[220] Hamilton was hoping to draw up the balances at the end of 1797 which he expected to finish in a few days. Once again he asked Watt to keep quiet about it for fear of their rivals learning how well they were doing. Watt received not only the dividend as a partner but also interest on money held as a loan:

> It appears to turn out very well & think I can promise you 15 pr C beside your interest — I am very cautious in saying anything about this business here, & always mention it as a triffling thing, in which light I believe it is commonly looked on, & am glad of it, because if we had a rival here, it would cut it down altogether, & indeed without doing our rival much good, as our profit depends entirely on selling a considerable quantity, & we can make as much as this market can take off, but if we had only half of the sales, it would scarce be worth the following.[221]

Hamilton's foreboding about competition would prove to be correct a few years later. From Hamilton's next letter, it seems that Laurence Dinwiddie must have died and his share had to be paid off. His family withdrew their other loans at the same time. Also the dividend on the shares worked out at 16%:

> Our Delftfield books are now balanced and we shall divide 16 pr. cent on our Capital — From paying up Laurie Dinwiddie's share & extending our Work has reduced our cash more than it used to be, and last week I had a demand made for all the money to be lodged with us by his friends viz

> £500 to Miss Coulter & £420 to his sister, which I instantly paid up which has put me to an advance, though I think the Work will soon repay it — Both these sums were lent to the business before I was in it, & I see the latter has been in it from the date of the bond for 28 years — We have now very little borrowed as we have been gradually paying it off since I took the management of it whenever we could spare it.[222]

It may be that Hamilton was trying to bring control of the company into the hands of his own family or relations by paying off other creditors. Hamilton had better news in March 1799, for trade seemed to be flourishing, 'The Delftfield has turned out exceedingly well & as you will wish to include it in your general state, the interest at your Credit there for last year is £119 & the profit £200 which is more than ever it was before, but our sales last year were very great'.[223] The next mention of Delftfield was even more encouraging, because in January 1801 Hamilton had just balanced the books and found the business had done better than ever. Watt was credited with £300. Hamilton hoped it would continue to do well 'notwithstanding the opposition we are to meet with'.[224] Watt was well pleased with the result and agreed that Hamilton's son, Archibald, should join the company as a partner, but this did not happen at that time.[225] The opposition must have come from the Caledonian Pottery which was set up in the northern part of Glasgow and, by March 1802, it had become well established. Watt thought that Delftfield should go into the manufacture of blue and white ware and that they would have 'to make some exertions otherwise we may lose the trade altogether'.[226]

It was proposed that the Delftfield Company should buy up their rival in 1803. Watt approved, provided the terms were favourable:

> I should think it right to purchase the new pottery if it can be had on terms you think it worth but I would not go far beyond that as it would incline the public to think our trade very profitable & probably might produce another opposition & then caution must be used lest they employ somebody to bid it up and enhance the price upon you. Whatever you and the rest of the partners do, I shall agree to on my part.[227]

This other pottery had not been purchased by the following November when Watt suggested buying it at a public sale to obtain its true valuation, but this also came to nothing. At the same time, Watt must have had to declare his interests in companies for a property tax, which of course included Delftfield. In his declaration he named Gilbert Hamilton, Robert Muirhead, William Young, Robert Hamilton and himself as partners,[228] showing that Delftfield had been taken over by Watt's relations and their manager.

At the beginning of January 1806, Young was so busy packing up goods that he had been unable to settle the books.[229] That April, Hamilton reported that sales had not been as good as the previous year. Young had omitted to enter some considerable invoices so that the profits were artificially inflated. He told Watt:

> As the Balance of Profits after paying interest was in this way reduced to about £400 we thought it better just to let it stand until next year when if the sales go on as they are just now I hope we shall have a good dividend. The sum that now stands at the credit of your stock account is £11:00, & at your Acct. Curt £3964.1.–.[230]

Watt's current account was probably a form of loan over and above his partnership account.[231] There was a further threat of a rival that summer through a Mr Turner from Staffordshire coming to Glasgow to set up a china works, although with this product he would not directly compete with Delftfield.[232]

In 1807, Young was once more so busy that he had not drawn up a balance but Hamilton expected 'from the quantity sold this year I think it should turn out well'. Once again we have no figures.[233] However 1807 must have been a bad year because Robert Muirhead had been calculating 'upon a couple of hundred pounds from the Delftfield for this years profits & interest which I intended for my expenses in England this spring our balce. neither gives profit nor interest but lands us in debt'.[234] In 1808, Watt queried a payment in his accounts of £166 10s 0d by the Delftfield[235] and Hamilton's reply also suggests that trade the previous year had not been so good, 'The interest from the Delftfield Compy was not paid up to any of us last year but it will come to your credit afterwards'.[236] This was the last of Hamilton's letters to Watt about the Delftfield since he died at midnight on 30 November 1808.[237] Muirhead was only too well aware what this loss would mean to the Delftfield as well as to himself. He acted quickly and told Watt:

> Our Delftfield affairs will want a strong support by our loss of GH and it will be absolutely necessary that some respectable business man be assumed a partner here to take the managing part which Mr Hamilton had, by the advice of the partners here I have spoke to Mr James Black our present Lord Provost for that purpose & he has agreed join us, if your approbation meets this measure, of which write to me in course: from my knowledge of the opinion Mr. Hamilton had of Mr Black I suggested his being applied to & I dare say you will hear no objections.[238]

This time Watt was too old to play any leading role but Muirhead, being on the spot, assumed the position as main partner with Archibald Hamilton, another of Gilbert's sons, taking his father's place as partner and secretary. Watt wrote agreeing that Black should be approached, hoping that then they would be able to make saleable goods.[239]

Muirhead's attempts to find a strong leader failed because Black declined the offer. Muirhead had shown him the balances for the years before Hamilton's death which were favourable except for one. But the last year had not turned out so well as had been expected and Black must have thought the concern was not as prosperous as had been represented.[240] Muirhead proposed looking for someone else but his suggestions seem to have met with opposition from Archibald Hamilton, who does not seem to have got on with the older man. His father had probably invested about £4,000 in the Company, and Archibald may have thought that he ought to have become the senior partner and was hurt by Muirhead's conduct.[241] However, he did not possess his father's business acumen.

Their problems were compounded through trouble with their manager, Young. Hamilton had proposed increasing Young's salary[242], to which both Muirhead and Watt agreed.[243] But the proposal by Young that his son should be made a partner met with a refusal by both the others who remembered all too well the near disaster over Duncan Nivien. Muirhead refused to countenance 'adopting partners whose character and disposition cannot be sufficiently fixed'.[244] This may have been the start of the troubles with Young. Muirhead, having taken over the direction of the Company, wanted to make it profitable. His proposals must have been rejected by Young who was of course a partner. Muirhead reported to Watt, 'I am sorry to say that Wm Young seems to sett his face against any of our intended schemes particularly the shop & you know if a manager does not heartily concur in everything proposed for the benefit of the concern

it will not succeed'.[245] In 1806, the Company had been importing wares from Staffordshire to supplement their own production and possibly it was hoped to extend this trade with the addition of a retail shop.[246]

We have seen how Young had not been able to balance the books through packing up orders and how some invoices had been apportioned to the wrong year so he may not have been keeping proper accounts. Muirhead now found other discrepancies:

> The contract is not yet found & I am sorry to inform you that the balance is nearly as unfavourable as last year, altho we had every reason to expect the contrary; after investigating the books very closely there appears a degree of confusion in the manner the business is conducted that I cannot reconcile to good management & how to rectify it I am unable. Robt Hamilton is here just now & giving his assistance to putting things in a proper train but we must adopt a very different system to be able to account for our want of success and be able to remedy our affairs in future. I have not a doubt that the business if properly managed must make money & we have made a good deal in it therefore we need not be discouraged.[247]

Watt's reply shows how he suggested remedying the accountancy side and also his hopes about markets. Once again we find a lack of direct involvement in the day to day running of the Company by its senior partners:

> I am sorry to find by yours of the 29th ulto that our Delftfield affairs are not in a more prosperous state though I scarcely expected it... I fear however that the radical defect lies in our manager who was brought up in slovenliness & continues ?...? to his education... As far as relates to the accounts the oftener they can be overhauled the better, as much mischief arises in business from neglect in that point as in any other, for people seldom like to go on in a losing way when they know they are doing so, at least if they have the power to remedy it. Much may be known from the weekly amount as to the quantity of ware made and its cost, to which if the general expenses of the business is added a good notion may be formed of our progress. If however the losses arise from want of sales they cannot be remedied in this way, but by making better ware & thereby commanding the home market, which is always the best. I was in hopes that the American market would have been opened again but I know not now what to think of it. These people seem to be willing to put out both their own eyes in order to put out one of ours. I think however that folly must have an end & not improbably may terminate in the subversion of their present constitution. I was also in hopes of a greater trade being opened with new Spain than has taken place but that people must be organised and our present connections with the mother country prevent us from setting them free.[248]

Business continued to languish throughout the summer of 1809.[249] The position then became more complicated through the acquisition of the Caledonian Pottery. Muirhead informed Watt on 22 February 1810:

> You would be advised that we had purchased the Works at the head of the Town for £6,000 besides the stock on hand & materials at about £1000 [...] took possession last week & soon [...] setting & making better ware than [...] at the Delftfield; it is intended to carry both on for some time & see which turns out best, by Mr McKenzies report I hope we will have some profit this balance & by his conduct I think it may yet be a thriving concern.[250]

Watt had not been kept informed and thought that they paid more for it than if they had purchased it earlier and told Archibald:

> I have no doubt you have made a judicious bargain which will enable you to dispose of our valuable property upon the River & perhaps be in other respects as good a situation besides being quit of a rival Mr. Muirhead advises me that for a time you keep on both works which I think very judicious & may by emulation tend to the improvement of the whole. I shall be glad to hear at your convenience how both works go on & under what management you have put the upper works, also how you mean to provide for payment of it.[251]

Watt wrote to Muirhead in the same vein and was pleased to hear that the concern was likely to be profitable despite trade being poor.[252] The price for the new pottery did not have to be paid immediately, but by instalments.[253] Its cost was expected to be met by sale of the old site by the river.

Young may have continued to manage the Delftfield site, where the partners in 1811 were Robert Muirhead, Archibald Hamilton, William Young, James Watt and Robert Hamilton,[254] while Daniel MacKenzie, who had been employed for six months by the following April, looked after the Caledonian Pottery.[255] Young is not mentioned in the correspondence again until 1817. Ways of paying MacKenzie had not been resolved in 1810:

> Mr McKenzie has taken Credit for £200 for management at 31 Decr. This I propose objecting to as the partners were not consulted, and it was done without the approbation or knowledge of any of them — Mr Muirhead alone had been spoke to but he was of opinion that a pr centage on the profit was a better plan than a fixed sum in which I agreed; and it may be observed also that Mr McKenzie was employed only six months.[256]

Watt thought a percentage on the profits would be a better way of rewarding MacKenzie of whom he had formed a high opinion while he was a 'Tradesman'.[257] His position was still not clear a year later, 'as no arrangement was ever made respecting his change of management; which was done last year without any authority, or even consultation, contrary to Mr Muirheads opinion and my own, as I advised you'.[258] But he carried on being manager and eventually took over the business.

There was also the problem of a lost contract. This was probably something to do with the terms of the partnership[259] but it may have referred to the terms on which Delftfield held the land it occupied. A dispute had arisen by November 1809 over the strip of land between the Delftfield buildings and the river Clyde.[260] The Company had been dumping its rubbish on the river bank here for some years and so increasing it.[261] But in 1797, the trustees of the river Clyde had decided to improve its banks and extend the Broomielaw quay to a point beyond Delftfield.[262] They paid £2,172 10s 10d for the part opposite Delftfield, which of course the Company claimed.[263] If this land were owned by the Company, it would give them a very valuable property with a good river frontage but it was also claimed by the Merchants' House of Glasgow. Both sides sought legal advice.[264] We have seen that the original terms of sale did not include the road along the river bank but Watt thought that the Company owned it and that the clerks of the Merchants' House were wrong.[265] However it would seem that there were deficiencies in the plans to show what had

been conveyed to Delftfield.[266] Muirhead was confident that they would win their case and the arguments continued for a long time.[267] Then in April 1811, the arbitrators decided against the legality of Delftfield's claim[268] and Watt feared they 'must submit to that as well as to other evils'.[269] The case dragged on for another few months with the Delftfield finally being offered £550[270] for their claim and as compensation for loss of entry to their works.[271]

At first there was optimism that the old Delftfield works would be sold quickly, as it was a prime property, and that it would fetch around £8,600 after deducting the value of the Waterside ground.[272] Muirhead did not receive any offers during the summer of 1810 but this may have been because they could not vacate the property for some time.[273] An offer of £6000 for part of the property that autumn came to nothing and this situation continued over the next couple of years partly through a trade depression, and partly through the river wall being only finished in 1813.[274] In 1814, a offer of £2,000 below its valuation was made and must have been refused. Then, in 1817, James Watt junior put in an offer because he was considering setting up a branch of the Boulton & Watt steam engine business in Glasgow. The partners must have agreed to his suggestion of 6,000 guineas although there had apparently been another bid at £7,200. Muirhead commented, 'I think it is a great bargain and regret that we shd. have paid as much for where our present works are and not 1/4th of the property in extent'.[275] The conveyances must have been made out that May[276] when the sale was completed.[277] Watt received £699 11s 6d as his share.[278] Watt turned this transaction to his own advantage because he had lent the whole of the purchase price to James Watt junior at 5% interest![279]

The partnership may have been reorganized at the time of the purchase of the Caledonian Pottery, with a new partnership being formed for this site, leaving the old one intact to wind up the sale of the riverside property. This could explain Archibald's writing to Watt:

> The Books of the Delftfield Co are now balanced for year ending 31 December 1809 and herewith enclose a State of your Account in these Books — Your Stock in the Sd Coys Books 31 December 1808 was 4/36 of £9,900 — say £1100, but as the houses ground etc reclaimed, with the Bad Debts deducted, amounted to £6094.15.7, which was taken off, there remained £3805.4.5 of actual stock your proportion of which £422.16 was transferred to your credit in new Company, where your share is 5/36 of the nominal capital of £9,900 and called up; and you retain the 4/36 of the property of the old Company standing at £677.4/– the price of the new Pottery is not required for sometime and it is expected the instalments may be made at such dates as to require no advance, particularly if we can get any part of the old ground sold this year or next.[280]

According to Archibald, Watt's balance in January 1810 was £5,674 4s 3d.[281] Watt thought this ought to be £5,899 7s 9d. He noticed that Archibald had charged himself with interest at 5% whereas his father had allowed only 4%. This is the only definite indication we have of interest rates being charged and paid. Watt wanted to see a copy of his account to check the figures.[282] 1810 was a bad year. Archibald was afraid there would be little to be divided, partly owing to the extra expense of running two factories and he was having second thoughts about the wisdom of their acquisition.[283] By April, Muirhead was forming the same opinion but he remained optimistic, 'No doubt the times are very unfavourable & I hope they are at the worst. we think confidence is returning'.[284]

While there was a lot of business before Christmas,[285] 1811 turned into a year of heavy losses and Muirhead trusted that they would never have another like it.[286] In February, Archibald estimated that the deficit might reach £2,000[287] and reported in May:

> Mr. Muirhead would inform you the heavy loss sustained by the Delftfield Co last year being £60 pr share off our stock, this upon your 5 shares is £300 — the amount of interest placed to your credit at 31 Decm on your stock is £54.5.10 and I have received on your account £200 — being interest on your Bond I hope this year will turn out pretty well, having had some considerable Orders for the West Indies and the expences etc of the Manufactory being brought within some bounds — trade however in general here is far from being good and not much prospect of its mending.[288]

The old Delftfield site had been closed down. Watt had to ask Archibald for his annual account towards the end of January 1813 and this seems to be the first sign of Archibald's incompetence in business.[289] Further requests followed over the ensuing years, with, for example, Watt complaining in January 1815 that he had received no accounts for two years, and then still nothing by that May.[290] Later, Archibald moved to England, having given up his affairs in Scotland. Despite these problems, business was looking up and Delftfield did well in 1812 which Muirhead reported in February 1813.

> We have this year sold £12,000. of goods which realy astonishes me as most of the sales have taken place since the American ?ports? were shut but this has not turned out so favourable as might have been expected owing to a great part of the goods not being of the best kind & therefore sold low we have however cleared ourselves of most of this kind & our inventory is only about £2700 — our profit this year will ?...? £900 or £25 pr share.
>
> I must also mention that our ware is much improved & I should imagine the concern will again do well.[291]

This was unexpected good news to Watt. He also hoped that the Baltic trade might soon be opened and replace the American market.[292] The following year also promised to be a good one. That November, Muirhead reported that 'Danl McKenzie what with crockery, & soap, & candle is so busy that he has hardly time to say his prayers'.[293] All the old ware had been sold and they had orders for more than they could make.[294] Yet the results were disappointing:

> Mr McKenzie has now balanced our books of the Delftfield & altho our sales have been very considerable indeed, I do not think the profit is such as I shoud have expected. It is about £45 pr 36th share — I wish he had agreed to purchase more English goods when our orders were so expensive; when Mr Bob Hamilton was here he clearly showed from the difference of dozens & other circumstances a profit of from 20 to 25 p ct...following his instructions but we might have divided £1000 more that year if this had been done sooner.[295]

Eventually Watt received his accounts from Archibald which showed £200 for 1813 but apparently nothing for 1814.[296] 1814 had turned out well, news which Watt heard from Robert Hamilton, who hoped:

> now they have got into the way of making it profitable that it will continue so. he [Mackenzie] says they have had no orders of consequence this year which I am rather surprised at, as there has been a very great demand for goods here [his pottery at Stoke on Trent].[297]

Robert Hamilton later commented on the confusion of his brother's accounts which would cause him to lose his position as banker in Glasgow on behalf of the Bank of Scotland.[298] But Robert Hamilton's hopes for the business did not last long. It was not until March 1816 that Watt was told about the problems of 1815. He received £200 due as the interest on his bond for £4,000 but then MacKenzie told him:

> I am sorry to inform you that from the pressure of the times Four of our principal Customers have been obliged to suspend their payments — they are owing us about £5000 — from the present prospects however, we expect that the loss upon the whole will not be very considerable — I have just balanced our Books up till the 1st Jany last — when there appears a balance in our favor of £1260.3.9 — I have shewn this state to all the Partners here, who agree with me in recommending that this sum should be carried to the Credit of Suspense Account in the hopes that it will make good any Loss that may occur in the recovery of these debts — this I hope will meet with your approbation.[299]

During 1816, the pottery industry did badly throughout the country, for Robert Hamilton commented that many people were out of work[300] and MacKenzie said that they had had 'very little business this last year, and our stock of goods is increasing on our hands but we must just wait till some revival take, as the depression has not been confined to any one branch of business'.[301] One advantage of having money on loan was that Watt was still paid his interest on it, but there is no mention of any payment on the shares. In 1817, sales were down to one half of the previous year's. Archibald was to leave for England. Young had been in poor health all winter and needed somebody to assist him. Muirhead, who was 70, wanted to discuss the situation with Watt and Robert Hamilton[302] and saw Watt in Birmingham in April 1818.[303] Once again Watt's £200 interest was paid but they had done little business in the past year and stocks were increasing on their hands. The trade depression was general and not just confined to the pottery industry.[304] Watt had received a letter from a C D Donald of Glasgow complaining about his treatment at the hands of the company:

> I know that you are already acquainted that I have for nearly ten years past acted as the agent for the Delftfield Company here and I have never yet learned from any of the members of the company that my exertions did not give them satisfaction— your friend Mr Muirheid has for some reason totally inexplicable to me been endeavouring by every means in his power to take away the business of the Company from me and give it to his own man of business a Mr King who is totally unknown to all the rest of the Company except perhaps to Mr Mackenzie who has no interest in the old concern... Mr Muirhead with less than a seventh part of the concern is not only to dictate to the Company who they are to employ but is to throw out a man of business who has long served them with fidelity and attention.[305]

We have no other details about this dispute but it shows Muirhead's share as only one-seventh.

Archibald's move to England caused him to wish to withdraw his money from Delftfield.[306] Watt was violently opposed to breaking up the partnership in this way unless Archibald could find someone willing to take his place. Such a person must be someone who understood the business both as regards manufacture and sales.[307] In view of the opposition from Watt and

probably other partners, Archibald would consult with Muirhead and MacKenzie to 'endeavour to get the Business put under better management'.[308]

Early in 1819, Watt sent instructions about paying the interest on his bond to various people and enquiring about the state of the Company. He was sorry to hear that sales had been 'so defective this year, but we must be content to bear our share of the present bad trade & hope for better times'.[309] MacKenzie told him that sales had 'not amounted to Seven Thousand pounds, so that we may lay our account with a loss ... Our customers that used to ship largely have been doing no business'.[310] Muirhead was equally gloomy about the losses:

> I am sorry to say my loss in this concern the last three years is upwards of £500 & yours in proportion There is no doubt that money is to be made in the Pottery but to do that we must sell goods & it is the deficiency of sales that we are the loosers by. I have for some time been both myself & some friends looking out for an active ?...? man who woud take a share & management of the outdoor business but hitherto without success. I understand from Mr Mackenzie that a person has been inquiring if we wd dispose of the concern intirely which I heartily agreed to & dare say you will have no objection, but I doubt the applicant wants the needfall to the amount we wou'd require. If such a Purchaser coud be got I woud rather prefer giving up the concern entirely than continuing at my time of life with a new Partner & new management. Our present manager Mr McK altho a most excellent book keeper is no salesman & there is our loss. however we must still be on the outlook.[311]

Having first received this letter from Muirhead and then MacKenzie's reports about the losses, Watt was equally gloomy about future prospects.

> The Delftfield concern seems hopeless of doing good under the present circumstances and as we seem unable to mend them I agree with you that it will be prudent for some of us to dispose of the concern, or of our shares as soon as we are able to find a purchaser for like you I have no desire to engage with new partners and my son has enough upon his hands. I shall write to Robt Hamilton upon the subject perhaps he may be able to help us to a customer for the whole [...] of the concern.[312]

This was Watt's final letter about Delftfield. He died on 25 August 1819. He must have been saddened to see the Company which he had done so much to promote in his early years running into such difficulties. Young died in the following year leaving Muirhead and Mackenzie to carry on. Muirhead retired in 1823 but MacKenzie continued to operate it until 1826 when it ceased to exist.[313]

NOTES

Abbreviations

B&W Col Boulton & Watt Collection
JWP James Watt Papers
Boulton Matthew Boulton Papers
NLS National Library of Scotland
SRA Strathclyde Regional Archives

1 Robinson & McKie 1970, 8, Letter 2, J Watt to J Black, 15 February 1768.
2 Kinghorn & Quail 1986, 11.

3 Kelly 1993, 44.
4 Ibid, 43–4.
5 Smeaton, *Designs*, Vol VI, f 54.
6 See *The Glasgow Journal*, 29 August–5 September, 5–12 September and 26 September–3 October 1765.
7 Ibid, 1–8 May 1766.
8 SRA, B10/15/7148, 'Disposition Patrick Nisbet to Trustees for the Creditors', 25 March 1765.
9 Quail 1981, 45.
10 Weatherill 1971, 14, n.
11 Robinson & McKie 1970, 10, Letter 3, J Black to J Watt, 19 February 1768.
12 Weatherill 1971, 10–14.
13 Ibid, 13.
14 Copeland 1972, 6.
15 Reilly 1992, 41.
16 Robison 1803, Vol I, 11.
17 Ibid, Vol II, 191–6.
18 Quail 1981, 47.
19 JWP, JW/19.44, 'Miscellaneous Salt & Other Accounts, 1733–1771', From J Muirhead, 30 December 1762.
20 Dickinson 1935, 29.
21 Kinghorn & Quail 1986, 39.
22 Bryden 1994, 16 lft.
23 Kinghorn & Quail 1986, 21.
24 Ibid, 23.
25 Dickinson & Jenkins 1927, 20 See also Fleming J A, 1923, Scottish Pottery.
26 *The Glasgow Journal*, 1–8 May 1766.
27 JWP, Letter Book 1, 176, J Watt to R Muirhead, 17 June 1786.
28 Ibid, 174, J Watt to G Hamilton, 18 June 1786.
29 Ibid, 4/7.11, J Watt sen to J Watt, 4 February 1768.
30 Robinson & McKie 1970, 12, Letter 5, J Watt to J Black, 20 April 1768.
31 JWP, 3/41.3, Pigott to J Watt, 6 June 1768.
32 Ibid, 4/7.8, J Watt sen to J Watt, 6 May 1769.
33 Ibid, C3/4, 'Journal', 16 February 1779.
34 Ibid, C3/5, 'Journal', 16 & 30 October and 27 November 1779.
35 Ibid, 4/15.12, D Nivien to J Watt, 25 February 1779.
36 Ibid, W5, J Watt to D Nivien, 29 April 1779.
37 See Quail 1981, for further details about Watt's dealings with Wedgwood.
38 JWP 6/36.41, J Watt to J Wedgwood, 19 February 1782.
39 Ibid, 6/27.20, J Wedgwood to J Watt, 25 February 1782.
40 Ibid, 6/36,39, J Watt to J Wedgwood, 19 May 1782.
41 Ibid, 6/27.18, J Wedgwood to J Watt, 9 May 1782.
42 Ibid, Letter Book 1, 2, J Watt to J Wedgwood, 19 May 1782.
43 Ibid, 1, J Watt to J Wedgwood, May 1782.
44 Ibid, 6/27.17, J Wedgwood to J Watt, 15 May 1782.
45 Ibid, 6/27.14, J Wedgwood to J Watt, 27 December 1782.
46 Kelly 1993, 47.
47 Kinghorn & Quail 1986, 23. See *The Glasgow Mercury*, 13–20 & 2–27 June 1782.
48 JWP, Letter Book 1, 201, J Watt to G Hamilton, 21 April 1787.
49 Ibid, 6/36.21, J Watt to J Wedgwood, 7 April 1787.
50 Ibid, 6/27.4, 'Accounts of Clay for Delftfield', 1787.
51 Ibid, Letter Book 1, 233, J Watt to J Wedgwood, 11 February 1788 and 6/36.4, J Watt to J Wedgwood, 11 February 1788.

52 Ibid, 6/27.1, J Wedgwood to J Watt, 14 February 1788.
53 Ibid, Letter Book 1, 264, J Watt to G Hamilton, 29 October 1788.
54 Ibid, 267, J Watt to J Wedgwood, 12 November 1788.
55 Ibid, Letter Book 2, 161, J Watt to G Hamilton, 10 August 1794.
56 Quail 1981, 48.
57 *The Glasgow Journal*, 9–16 June 1768.
58 B & W Col, MI, 1/19, 'Journal', 22 August 1772.
59 Ibid, 5 September 1772.
60 Hills 1994, 178–9.
61 JWP, 4/43.24, G Hamilton to J Watt, 21 August 1783.
62 Ibid, 4/43.29, G Hamilton to J Watt, 15 March 1784.
63 Ibid, 4/43.32, G Hamilton to J Watt, 20 October 1784.
64 Ibid, 4/43.39, G Hamilton to J Watt, 1 January 1786.
65 Ibid, 6/36.32, J Wedgwood to J Watt, 14 January 1785.
66 Ibid, 6/36.43, J Watt to J Wedgwood, 12 January 1786.
67 Ibid, Letter Book 1, 159, J Watt to G Hamilton, 8 January 1786.
68 Ibid, 168, J Watt to G Hamilton, 23 April 1786.
69 Ibid, 4/43.41, G Hamilton to J Watt, 3 May 1786.
70 Robinson & McKie 1970, 11, Letter 4, J Watt to J Black, 1 April 1768.
71 Reilly 1992, 17.
72 Turnbull 1997, 144.
73 Ibid, 144 and NLS, Ms 5098, f 49, Erskine Murray Papers.
74 Robinson & McKie 1970, 8, Letter 1, J Black to J Watt, 10 January 1768.
75 NLS, Ms 5099, Erskine Murray Papers, J Watt to Ld Barjarg, 14 March 1769. I wish to thank Mrs Jean Jones for drawing my attention to this letter.
76 Turnbull 1997, 150.
77 JWP, C3/6, 'Diary, June 1780–1782'.
78 Ibid, C3/10, 'Common Place Book', 30.
79 Ibid, 3/18, J Watt to J Wedgwood, 10 February 1782.
80 Ibid, Letter Book 1, 1, J Watt to J Wedgwood, 4 May 1782.
81 Ibid, 6/27.18, J Wedgwood to J Watt, 9 May 1782.
82 Ibid, 6/27.14, J Wedgwood to J Watt, 27 December 1782.
83 Ibid, Letter Book 2, 16, J Watt to G Hamilton, 18 September 1789.
84 B & W Col, MI, 1/15, 'Journal', 8 August 1770.
85 Ibid, 1 September 1770.
86 Ibid, 17 September 1770.
87 Ibid, MI, 1/17, 'Journal', 31 October 1771.
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NLS, Ms 5098 & 5099 Erskine Murray Papers

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