

MATTHEW BOULTON
AND THE SOHO MINT:
COPPER TO CUSTOMER

by **SUE TUNGATE**

A thesis submitted to The University of Birmingham
for the degree of

DOCTOR OF PHILOSOPHY

Department of Modern History
College of Arts and Law
The University of Birmingham
October 2010

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ABSTRACT

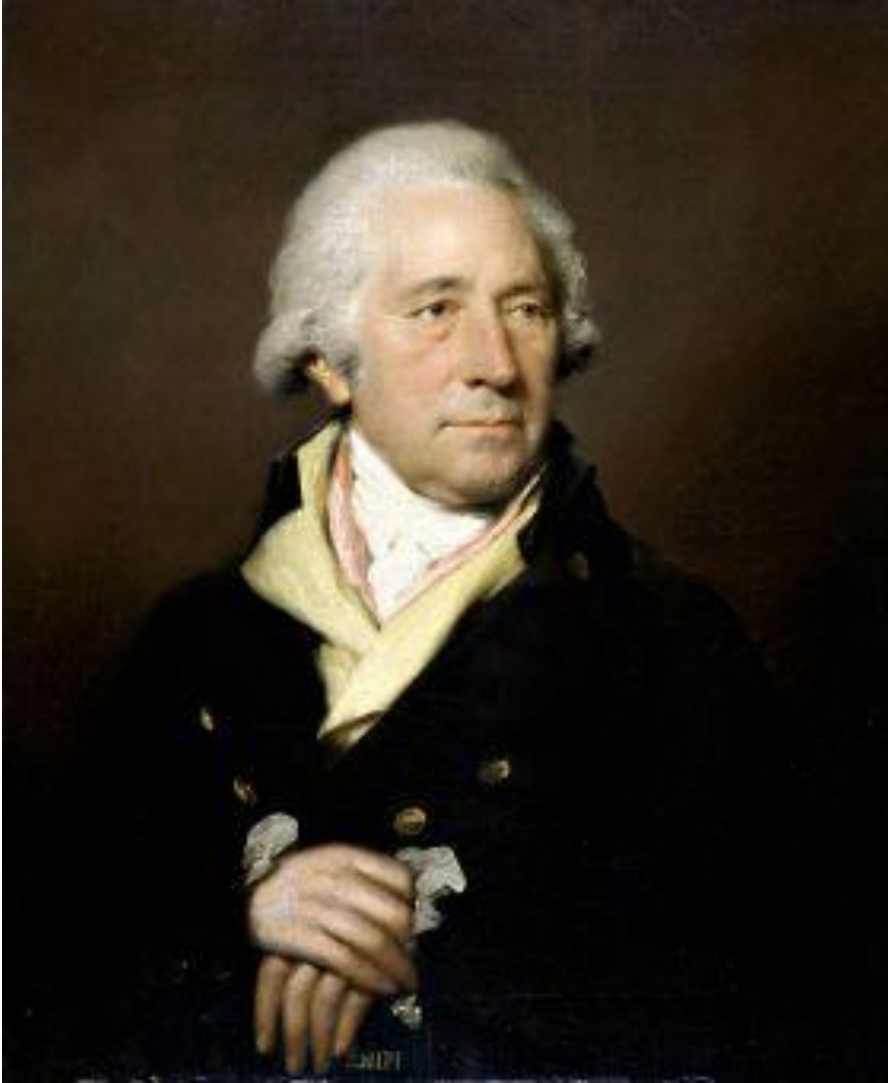
Matthew Boulton (1728-1809) is well known as an eighteenth-century industrialist, the founder of Soho Manufactory and the steam-engine business of Boulton and Watt. Less well known are his scientific and technical abilities in the field of metallurgy and coining, and his role in setting up the Soho Mint. The intention of this thesis is to focus on the coining activities of Matthew Boulton from 1787 until 1809, and to examine the key role he played in the modernisation of money. It is the result of an Arts and Humanities Research Council-funded collaboration with Birmingham Museum and Art Gallery, where, after examination of their extensive collection of coins, medals, tokens and dies produced at the Soho Mint, research was used to produce a catalogue. A close visual study of the artefacts has been combined with evidence from contemporary archival material, and information from secondary sources, to provide a synthesis of the processes involved in making coins, and Matthew Boulton's working practices in the eighteenth century.

The thesis describes processes involved in making the 600 million coins, medals and tokens made at Soho Mint during Boulton's lifetime. Chapter one briefly discusses his eighteenth-century background and the reasons for setting up the Soho Mint. In chapter two Boulton's involvement in the copper and iron industries are discussed, including the importance of his contributions to both industries. He needed large amounts of copper and specialized iron products such as steel to make his coins at Soho Mint. In chapter three the technical aspects of minting are discussed, including Boulton and his team's

contribution to developing new techniques. The final chapter details how materials and products were transported, commissioned, and designed.

The second half of the thesis is a sample catalogue of items produced at the Soho Mint prior to Boulton's death in 1809. Fuller catalogues of Soho Mint products have been produced for several institutions as a result of this research, for use by museum curators, historians and professional and amateur numismatists. Only a selection of this aspect of the research is included, because of the word limitations for PhD theses.

If the life of Matthew Boulton can teach us anything, surely it is that openness to new ideas, and determination to pursue a vision, are what move our world forward.¹



Matthew Boulton by Lemuel Francis Abbott²

¹ Foreword by M. Whitby in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires* Yale University Press, London and New Haven

² Portrait of Matthew Boulton c 1798-1801 Lemuel Francis Abbott BMAG 1908P20 Oil on canvas 74 x 62cm.

ACKNOWLEDGEMENTS

Firstly I would like to thank my husband Garry Tungate, for his encouragement and his help. I am also very grateful to my son David and my daughter Wendy for persuading me to apply for a Ph D in the first place. I am indebted to the Arts and Humanities Research Council for the Collaborative Award which funded this research. It offered me the opportunity to be involved in activities associated with Matthew Boulton's bicentenary celebrations in 2009, including an international conference, and exhibitions at Birmingham Museum and Art Gallery (BMAG), and at the Barber Institute of Fine Arts, University of Birmingham. I was able to work with a wonderful group of individuals, who are also passionate about the interlinking yet different aspects of Boulton's work.

In particular I would like to thank Dr David Symons for all his support in cataloguing the BMAG collection, and Dr Sally Baggott for allowing me to view the Assay Office collection of Soho Mint products, and both for loans for the Boulton Exhibition at the Barber Institute. Dr Baggott was particularly helpful in reading through the final drafts of this thesis. I have also found the advice of Dr Eurydice Georganteli very informative in the final stages of writing up. Dr Richard Clay was very generous with his time, and I am grateful to him for the opportunity to co-curate an exhibition *Matthew Boulton and the Art of Making Money* at the Barber Institute for Fine Arts, University of Birmingham. I would also like to thank the staff of the Barber Institute for their help. Thanks too, to Professor Peter Jones for providing me with information relevant to my research.

Thanks also to the following:

The staff of Birmingham Archives and Heritage, in particular Dr Sian Roberts, Fiona Tait, Alison Smith, Rachel Macgregor, Alison Laitner and Angela Skitt

Lucy Blakeman for her help in putting information onto the Minisis system at BMAG

Dr Kevin Clancy for arranging a visit to the Royal Mint. Llantrisant

Jon Clatworthy Lapworth Museum for providing images of William Murdoch's mineral collection

Laura Cox and Annette French, Curators, Soho House, Birmingham for access to the Soho Mint items on display there.

John Doran, former Curator, Avery Historical Weighing Museum, Birmingham for allowing me to see the Soho dies and medals held there

Dr Catherine Eagleton of the British Museum for help and for loan of material for the Boulton exhibition at the Barber Institute

Dr Jack Kirby for allowing me to view the dies and various other Soho items at Think-tank, Birmingham.

Dr Peter Northover for allowing me to visit his laboratory at Department of Materials, University of Oxford, and for providing me with copies of various theses.

.David Vice for a copy of his forthcoming publication on Soho Mint

Thanks to the following for various translations.

Arabic: Salach Baban

French and Portuguese: Barbara and David Forbes

Hindi and Urdu: Nina Soni

Italian: Nadia Macis-Amos

Latin: Tom Freeman

Spanish: Mirin Jones

Persian: Abdulmonem Alshino

Russian: Lydia Baban

Sanskrit: Arundhati Virmani

Welsh: Goronwy Tudor Jones

I would like to thank also Connie Wan, Val Loggie and Laura MacCulloch for sharing the Collaborative PhD experience and for their friendship.

ABBREVIATIONS:

Assay Office = The Birmingham Assay Office, Newhall Street, Birmingham B3

Avery = Avery Historical Museum, Avery Weigh-Tronix, Foundry Lane, Smethwick, West Midlands B66 2LP

BA&H = Birmingham Archives and Heritage, Central Library, Chamberlain Square, Birmingham B3 3HQ All MS references are from this archive.

BMAG = Birmingham Museum and Art Gallery, Chamberlain Square, Birmingham B3 3DH

British Museum = Coin and Medal Collection, British Museum, Great Russell Street London WC1B

D&H = R.Dalton and S.H. Hamer (1910-1915) *The Provincial Token-Coinage of the eighteenth Century Illustrated* Volume 1-3

Eimer = Christopher Eimer (1987) *British Commemorative Medals and their Values* Seaby, London

ESC = H.A. Seaby and P.A. Rayner (1949; 3rd edn 1968) *The English Silver Coinage from 1649* B.A. Seaby Publications

Margolis = Richard Margolis (1988) *Matthew Boulton's French Ventures of 1791 and 1792: Tokens for the Monneron Frères of Paris and Isle de France* British Numismatic Journal Volume 58, p 102-109

MB = Matthew Boulton

MRB = Matthew Robinson Boulton

Peck = Charles Wilson Peck (1970) *Copper Coins of George III from English Copper, Tin and Bronze Coins in the British Museum 1558-1958* Trustees of the British Museum, London

Pollard = J.G.Pollard (1970) *Matthew Boulton and Conrad Heinrich Kuchler* The Numismatic Chronicle Volume X p 259-318 (published by the Royal Numismatic Society, London)

Pridmore = F. Pridmore (1962) *The Coins of the British Commonwealth of Nations Part 2: Asian Territories* and F. Pridmore (1975) *Part 4 India: Volume 1 East India Company Presidency Series c 1642-1835* Spink and Son

Think Tank = Think Tank (Birmingham Science Museum), Curzon Street, Birmingham B4 7XG

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INTRODUCTION

The purpose of this thesis is to explore aspects of the history of Soho Mint, set up in Birmingham from 1788 by Matthew Boulton. It will discuss the processes involved, from obtaining the copper, to the finished coin in the customer's hand. My research has focused on the investigation of the scientific and technological dimensions of the business, and aspects of design, production, marketing and distribution. It brings together information from numismatic, scientific, technological, art historical and transport sources, and uses research into museum holdings and archival investigations, to explore the production of coins, medals and tokens at Soho Mint. Technical information on copper mining, smelting and coining was integrated with historical information to understand the nature of control that Matthew Boulton exercised over the whole operation. The thesis brings to light the true extent of his contribution to industrial processes and manufacturing, through the application of scientific and technical knowledge and understanding. It will be argued that Boulton was responsible for revolutionising minting practices in the eighteenth century, and that it was due to Boulton's perseverance and drive that the Soho Mint finally succeeded. The research into science and technology carried out by Boulton and his team was fundamental to the setting up the first steam-powered press in the world.

Matthew Boulton (1728-1809), a Birmingham entrepreneur, manufacturer, engineer, and scientist, was a significant figure of the eighteenth century, linked to many other key players through his social and business contacts.¹ He was not just important for what he

¹ His background and activities have been discussed in more detail in several recent publications. M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* Brewin, Studley; S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires* Yale University Press, London and New Haven.

produced, but because he introduced new forms of industrialisation, including advertising, and the transformation of power supplies. Among his achievements can be numbered the setting up the Soho Manufactory and the development of the steam engine business of Boulton and Watt. This thesis is solely concerned with the Soho Mint set up in Birmingham in 1788-1789 and it sets out to trace Boulton's role in the entire process of coining; from mining the copper and producing the steel used for dies, to the design, and final delivery of the product. It will be argued that the Soho Mint he built was able to solve the currency shortage, which threatened to derail industrial progress at the end of the eighteenth century, and that the practices and technologies he initiated spread across the world.

This thesis should be understood as a synthesising exercise using archival sources, numismatic and historical literature, plus an examination of artefacts made at the Soho Mint, which contained the first steam-powered coining press in the world. It also includes field work at sites associated with various aspects of the metal industries. The study concentrates on the more technical aspects of minting, including an account of aspects of the metal industries not previously studied in detail in association with Soho Mint. These aspects include Matthew Boulton's involvement in the extraction and supply of copper, iron and steel. No complete account of all the different technologies used has previously been written, so research using evidence from the artefacts and from archives will be utilised to provide an original comprehensive account of coining practices at the Soho Mint. Since this PhD research was funded by the collaborative programme of the Arts and Humanities Research Council (AHRC), around forty per cent of the thesis is devoted

to a selected catalogue of Soho Mint products.² This catalogue highlights topics discussed and the thesis should be read in conjunction with the catalogue.

Boulton's organisational abilities in obtaining the orders, commissioning the designs, and transporting his completed products around the world will also be considered. The close relationship between art and paintings of the time informed the design of Boulton's products. His design processes, and how the objects produced at the Soho Mint became collectors' items will be discussed.³ The reasons for setting up the mint and how Matthew Boulton became involved in coining will be briefly mentioned. The thesis offers an integrated study of the numismatic, technical and socio-economic aspects of minting.

Matthew Boulton was an important participant in the profound changes that were taking place in the eighteenth century, making a significant contribution to the growth of industrialisation and globalisation. His interests were wide ranging, and apart from his manufacturing businesses at Soho, included activities such the extension of the canal system to Birmingham, the establishment of the Birmingham Assay Office and work with various local and government committees. He sought improvement in all things; techniques, organisation, land enclosure, education, science and manufacturing. His Soho Manufactory became a centre of excellence in metal working, where clever designs were used, enabling many products to be assembled from a relatively small number of components, each of which was manufactured in quantity. His workers were skilled

² The catalogue contains only selected Soho Mint products. Much fuller catalogues were made for Birmingham Museum and Art Gallery, the Birmingham Assay Office and elsewhere.

³ Aspects of design have been covered by S. Tungate (2009) 'Technology, Art and Design in the Works of Matthew Boulton: Coins, Medals and Tokens produced at the Soho Mint' in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 185-200.

craftsmen, well paid, and equipped with all manner of labour-saving devices, which enabled them to be more productive.⁴ By 1765 Boulton had brought all the functions of a modern business, including research, design and marketing under his control, and was beginning to sell his products all over Europe.⁵

Boulton's technical ability and his background in metal manufacture, creative design, and steam-engine technology enabled him to set up the Soho Mint in 1788, which, unlike most of his other ventures, he controlled virtually single handed. There, he was able to compete with the state monopoly in coining at the Royal Mint, which was dominated by old practices and hereditary rights. His skill in campaigning, and familiarity with public affairs, together with his ability to organise his team of skilled workers industrially, enabled him to find a solution to the shortage of regal coin. He initiated coining methods which were to revolutionise mints around the world, and produced the first recognisably modern coinage. He introduced the technology and quality control necessary to produce millions of standardised coins. His coins, medals and tokens were also of great artistic merit, and were sent across the world.⁶

There is a considerable volume of literature about Boulton and the Soho Mint. The most significant work in this area has been done by Richard Doty, who discusses the development and social history of the various incarnations of the Soho Mint, but he does

⁴ For details of his activities see S. Tungate (2009) 'Introduction' in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* Brewin, Studley pp vii-xiv.

⁵ A letter from Fothergill to Boulton in 1764, quoted by Goodison, lists the merchants handling their goods in Germany, America, Spain, Russia, Italy, Holland, Sweden as well as in Britain; Goodison lists the patrons that Boulton cultivated by 1778, including ambassadors and visitors from America, Austria, Denmark, France, Germany, Italy, Netherlands, Poland, Portugal, Russia, Sardinia, Spain, Sweden and Switzerland. N. Goodison (1974 amended 2002) *Matthew Boulton Ormolu* Christies, London pp 404-406.

⁶ R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* pp 39-55.

not deal in detail with the techniques of coining. He credits the Soho Mint to Boulton and James Watt, but in fact, it was solely Boulton's enterprise.⁷ David Vice has also done some important work on the Soho Mint, and has produced a very useful list of items made there.⁸ Recent work by George Selgin focuses on the development, production and use of tokens during the early years of the industrial revolution from an economic and fiscal viewpoint, and how the shortage of small value coins was resolved for a while by Boulton and others.⁹ Selgin also covers in detail the problems of the lack of copper and silver coin. Also useful sources are studies of the Royal Mint, works on the corpus of eighteenth-century money, and the numerous articles on individual coin, medal or token issues made at Soho Mint.¹⁰ Many of the Soho Mint products have been studied individually.¹¹ Some of these sources give details of what was made, including amount produced, and the historiographical background to the specific issue. Other sources emphasise technical or design aspects. Technical aspects of coining are covered in various publications such as numismatic journals.¹² The studies of the iron and copper industry by K.C. Barraclough, J.R. Harris and Henry Hamilton proved particularly useful when considering the sourcing of the raw materials. Hamilton discussed the history and industrial organization of the brass and copper industries in Birmingham, where the small

⁷ R. Doty (1998) *The Soho Mint and the Industrialisation of Money* British Numismatic Society Special Publication No 2 London.

⁸ D. Vice (forthcoming) *A Numismatic History of Soho Manufactory and Mint 1772-1850* British Numismatic Society Journal, Special Publication. Vice has written at least twenty two articles on various Soho Mint products, see bibliography.

⁹ G. Selgin (2008) *Good Money Birmingham Button makers, the Royal Mint and the beginnings of Modern Coinage (1775-1821): Private Enterprise and Popular Coinage* University of Michigan, Ann Arbor.

¹⁰ C.E. Challis and J. Craig have both contributed to histories of the Royal Mint. C.W. Peck has written the definitive reference to the copper coinage made by Matthew Boulton. R. Dalton and S.H. Hamer have catalogued the tokens of the eighteenth century. For full details, see bibliography.

¹¹ For example there are individual articles on the Cronebane Token of the Associated Irish Mine Company, the Tullamore Token of Viscount Charleville, the Lancaster Token by Daniel Eccleston and the Leeds Token of Henry Brownbill and Samuel Birchall which are referred to at an appropriate point in the catalogue.

¹² There were interesting articles on the techniques of coining in: M.M. Archibald, Michael R. Cowell (eds.) (1993) 'Techniques of Coining: Coin Symposium 9-10 Sep 1988' *Metallurgy in Numismatics* Volume 3 Royal Numismatic Society Special Publication 24, London.

employer, domestic worker and out-worker existed alongside of large manufacturers such as Boulton.¹³ Harris concentrated on the career of Thomas Williams of Anglesey, the ‘Copper King’, whose story is interlinked with Boulton as will be demonstrated in chapter two.¹⁴ Barraclough, meanwhile, has analysed the production of steel in great detail.¹⁵ Aspects of coin design have been researched in books by authors such as David Bindman, John Brewer and F.D. Klingender. This will be discussed further in chapter four.¹⁶

There are also several recent publications which include details about Matthew Boulton himself, such as Jenny Uglow’s *Lunar Men* and Nicholas Goodison’s work on ormolu.¹⁷ The former discusses his connections with important individuals such as Josiah Wedgwood, Joseph Priestley, Erasmus Darwin and others, and provide a background to Boulton’s intellectual and scientific interests.¹⁸ The latter discusses the production, design and customer base that Boulton developed at the Soho Manufactory, to produce some exquisite pieces of work.¹⁹

The first major account about the lives of Boulton and Watt was by Samuel Smiles in 1865. Smiles devoted little space to the development of the Soho Mint, and in fact his book contains several errors of fact, such as the timing of the introduction of the steam-

¹³ H. Hamilton (1926; 2nd ed. 1967) *The English Brass and Copper Industries to 1800* Cass, London p 268.

¹⁴ J. R. Harris (1964) *The Copper King: A biography of Thomas Williams of Llanidan* Liverpool University Press, Liverpool.

¹⁵ K.C. Barraclough (1984) *Steel Making before Bessemer Volume 1: Blister steel; Volume 2: Crucible Steel the growth of technology* Metals Society, London.

¹⁶ For full details see bibliography.

¹⁷ Other publications include Tann (1996) on Boulton and the Assay Office; and Roll (1930) and Tann (1995) on the firm of Boulton and Watt. These are discussed later in chapter three. For full details see bibliography.

¹⁸ Jenny Uglow (2002) *The Lunar Men: Friends who Made the Future* Faber and Faber, London.

¹⁹ Nicholas Goodison (1974; 2002) *Matthew Boulton’s Ormolu* Christies, London.

powered press.²⁰ No single biography of Boulton has been written since H.W. Dickinson in 1937, and he did not claim to have covered Boulton fully. Dickinson devotes a chapter to coinage and the Soho Mint, it is true, but he also perpetuates the same errors as Smiles.²¹ During the period of my research, various authors produced chapters for the 2009 Matthew Boulton bicentenary books which proved informative.²² After the 2009 Boulton conference further information came to light about various aspects of research being carried out, which proved helpful to this thesis.²³ Boulton's eighteenth-century background is detailed in a contemporary publication, William Hutton's *History of Birmingham*, and by recent authors such Maxine Berg, Francois Crouzet, Eric Hopkins and Pat Hudson. Peter Jones' book on *Industrial Enlightenment* was also illuminating, as was the recent publication *The Enlightened Economy* by Joel Mokyr.²⁴

Mokyr suggests that industrialisation was the product of a fruitful interaction between economic factors and the enlightenment culture of useful knowledge. He sees the Lunar Society as a knowledge transfer market, with Boulton and Wedgwood as the buyers, and Priestley and Darwin as the sellers. This is similar to the proposition advanced by R.E. Schofield, who viewed the Lunar Society as akin to an industrial research establishment,

²⁰ For example Smiles states that the steam powered press was used to make the 1786 Sumatra coinage contract of about 100 tons. This is not true. His account has also been criticised for its lack of references. Samuel Smiles (1865) *Lives of Boulton and Watt* John Murray, London p 389.

²¹ Dickinson includes a description of the working of a fly press and reproduces an image of the patent diagram with an account of its working. He also quotes Boulton's description of the mint in 1792. H.W. Dickinson (1936; republished 1999) *Matthew Boulton* TEE Publishing, Leamington Spa p 13; pp 140-143.

²² Useful discussions were held with George Demidowicz and Ken Quickenden and others. G. Demidowicz 'The three Sohos: Manufactory, Mint and Foundry'; K. Quickenden 'Matthew Boulton's Silver and Sheffield Plate' both in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires*.

²³ Conference held 3rd-5th July 2009 at the University of Birmingham. *Where Genius and Arts Preside: Matthew Boulton and the Soho Manufactory 1809-2009*. Dr Peter Northover was very helpful in discussions on copper, and a visit to his laboratory at the Department of Materials, University of Oxford, Begbroke Science Park, Sandy Lane, Yarnton, Oxford, OX5 1PF. Thanks to Dr Northover for supplying me with a copy of Jeremy Knowles' thesis and to Penny Watts-Russell for copies of her research which will be discussed in chapter two.

²⁴ P. M. Jones (2008) *Industrial Enlightenment: Science, Technology and Culture in Birmingham and the West Midlands, 1760-1820* Manchester University Press, Manchester; J. Mokyr (2009) *The Enlightened Economy: An Economic History of Britain 1700-1850* Yale University Press. For other publications see bibliography

with a group of friends meeting together, and fusing useful knowledge with technical know-how to produce the conditions described by Mokyr as the Industrial Enlightenment.²⁵ The 1780s was the most intellectually productive period of the Lunar Society as regards the dissemination of useful knowledge, and this is when the Soho Mint was established. Soho was the hub of an international exchange of information, as Jones has demonstrated, and it was the hub of a network of people to whom the benefits of improved coining methods could be brought.²⁶ This thesis moves on from Jones' work to discuss the research that Boulton carried out in setting up the Soho Mint. A comparison of the Soho Mint with other industrial concerns of the time is difficult to undertake, as it was so different from other businesses. This research on the Soho Mint scarcely permits general observations to be made about industry in the eighteenth century, but it does provide a convincing account of vertical integration from mining through to distribution.

In order to assess the contribution made by Boulton and the Soho Mint to coining practices of the period the following questions must be answered: where did the materials, copper, iron, and steel, used in the Soho Mint come from? How was Boulton connected to the copper mining industry in Cornwall and Anglesey? What technical problems needed to be overcome to make a functioning mint, and who was involved in building it and making its products? How were the dies and blanks formed? How were the coins ordered, commissioned and designed and how much influence did Boulton himself have on the designs? How were his coins, medals and tokens sold and distributed all over the world? Boulton's famous Cartwheel pennies and two pence pieces remain

²⁵ R. E. Schofield (1963) *The Lunar Society of Birmingham: a social history of provincial science and industry in eighteenth-century England* Clarendon London.

²⁶ P.M. Jones (2008) *Industrial Enlightenment: Science, technology and culture in Birmingham and the West Midlands, 1760-1820* Manchester University Press, Manchester.

the largest and heaviest British copper coins ever issued. Why were they made by Boulton and not by the Royal Mint in London? How did Matthew Boulton manage to reform coinage in the eighteenth century, while continuing to work at many other activities? What lasting influence did he have on minting throughout the world? How far was Boulton reliant upon his skilled workers, or did he possess the technological knowledge of coining himself?

Methodology

Artefacts

Research was focused on a body of artefacts made at Soho Mint, as stipulated in the specifications of the AHRC collaborative award. This offered an opportunity to study over two thousand Soho pieces in various collections, including those in the main collection at Birmingham Museum and Art Gallery (BMAG).²⁷ Further items which form part of the BMAG collection were examined at Soho House²⁸ and Thinktank, Birmingham.²⁹ An additional two hundred items were studied at the Birmingham Assay Office, including an example of the sexpartite collar-die, which was of particular interest.³⁰ Further examples of Soho Mint products have been studied at the Avery

²⁷ A main purpose of the Arts and Humanities Research Council Collaborative PhD Award was to research and catalogue the collection of Soho Mint products at Birmingham Museum and Art Gallery. Heartfelt thanks to Dr David Symons for allowing me to view the collection at BMAG over many visits, and his help and encouragement throughout my research. Dr David Symons, Curator of Antiquities and Numismatics, Birmingham Museum and Art Gallery, Chamberlain Square, Birmingham B3 3DH.

²⁸ Thanks to Laura Cox and Annette French, Curators, Soho House, Soho Avenue, Handsworth, Birmingham B18 5LB.

²⁹ Thanks to Dr Jack Kirby, Collections Interpretation Manager, Think Tank (Birmingham Science Museum), Curzon Street, Birmingham B4 7XG for his help.

³⁰ The Assay Office collection included sixty three medals, twenty two tokens, fifty seven foreign coins and thirty five regal coins made at the Soho Mint, plus ten from the Isle of Man, Ireland and Guernsey. It also holds a Trafalgar medal die and Nile medal die. Other items not made at Soho Mint were examined for comparison purposes. Many thanks to Dr Sally Baggott, Curator, The Birmingham Assay Office, Newhall Street, Birmingham B3 for allowing me to examine these objects, and for her help and encouragement.

Weighing Museum, located at the site of the Soho Foundry.³¹ The collections at the British Museum have supplied additional examples.³² Such a large-scale and comprehensive study of the range of Soho Mint products has not been carried out before. The catalogues produced for BMAG and elsewhere in the context of this PhD research featured all Soho Mint products, though it was not possible to include everything in this thesis. Given the word constraints, only a selection from the catalogues is included.

Initially the intention was to trace all the products made there, and to draw up a timeline, which can be seen in Appendix 1.³³ The individual products were also contextualised, to find out why and when they were made, as detailed in the catalogue. Research involved detailed inspection and identification of coins, medals, tokens, dies, punches and trial strikes made at the Soho Mint between 1787 and 1850.³⁴ Measurements and photographs were made of each item as listed in Appendix 2.³⁵ Data were recorded and collated to enable conclusions to be made on the range of sizes and weights of Soho pieces. It was a challenge to deal with the sheer volume and wide variety of products from the Soho Mint, and a computer-based method of dealing with the data was developed. This research

³¹ Thanks to John Doran, Curator (now retired), Avery Historical Weighing Museum, Avery Weigh-Tronix, Foundry Lane, Smethwick, West Midlands B66 2LP.

³² At the British Museum a further forty medals, coins and tokens were viewed, plus some works on paper from the collection of Sarah Sophie Banks. Thanks to Dr Catherine Eagleton, Curator of Modern Money, Coin and Medal Collection, British Museum, Great Russell Street, London WC1B for her help.

³³ After a year of research David Vice gave me a copy of his numismatic survey of the Soho Mint which lists all the coins, tokens and medals produced at the Soho Mints between 1772 and 1850. This article is not referenced, but where possible my own research has confirmed his findings, and he has been given information about items he missed from my research. Thanks to David Vice for a preview of his article. D. Vice (forthcoming) *A Numismatic History of Soho Manufactory and Mint 1772-1850*. British Numismatic Society Journal, Special Publication.

³⁴ There are about sixty different types of medals and at least thirty five versions of the twenty or so token orders made at Soho, plus fifty five varieties of coins from at least fifteen different countries, and numerous pattern and proof coins made between 1787 and 1795 for the regal coinage contract, and for other countries to evaluate proposed coin designs. Boulton then carried out three contracts for the government in 1797, 1799 and 1806-7. Only pieces made up till Boulton's death in 1809 will be considered.

³⁵ The axis, diameter, weight and metal for each individual item were measured, and a description of the edge markings, obverse and reverse images and inscriptions was recorded. The measurements were checked on at least two occasions. The catalogue shows details for specific coins, medals and tokens. The list does not include restrikes, or items made elsewhere which were also examined for comparison during research. Images in this thesis were taken by the author unless otherwise credited.

revealed the extensive range of products made, which varied from simple tokens with inscriptions intended for use at a particular works, to regal coinage issues intended to serve Britain. It also highlighted the contacts that Boulton had and the clientele he targeted. It also demonstrated the wide geographical distribution of his customer base, as his products were sent all over the world. The study also offers information about the artistic influences on Boulton's products, and the technology used to make them.

Archives

Original sources in a variety of archives were investigated to answer questions raised during my preliminary research.³⁶ One of the reasons that Matthew Boulton has been studied by so many authors is the availability of the wide-ranging holdings of letters, plans, patents, diaries, notebooks and so on, which are known as the Archives of Soho.³⁷ Much of Boulton's correspondence was copied at the time, using James Watt's copying machine developed and patented in 1779, so both sides of the correspondence are often available. This gives an extraordinary contemporary view of events, with different opinions from a variety of writers. Soho Mint records exist as a separate collection from 1791-1850.³⁸ The Soho documents are far too extensive to investigate comprehensively,

³⁶ For example particular pieces were ascribed to different engravers by various authors. Questions were resolved and will be discussed where appropriate in this thesis. When transcribing archival material, original spelling and punctuation has been retained as far as possible. Names in use in the eighteenth century have been used, with the exception of the area now known as Germany, and Paris Mine, Anglesey where their modern names are used.

³⁷ Primary sources beginning with 'MS' are from the Archives of Soho, at Birmingham Archives and Heritage (BA&H), Birmingham Library and Archives Services (BL&AS). The Boulton & Watt business records include about 200 letter books and 50,000 incoming letters; the Matthew Boulton papers and the James Watt papers each contain about 25,000 letters, plus other items. F. Tait 'Coinage, commerce and inspired ideas: the notebooks of Matthew Boulton' in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 77-91; F. Tait 'How do we know what we know? The Archives of Soho' in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires* pp 108-116.

³⁸ Soho Mint records include accounting records and operational records for coinages issued and for mint machinery in the form of day books, order books, cash books, bankers' books, bill books, wages books, packers' books and inventories. There are also letters from many of Boulton's Mint customers and records of orders. For many issues the number of dies used, number of presses forging dies, times in and out, and the weight of coins struck per die were recorded. Copper stock books and packing books exist in tabular form, with details of lappers up, standard weights, and

but certain sections have been studied in detail for this thesis, including correspondence from various employees and customers of Soho Mint.³⁹ It is possible to link the various sources, for example letters can be linked to invoices, and with packing books. This helps to reveal Boulton's working practices, including how orders were commissioned and designed. This research also offered the opportunity to confirm the provenance of some previously un-attributed items.⁴⁰ The Mint record books, Boulton's experimental notebooks and diaries, his letters and his notes on the copper industry have been studied in detail.⁴¹ Boulton often used his jottings to clarify his ideas and to record information on experiments he carried out. These provide a rich source of information to follow the technical and design processes involved in setting up the Mint. Not only the business records of the firm were consulted, but also the personal letters, diaries, notebooks, newspaper cuttings, and diagrams. The use of commercial archives for the study of the history of technology is a methodology recently pioneered by Liliane Hilaire-Perez.⁴²

There are obvious limitations in taking a large body of evidence from the Soho Archives, as this may introduce a bias.⁴³ Nevertheless, a decision was made to concentrate on these papers as they have not previously been considered closely from the perspective of Boulton's technical and scientific abilities. There are also Royal Mint documents related

the work done by each workman, and so on. These documents are held at Birmingham Archives & Heritage, Birmingham Central Library (GB 143 BA&H). All references to MS documents come from there.

³⁹ There are 180 volumes of records and 24 boxes of correspondence concerning Soho Mint alone [MS 3782/3]. There are also personal papers of Matthew Boulton [MS 3782/12] and Matthew Robinson Boulton [MS 3782/13] and correspondence from a variety of individuals including James Watt [MS 3147] which related to the business of the Mint. For a full list of the documents investigated see the bibliography.

⁴⁰ For example the Penyardarren token was thought possibly to be a Soho Mint product, and this has been confirmed by archival evidence which was not previously known.

⁴¹ In transcriptions of archival material, original spelling has been retained. Some punctuation has been added to make excerpts easier to read.

⁴² Symposium *Useful Knowledge in the Eighteenth Century* Universities of Birmingham and Warwick Eighteenth Century Centres, held at Soho House, Birmingham, 19 May 2011

⁴³ The archives of Soho are so large, that it is unlikely that they were biased by Matthew Robinson Boulton, to give the best picture of his father, but this is a possibility which needs to be considered.

to Boulton in the National Archives, and Privy Council Committee (Board of Trade) papers. However these have already been examined by other authors, such as Craig and Challis, who have produced definitive publications on the Royal Mint.⁴⁴ David Symons' recent publications have covered Boulton's relationship with the Royal Mint, forgers and the shortage of coins.⁴⁵ Therefore a judgment was made not to include these sources. There is a wealth of information about the Soho Mint in a variety of other less well known archives. This material has been used insofar as it relates to the technical and artistic aspects of Boulton's coining activities. There is still huge potential to study of the economic and business aspects of the Soho Mint.

Among the other archival sources used in this thesis are those of the Anglesey Industrial Heritage Trust and the Cornwall Heritage Trust, now available electronically. They provided useful insights into various aspects of the activities of the Soho Mint. For example the Cornwall Heritage Trust holds a collection of around 1,100 letters from Matthew Boulton and James Watt to Thomas Wilson, their mining agent in Cornwall.⁴⁶ The collection of letters spans the years 1780-1803, making them the longest and largest run of correspondence entered into by Boulton and Watt, but which has not been 'edited' or rearranged by a member of the Boulton or Watt family. In particular they offer a viewpoint of the start of Boulton's coining activities and his links with the copper industry. Valuable information is also available on the Anglesey Industrial Heritage Trust

⁴⁴ J. Craig (1953) *The Mint: A History of the London Mint from AD 287-1948* Cambridge University Press; C.E. Challis (ed.) (1992) *A New History of the Royal Mint* Cambridge University Press.

⁴⁵ D. Symons (2009) 'Matthew Boulton and the Royal Mint' in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* p 171; D. Symons (2009) *Matthew Boulton and the Forgers* in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* p 7; D. Symons (2009) 'Products of the Soho Mint' in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires*.

⁴⁶ All these letters have been read for this thesis and have references starting AD1583. They are available on line at <http://www.cornish-mining.org.uk/story/boulton.htm>

website on copper mining.⁴⁷ An on-line collection of letters and documents concerning Sir Joseph Banks and his connection with Boulton also made a useful contribution to this thesis.⁴⁸

Field work

In addition to the study of the artefacts and in the archives, site visits were made by the author during the course of research to places associated with the Soho Mint. Although much has changed in the two hundred years since Boulton's death, there was still useful information to be gained. The topography of Handsworth, where Boulton set up his manufactory and mint, is essentially the same, and one can see why the water-powered factory was sited near the water course, while the steam-powered mint could be on higher ground, closer to Boulton's house for security. The use of the canal system is seen to be important, such as at the site of the former Soho Foundry, now Avery's works. Visits were also made to the copper mining areas in Cornwall, Anglesey and the Peak District, to various ports used to ship copper ore, and to metal working centres in Flintshire, Shropshire, Wrexham and Stirlingshire. These site visits made possible a greater understanding of the processes necessary to provide the raw materials for the Soho Mint. For example the difficulty of moving heavy ore and coal over the hilly terrain in Cornwall meant that the transport of coal was an important factor in the cost of mining. The author confirms how the use of Boulton and Watt engines, which provided savings in coal, led to Boulton's initial involvement in the copper industry. This question will be discussed further in chapter two. Visits to both Cornwall and Anglesey brought out the differences in the local terrain, which elucidated the problems of transporting goods and

⁴⁷ Anglesey Industrial Heritage Trust at <http://www.angleseymining.co.uk>; <http://www.parysmountain.co.uk>.

⁴⁸ State Library of New South Wales Australia at <http://www2.sl.nsw.gov.au/banks>

raw materials in the eighteenth century. When one thinks of the complexities of shipping large amounts of copper, steam-engine cylinders and coin, Boulton's organisational ability can only be admired.

The industrial heritage sites at Thomas Williams' Greenfield copper works, Holywell and Wilkinson's ironworks at Bersham were also visited. These are all within easy reach of Birmingham by modern transport but their location meant that Boulton and his fellow industrialists would have had protracted journeys to maintain collaboration in their diverse business ventures. In addition, important iron manufacturing sites at Ironbridge, Shropshire, and at Carron, near Falkirk, Stirlingshire were visited. There is little left at Carron Ironworks, except for a gateway and part of Watt's original cylinder, but the site showed the potential for the supply of water power. Much more can be seen with the remains of Abraham Derby's ironworks at Coalbrookdale, which was helpful in understanding the processes of iron and steelmaking. This is discussed further in connection with the technologies used at the Soho Mint. A visit to the Royal Mint proved very instructive, enabling the author to see coining equipment at work, and to contrast Boulton's practices with those now used to make a modern coinage issue.⁴⁹ All of these dimensions enabled a greater understanding of how Soho Mint obtained its raw materials and produced the coins.

The above discussion provides a brief introduction to the aims of the thesis as well as an indication of the methodology that has guided the decisions underpinning the argument.

The introductory chapter also investigates the background to the provision of money in

⁴⁹ Thanks to Kevin Clancy for arranging this visit. Dr Kevin Clancy, Head of Historical Services, The British Numismatic Society, Royal Mint, Llantrisant, Pontyclun CF72 8YT.

the eighteenth century, and to Matthew Boulton himself. Reasons for Boulton's involvement in coining will be suggested. As will be discussed, his motives included reform of the coinage in order to defeat counterfeiters, but he may have had other reasons such as using up the copper surplus, and enhancing his own reputation. A brief explanation will be given for the need for small change, and why copper money was in short supply.

The practices involved in copper mining and smelting are briefly covered in chapter two, as well as advances made in producing iron, and steel required for dies. Boulton's links with the Cornish and Anglesey copper mines, and with entrepreneurs such as Thomas Williams, are also shown to be important. It is argued that Boulton's role was essential in improving metal technologies of the industrial revolution, and to the supply of resources needed at the Soho Mint, though he was helped by many able assistants. Chapter three is devoted to a discussion of the technologies involved in coining and how Boulton improved upon these practices. Finally, the thesis tackles the commissioning of the coins, their design, and the transport of both materials and the final products. The importance of Boulton's international connections is also explored, especially with customers such as the Honourable East India Company, as well as the significance of orders for tokens. Boulton's role in the production of the regal coinage will be considered, including the implications of his improvements in the distribution of coins. The pieces produced at Soho Mint were also sold to collectors as objects of artistic worth and the author will argue that Boulton himself had considerable input into their design. The chapters conclude with a discussion of the overall importance and key role that Matthew Boulton played in the modernisation of money. The second half of the thesis is a sample catalogue

of items produced at the Soho Mint prior to Boulton's death in 1809. The catalogue produced for BMAG is being used as a research tool by museum curators and could prove valuable to professional and amateur numismatists. This thesis has involved working with individuals from many separate disciplines, thanks to the Arts and Humanities Research Council award, which has provided an unusual combination of information from the arts, science, industrial history and numismatics during the research. This has led to a unique understanding of Matthew Boulton and his coining practices at the Soho Mint in late eighteenth-century Britain

CHAPTER ONE: MATTHEW BOULTON AND COINING

Matthew Boulton

Matthew Boulton at the Soho Mint initiated coining methods which transformed minting techniques. This chapter details his background, how he became interested in coining, and discusses briefly the state of the currency in the eighteenth century. It clarifies how the shortage of small change was affecting industrial development and how Boulton was able to tackle this problem. It also suggests that his ability to network with other industrialists and entrepreneurs was essential in setting up the Soho Mint.

Boulton's main characteristics, as can be seen in his correspondence about the Soho Mint, were a talent for innovation and passion for finding solutions to problems.⁵⁰ He was, as T.S. Ashton has suggested, an entrepreneur: *'quick to devise new combinations of productive factors, eager to find new markets, receptive to new ideas.'*⁵¹ With his wives' inherited wealth and a relatively prosperous background, Boulton could have chosen to be an 'idle gentleman' but he was more interested in doing something useful with his life. He wrote: *'I am partial to Trade in as much as it extends a man's powers of doing good and I would rather be distinguished as the greatest Manufacturer in Europe than as a Count of the Holy Empire.'*⁵² He started work in the family button and buckle works in Birmingham in the 1740s and by the time Britain was emerging as a colonial power after the Seven Years War (1756-1763), he had established, what was in its time, the most famous manufacturing business in the world at Soho Manufactory.

⁵⁰ There are numerous examples in letters in the Archives of Soho held at Birmingham Archives and Heritage.

⁵¹ T.S. Ashton (1948; 1980) *The Industrial Revolution 1760-1830* p 12; p 97.

⁵² Boulton's first wife Mary died in 1759, the same year as Boulton's father. He then married her sister Ann Robinson and had two children, Ann and Matthew Robinson Boulton. His second wife died in 1783. S. Mason (2005) *The Hardware Man's Daughter: Matthew Boulton and his 'Dear Girl'* Phillimore, Chichester. MS 3782-13-36 Item 27 18th December 1788 MB (Soho) to MRB (Germany) 18 Dec 1788.

Many authors have written about the dawn of the industrial revolution. Pat Hudson considered that Birmingham was already a centre for highly-skilled metal-work in the sixteenth century, and the West Midlands had become an area of specialisation in metal working, with Birmingham being the hub of an alternative pathway to industrialisation.⁵³ Boulton's contemporaries included many of the first industrialists, described by Francois Crouzet as people who own and operate factories with significant capital invested in fixed assets, transport and facilities for their workers.⁵⁴ W.B. Court concluded that new methods and trades were introduced due to '*the energy of a few men.*'⁵⁵ Boulton was one of these men who used his personal contacts to bring about changes in mining as is argued in chapter two, and in minting technology as discussed in chapter three. This thesis shows that improvements both in the technological and artistic aspects of coin design were due to his leadership of the team at Soho Mint.

Boulton was a member of the important mercantile class who belonged to interlocking associations of economic activity, as portrayed by Rule.⁵⁶ In general, the eighteenth century was a time of growth, made possible due to victories in war which had ensured the security of the country.⁵⁷ More described the expansion of industry, due to a stable government and a well-developed legal system, plus the improved '*efficiency of financial systems in channeling funds to where they were needed.*'⁵⁸ Increased mobility of money via county bankers enabled large scale enterprises such as those in the metal industries,

⁵³ P. Hudson (1992) *The Industrial Revolution* Arnold, London p 132.

⁵⁴ F. Crouzet (1985) *The First Industrialists* Cambridge University Press, Cambridge.

⁵⁵ W.B. Court (1938) *The Rise of Midland Industries 1600-1838* Oxford University Press, p 29; p 74.

⁵⁶ J. Rule (1992) *The Vital Century: England's Developing Economy 1714-1815* Longman, London p 257.

⁵⁷ During Boulton's life time, indeed for much of the eighteenth century, Britain was at war. Boulton was twelve years old when the War of the Austrian Succession (1740-1748) broke out and seventeen during the Jacobite Revolution of 1745. He developed the steam-engine with James Watt during the American War of Independence (1775-1783). His minting enterprises were most affected by the events of the French Revolutionary War (1792-1802) and the final part of his working life ended with his death in 1809 during the Napoleonic Wars (1803-1815).

⁵⁸ C. More (1989) *The Industrial Age; Economy and Society in Britain 1750-1985* Longman, London p 42.

mining and smelting to be set up, as discussed in chapter two. More individuals were willing to ‘*employ savings productively*’ and money could be raised to fund industrial activities by ‘*mortgaging factory buildings to some landowner, solicitor, clergyman or widow, whose savings were put out on loan.*’⁵⁹ For Matthew Boulton, the support of William Matthews, the firm’s London agent who took over the banking of the firm in 1785, was very helpful in sourcing finance for the Soho Mint. When Matthews died in 1792, his wife Charlotte continued to support the Mint business and played an important role in distributing the regal coinage orders from her London house.⁶⁰

Most business transactions took place within networks of personal trust with complex webs of credit to pay for goods and carriage, and such connections were vital in driving industrial momentum, including setting up the Soho Mint.⁶¹ Briggs sees these networks as ‘*individual biographies linked in time*’.⁶² These sets of connections included rivals, as well as partners, suppliers, customers and friends. Boulton was the ultimate networker, making links to enable payments for raw materials, for credit and banking, and thus his personal reputation was important as bills of exchange were drawn up on known and trusted names. Moreover networks were important in obtaining commissions for Soho Mint and for guiding applications through parliament; it was vital to have the support of local aristocratic landowners.⁶³ Boulton’s first appearance before a House of Commons committee was in April 1760, as a representative for Birmingham, Warwick and Wolverhampton buckle makers. He had lobbied for the establishment of the Birmingham

⁵⁹ T.S. Ashton (1948; 1980) *The Industrial Revolution 1760-1830* p 12; p 97.

⁶⁰ MS 3792-12-68 Letters between Matthew Boulton and William and Charlotte Matthews 1792-1796; MS 3792-12-69 Letters between Matthew Boulton and Charlotte Matthews 1797- 1799 and MS 3792-12-70 Letters 1800-1801.

⁶¹ W.B. Court (1938) *The Rise of Midland Industries 1600-1838* p 71.

⁶² A. Briggs (1979) *Ironbridge to Crystal Palace: Impact and Images of the Industrial Revolution*, London p 108.

⁶³ H.W. Dickinson (1937) *Matthew Boulton* p 31.

Assay Office in 1773.⁶⁴ Lord Shelburne, Benjamin Franklin and John Motteux of the East India Company, were influential friends, who all helped in extending the steam-engine patent.⁶⁵ His contacts with bankers and other influential members of the establishment meant that he had sponsors to exert influence on his behalf in parliament regarding the regal coinage contract.⁶⁶ These included individuals such as Charles Jenkinson, President of the Board of Trade (1786-1801), who was made Baron Hawkesbury in 1786, and later became Lord Liverpool; William Faulkener, Secretary to Privy Council on Coin, and Thomas Howard, Lord Effingham (1747-1791), Treasurer of the Kings Household and Master of the Royal Mint from 1784-1789. Boulton also had contacts with William Pitt, the Prime Minister.⁶⁷ These contacts would prove essential in his attempts to obtain a regal coinage contract and are discussed further in chapter four.

Coining

During the eighteenth century small change was in short supply, and there were many counterfeits in circulation. When Boulton became interested in coining he estimated there were 72 counterfeit halfpence to the pound weight, versus 46 for the Royal Mint issue.⁶⁸ He wanted to reform the regal coinage to provide sufficient small change, and defeat counterfeiters. He succeeded in breaking the monopoly of the Royal Mint with regard to copper coin production, and not only produced high quality coins to serve the growing

⁶⁴ Matthew Boulton received valuable advice from the Earl of Dartmouth and claimed to have approached a total of forty peers to help in the establishment of the Assay Offices at Sheffield and Birmingham. J.V. Beckett (1986) *The Aristocracy in England 1660-1914* Blackwell, London p 229.

⁶⁵ Letters from all these individuals occur in Boulton's correspondence held in the Archives of Soho.

⁶⁶ J. Scott (1991) *Who Rules Britain?* Polity Press, Cambridge p 41.

⁶⁷ 'I have this morning with Mr Garbett, met the Lord Advocate, Mr Brown and Mr Rose at Mr Pit [sic] but the latter hath beg'd off till 9 o'clock Wed morning.' MS 3147-3-10 Item 5 MB (New River Head) to James Watt (Birmingham) 5 Mar 1786; 'We have been twice with Mr Pitt, thrice with the Lords of Council, often at Mr H Browns at Mr Eden's begged my attendance at Guild Hall. Tolerable regulation of patents both with Mr Pitt and Privy Council.' MS 3147-3-10 Item 6 MB (London) to James Watt (—) 15 Mar 1786.

⁶⁸ His 1799 halfpence were struck at 35 to the pound, and of a much better quality than those struck at the Royal Mint. A. Wager (1977) *Birmingham and the Nation's copper coinage 1750-1820. A study in local initiative* Dissertation for BA Dec 1977 Birmingham.

industrial population, but also changed the technical processes of minting. This is discussed in chapter three.⁶⁹ In order to understand the significance of these achievements it is necessary to understand the state of British currency at the end of the eighteenth century. Coins have been in use since around 600 BC and are evidence of an urban lifestyle, based on trade in manufactured as well as agricultural goods.⁷⁰ Gold coins were in use in Celtic Britain in the first century BC, remained in Roman Britain, but disappeared from circulation around 425 AD. A coin is a piece of metal to be used as money which conforms to a standard approved by a government or ruling authority. They were originally made from silver and gold, with the face value theoretically being the intrinsic value of metal, so production was determined by the availability of precious metal.⁷¹ Tokens on the other hand were not authorized by the government and did not necessarily represent the value of the metal they contained. However it was difficult to make coins of one metal only as it was impractical to use gold or silver to make very small value coins, and if base metal such as copper was used for high value coins, they were usually too big and easy to counterfeit.⁷² Therefore different metals were usually used for different value coins. Bimetallism, that is the ratio in value of gold and silver, was at the heart of the shortages of coin in eighteenth century Britain. This topic has been

⁶⁹ Brass farthings were made under license in 1613 by Lord Harrington in the reign of James I, but none were issued under the Commonwealth though patterns in copper and pewter were made. J.R.S. Whiting (1971) *Trade tokens: A Social and Economic History* David Charles, Newton Abbott.

⁷⁰ Coins originated in Lydia (modern Turkey). C. Howgego (1995) *Ancient History from Coins* Routledge, London, p 1.

⁷¹ The metal came mainly from Bohemia, Austria, Serbia and Sardinia by the early fourteenth century, but later most of the gold came from Guinea and the Gold Coast via the Africa Company of Merchants. C.E. Challis (ed.) (1992) *A New History of the Royal Mint* Cambridge University Press; G. Selgin (2008) *Good Money* pp 8-18.

⁷² The silver penny of 1660 weighed 0.5g whereas Boulton's 1797 copper penny weighed 28g and the twopence 56g. However these coins were very light in comparison with Swedish money. Sweden had a lot of copper so plate money, weighing as much as 20kg, was used between 1644 and 1776. D.R. Cooper (1988) *The Art and Craft of Coin-making* p 25.

ably covered by Angela Redish.⁷³ Kevin Clancy also discusses the shortage of coin and the Royal Mint's responses.⁷⁴ It is not part of the purpose of the thesis to revisit this issue.

From the late seventh century silver coins known as sceattas became more commonly used in Britain. These were superseded by silver pennies, and silver halfpennies, issued from the time of Offa of Mercia (757-796).⁷⁵ Silver pennies were the main form of small change, with halfpennies being very rare until Edward I (1239-1307) issued large numbers, and introduced farthings. A shilling, still commonly used in Boulton's time, was first worth five pennies, but was then divided into twelve pennies, denoted by 'd'.⁷⁶ By 1489 the highest value English gold coin was the sovereign, originally issued as twenty shillings by Henry VII (1457-1509). Selgin has discussed the policies of the Royal Mint which led to the official monetary unit, the pound (£), not actually existing as a coin, but being represented by a gold guinea with a value stabilised at 21s in 1717.⁷⁷ The guinea was used in Boulton's time for large value transactions, though all monetary values were given in pounds (£), shillings (s) and pence (d).⁷⁸ This system, with twenty shillings and 240 pennies to the £, was retained until decimalisation of the regal coinage in 1971.⁷⁹ Regal coinage was issued from the Tower of London from 1279. The Royal

⁷³ A. Redish (2000) *Bimetallism: An Economic and Historical Analysis* Cambridge University Press.

⁷⁴ Kevin Clancy (1999) *The recoinage and exchange of 1816-17* PhD Thesis, University of Leeds, December 1999

⁷⁵ Julius Caesar, visiting Britain in 55 and 54 BC noted that the British had gold and iron coinage. The penny standard was set by Charlemagne in 794 AD at 240 pennies to one pound weight, and by 956 AD one currency was valid throughout Britain. J. Kent (1978) *2000 Years of British Coins and Medals* Trustees of the British Museum, London

⁷⁶ Pennies were descended from roman 'denarius', hence 'd'; and shillings from 'solidus' hence 's'.

⁷⁷ By 1710 one pound sterling = 113 grains of fine gold. However both gold and silver coins became devalued. Good quality silver coins tended to be melted down. In 1717 alone the EIC exported 3 million oz of silver bullion. In 1816 the gold standard was officially adopted but pound coins, or sovereigns, worth 20s, were not officially made until 1817. G. Selgin (2008) *Good Money* pp 8-18.

⁷⁸ Values in this dissertation will be given in £ (pound), shilling (s) and pence (d) for example: £300 2s 5d, but in original documents the values may be written as 300£ 2/- 5d or in other notations.

⁷⁹ Post decimalisation, there are now 100 pence to the pound and 1p equals 2.4d. New decimalized coins, 50p, 20p, 10p, 5p, 2p, 1p and ½p coins, were introduced on 15th February 1971. £1 coins were introduced in 1983 and £2 coins in 1986 (bimetal type in 1997). Information from <http://www.royalmint.com>.

Mint achieved a monopoly on coining in the sixteenth century, when some processes of minting were temporarily mechanised. This is discussed further in chapter three.

By the late eighteenth century, the main regal coins in use were the gold guinea, silver shilling, and copper halfpenny. Half crowns and sixpences were also used. Silver pennies and halfpennies had ceased to be practical from the reign of Charles II on, and the last silver farthing had been produced in the reign of Edward VI (1547-1553).⁸⁰ A variety of other coins were available, including a range of tokens, foreign coins, and counterfeits. Gold coins, guineas and half guineas, were usually of good quality, and generally struck in sufficient quantities. A few hammered gold coins were still in circulation despite efforts to remove them. Further re-coinages of gold was carried out in 1734 when 15,500lb of old coins were melted down, including coins dating back to Elizabeth I, and again in the 1770s 39,525 half guineas and 468,636 guineas were re-struck, as they were not of standard weight.⁸¹ Boulton was involved in this re-coinage as an exchanger of gold coin.⁸²

Silver coins were theoretically convertible by tale (number) into gold. Silver shillings and sixpences were produced in sufficient numbers until the reign of George II. But for the first fifty five years of George III's reign, they were made in very low numbers. There was no shortage of silver bullion but an unwillingness to mint it as the market price for

⁸⁰ C.E. Challis (ed.) (1992) *A New History of the Royal Mint* p 17.

⁸¹ The standard for gold coins was confirmed in April 1776. Around 10-50,000 lb troy of gold was used to make gold coins in some years. C.E. Challis (ed.) (1992) *A New History of the Royal Mint* p 440.

⁸² D. Symons (2009) talk at conference: *Where Genius and Arts Preside: Matthew Boulton and the Soho Manufactory 1809-2009* 3rd-5th July 2009.

silver was above what the Royal Mint was authorized to pay.⁸³ Any good quality silver coins were likely to be converted into bullion and exported.⁸⁴ The grossly underweight silver shillings in use were effectively a token coinage. To make up for the lack of change, silver ‘pieces of eight’ or eight reales from Spanish bullion, mined in their American colonies, circulated freely.

For small value transactions the halfpenny and farthing were used. Copper farthings, first introduced during the reign of James I (1603-1623), were not a huge part of the circulating medium.⁸⁵ Copper halfpennies were used from the reign of Charles II (1668-1702).⁸⁶ Under Newton’s direction from 1717, the Royal Mint produced £30,289 worth of copper coins over seven years, with halfpennies being predominant. Around one thousand tons of halfpennies and farthings were struck up till 1775, which sufficed until greater calls for small change were caused by the expansion of industry.⁸⁷ However there were no copper pennies until Boulton’s issue of 1797 from the Soho Mint as the Royal Mint had never considered that minting copper was part of its remit. Poor quality control meant that copper coins of the same denomination were not necessarily of uniform size or

⁸³ The Bank of England had issued countermarked silver dollars in 1797 but these were quickly counterfeited. A short-lived issue of silver coins was minted in April 1798 when £30,000 of bullion (9,895lb) was brought for coining by individuals led by Magen Dorrien Magens. The issue, due for delivery on 16th May, was stopped by William Pitt. G. Dyer and P.P. Gaspar *The Dorrien and Magens Shilling of 1798* British Numismatics Journal Volume 52 (1983) pp 198-214.

⁸⁴ A. Redish (2000) *Bimetallism: An Economic and Historical Analysis* p 5. H.E. Manville (2001) *Tokens of the Industrial Revolution: Foreign silver coins countermarked for use in Great Britain c 1787-1828* British Numismatic Society Special Publication No. 3 Spink, London.

⁸⁵ Groats (value four pence) were only used as Maundy money in the reign of George III. The sixpence had replaced the groat by 1561 in general circulation and by this time the smallest silver coin was a halfpenny weighing 4 grains or 0.26g. From the time of Elizabeth I (1533-1603) twenty shillings was now called a pound sterling (£) to distinguish it from a sovereign which was worth more, and from 1663 (Charles II) the gold guinea replaced the sovereign. H.A.

Seaby and P.J. Seaby (1949 edn) *Catalogue of Copper Coins and Tokens of the British Isles* B.A. Seaby Ltd. London.
⁸⁶ These halfpennies weighed between 10.0 and 12.0 grams with a diameter of 28–31mm, and were dated 1672, 1673, and 1675. Farthings were issued in 1672, with 497 barrels of blanks weighing 300lb imported from Sweden. Farthings were not discontinued until 1956. J.S. Whiting (1971) *Trade tokens: A Social and Economic History* David Charles, Newton Abbott.

⁸⁷ 818 ton of copper coins, mainly halfpennies, were struck between 1729 and 1754, with a further 234 tons between 1762 and 1775. C.E. Challis (ed.) (1992) *A New History of the Royal Mint* p 436.

weight; those in circulation could be worn, with indistinct images, which meant that they were easy to counterfeit.⁸⁸ Even when copper coin was supplied, this often just contributed to more counterfeits as the full bodied (i.e. of correct weight) coins were melted down and used to make lighter weight counterfeits.⁸⁹ After 1775 no more copper coins were made by the Royal Mint until 1821.⁹⁰

The situation facing Boulton and others, when he decided to set up the Soho Mint, was an uneven distribution and considerable lack of small change, plus many counterfeit coins in circulation.⁹¹ Throughout the medieval period (1158-1464) coin dies were almost always centrally made but then issued from the Exchequer to mints located around the country. Stocks of dies were kept at some royal castles and exchanged when worn, to avoid unnecessary travelling. This meant that the distribution of coin was widespread.⁹² However in the eighteenth century all coins had to be collected from the Royal Mint at the Tower of London, and no arrangements were made for distributing them round the country.⁹³ If increased quantities were made available, they tended to end up in the coffers of London brewers and other wholesalers. Small value coins could not be accepted in large numbers to pay customs and excise, or exchanged for gold at the Royal Mint, and consequently there were many complaints which led to the Mint ceasing to

⁸⁸ J. Craig (1953) *The Mint: A History of the London Mint from AD 287-1948* Cambridge University Press p 252. A royal proclamation in 1751 was issued against coiners and offenders were sentenced to two years imprisonment. In 1771 there was an Act (24 June) to make counterfeiting a felony, but neither had any effect. G. Selgin (2008) *Good Money* pp 29-30.

⁸⁹ *The Monthly Review* of September 1771 reported that 20 tons of copper coin had been delivered but in vain; the counterfeits made were used as nothing else was available. G. Selgin (2008) *Good Money* pp 20-22.

⁹⁰ H.A. Seaby and P.J. Seaby (1949 edn) *A catalogue of Copper Coins and Tokens of the British Isles* B.A. Seaby Ltd. London.

⁹¹ This section is based on Challis and Craig's accounts of the Royal Mint.

⁹² There were mints at Durham, Canterbury and York until 1544. C.E. Challis (ed.) (1992) *A New History of the Royal Mint* p 111 and p 222.

⁹³ The Royal Mint moved to Llantrisant in South Wales from December 1968 and the Tower Hill Mint finally closed in 1975. Information from <http://www.royalmint.com>.

coin. However other areas further away from London suffered from a great shortage of coin. Employers found it difficult to find sufficient cash to pay wages to their workers, especially in new industrial areas such as Anglesey, which is why tokens were used.⁹⁴ The distribution of coins was important as well as their production, and needed to be remedied by the end of the eighteenth century, to avoid limiting economic activity..

Why were coins needed? Even by the early eighteenth century two thirds of Government revenue came via small cash purchases in the form of customs duties on imports and excise on home produced articles.⁹⁵ Burgeoning urban populations generated unprecedented demand for low denomination coins for the purchase of goods and services.⁹⁶ More and more people were dependent on a money wage, as barter trading and subsistence farming decreased, especially after further parliamentary enclosures of common land between 1750 and 1780. Daily necessities, such as malt, beer, sugar, tea and tobacco, where the unit of transaction was small, were purchased in a variety of retail shops or from itinerant sellers.⁹⁷

George Selgin has written about ‘Britain’s Big Problem’ of cash shortages in the eighteenth century in his book ‘*Good Money*’. He describes the difficulties caused to employers who sought to find sufficient coin to pay their employees.⁹⁸ He suggests that workmen had very little likelihood of ever seeing any gold coins, and were forced to

⁹⁴ David Vice (1989) *The Soho Mint and the Anglesey Tokens of the Parys Mine Company* Format 38 March 1989.

⁹⁵ By 1785 London had 21,600 shops. P. Matthias (2004) *Official and Unofficial Money in the Eighteenth century* British Numismatic Journal Volume 74 pp 68-83.

⁹⁶ Peter Jones estimates Birmingham’s population to have been between 7,000 and 8,000 in 1700. By 1792 Birmingham had a population of 60,000. P.M. Jones (2008) *Industrial Enlightenment: Science, technology and culture in Birmingham and the West Midlands, 1760-1820* Manchester University Press, Manchester p 34-38.

⁹⁷ P. Matthias (2004) *Official and Unofficial Money in the Eighteenth century* British Numismatic Journal Volume 74 pp 68-83.

⁹⁸ G. Selgin (2008) *Good Money* pp 24-29.

accept poor quality shillings in their pay which might buy only sixpence worth of goods. They might receive counterfeit pennies or halfpennies in their change. The *Birmingham Gazette* noted that a workman in Birmingham received on average 9s or 10s per week in 1787, while the agricultural wage was around 7s 6d per week as late as 1793, though women were more poorly paid.⁹⁹ The wages and working conditions at Soho Mint, where some experienced workers were earning up from 18s to £1 10s per week, are discussed in a forthcoming publication by the author.¹⁰⁰

Boulton himself needed to be able to supply the large workforce at Soho with wages. As early as 1771, he was having problems in finding sufficient small change for his wage bill. A correspondent, Francis Cobb, wrote: *'The scarcity of cash in this part & for many miles round us as been for some time past greater than I ever remember, & had it been to have saved my life don't believe I could have raised so much as to have satisfied your last weeks bill.'*¹⁰¹ Similarly in 1783, Zaccheus Walker, Boulton's brother-in-law and warehouse manager, wrote: *'At present there is a very great scarcity of cash at Birm^m & Lichfield.'*¹⁰² Selgin describes the stratagems employers had to resort to in order to pay their workers, including remuneration in kind, truck tokens, payment at intervals and

⁹⁹ Other estimates gave an average wage of 15s-20s with a maximum wage of £2 per week. H. W. Dickinson (1936) *Matthew Boulton*, Cambridge p 139; Witt Bowden (1925) *Industrial society in England towards the end of the eighteenth century*, Macmillan, New York, p 219. Selgin has estimated that £1 in 1787 was equivalent to 90 dollars or around £50 but various web sites give an equivalent of anything from £100 to £1000 equivalent to £1. For a full list of British monetary units and their purchasing power see G. Selgin (2008) *Good Money* p 9.

¹⁰⁰ S. Tungate (forthcoming) *Workers at the Soho Mint* in: S. Baggott and K. Quickenden (eds.) *Matthew Boulton-Enterprising Industrialist of the Enlightenment* Ashgate, Farnham.

¹⁰¹ Cobb continued: *'Mr Robinson w^d bring some cash out of Shropshire.'* MS 3782-12-23 Item 194 Francis Cobb (Lichfield) to MB (London) 3 Apr 1771.

¹⁰² Cobb continued to supply small change but in limited amounts. *'Mr Cobb last week ...could only supply £100 each Friday. ...He expects the scarcity to continue two or three weeks longer with him, and under this circumstance I fear it will become general, as those kind of folks are apt to drain each other. By a hint from Mr Tyson I have this evening wrote to Mr Barton (at the Post Office in Lichfield) desiring he wd if possible assist you with a little Cash for Two or three weeks towards supplying the wants of Soho, but its doubtfull if my application will succeed.'* MS 3782-12-74 Item 74 Zaccheus Walker (Birmingham) to MB (London) 15 Feb 1783.

group pay.¹⁰³ An explosion of counterfeits and similar unofficial pieces were produced by the end of the century and were accepted in circulation as they were all that were available.¹⁰⁴

When and why did Matthew Boulton involve himself in coining?

Matthew Boulton was well known for insisting on making goods of superior quality, and produced a vast array of products.¹⁰⁵ He seems not primarily motivated by profit in setting up most of his business transactions, although profit was of course important. He often seemed on the brink of financial disaster, but he always seemed to recover just in time.¹⁰⁶ Why did he set up the Soho Mint when he could have been at the point of retirement? He was after all in his late fifties when he first had the idea and sixty-nine years old when, after many setbacks, he finally achieved his regal coinage contract in 1797.

Apart from a possible profitable business opportunity, in setting up the Soho Mint Boulton was motivated by the enjoyment of innovation, the desire to improve the supply of money, and the enhancement of his reputation. His friend, James Keir in a memoir, said *'it was always in Mr B's mind to convert such trades as were usually carried on by individuals into Great Manufactures by the help of machinery, which might enable the article to be made with greater precision, and cheaper than those commonly sold.'*¹⁰⁷

Similarly Boulton had a keen appreciation of the commercial opportunities offered by an

¹⁰³ Samuel Oldknow's textile business had a monthly wage bill of £1000 in 1786. G. Selgin (2008) *Good Money* p 24.

¹⁰⁴ D. Symons (2009) in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* p 7.

¹⁰⁵ G. Selgin (2008) *Good Money* p 85.

¹⁰⁶ He was saved by the steam engine business as discussed further in chapter two. G. Selgin (2008) *Good Money* p 86.

¹⁰⁷ MS 3782-13-37 'Memorandum for the Memoir of M Boulton'. It is not dated but accompanies a covering letter from James Keir to MRB 3 Dec. 1809; quoted in E. Robinson *Eighteenth-Century Commerce and Fashion: Matthew Boulton's Marketing Techniques* Economic History Review, Volume XVI No. 1(1963) pp 39-60.

engine producing rotary motion and saw that steam power could be harnessed to solve the problems posed by Britain's serious shortage of small change.¹⁰⁸ Another motive was esteem from his peers. As a member of the important mercantile class who was bent on gentrification, Boulton wanted to perform a public service in making coin. A different reason was to use up copper surpluses in order to maintain the viability of Cornish copper mining where many of Boulton and Watt's steam-engines were employed, which is discussed in chapter two.

Boulton had been interested in coinage reform from at least the 1770s. Dickinson quotes a letter from Boulton to Lord Dartmouth on 10 November 1772, suggesting that the Legislature should consider the poor condition of coined and paper currency.¹⁰⁹ By 1773, a correspondent commented on Boulton's ideas to prevent shaving of guineas: *'I think it a very good expedient & if you will send me the particulars of the expense etc. It shall be laid before him [Lord North] when I next go to London.'*¹¹⁰

Boulton contributed to the investigations into the Royal Mint in September 1782 when Lord Shelburne, (Marquis of Lansdowne from 1784), appointed Samuel Garbett (1717-1803) and his son Francis (1742-1800) to report on the Royal Mint. Boulton wrote:

My friend Mr. Samuel Garbett hath been appointed to investigate sundry important matters relative to the weight and standard of the coin, as well as what ever relates to the conduct of the business of the Mint. The Lords of the Treasury

¹⁰⁸ Many instances of technical improvements concerning the steam-engine and the mint are found in Boulton's correspondence with Watt. Indeed, in 1783 Boulton discussed reports of him being credited with its invention alongside Watt. MS 3147-3-7-7, 16 April 1783, MB (London) to James Watt (Birmingham).

¹⁰⁹ H.W. Dickinson (1937) *Matthew Boulton* p 135.

¹¹⁰ MS 3782-12-23 Item 282 Sambrook Freeman (Fawley) to MB (Soho) 1 Aug 1773.

*have certainly made a proper choice, for I do not think there is a man in England better qualify'd, more to be depended upon, or more proper in every respect.*¹¹¹

Garbett reported all his findings, including the costs of the Royal Mint, to Boulton. The report was not followed through as Shelburne's Ministry fell in February 1783.¹¹² Garbett was later involved in planning a new regal coinage with Boulton and Thomas Williams.¹¹³ By 1786, Boulton was involved personally in coining and was making coins for the Honourable East India Company. Eventually the Soho Mint was started in 1788 with the intention of making a regal coinage for the government.¹¹⁴

An important motive, claimed by Boulton himself, was to put an end to counterfeit coin. At the end of the eighteenth century, evasive and counterfeit money was widespread in Britain, but was essential to keep the economy working.¹¹⁵ Patrick Colquhoun, a magistrate, had investigated counterfeiting during the promotion of the 1785 Police Bill and published his ideas in his *Treatise on the Policing of the Metropolis*.¹¹⁶ Boulton had contributed to the report and wrote:

In the course of my journeys, I observe that I receive upon average two thirds counterfeit halfpence for change at tollgates etc, and I believe that the evil is daily increasing as the spurious money is carried into circulation by the lowest class of

¹¹¹ The first half of the letter is a transcription of a report on the state of the Mint, sent by Samuel and Francis Garbett to 'The Right Honourable The Lords Commissioners of his Majesty's Treasury'. MS 3782-12-108 Item 32 23 Nov 1782; MS 3782-12-27 Item 259 MB to Mr. Gilbert 11 Dec 1782.

¹¹² Lord Shelburne, the Marquis of Lansdowne from 1784, commissioned the report in September 1782. D.W. Dykes *Mr Garbett's Sixpence* Numismatic Circular June 2005 Volume CXIII Number 3.

¹¹³ MS 3782-12-61 Item 44; Item 45; Item 47 S. Garbett (London) to MB (Soho) 2 Sep 1782; 22 Oct. 1782; 5 Dec 1782.

¹¹⁴ D.W. Dykes (2005) *Mr Garbett's Sixpence* Spink Numismatic Circular June 2005 Volume CXIII No. 3.

¹¹⁵ D. Symons (2009) in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* pp 1-23.

¹¹⁶ G. Selgin (2008) *Good Money* p 31.

*manufacturers, who pay with it the principle [sic] part of the wages of the poor people they employ.*¹¹⁷

Boulton was himself asked to make counterfeit gold coins for Portugal in 1794, and counterfeit Anglesey tokens in 1796, and in 1801, base silver Danish coins, but refused.¹¹⁸ Other manufacturers did not, as it was possible to make an excellent profit on ‘currency speculation’.¹¹⁹ Several attempts had been made in Birmingham to prevent counterfeiting.¹²⁰ The poorest workers risked having bad coin in their pay refused at local shops or only taken at a discount. As an unabashedly paternalistic employer, their plight appears to have been close to Boulton’s heart.¹²¹ He was also eager to raise the reputation for Birmingham goods and was keen to provide a coinage containing the intrinsic value of metal, of constant diameter, thickness and weight, and to use steam power to produce it cheaply so that it would not be worth counterfeiting.¹²² Boulton believed that he could produce sufficient coinage to supply the needs of the growing industrial workforce, and that he could do it more economically than the Royal Mint.¹²³

In 1788 Boulton decided to build the Soho Mint. He wrote to Watt following a meeting of the Privy Council for Coin: *‘Although I make no dependence on Gov’ coinage yet having an order from another King and one from America I am determined to finish my Mint at*

¹¹⁷ J. F. Sanders (1970) *Matthew Boulton and the Copper Coinage of Great Britain* Coin and Medal Bulletin, Seaby, London p 233.

¹¹⁸ D. Symons (2009) in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* pp 18-23.

¹¹⁹ One merchant alone was exporting the modern day equivalent of a million pounds. D. Vice *A trial strike of a Birmingham counterfeiter’s die* Format 37 September 1988.

¹²⁰ In February 1776 a meeting of the ‘principal inhabitants’ of the town decided to offer a reward of £20 for information. Two years later, in 1778, the ‘principal traders’ signed an agreement to prosecute offenders. In 1780, the town officers announced that they were determined to put an end to the manufacture of base coin once and for all. W.J. Davis (1895) *The Token Coinage of Warwickshire*, Birmingham p xiii.

¹²¹ J. Powell (1993) *The Birmingham Coiners 1770-1816* History Today Volume 43, July 1993 p 31.

¹²² R. Doty (1998) *The Soho Mint and the Industrialisation of Money* pp 15-16.

¹²³ Boulton wrote a series of answers in response to questions from the Privy Council for Coin in January 1788 detailing proposals to improve the supply of coin. MS 3782-12-97 Copper coinage and government 112 a and b.

*Soho for that purpose.*¹²⁴ By 8th February 1788 Boulton was encouraged to think that a regal coinage contract was imminent. He wrote to his son Matthew Robinson Boulton with enthusiasm:

*I was sent for to Town by Mr Pitt and the Privy Council about a new copper coinage which I have agreed for, but at a very low price, yet nevertheless it shall be the best Copper Coin that ever was made. I am building a Mint & new Manufacture for it in my Farm Yard behind the Menagery at Soho.*¹²⁵

He appears to have been disappointed in his expectations as no regal coinage or other contracts ensued at this point, but he did produce some beautiful pattern coins.

Boulton explained his motives for setting up the Soho Mint in letters to Joseph Banks in 1789 but also complained that nothing was being done by the Government.¹²⁶ He wrote in September: *'I took up the subject because I thought it would be a publick good, and because Mr. Pitt had express'd a wish to me of seeing something done to put an end to counterfeiting the copper coin'*. In the same letter he wrote: *'It is not sufficient for a copyist to immatate my coin, but 'tis absolutely necessary that it should be done at half the expence which the bad coin hath cost our Government, as the best preventitive against counterfeits.*¹²⁷ Further letters to his son in November expressed a similar motive: to prevent counterfeiting. He was worried that workmen were being cheated and trade harmed. Boulton was concerned that this would lead to counterfeiting of gold and

¹²⁴ MS 3147-3-12 Item 2 MB (London) to James Watt (Harper's Hill) 25 Jan 1788.

¹²⁵ MS 3782-13-36 Item 19 MB (London) to MRB (Paris) 8 Feb 1788.

¹²⁶ MS 49 Reference 82934 Timmins Album Volume 1 Item 10 MB (Soho) to Sir Joseph Banks 14 Aug 1789.

¹²⁷ MS 3782-21-1 MB (Buxton) to Joseph Banks (Soho Square, London) 10 Sep 1789.

silver coins and a debasement of the currency.¹²⁸ In addition, a stable coinage might reduce pressure from workers for higher wages.

The government repeatedly postponed a decision about a new coinage for nearly ten years. The issue of regal coinage is further discussed in the catalogue. Meanwhile the shortage of small change had also led to the provision of tokens from 1787, by certain individuals including the major copper producer Thomas Williams and the ironmaster, John Wilkinson. When he failed to achieve the regal contract in 1789, Boulton started to provide tokens for such customers, gaining much useful technical information in the process. It was a financial crisis caused by the war with France which eventually gave Boulton his opportunity to make his first regal issue in 1797, but despite his claims, these cartwheel coins were not difficult to counterfeit.¹²⁹ Counterfeiting was again rife in February 1799 when Boulton wrote to Sir Joseph Banks who was on the committee for Coin: *'The number of counterfeit money makers are very numerous in Birm^{gm} but the prosecutions are few & the punishment still fewer because nobody seems interested in bringing the offenders to Justice.'*¹³⁰ The design of the 1799 regal coinage included various technical improvements including edge markings and concave blanks which made coins much more difficult to counterfeit. This is discussed in chapter three.

¹²⁸ *'It is now too common a custom among many of the lower classes of Manufacturers and traders, to purchase these counterfeit halfpence at little more than half their nominal value, and to pay with this money their workmen & labourers, greatly to the injury of the honest part of the community, and to the detriment of Trade.'* MS 3782-13-36 Item 37 MB (Soho) to MRB (Langensalz, Germany) 12 Nov 1789.

¹²⁹ G Dyer (2002) *The Currency Crisis of 1797* British Numismatics Journal Volume 72 2001 pp 135-142

¹³⁰ MS 3782-12-56 Item 96 MB (Soho) to Sir Joseph Banks (—) 1 Feb 1799. David Symons describes the raid on counterfeiters by Boulton and his workers on 30th Jan 1799. D. Symons (2009) in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* pp 13-15.

Was the Soho Mint a viable concern?

Various authors have discussed Boulton's financial affairs. However a detailed financial analysis of the Soho Mint is beyond the scope of this study. When the Soho Mint was first established, no separate record books were initially kept, so it is difficult to assess whether it was profitable. Large sums were invested in its construction, but it is not easy to give a final cost, as both buildings and machinery were altered so many times, as discussed in chapter three. However the finances of other parts of Boulton's businesses may have influenced his decision to become involved in coining, in particular the connection between the copper industry and the steam-engine business as discussed in chapter two.

Several authors have made attempts to discuss Boulton's financial affairs, but have found it difficult to come to any definite conclusions. In 1940 J. Cule discussed the financing of the steam engine business.¹³¹ But later authors have disagreed about his analysis: J. Lord suggested in 1966 that the capitalisation of Boulton and Watt owed much to the '*resources of Boulton and Fothergill*.'¹³² However Eric Hopkins concluded that the firm of Boulton and Fothergill suffered severe financial difficulties.¹³³ Some financial affairs were discussed in the correspondence between Boulton and Watt and their agents. But these letters give only snapshots, so any detailed analysis of accounts is limited.¹³⁴ Financing from Lowe, Vere, and Williams had reached over £18,000 by the end of 1780. However under James Watt's control the debt was slowly repaid. R. Hills

¹³¹ J. Cule (1940 *Finance and Industry in the Eighteenth Century* Economic History Vol. IV, No 15 pp 319-325.

¹³² J. Lord (1966) *Capital and Steam Power 1750-1800* London p 110.

¹³³ E. Hopkins (1984) *Boulton before Watt: the earlier Career re-considered* Midland History Volume IX page 43-58

¹³⁴ J. Tann (1995) *Riches from Copper: the Adoption of the Boulton and Watt Engine by Cornish Mine Adventurers* Transactions of the Newcomen Society, Volume 67 pp 27-52.

has noted that up to 1783 Cornwall had generated close to £20,000 new capital.¹³⁵ Jeremy Knowles has also suggested that the steam-engines used in Cornwall represented the primary contributor of new capital during the early years of the B&W partnership and provided the stimulus behind the economic revival of the firm in the early 1780s. Whatever version was correct, the reality of the situation was that by 1784 Boulton and Watt received their first clear share of the engine business profits.¹³⁶ However the Cornish engine market weakened, due to increasing problems with sales of copper (as discussed in chapter two). The annual premiums received from steam-engine use peaked at £9,422 4s 2d in 1787 then declined sharply. This was not due simply to lack of engine sales, but, from 1787, the proportion of premiums paid by the Cornish Mine Adventurers steadily decreased. In 1788, Boulton and Watt received around £5,000 out of £12,000 royalties owed, and in 1798 the firm only received 14% of the year's total premiums.¹³⁷ This meant that from the mid 1780s the copper industry was vital to the finances of Soho, which is why Boulton was so concerned with copper sales and possibly a reason for developing the Soho Mint.

John Roberts, who kept the household accounts from around 1787, seems to have had initial responsibility for paying the wages of the workers at the Soho Mint. He complained in May 1789 that: '*No one at present seems to have the active management of*

¹³⁵ W. Matthews to J. Watt, 18th Dec 1780 in: R. Hills (2005) *James Watt Moorland*, Ashbourne.

¹³⁶ This amounted to £10,978.4s.5¾d out of a total income of £17,681.6s.6½d. J. Knowles (2008) *An Assessment of the Application of James Watt's Reciprocating Steam Engine in Cornwall on the Development of the Firm of Boulton and Watt, 1775-1795*. A Dissertation submitted for the Degree of B.A. Hons, Medieval and Modern History, University of Birmingham.

¹³⁷ B&W received £5,209 13s 9d of royalties totalling £12,312 14s 1d. By the end of 1798 Boulton and Watt did receive a total £105,904.9s.5d., but despite collecting £30,000 in back royalties in 1799, claimed that in reality they were still owed £162,052.3s.7d from the Cornwall mines. T. Wilson to M. Boulton and J. Watt 22nd Feb 1799, in: H. W. Dickinson (1936; republished 1999) *Matthew Boulton* p 176.

*the mint.*¹³⁸ However Zaccheus Walker, Boulton's brother-in-law, in charge of the Birmingham warehouse, was able to supply some details.¹³⁹ Mint records were kept from February 1791 when Matthew Robinson Boulton took over responsibility for day-to-day management, though the decisions were left in Matthew Boulton's hands.¹⁴⁰ Accounts recorded in October 1792 give a total of over £20,000 for metal alone, with claims against this totalling around £13,200 for items owed, including copper and transport.¹⁴¹ However, it appeared in November 1792 that Boulton was about to become solvent, and was planning to pay off the mortgage owed to Wedgwood.¹⁴² Like modern businesses, he had cash flow problems; his capital was tied up in copper stocks, and payments for completed mint orders were not always easily obtained. In 1793, for example, he needed to pay Mr Townsend of the Yorkshire Copper Company, before he had received £1500 owed by the Sierra Leone Company, and 2000 guineas owed for copper sales. But once these payments were sorted out he was finally solvent and wrote: *'This being paid, I have the satisfaction of saying that I do not owe a single guinea for copper or brass or any*

¹³⁸ MS 3782-12-66 Item 111 John Roberts (Soho) to MB (—) 7 May 1789.

¹³⁹ *'The whole of the expenses incurred on Coinage account, both at Soho and Birmingham.....The nett sum at the debit of Coining account in Birmingham Books is £502.4 3d besides this you incurred expenses of Postage, Portorage &c.'* However Walker was unable to work out the amount given to Jean-Pierre Droz. *'In a correspondence with Mr Droz previous to the coining account being opened, or my knowing that you would have one opened, I cannot say the amount.'* MS 3782-12-74 Item 172 Zaccheus Walker (Birmingham) to MB (London) 19 Jan 1789.

¹⁴⁰ MS 3782-3-13 Mint day Book 8th February 1791-16th May 1795.

¹⁴¹ The buildings were valued at £584. Running costs came to approximately £1,370 which included wages of £821, building expenses, coal and general carriage. The amounts paid to the engraver Ponthon and to Swediaur in Paris were listed separately (£134 and £169 respectively). Effects to the value of £20, 675 were mainly for 222 tons, 12cwt 3q 5lb 7 oz of copper coming from John Hurd (133 tons), with more from Thomas Wilson. Other metals included silver to the value of £17. Money was owed to Michel & Co £758; John Hurd £4,499; Boulton & Hurd £554; Thos Wilson £4,418; Thos Williams £198; for copper; and various sums to the individuals who delivered copper and distributed coin: Chas Broadley £98; Bordieu & Co £1,960; Henshall £130 and Thos Sherrat £80. With sundries this came to £13,200 owed. MS 3792-13-120 Coinage 22 October 1792.

¹⁴² Boulton wrote hopefully: *'As to my Currant Account, it shall be wiped off in a few weeks, or at least so soon as I can sell off my stock of copper, which is now very great* [Marginal note: *£10,000 worth], but when that is sold and I have paid what ballance I owe on Coinage Account, it appears (by an account deliver'd to me this morning by Mr. Brown) that I shall have a net ballance in hand of £7500.'* MS 3792-12-68 Item 16 MB (Soho) to Charlotte Matthews [London] 12 Nov 1792

other metal, but have much owing to me for those materials.'¹⁴³ This is when the Soho Mint was first fully employed, but not when the large coinage issues were being made.

The Soho Mint, which contained the first steam-powered press was run successively by Matthew Boulton from 1788-1809, Matthew Robinson Boulton between 1809-1841, and Matthew Piers Watt Boulton from 1841-1850. It was one of Boulton's proudest achievements as indicated in the three portraits of him painted between 1792 and 1801. In two of these he is holding a coin or medal, and in the third he is leaning on the Mint record book as seen in the frontispiece.¹⁴⁴ Initially, the Mint was solely engaged in the manufacture of coins, medals, and tokens, but it later supplied machinery for mints in various parts of the world.¹⁴⁵ David Vice has estimated that between 1793 and 1799 in excess of £109,000 was made at the Soho Mint, making it one of Boulton's more profitable enterprises.¹⁴⁶ When the further regal coinage issues of 1805-1807 and contracts for the East India Company from 1803 are also considered, Soho Mint was successful financially as well as technologically and artistically. As Richard Clay points out, Boulton had refined the 'Art of Making Money' and had indeed made money from the Soho Mint.¹⁴⁷ The processes by which he did this are discussed in further chapters.

¹⁴³ MS 3792-12-68 Item 43 MB (Soho) to Charlotte Matthews [London] 7 May 1793.

¹⁴⁴ 1792 Charles Frederick von Breda BMAG 1987F106 oil on canvas 145x120.5 cm; 1798-1801 Lemuel Francis Abbott BMAG 1908P20 Oil on canvas 74 x 62cm; 1798 Sir William Beechey BMAG 2003.007.44 (1810 copy). Val Loggie discusses these portraits. V. Loggie (2009) 'Portraits of Matthew Boulton' in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 63-76

¹⁴⁵ In general only records until 1809 will be considered. In 1850 a sale of the Soho Mint equipment was held when most of the equipment was sold to Ralph Heaton who operated a mint in Birmingham and to James Watt and Co who established a mint at the Soho Foundry in 1860, but these mints will not be discussed. MS 3147-10-74-1 Catalogue of the auction sale of Soho Mint on 29 April 1850.

¹⁴⁶ D. Vice (forthcoming) *A Numismatic History of Soho Manufactory and Mint 1772-1850* p 5.

¹⁴⁷ R. Clay (2009) 'How Matthew Boulton helped make Birmingham 'the art capital of the world' in: R. Clay and S. Tungate (2009) *Matthew Boulton and the Art of Making Money* p 55.

CHAPTER TWO: COPPER AND STEEL

Advances in metal technologies were essential to the rise of industrialisation during the eighteenth century. This chapter will consider Boulton's part in the embryonic steel industry and his involvement in the copper trade, and the importance of these developments for Soho Mint. Birmingham, a centre for skilled metal workers, produced items such as locks, gun fittings, and 'toys' in brass and other alloys, and this was where Matthew Boulton got his start in business.¹⁴⁸ His enterprises at Soho Manufactory used a variety of metals, including copper, gold, brass, silver, pewter, iron and steel, and therefore he took a great interest in many aspects of the metal industries, such as how ore was mined and smelted. I will argue that it was his practical experiences with copper, iron and steel that enabled him to make a success of the Soho Mint.

Iron and coal were available locally and easily obtained, especially after the canal system was established, as discussed in chapter four. However, it is somewhat surprising that Birmingham became a centre of the copper trade since it had no local supplies except for limited amounts from the Peak District. Soho Mint was supplied with copper in a variety of forms, and from a variety of sources, including Cornwall and Anglesey. Earlier mines in the Lake District had been worked out by around 1795.¹⁴⁹ This section discusses how Boulton became involved with copper mining from the 1770s onwards, and how he was linked to progress in the various metal industries.

¹⁴⁸ 'Toys' are small metal objects such as buckles, snuff boxes etc. for personal use. The earliest brass foundry in Birmingham was run by Henry Carver and Walter Tippin in 1715. Turner's brass manufactory was established by 1740. By 1770 there were 38 brass founders; 56 in 1788; and 71 in 1797. The small metal goods made in Birmingham, such as buttons made from at least 1685, were easier to transport, the value being in the workmanship rather than the metal. Boulton's pattern books from the Soho Manufactory showed 1470 different articles for the toy and other metal trades H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 268.

¹⁴⁹ Copper ore was extracted in Roman times, and then again from 1565 at mines near Keswick. H. Hamilton (1967) *The English Brass and Copper Industries to 1800*; J. Morton (1983) *Thomas Bolton and Sons Limited 1783-1983: Bicentenary history of a copper and brass manufacturer*. Morland, Ashbourne, Derbyshire.

The iron and steel industry has been discussed by a variety of authors including Ashton and Barraclough.¹⁵⁰ The use of iron in steam-engine cylinders, powering blast furnaces and draining mines, was connected with important advances in iron manufacturing. Iron and copper were linked by the use of Boulton & Watt steam-engines at copper mines. This chapter will mainly focus on copper as it was vital to setting up the Soho Mint, and also to its functioning. However, the advances in steel production, which were essential for die making at the Soho Mint, will also be discussed.¹⁵¹ The technology of coining using both copper and steel will be discussed further in chapter three.

Copper was essential to the manufacture of items at the Soho Mint. It is one of the most easily worked metals after gold and silver, and was among the first to be used extensively by mankind.¹⁵² Most early coins were made of silver and gold, though copper coins were in use from the seventeenth century in Britain. Boulton had experience in working with copper, and was casting brass in the 1760s. He also used copper in making ormolu which enhanced his reputation as a manufacturer of high class wares.¹⁵³ He became heavily involved in both producing and selling copper, and was also a large consumer of the metal. On its own copper had little use apart from as coinage, and needed to be alloyed with other metals, for example with zinc to form brass, to increase its toughness. Other cheap metals were unsuitable for coining; pewter was not sufficiently robust, brass was too hard to be easily embossed with an image, and iron rusted. Copper, however was malleable and did not shatter, with a distinctive hue so that a freshly minted coin had an

¹⁵⁰ T.S. Ashton (1924) *Iron and Steel in the Industrial Revolution*; K.C. Barraclough (1984) *Steel Making before Bessemer Volume 1: Blister steel; Volume 2: Crucible Steel: the growth of technology* Metals Society, London.

¹⁵¹ R.F. Mikesell (1988) *The Global Copper Industry: problems and prospects* Croom Helm, London.

¹⁵² R. F. Mikesell (1988) *The Global Copper Industry: problems and prospects*.

¹⁵³ Ormolu was copper or brass plated with gold. Its production at Soho peaked in 1771 but though unprofitable, was not abandoned completely till 1799. J. Morton (1983) *Thomas Bolton and Sons Limited 1783-1983* p 27.

attractive appearance, and thus was both practical and decorative. It also had a high resistance to many corrosive environments, and was relatively cheap, which was why it was used to make low value coins.¹⁵⁴

The history of the copper industry has been covered by authors such as Henry Hamilton, R. Rees and J.R. Harris.¹⁵⁵ Until the 1740s most copper used in Britain came from the area now known as Germany, and from Scandinavia.¹⁵⁶ When halfpennies and farthings were minted for Charles II, copper blanks needed to be imported from Sweden as there was not sufficient copper mined in England.¹⁵⁷ In 1692 Sweden and Norway produced around 1600 tons of copper per year, and in contrast the most productive company in Britain, Dockwra's, was producing just 80 tons. But in 1717 the English Copper Company, set up in 1691, was contracted to provide 700 tons of copper locally for coining.¹⁵⁸ Coinage contracts were eagerly sought by manufacturers to help develop the copper trade, including by Matthew Boulton. The supply of copper was a major factor in setting up the Soho Mint as large amounts were needed.

Iron and steel were also essential at the Soho Mint. Parts of the coining apparatus were cast in iron, and steel was vital for die making. Iron furnaces had been set up at

¹⁵⁴ Copper alloyed with zinc makes brass, and with tin makes bronze, also known as bell metal. Brass was used for ordnance such as cannon; hollow ware, such as pans and kettles; boilers in industries such as brewing; for wire making for pins, wool cards, sieves, and for ornamental ware such as coffin handles. Its thermal conductivity and electrical properties were known but not used extensively as it varied considerably depending on purity. Boulton's friend Franklin investigated copper's use as lightening conductors, and William Henley did comparative conductivity measurements in 1774. J. Morton (1983) *Thomas Bolton and Sons Limited*.

¹⁵⁵ H. Hamilton (1967) *The English Brass and Copper Industries to 1800*; Ronald Rees (2000) *King Copper: South Wales and the Copper Trade 1584-1895* University of Wales Press, Cardiff; J. R. Harris (1964) *The Copper King*.

¹⁵⁶ The right of mining gold, silver, copper, tin and lead in Britain was a royal prerogative until 1689, with the Mines Royal Company and Mineral and Battery Company set up in the reign of Elizabeth I. German mining specialists provided the finances and expertise. R. Prain (1975) *Copper: the anatomy of an industry*; R. Rees (2000) *King Copper: South Wales and the Copper Trade 1584-1895* University of Wales, Cardiff.

¹⁵⁷ 497 barrels each containing 300 lb of halfpenny copper blanks were imported. H.A. Seaby and P.J. Seaby (1949 edn) *A catalogue of Copper Coins and Tokens of the British Isles* B.A. Seaby Ltd. London.

¹⁵⁸ H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 108.

Coalbrookdale by Abraham Derby in 1709. Before 1750, three other iron furnaces were started at Redbrook, Forest of Dean, where copper works were also located, at Bersham and in Cumberland.¹⁵⁹ Another significant iron works was set up in 1759 at Carron, near Falkirk, as a partnership between Samuel Garbett, a friend of Matthew Boulton, and Dr John Roebuck, with finances from a wealthy Scottish ship-owner, William Caddell. It was here that James Watt had his first steam-engine cylinder made in 1766.



Figure 2.1: Carron works, near Falkirk, Stirlingshire, with the remnants of James Watt's first steam-engine cylinder from 1766¹⁶⁰

Further important iron furnaces were set up by John Guest at Broseley in 1776; later his son was in partnership with Thomas Lewis and Isaac Wilkinson at Dowlais, near Merthyr Tydfil. The Homfray family joined Anthony Bacon at the nearby Cyfartha iron works in 1782 and also ran Penyardarren Iron works for which Boulton later supplied tokens, as described in the catalogue. The increased output of iron freed Britain from dependency

¹⁵⁹ Iron works were set up at Redbrook in 1716-7, Bersham in 1721 and Little Clifton, Cumberland in 1723. T.S. Ashton (1924) *Iron and Steel in the Industrial Revolution*. The copper works at Redbrook were set up in the late seventeenth century. J.R. Harris (1964) *The Copper King* pp 4-6

¹⁶⁰ Image taken by author, August 2010.

on imported iron from Sweden and Russia, except for high grade iron needed for steel making.¹⁶¹

Many of these early iron furnaces were linked to a network of entrepreneurs who were personally known to Boulton. Key players in the iron industry were the Wilkinson family, having partnerships in Cumbria, the Midlands and South Wales.¹⁶² Isaac Wilkinson introduced innovative cast-iron blowing cylinders, patented in 1757, to coal-fired furnaces. These were further developed by his son, John Wilkinson (1728-1808), who was an exact contemporary of Matthew Boulton and a similar type of thrusting entrepreneur. Their friendship had started in December 1766 when Wilkinson had wanted to form an '*Acquaintance with a Genius, that might in future afford Me great Satisfaction on many Acc[oun]ts*'.¹⁶³ Most importantly, John Wilkinson was responsible for inventing an accurate boring machine which enabled Boulton and Watt to develop successful steam-engine technology. His New Willey works at Broseley later made iron on a large scale with bellows powered by the first Boulton and Watt (B&W) rotary steam-engine.¹⁶⁴ He was also involved in copper mining and with regal coinage contract negotiations which will be discussed later. Wilkinson himself issued three different types of tokens from 1787, some of which were made at Soho Mint, as described in the catalogue.

¹⁶¹ Production increased from 33,000 tons bar iron in 1788 to 50,000 tons puddled rolled iron alone in 1791. T.S. Ashton (1924) *Iron and Steel in the Industrial Revolution* pp 95-100.

¹⁶² Bersham Furnace near Wrexham was originally set up by a relative of Derby, and was run by Charles Lloyd and others before being taken over in around 1750 by Isaac Wilkinson. C. Evans and G. Rydén (eds.) (2005) *The Industrial Revolution in Iron: The Impact of British Coal Technology in Nineteenth Century Europe* Ashgate, Aldershot p 21.

¹⁶³ Wilkinson sent a letter to Florry asking to be introduced so that he could supply Boulton with iron castings. MS 3782-12-23 Item 81 John Florry (Birmingham) to MB [Birmingham] 7 Dec 1766.

¹⁶⁴ D. Vice (1990) *The tokens of John Wilkinson* Format 40 March 1990.

Mining copper

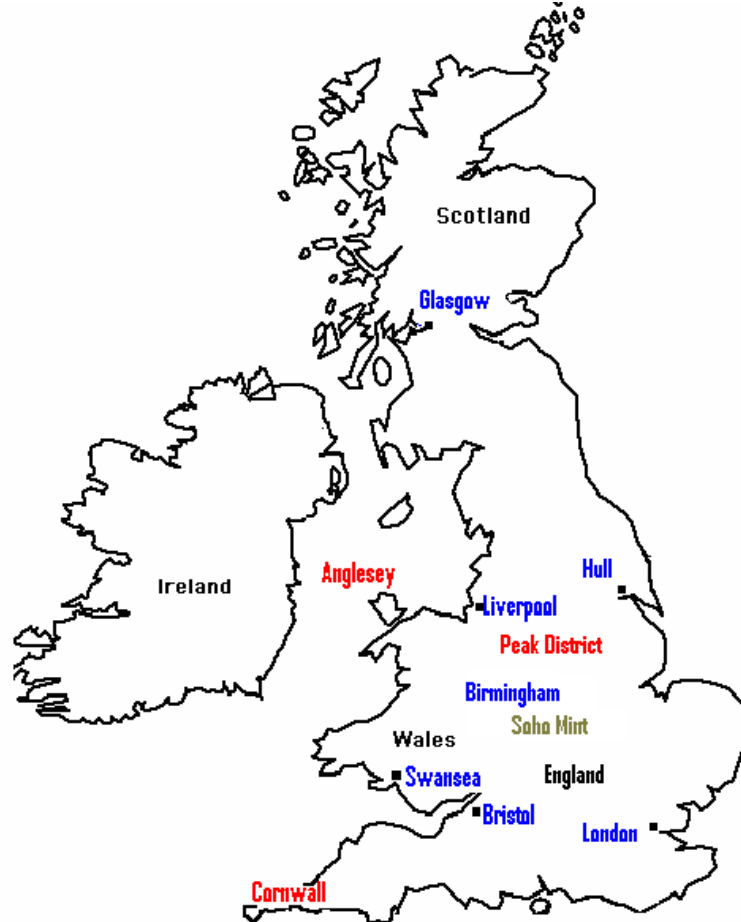


Figure 2.2: Location of places associated with copper production and Boulton (towns marked in blue, copper mining areas in red)

Many accounts have been written on the various technical aspects of copper mining.¹⁶⁵

The earliest description of mining ore from open shafts comes in 1556 from *De Re Metallica*, by Georgius Agricola, which has engineering drawings of copper furnaces and

¹⁶⁵ There are 1100 references to Cornish copper mining listed in P.G. Embrey and R.F. Symes (1987) *Minerals of Cornwall and Devon* British Museum, London. Copper ore was obtained first from open cast mines. Later shafts were sunk using braces, wedges and levers, or by fire setting (i.e. heating rocks and then quenching them quickly with water to alternately expand and contract them in order to crack them up). R. Prain (1975) *Copper: the anatomy of an industry* p 11-12; H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 44.

stamping mills.¹⁶⁶ Copper ore had to be extracted using picks, shovels and drills and brought up to the surface by windlasses.¹⁶⁷ The first tokens made at the Soho Mint for the Cronebane mine show the tools used by mine workers.¹⁶⁸ The ore was then treated by surface workers, usually women and children, to concentrate the copper ores for smelting by handpicking the coarser fractions from the rock, and then after crushing, by gravitational and flotation methods of separation.¹⁶⁹



Figure 2.3 1789 Cronebane halfpenny showing picks, shovels and windlass¹⁷⁰

In Cornwall until the early nineteenth century, practically the entire copper mining region was within a 13km radius of Carn Brea Hill where Boulton's direct involvement started in 1777. Boulton, with his usual enthusiasm, suggested improvements including an

¹⁶⁶ D. Sellwood (1994) *Early Austrian and German machine minting Metallurgy* in Numismatics 4, Royal Numismatic Society Special Publication, London pp 108-111.

¹⁶⁷ Mine captains were responsible for the organization of the workers. 'Tributers' (the miners) were paid per ton of ore, and in turn paid less skilled 'tut' workers as labourers. They bid for 'bargains' to work for a certain period, sometimes making great progress and profit when they hit a rich vein, and at other times striking only bare rock. Where possible water wheels were used for power, but there were few suitable sites so often ore was raised to the surface 'to grass' by man powered windlasses or the horse whim. Later steam-engines became important in copper mining. Information from on site visit to Levant Mine, Trewellard, Pendeen, Cornwall.

¹⁶⁸ Boulton also made tokens for the Anglesey Mines and the Cornish Metal Company (see catalogue).

¹⁶⁹ It was relatively easy to see the yellow chalcopyrite ore.

¹⁷⁰ 1789 Cronebane Halfpenny D&H 18 BMAG: 1885N1541.26

improved bucket system to bring copper ore up to ‘grass’; and also had plans made of the mines.¹⁷¹

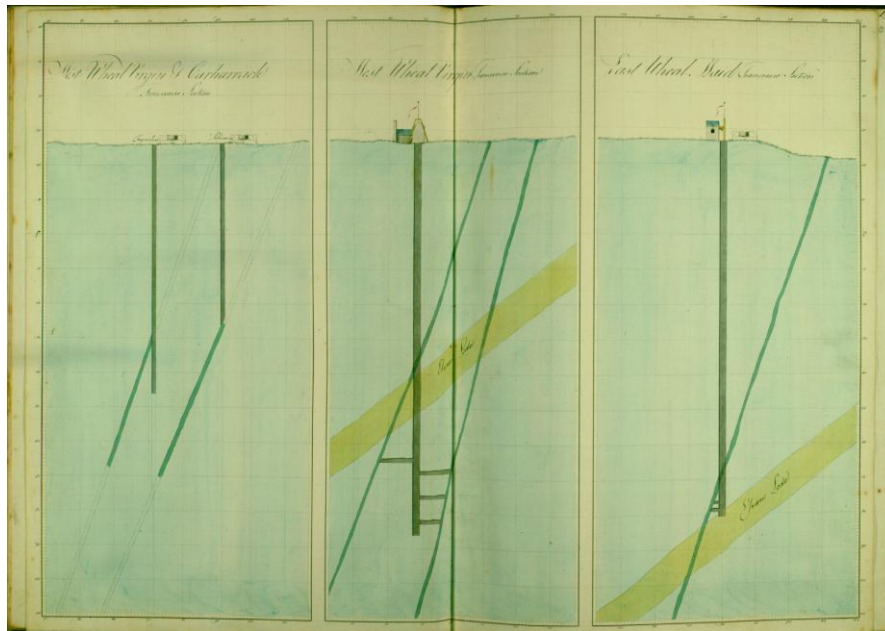


Figure 2.4: 1784 Cornish mine plan showing shafts and copper lode¹⁷²

In 1784 he wrote:

*hitherto the Adventurers have seen through the Eye of the Captains which are not so clear as these plans are, & if these plans are fill'd up from time to time (say once a quarter) with all of the workings the Adventurers may soon become more distinct Miners than the Captains. If I could but continue here for one Year I should become a Miner & able to remove many grievances & bad customs.*¹⁷³

Boulton obviously had a good understanding of copper production, including the mining of the ore, which proved useful later in setting up the Soho Mint.

¹⁷¹ Plans include longitudinal and transverse sections of Poldice, Wheal Virgin, Consolidated, North Downs, Chacewater and Polgooth Mines. MS 1381-1 Maps showing the shafts and adits in several Cornish Mines drawn by Lawson c 1785.

¹⁷² MS 1381-1-14-39 1784 Mine plans. Carharrick, Cornwall.

¹⁷³ The Adventurers were the mine owners. MS 3782-12-73 Item 147 MB (Cusgarne) to John Wilkinson 20 Sep 1784

John Coster, a metallurgist and engineer, had developed the first true copper mine in Cornwall, at Chacewater Mine (Wheal Busy) in the early 1700s. Most Cornish mines were dug as deep shafts and often suffered from flooding. In order to drain the mines Coster pioneered adit drainage and erected one of the first horse-whims in Cornwall to power primitive suction pumps. He also made significant advances in assaying and dressing copper ore. Chacewater became the focus of innovation in mining technology, with early Newcomen engines installed at Wheal Rose, Scorrier and Wheal Busy by Joseph Hornblower in 1725, and where the first Boulton and Watt steam-engine in Cornwall was also used use to pump water.¹⁷⁴ Brass cylinders had limited the size of early Newcomen engines but iron casting techniques, pioneered by the Coalbrookdale Company in the 1720s, allowed larger iron cylinders to be made. Developments by John Wilkinson with his boring machine increased precision. From 1765 John Smeaton was using cylinders up to 72 inches in diameter and by the time he erected a new Newcomen engine at Wheal Busy in 1775 about 600 Newcomen engines had been built.¹⁷⁵ However, due to the cost of fuel which had to be imported from South Wales, the Cornish mines were becoming less economic.¹⁷⁶ The use of the more fuel-efficient B&W steam-engines

¹⁷⁴ Joseph Hornblower (1696?-1762), born at Brosely, Shropshire, made the acquaintance of Newcomen when the latter was building a machine at Wolverhampton in 1712. Oxford Dictionary of National Biography, <http://www.oxforddnb.com>.

¹⁷⁵ Smeaton was able to increase the 'duty' of an engine from 5.5 to 9.5million pounds. Duty was measured by the weight of water raised through one foot using of a bushel of coal (the bushel varied in weight either 94 or 84 pounds and the type of coal had to be specified as well). The size of a steam-engine was normally given by diameter of the cylinder. P.G. Embrey and R.F. Symes (1987) *Minerals of Cornwall and Devon* British Museum, London p 26.

¹⁷⁶ The Newcomen steam-engine was not efficient as the cylinder was cooled every time the steam was condensed, and much heat was lost. Therefore, the gradual introduction of Boulton and Watt (B&W) engines, incorporating a separate condenser, was a significant improvement. However Common Engines (as Newcomen engines were then known) remained in use for a considerable time, and many more were built as they were less complicated and cheaper to maintain and install. Of the 2,200 engines built in the eighteenth century; only about 450 were B&W engines. The separate condenser was added to many of Newcomen's engines and also to at least 83 'pirated' engines. H. W. Dickinson and Rhys Jenkins (1927; republished 1981) *James Watt and the Steam Engine* Moorland, Ashbourne.

was essential to maintain profitability, with the first engine in operation at Chacewater by September 1777.¹⁷⁷

The introduction of the B&W steam-engine brought about a dramatic improvement in mine drainage and the owners, the Mine Adventurers, were able to make considerable savings in coal.¹⁷⁸ It was also vital to the fortunes of Boulton and Watt. Jennifer Tann has calculated that, during the late 1770s to the mid 1780s, 28-80% of the engines made by Boulton and Watt were being sold in Cornwall, and that the majority of the profit was from the premium charged on savings in coal.¹⁷⁹ Boulton wrote in 1782:

I have long turned my eyes upon the mines of this county [Cornwall] as the most likely means of rewarding me for the ten years' attention I have bestowed upon fire engines, and of refunding me the money I have expended upon that subject, and likewise (what is still greater) the money I have lost getting, by withdrawing my attention from my manufactory [.....] I have set nine large new engines to work since my arrival here in September last, and have now the pleasure to see twenty-one of them going in this county, and likewise to say with truth that not one of the great copper mines in Cornwall at this time working would have existed as a mine had it not been for me and my partner.¹⁸⁰

¹⁷⁷ Jonathon Hornblower, son of Joseph, was involved in the first order for a 52 inch (132cm) engine for Tingtang Mine near Redruth in Gwenapp, but a smaller 30 inch engine ordered by Thomas Wilson for Wheal Busy Mine run by Fentons, Yorkshire Company at Chacewater was the first in operation by September 1777. By the mid 1780s there were around 40 B&W engines in operation in Cornwall. <http://www.cornish-mining.org.uk>.

¹⁷⁸ Wilson gave an example of Consolidated Mines where a saving of £10,830 9s 4½d was made in one year between June 1783 and June 1784. AD1583/11/102 Thomas Wilson c 1795.

¹⁷⁹ J. Tann (1995) *Riches from Copper: the Adoption of the Boulton and Watt Engine by Cornish Mine Adventurers* Transactions of the Newcomen Society, Volume 67 pp 27-52.

¹⁸⁰ MS 3782 Letter Book 1781-1783 Item 259 MB to Mr. Gilbert 11 Dec 1782.

B&W steam-engines were not sold initially as complete machines, but as designs, with the parts being made by various other firms and erected by engineers paid by the Mine owners. Specialist parts, such as valves were made at Soho but the cylinders were usually made at Bersham by John Wilkinson or at Coalbrookdale. In return for the use of their patent, Boulton and Watt wanted one third of the savings in fuel made by a B&W engine compared to a common (Newcomen) engine. Complex tables of premiums were agreed for engines of various cylinder-diameters with a comparison to a standard set at Poldice Mine during the months of August and September 1778.¹⁸¹ Both Boulton and Watt spent a lot of time in Cornwall acting as supervising engineers and generally promoting their engine business which was initially profitable.¹⁸² Experience with the reciprocating engine in Cornwall led to the development of the rotative engine, without which the steam-powered coining press at Soho Mint could not have been developed. The Cornish mining industry provided a training ground for many of the important engineers of the eighteenth century and many worked for the firm of Boulton and Watt at some time. The list included the Hornblower family, Edward Bull and Richard Trevithick, who all used B&W designs later without permission; and William Murdock, and James Lawson. Bull, Trevithick and the Hornblowers were taken to court for infringing Boulton and Watt's patent.¹⁸³ For Lawson and Murdock, their experience in installing B&W engines for the Cornish mining industry helped in setting up the Soho Mint.

¹⁸¹ Boulton and Watt stated that '*for every pound which can become due to us, the proprietors must have gained by the use of our engine two pounds.*' Later the engines were charged by the size of the cylinder (2 horse power engine with 10 inch cylinder to largest 72 inch cylinder; 72 inches equals 6 feet or 1.8 m) at an annual fee. AD1583/11/66 Method of Calculating tables for Wheal Maid, Poldice Mine by standard trials.

¹⁸² Money owed included '*£129 16s 9d from the Wheal Union Adventurers, Chasewater Adv^{trs} Wheal Chance Adv^{trs} £388 3s, Poldice Adv^{trs} £178, United Mines £412 12s and also £86 for November, Tresavean Adv^{trs} £61 19s 5d, Wheal Treasury £83 10s 5d; Hallaminin £36 6s and Ting Tang Mine £74 0s 4d*'; a total of £1522 7s 11d but Boulton and Watt received only £669 18s 2d in three sums. MS 3782-13-96 Copper trade Volume 1 Item 5. Debts due to Messrs Boulton and Watt Dec 1780.

¹⁸³ Ironically the injunction against Hornblower's engineer, Richard Trevithick, was served in December 1796, in a pub opposite Soho Manufactory. AD1583/9/55 James Watt Junior to Wilson 30 Dec 1796.

Profitability in the Cornish mining industry peaked in 1782 and then declined until the late 1790s.¹⁸⁴ Due to lack of copper sales some Mine Adventurers started to use pirated engines and refused to pay premiums to Boulton and Watt.¹⁸⁵ The lack of engine premiums was a serious drain on Soho's finances and from May 1793, Boulton and Watt spent a lot of time in London dealing with patent infringements.¹⁸⁶ By the end of 1798, premiums were due from at least thirteen mines and a court case, which extended until 1799, showed that the Cornish Mine Adventurers owed Boulton and Watt £268,000. They were eventually paid £106,000 for a total of fifty-seven engines which had saved £800,000 worth of coal.¹⁸⁷

Copper ore prices were reducing in Cornwall due to competition from Parys Mine in Anglesey. In 1779, copper was selling for £90, with Anglesey producing around a quarter.¹⁸⁸ But by 1783 Garbett wrote: '*That the Anglesea Copper Company have already very much undersold the Cornish copper. That there is reason to believe they already have it in their power to stop some of the mines in Cornwall.*'¹⁸⁹

¹⁸⁴ Copper ore production increased from 23,961 tons in 1778 to 35,809 tons in 1783 and to 37,263 tons by 1784. MS 3782-13-93-1 History of copper trade and a vindication of price rises by Matthew Boulton 1793.

¹⁸⁵ B&W actually received a total of £76,158 9s 10d as premiums from Cornish copper mines between 1780 and 1791, but could have insisted on a lot more. AD1583/11/70 Sums received by Boulton and Watt. At Consolidated Mines for example Wilson pointed out that B&W would have been entitled to '*a total of £12,868 as their 1/3 of the savings in one year, whereas their whole demand only amounted to £5,133 7s.*' AD1583/11/102 Questions and answers by Thomas Wilson 1795.

¹⁸⁶ In 1794 Thomas Wilson, B&W agent in Cornwall wrote an '*Account of the State of the Principal Mines in 1787 which used B&W engines*' as part of a legal case against those who were pirating their engines. It includes a list of around 19 mines with details of all those employed there, and the expenses, and so on (see Table 1). He calculated the savings made by the use of B&W engines to be from £8 to £10 a day. AD1583/11/68 Account of the State of the Principal Mines in Cornwall in 1794.

¹⁸⁷ Chacewater Mine owed £2500 but had saved about £11,000 worth of coal. D.B. Barton (1961; 3rd edn 1998) *A History of Copper Mining in Devon and Cornwall* D Bradford, Barton Ltd, Truro Ch 2.

¹⁸⁸ A note from 1779 stated: '*the average production was 80 tons of copper from 1000 tons of ore at the Anglesey Mines with Macclesfield Co producing 3000-3600 tons of ore and Parys Co 8400, a total 12,000 tons. The Cornish ores for 1779 produced 4040 tons compared to 1160 tons of copper of copper from Anglesey, with the Duke of Devonshire's mines in Cheshire producing 200 tons. This gives a total of 5400 tons at £90 which is £486,000.*' MS 3782-12-108-27 1780-1790 General notebook.

¹⁸⁹ MS 3782-12-61 Item 49 Samuel Garbett (Birmingham) to MB [London] 17 May 1783.

Ore from Anglesey could be produced cheaply since unlike the Cornish copper mines, the Parys and Mona mines were mainly mined from the surface as open pits. Site visits showed that, in stark contrast to the Cornish mines, which are visible only through the derelict buildings of subsequent tin mines, Williams' mines on Anglesey are still impressively evident, as can be seen in Figure 2.5.



Figure 2.5: Parys Mine, Anglesey¹⁹⁰

Both mining areas were remote from large population centres, and in particular from Boulton's mint in Birmingham, but were served by ports shipping copper ore and coal by sea. Parys mine is only two miles from a natural harbour at Amlwch. Ore could also be

¹⁹⁰ Image taken by author, August 2009.

shipped from local beaches, where ships were loaded at low tide and re-floated when the tide was high. The Cornish mines, spread over a larger area, tended to be further away from the sea, though the Cornish peninsula was well supplied with small ports. Harbours such as Portreath on the north coast and Devoran to the south were used. These would have been bustling with vessels, taking the ore to the smelters, and returning with coal for the steam engines. Transport of the copper onwards to Soho Mint is discussed further in chapter four.

By 1785 Thomas Williams, who had control of the Anglesey mines, was producing one third of the national output of copper, 2,300 tons compared to 4,700 tons from Cornwall. At the peak of operations around 1787, 60-80,000 tons of ore were produced annually in Anglesey.¹⁹¹ A year later Boulton estimated that Cornwall was generating 5,300 tons of copper compared to Anglesey's 4,000 tons. A small amount, 900 tons, was coming from the Duke of Devonshire's mines at Ecton, Derbyshire, and 600 tons from the Macclesfield Company with a grand total of 10,800 tons of copper per year.¹⁹² Not all of this was easily sold. The overproduction meant that Boulton became more and more involved in the copper industry, promoting the sale of copper, as the more sales there were, the better the chance Boulton and Watt had of being paid their engine premiums.¹⁹³ He also tried to find new outlets for copper, including its use in coinage, which led to the development of the Soho Mint.

¹⁹¹ The best ore was transported to the port of Amlwch two miles away and shipped to smelting works at Swansea and Ravenshead. Some of the poorer ore was calcined on the spot. By 1786 there were thirty one smelting furnaces at Amlwch. <http://www.parysmountain.co.uk> (accessed 5.9.2008).

¹⁹² MS 3782-12-108 Item 53 Mint Book 1788 p 24.

¹⁹³ H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 167.

Smelting process

Extraction of ore from a mine was only part of the procedure necessary to obtain copper or iron, and Boulton understood, not only how ore was mined, but then how to obtain the metal by the smelting process. Copper for use in coining was rarely found as pure crystals, but as ores such as chalcopyrite and azurite. Very early copper mines provided ore with 10-20% pure copper but usually the ore contained iron, sulphur and often arsenic which needed to be removed by heating at high temperatures known as smelting.¹⁹⁴



Figure 2.6: Copper ore (chalcopyrite and azurite)¹⁹⁵

Similarly iron is found as a variety of ores such as magnetite, or haematite usually combined with silica.¹⁹⁶ The production of copper, iron and steel were all vital to the Soho Mint, either as raw materials for its products, or in the manufacture of its equipment.

¹⁹⁴ The principle ore, chalcopyrite 'yellow ore' (CuFeS_2), contains copper (Cu), iron (Fe) and sulphur (S), but may contain various impurities such as arsenic (As). Bornite 'peacock ore' (Cu_5FeS_4) contains iron sulphide, and chalcocite, (Cu_2S) both have a slaty grey or sooty appearance. Other forms of the ore azurite ($\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$), cuprite ($\text{Cu}_2\text{OCuCO}_3\text{Cu}(\text{OH})_4$) and azurite ($2\text{CuCO}_3\text{Cu}(\text{OH})_4$) are less common. R. Prain (1975) *Copper: the anatomy of an industry* Mining Journal Books Limited, London.

¹⁹⁵ Copper ore (chalcopyrite and azurite) samples from Sygun Copper Mine, Beddgelert, North Wales. Image taken by author, July 2009.

¹⁹⁶ Most iron ores such as magnetite (Fe_3O_4) and haematite (Fe_2O_3) contain oxygen which has to be removed.

Malleable or wrought iron was first produced from its ores as a batch process, by direct reduction using charcoal in a bloomery.¹⁹⁷ By the end of the fourteenth century, the iron furnaces used in smelting were becoming larger, with bellows being used to force air through the ‘charge’ of iron ore, limestone and charcoal. This produced carbon monoxide which reduced the iron ore to a spongy mass of brittle pig iron, an alloy that melts at a lower temperature than steel or wrought iron.¹⁹⁸ The pig iron was used to produce wrought iron by hammering it in a finery forge to consolidate it and to remove slag and carbon. Iron could also be further processed to make steel.

Boulton did not appreciate the molecular structure of metals including steel, or their crystalline structure and chemical composition, but did have a deep practical understanding of the metallurgy involved.¹⁹⁹ He was eager to keep up with current developments and discussed the French chemist Antoine Lavoisier’s theories, in January 1788, with his son Matthew Robinson Boulton even before Lavoisier published *Traité élémentaire de chimie (Treatise on Chemical Elements)* in 1789.²⁰⁰ He wrote about the old doctrine which was that ‘*all metals are composed of a Metallick Earth & phlogiston*’ and compared it with the new theory that metals were one homogenous substance.²⁰¹ He

¹⁹⁷ Wrought iron contained very little carbon and was tough, malleable and ductile and was easily welded but could not be cast as it was too soft. It was used when a tough material was required to withstand strain, such as in rivets and chains. Wrought iron had less than 1.7% carbon and melts at 1160-1500°C. Cast-iron was produced by remelting pig iron and was tough but brittle. K.C. Barraclough (1984) *Steel Making before Bessemer Volume 1: Blister steel* pp 1-10.

¹⁹⁸ Carbon comes from coal, coke or charcoal. Limestone is CaCO_3 which breaks down to CO_2 and CaO (calcium oxide). The CaO then combines with the rock (SiO_2) in the ore to make slag (CaSiO_3). By a series of reactions, the C and CO_2 produce carbon monoxide (CO) with the oxygen in the air and reduce the iron oxides to iron. ($\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$).

¹⁹⁹ Boulton’s notebooks provide multiple examples of the experiments he personally carried out and the research he made into various aspects of producing copper. MS 3782-12-108-27 1780-1790 General notebook.

²⁰⁰ ‘*Dr P[riestley] & our Lunar Society find that Mr Le Voisier and other chymists are mistaken who have fancied that they made Δ [water] by the deflagration of inflammable and dephlogisticated air. They have not but they have thereby separated the water that was combined with the two airs.*’ MS 3782-13-36 Item 17 MB (London) to MRB (Paris) 15 Jan 1788.

²⁰¹ ‘*Metals are according to their respective kinds consist of one homogenous substance & that by combineing air with that Metal it forms a Calx & again by driving out that Air by heat & at the same time supplying some inflammable*

understood that metals would form a calx with the air, in other words become oxidised.²⁰²

Smelting the ore removed oxygen, reducing it to the metal, what we would now call an element. Boulton advised his son to: '*Hear all sides with candor see all the Experiment, read all the modern Authors & then judge for yourself.*'²⁰³

Smelting copper

Unlike some other manufacturers in metal, Boulton knew the copper business from mining to refining, which helped considerably when it came to making products in the Soho Mint. In his notebooks and letters Boulton described in full the smelting process and how to set up a smelting works. He worked out all the details of costs, and staff required, including the transport of copper ore and coal supplies.²⁰⁴

Smelting techniques for copper were first developed in Israel in 4000 BC and for nearly 6000 years the process, known as calcining, was to heat the crushed and concentrated ore with charcoal, burning in heaps in the open or in charcoal fired furnaces.²⁰⁵ This process was repeated, and initially could involve up to sixteen calcinings over a period of up to three months.²⁰⁶ Impurities were removed by converting them to oxides such as arsenic oxide and sulphur dioxide.²⁰⁷ The toxic waste-products, created by smelting, left barren

substance with which the air hath a greater affinity than with the Metallic earth you get rid of the air & the remainder is a Maleable Metal. MS 3782-13-36 Item 19 MB (London) to MRB (Paris) 8 Feb 1788.

²⁰² The phlogiston theory was that all flammable materials contained a substance without colour, taste or mass which is liberated by combustion. Nitrogen and carbon dioxide were sometimes referred to as 'phlogisticated air' and 'inflammable air' was hydrogen. Lavoisier showed that combustion required a gas (oxygen) which had weight.

²⁰³ MS 3782-13-36 Item 19 MB (London) to MRB (Paris) 8 Feb 1788.

²⁰⁴ MS 3782-12-108-27 1780-1790 General notebook.

²⁰⁵ R.F. Mikesell (1988) *The Global Copper Industry: problems and prospects*

²⁰⁶ R.F. Mikesell (1988) *The Global Copper Industry: problems and prospects*

²⁰⁷ The copper ore was roasted to convert the copper pyrites to oxides and sulphides known as calcine. $2\text{CuFeS}_2 + 3\text{O}_2 \rightarrow 2\text{FeO} + 2\text{CuS} + 2\text{SO}_2$. The sulphur (S) and arsenic (As) were also oxidised and driven out by heating, releasing sulphur dioxide (SO₂) and arsenic sulphide (AsS), which poison the atmosphere. F. Sherwood Taylor (10th edn 1960) *Inorganic and Theoretical Chemistry* Heinemann p 295.

areas which are still found two hundred years later, for example at Parys Mountain in Anglesey.²⁰⁸ Here, the naturally acidic water was also used to leach out the copper.²⁰⁹ In 1787, when he visited Williams, Boulton was interested in the profit being made from the different by-products of the smelting process, such as sulphur, and explained the processes used at Parys Mine to his son.²¹⁰ Sulphur was used to produce sulphuric acid, needed to clean the scale from copper metal as discussed in chapter three.

The eighteenth-century smelting process was described in great detail by Lenten in a contemporary document. He compared it with the practices used in his native Germany. Interestingly he mentioned the role of oxygen, recently discovered by Lavoisier and Priestley.²¹¹ Boulton was also interested in the chemistry of the process, and though he did not understand smelting in modern terms, he knew from practical experience what worked:

*if you have one sort of Ore that contains much Iron & another that contains much Sulpher be sure & mix those 2 sorts & not melt them seperately - Where Iron predominates it is necessary to add Sulpher & where Sulpher predominates add IronRefine high by much Fire & last of all phlogisticate well with good Charcoal stoping the draft of air over the metal.*²¹²

²⁰⁸ In the eighteenth century arsenic was generally regarded as an undesirable waste material in the tin and copper lodes. Similarly zinc ores were commonly discarded, as there was only a limited requirement of zinc for brass making.

²⁰⁹ The mine drainage water and leachate from ore dumps was collected in large tanks as the sulphur in the ore formed sulphuric acid (H₂SO₄) which leached out the copper in the form of copper sulphate solution. The copper was precipitated out by using scrap iron, copper being lower in the reactivity series than iron.

²¹⁰ 'They calcine [the ore] in Kilns built of Brick in a Conical form A [see diagram] & as it burns the Sulphur arises to ye top & is condensed in the form of flowers of Brimstone in the Condenser B w^{ch} is a long empty space built with brick in the Ground. When that is nearly full it is put into a Cast Iron Cylindrical Vessel & melted by a gentle heat into a Solid form & laded out & poured into Moulds. This Brimstone is sold for the purpose of making Oyl of Vitriol' [sulphuric acid]. MS 3782-13-36 Item 10 MB (London) to MRB (Versailles) 21 Sep 1787.

²¹¹ Lenten letters. <http://www.parysmountain.co.uk> (accessed 5.9.2008).

²¹² AD1583/2/41 Boulton (Soho) to Wilson (Cornwall) 22 Mar 1787.

Ore was generally sent to smelting works near Swansea where there was a good supply of coal. It could also be smelted at Ravenshead near Liverpool. Boulton knew exactly what sort of copper would be suitable for coining. He found it took 24 tons of coal to produce a ton of copper from the ore, and priced the process.²¹³

Boulton was aware that the introduction of the reverberatory furnace, applying heat from above, had improved the copper smelting process. It produced 'blister' copper, so called because of the broken surface created by the escape of gases as the copper ingots were cast.²¹⁴ This ground-breaking method had been used at Redbrook, in the Forest of Dean in the late seventeenth century by one of the pioneering Clerke family from Bristol, with their technical advisor John Coster, previously mentioned in connection with Chacewater Mine.²¹⁵ Unlike in a blast furnace, ore was not in direct contact with the fuel, and reduction was more efficient due to a draught caused by a tall chimney.²¹⁶

²¹³ 'Regulus' also known as 'matte' is the first metallic mass formed from the ore and still contains some copper and iron sulphides (CuS and FeS). 'Mr Williams of Paris Mountain says that each ton of their ore when dressed requires 2 1/2 ton of coals to make it into copper, but copper ore in general requires 3 tons of coal for every ton of ore. And that 8 ton of ore makes 1 ton of copper Hence each ton of copper takes 24 ton of coal but Mr Watt says he thinks that each ton of ore will take only 1 1/2 ton of coal. 100 tons of common ore will make 25 tons of regulas & 100 tons of regulas will make 25 tons of fine copper. Or 100 tons of ore will make 6 or 7 tons of fine copper. Mr Coltman says it costs 10d per ton to carry the ore from mines to works in Wales.' MS 3782-12-108-27 1780-1790 General notebook.

²¹⁴ In a reverberatory furnace a 'charge' of concentrated ore was smelted at 1200 °C in an exothermic reaction to form heavier copper matte (CuS and FeS) which was tapped into ladles. The iron oxides (FeO and Fe₂O₃) and sulphide (FeS) were reduced to slag and the copper sulphide and copper oxide to copper (Cu₂S + 2Cu₂O → 6Cu + SO₂). Poisonous gases were released. F. Sherwood Taylor (10th edn 1960) *Inorganic and Theoretical Chemistry* Heinemann p 295.

²¹⁵ M.K. Komanecky (1999) *Copper as Canvas: Two Centuries of Masterpiece Paintings on Copper 1575-1775* Phoenix Art Museum, Oxford University Press p 125.

²¹⁶ A reverberatory furnace was built with refractory materials such as firebricks. The combustion chamber and the chimney were situated at opposite ends of a rectangular shape. Various doors or openings were provided to add fuel or remove slag and a grating to collect ash in an ash pit. The hearth portion was lined with molten slag or rich iron ore and was supported on steel plates, which in turn are supported on dwarf brick walls. The roof was shaped so that flames were concentrated on hearth. www.absoluteastronomy.com/topics/Reverberator.

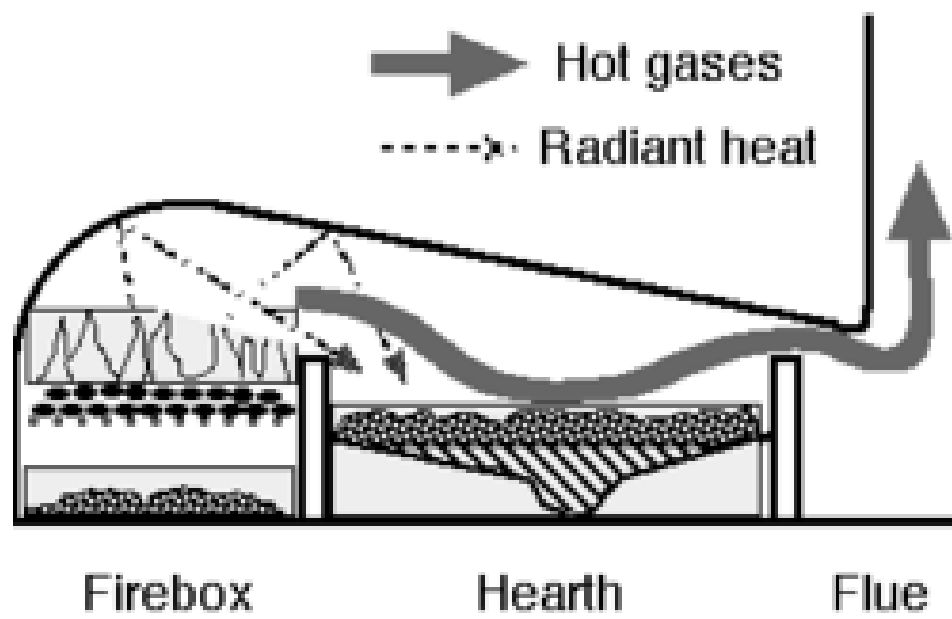


Figure 2.7: Reverberatory furnace²¹⁷

The English Copper Company built a second copper smelting works at Redbrook in 1692 where Abraham Derby may have learnt the techniques that he later applied successfully in the iron industry.²¹⁸ Sir Humphrey Mackworth was another early pioneer in the copper industry, setting up a reverberatory furnace near Swansea in 1698.²¹⁹ Mackworth built tramlines to carry the ore to the smelting furnaces and also exported coal to Cornwall.²²⁰ The smelting works at Warrington, run by Thomas Patten (1690-1772) from 1719 had twelve reverberatory furnaces by 1754 and supplied the Birmingham area including the

²¹⁷ Image taken from www.absoluteastronomy.com/topics/Reverberatory.

²¹⁸ H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 102.

²¹⁹ R Prain (1975) *Copper: The Anatomy of an Industry* p 18; H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 105.

²²⁰ Mackworth died in 1727, and despite difficulties had built up battery mills as well as the smelting works. Five other copper manufactories were built between 1690 and 1703, which smelted copper ore and produced brass in various forms such as wire and sheets. Another area for smelting copper ore was in the north west of England. Ronald Rees (2000) *King Copper: South Wales and the Copper Trade 1584-1895* p 9.

Soho Manufactory.²²¹ Further early copper companies included Roe and Company of Macclesfield who later ordered the first tokens made at Soho Mint (see catalogue T3).

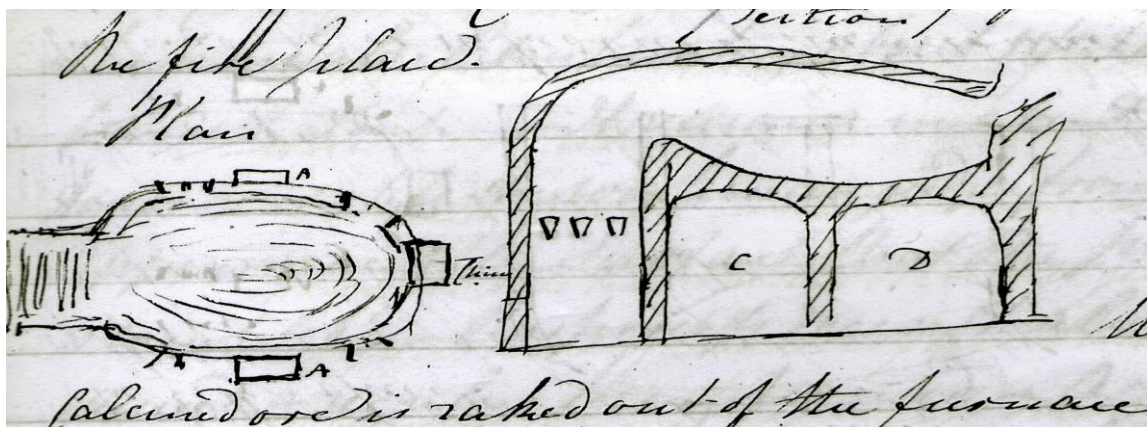


Figure 2.8: 1800 Reverberatory furnace drawn by Matthew Boulton²²²

The great breakthrough in the metal industries was the use of coal instead of charcoal for smelting both iron and copper ore. Abraham Derby introduced smelting using coke instead of charcoal to the iron industry at Coalbrookdale, Shropshire in 1709. A stream was initially used to power the furnace blast but later B&W steam-engines were used.²²³

Derby's techniques, learnt from his experiences in the copper industry, initially spread slowly. Boulton was still writing about the amount of charcoal needed to make a ton of iron in his 1780-1790 notebook.²²⁴ Further developments by Henry Cort (1740-1800) were patented in 1783. The bars of iron might be tied together or faggotted, then heated

²²¹ Patten had a brass works at Alton, Derbyshire and a brass wire mill at Cheadle and also extended his activities to the Greenfield valley, near Holywell, North Wales which was to become important later when run by Thomas Williams. John Morton (1983) *Thomas Bolton and Sons Limited* p13; The Cheadle Company had a capital of £3,600 in 1734 and £40,000 by 1780. H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 246.

²²² This furnace was 18 foot long, 12 foot wide and 4 foot deep and could contain over 3 tons of copper in each 18-36 hour calcining. MS 3782-13-93 Item 32 Notes made by Boulton on copper and smelting 15 Apr 1800.

²²³ The firm was continued by the family until Abraham Derby III died in 1789, and then by his son-in-law Richard, and William Reynolds and Company. The Reynolds firm was also known as the Coalbrook-Dale Iron Company or 'Dale' Company, with a branch at nearby Ketley, using the river Severn for transport. They commissioned the Ketley Plane/ Coalbrookdale token 1797. T.S. Ashton (1924) *Iron and Steel in the Industrial Revolution* p 95.

²²⁴ 'Each ton of iron needs 4 ton of charcoal in a charcoal iron furnace. 16cwt charcoal to one ton pig iron, 24 cwt charcoal to 1½ ton of pig iron to one ton of bar iron.' MS 3782-12-108-27 1780-1790 Boulton's General notebook.

and rolled to give wrought iron of the desired quality.²²⁵ Boulton was immediately aware of this process as Cort wrote in June of that year from Stourbridge to show Boulton the tough iron he had made.²²⁶ Boulton was well ahead of the field, as Cort's processes did not become fully established until the 1820s, nor did Huntsman's as discussed below.

Just as developments in extraction of iron and copper were interlinked, through the work of Derby, who had been involved with the Bristol Brass Company in 1702, innovations introduced in the brass industry by the Champion family and others may have inspired parallel improvements in forming steel by Benjamin Huntsman.²²⁷ Although William Champion of Bristol took out a patent for making spelter (zinc) in 1738, brass was generally made by the cementation process where metallic copper was heated with charcoal plus calamine ($ZnCO_3$) in enclosed containers. Boulton was in correspondence with Champion and wrote in his notebook: '*Champion says he has a patent for making brass in spelter pots; that the same furnace serves either for spelter or brass as you want.*'²²⁸ He then suggested his own method with a research program to find out at what

²²⁵ Cort set up a rolling mill in Fontley, Hampshire where he developed ideas patented in 1783 for the grooved rolling process and in 1784 for his balling or puddling furnace which made standardised bars of metal. The puddling process involves stirring the molten iron in a series of stages to allow the separation of impurities. First the iron was melted in a 'refinery'. The iron was poured into a trough and the slag run off, thus reducing silicon content. This produced a brittle white or 'finers' metal which was re-melted and stirred in the puddling furnace. A resultant puddled ball of iron was extracted from the furnace using a rabbling bar and hammered, or 'shingled', and then rolled in a rolling mill to form bars which would be broken up and faggotted. Wrought iron which had been faggotted twice was referred to as 'Best'; if faggotted again it would become 'Best Best', then 'Treble best' etc. Chris Evans and Göran Rydén (eds.) (2005) *The Industrial Revolution in Iron: The Impact of British Coal Technology in Nineteenth Century Europe* Ashgate, Aldershot p14.

²²⁶ MS 3782-12-29-32 Henry Cort (—) to MB (Soho) 3 Jun. 1784; MS 3782-12-29-31 Joseph Black (Edinburgh) to Mr. Cort (Stourbridge, Worcestershire) 28 May 1784.

²²⁷ T.S. Ashton (1924) *Iron and Steel in the Industrial Revolution*; K.C. Barraclough (1984) *Steel Making before Bessemer Volume 1: Blister steel* pp 60-69.

²²⁸ Boulton wrote: '*3 furnaces in one set and require one man and assistant. Each furnace has 9 pots; 8 in a circle and 1 in centre; at each melting they make 2 cwt of brass in 24 hours Pots may last ½ a year or less. The bottom of the furnace on which the Pots stand is called a siege and is made of cast iron with some holes in it to give air to the furnace. 20 tons per furnace per year. So will need 10 furnaces at Birmingham New Co. to make 200 tons pa but as 3 in set will need 12 furnaces. Each furnace is charge with 48lb brass and 72lb of calamine divided into 9 pots with charcoal sufficient to fill & phlogisticate them. One furnace burns 12 bushels or 9 cwt of coals in 24 hours; 1s 6d per day in coals for each bushel.*' MS 3782-12-108-27 1780-1790 Boulton's General notebook.

temperature zinc, bath metal, brass and copper melt.²²⁹ This research was in conjunction with setting up a Brass Company in Birmingham.²³⁰ There was no large scale manufacture using home produced zinc until 1781.²³¹ The cementation method was brought to perfection at the Cheadle Brass Company. A similar process, where carbon was added to iron bars in an enclosed container, was used for steel.

Steel

Steel, an alloy of iron, was considered a semi-precious metal in the eighteenth century, made in small batches, and used to make decorative objects such as buttons and buckles, with methods of production more often associated with gold and silver. It was also important for making functional objects such as specialist tools and dies.²³² Steel can have a wide variety of differing mechanical properties, due the different formation of its alloys but this was only understood in a very empirical way in the mid-eighteenth century. Steel was made at first by ‘accident,’ as a by-product in the bloomery. To a trained eye it was possible to select the bits of iron that had been ‘steeled’ due to carbon being added.²³³ Blister steel had been made in Britain by the cementation process, on a small scale, since the early decades of the seventeenth century, by heating iron bars with

²²⁹ This was done by pouring molten samples into cold water and calculating the increase of heat. MS 3782-12-108-27 1780-1790 Boulton’s General Notebook.

²³⁰ Williams wrote in June 1781: ‘*I was told yesterday your new Metal Company at Birmingham differed among themselves insomuch that their dissolution was apprehended, that their dissension had arisen from the peremptory demand to have old Champion as chief manager of all their intended works.*’ MS 3782 12-73 Item 20 Thomas Williams (London) to MB [Soho] Jun 1781.

²³¹ J. Morton (1983) *Thomas Bolton and Sons Limited 1783-1983*

²³² G. Rydén (2007) *Steel in Britain in the age of Enlightenment* A report on the colloquium held with the support of the British Academy, Cardiff 7-8 December 2007.

²³³ Catalan steel, also known as ‘german’, acier or natural steel, was formed when iron ore containing a low silica and high manganese content was selected, and more charcoal and a rapid air flow were used. T.S. Ashton (1924) *Iron and Steel in the Industrial Revolution* p 87; The *Südergebirge*, a hilly region to the south of the Ruhr basin, was the source of much of the high-grade german steel, imported into Britain before the rise of domestically produced cementation steel, and for much that was imported for specialist uses long after. This area was also the point of origin for the steel refining techniques that were transplanted to the North-East of England at the turn of the eighteenth century. H.L. Knau (2007) *Steel in Britain in the age of Enlightenment* Colloquium held in Cardiff 7-8 December 2007.

charcoal in chests in a similar way to brass making. An expansion of production of English bar iron led to more steel being made in Britain. By 1750, there was a steel works in Birmingham making five tons per five day charging using pit coal. Boulton investigated new sources of suitable iron to convert into steel, obtaining it from a variety of sources; for example pig iron from Spooners of Birmingham, Wright and Jesson at Wren's Nest, Nicholas Ryder of Marston Forge, and Richard Dearman of Eagle Foundry in Birmingham.²³⁴ He needed steel for dies and tools used in his Soho Manufactory.

Sven Rinman (1720-1792), a Swedish chemist and mineralogist, wrote a book about steel making in 1772, detailing the link between British blister steel production and the consumption of the so called Oregrund iron, made from Dannemora ore at less than twenty forges in Sweden.²³⁵ Boulton, aware of qualities of different ores, owned a book of Swedish ore marks,²³⁶ as in making high-quality steel for dies at the Soho Mint, Swedish iron of a specific sort was crucial. Other forms of iron just did not work as well.²³⁷ However there was still a need for a supplementary refining technique that could render the steel more homogeneous in structure and predictable in its qualities. A subsequent advance was made by Benjamin Huntsman (1704-1776) who first made crucible steel in 1756. The firm was continued and extended by his sons William (1733-1809) and Benjamin Junior (dates unknown).²³⁸ Blister steel from the cementation

²³⁴ C. Evans (2007) *Steel in Britain in the age of Enlightenment* Colloquium held in Cardiff 7-8 December 2007.

²³⁵ G. Rydén (Uppsala University) *Sven Rinman and Swedish knowledge about British steel* A report on the colloquium held with the support of the British Academy, Cardiff 7-8 December 2007.

²³⁶ Swedish iron marks included Leufsta circled L, Akerby crowned PL, Stromsberg/ Vessland double W, Osterby two circles and Gimon circled G. MS 3147-10-4 Swedish Iron and Steel Marks.

²³⁷ K.C. Barraclough (1984) *Steel Making before Bessemer Volume 1* pp 220-221.

²³⁸ Huntsman was originally a clock, lock and tool maker and found that the bad quality of the steel then available for his products seriously hampered him. So he began to experiment in steel manufacture, first at Doncaster, and subsequently at Handsworth, near Sheffield in 1740, where cheaper fuel (coke) was available and which was more efficient than charcoal. After several years trials he produced a satisfactory cast steel, purer and harder than any steel

process was melted in a crucible to prevent the entry of air which would oxidize the iron, with the result that the steel became more homogeneous.²³⁹ Clay pots or crucibles were manufactured for the purpose, capable of holding about 34 lbs each, and charged with bar steel broken into pieces of about a pound each. Ten or twelve of these crucibles were placed in a melting-furnace, similar to that used by brass founders, and heated by a coke fire to white heat. The liquid steel was poured to make ingots of the required shape and size, which could be forged into rods or bars suitable for die making.

Boulton was himself investigating steel making, and was in contact with Huntsman and others to find ways of making better steel.²⁴⁰ When James Watt first came to Soho in 1767:

*Boulton had a steel house for converting iron into steel, which was frequently employed to convert the cuttings of chapes and other small iron wares into steel which was afterwards melted & made into cast steel for various purposes.*²⁴¹

By 1779, there was a three chest steel furnace with a capacity of about 8 tons at Snow Hill. Boulton was still interested in methods of making iron and steel in 1790 when he went to Bradley with Wilkinson to ‘*see the result of a new mode of making good Bar Iron without the use of any forge, or any charcoal de bois which experiment fully answered our expectations.*’²⁴² But most good quality iron for use in steel-making was still imported from Swedish and Russian sources in 1793.

then in use made by the crucible method. But his process did not become fully established until the 1820s. Chris Evans *Steel in Britain in the age of Enlightenment* Colloquium held in Cardiff 7-8 December 2007.

²³⁹ Personal communication; Dr Chris Evans, University of Glamorgan.

²⁴⁰ One correspondent suggested using ‘9 stone of files to make 1 cwt of steel which will be quite as good as Huntsman’s.’ MS 3782-12-23 Item 37 Benjamin Withers (—) to MB (Birmingham) 28 Jun 1764.

²⁴¹ J. Watt, *Memoir of Boulton by Watt* written 17 September 1809 in: H.W. Dickinson (1937) *Matthew Boulton* p 203.

²⁴² MS 3782-13-36 Item 41 MB (Soho) to MRB 4 Jan 1790.

Boulton owned a copy of Réaumur's *L'art de convertir le fer forgé en acier* (1722), a major attempt to theorise the properties of steel. This had been produced in an effort by the French government to rectify their lack of steel production by promoting a domestic manufacture. Réaumur's practical exercises, although heavily subsidised, came to nothing, even though France was the largest single producer of bar iron in Europe. State sponsorship in France also underpinned attempts to master the cementation technique in the 1720s and 1730s. None succeeded, despite the best advice of the Academy of Sciences. Gabriel Jars (1732-1769), a star pupil of the *École des Mines*, was commissioned to investigate foreign steel making, but he was warned against attempting a scientific understanding of the processes involved. His brief was to record the actual work procedures in minute detail. In 1765 he published his *Voyages Metallurgiques* which Boulton also read.²⁴³ Boulton's interest in scientific matters kept him abreast of developments which helped in his business activities.

In Britain it was practical knowledge in the workshop that counted in making steel, which was where Boulton excelled.²⁴⁴ The iron was processed by heating to the correct colour of flame and metal, depending on the type of steel required. The different degrees of hardening afterwards depended on what the steel was to be used for.²⁴⁵ Goran Rydén emphasises the importance of knowledge generated in the marketplace. He suggests that it was the consumers of steel, not producers, who decided how steel was to be defined.

²⁴³ Jean-François Belhoste (2007) *Steel in Britain in the age of Enlightenment* Colloquium held in Cardiff 7-8 December 2007.

²⁴⁴ Chris Evans and Göran Rydén (eds.) (2005) *The Industrial Revolution in Iron* p14.

²⁴⁵ Pure iron melts at 1535°C but cast-iron with 3-4% carbon at 1130°C. Different colours of flame indicate different degrees of hardening: pale yellow gave a very hard but brittle steel used for razors and fine cutting tools; straw coloured for chisels; blue heat was used for saws which needed to be flexible. Steel was hardened by plunging into a cold bath, then tempered as it was brittle. Red heat at 900-1000°C was used for sharp tool steel, which was reheated to 150-650°C to temper the metal. K.C. Barraclough (1984) *Steel Making before Bessemer Volume 1: Blister steel; Volume 2: Crucible Steel: the growth of technology*.

Agreements on the prices were made according to the qualities of steel required and the shapes of the semi-manufactured products. Tool steel was produced according to patterns provided by the customer, to their models.²⁴⁶ The firm of Huntsman & Asline supplied different qualities of steel products, not only cast steel, but ‘german steel’, blister steel, and a wide range of qualities termed as ‘best’, ‘super fine’, ‘common sort’. Huntsman’s son asked Boulton to recommend his rolled steel to other manufacturers and said that it would not ‘*rust so soon as that made by other Steel makers* and that: *It hardens very well*’.²⁴⁷

Boulton had specific requirements for the steel he ordered for the Soho Mint. An order received in 1788 consisted of: ‘*Fine cast steel rolled for the Birmingham Manufactory 84/ [84s] for 112 lb; D[itt]o drawn square for 2 inch down to ¼ inch for 84/ ; D[itt]o drawn flat from 6 inch to 3/9 & the thickness in proportion.*’ Steel for use as dies and punches was marked ‘*B HUNTSMAN*’ but Huntsman warned that ‘*My mark hath been often counterfeited & Inferior sold for mine.*’²⁴⁸ Barraclough has concluded that both Boulton and Huntsman contributed to developments which put Britain ahead of other countries in manufacturing metals.²⁴⁹ The developments in die making, to which both contributed, will be explored further in chapter three.

²⁴⁶ L. Pérez and G. Rydén (2007) *Steel in Britain in the age of Enlightenment* Colloquium held in Cardiff 7-8 December 2007.

²⁴⁷ MS 3782-12-26 Item 101 Benjamin Huntsman (Sheffield) to MB (Soho) 10 Sep 1781.

²⁴⁸ MS 3782-12-26 Item 591 William Huntsman (Sheffield) to MB (Soho) 4 May 1788.

²⁴⁹ Quoted in: L. Pérez (2007) ‘Steel and toy trade between England and France: the Huntsmans’ correspondence with the Blakeys (Sheffield-Paris, 1765–1769)’ *Steel in Britain in the age of Enlightenment* Colloquium held in Cardiff 7-8 December 2007.

Types of copper

As well as being aware of technical breakthroughs in the steel industry, Boulton had kept abreast of advances in the copper industry. With his usual attention for detail he made extensive notes on the manufacture of different grades of copper which depended on how many refinings the ore went through, and how the metal was processed at the smelting works.²⁵⁰ He also ordered a small reverberatory furnace in March 1787:

*I should be obliged to you if you would procure for me a Drawing of one & charge the expence to me; at the same time pray inform me what it & the Chimney will cost Building & how much Copper it will melt at one time & how many meltings it is capable of makeing p[e]r day. I should also be glad if you would tell me at what expence you think I could melt p[e]r Ton Scraps of Copper into Cake supposeing I have from ten to 20 Ton to melt.*²⁵¹

At the time he was already making blanks for the Sumatran coinage that was struck in London, as discussed in the catalogue, and the furnace was needed in order to be able to experiment and to melt scrap copper.

When purchasing ore it was usual to give an allowance for the quality and the amount of water it contained.²⁵² Boulton investigated the subsequent treatment of the ore in October 1780 and wrote:

The copper smelters aim at making the first regulas not too good but to contain about 25 % of fine copper. They charge their reverbatory (sic) furnace about 6

²⁵⁰ Boulton's General Notebook MS 3782-12-108 Item 55 1789-1795.

²⁵¹ AD1583/2/41 Boulton (Soho) to Wilson (Truro) 22 Mar 1787.

²⁵² 'The accustomed allowance of seven pounds weight has ever been made upon every barrow containing three hundred of unstamped ore not being Fluken & Twenty Eight pounds weight upon every such barrow or Stamped or Fluken Ore.....Mr Vivian & other agents are of Opinion there is at least seven pounds of water contained in every hundred of Ore in the three last parcels of Wh[ea]l Unity Ore sold the 19th Ins[ta]n[t] which makes the allowance of Twenty one pounds..... absolutely necessary to make up the deficiency.' AD1583/6/71/2 Spedding to Villers concerning Mines Royal Company 26 Dec 1793.

*times in 24 hours and run of at each charge about ...(sic) Hundreds of the regulas. It runs into ▼ [water] out of a tap hole but is obstructed by a wooden pole which breaks it into smaller parts & saves pulverising. It is then roasted & then smelted again & is then called black copper. It seems necessary to have a certain quantity of sulphur in the ore in order to vitrify the large quantities of earth and stony matter that is mixed with it.*²⁵³

Boulton wanted the best copper for his Soho Manufactory products and continued to seek high quality metal for the Soho Mint. He knew that if he was to succeed in his project, every aspect of metal production needed to be considered.

Copper could be sold as *'best or common shot, Japan, or common Battery or Brass Copper'*, or as *'Bowls; Tough cake; Tile; Shruff; Pot'*, 'common' copper, 'best copper', and so on.²⁵⁴ Ingot brass known as 'common copper' was poured into iron moulds to make slabs or cakes for the brass founders of Birmingham and the Black Country.²⁵⁵ A typical example is an order sent to the Birmingham Warehouse of Hurd and Boulton in Aug 1789 by the Cornish Metal Company: *'Bowls (9 cwt 3 q 6 lb); Tough cake (31 tons 10cwt 3q 6lb); Tile (130 tons 6cwt 1q 4lb); Shruff 11 tons 5lb The total of 186 tons 15cwt 3q 21 lb at a cost of £78 6s. There was also 6 tons 19cwt 1q 21 lb of Shot at £80 6s and 20 tons 3cwt 0q 19lb of Pot Metal.*²⁵⁶ The prices of various metals were published weekly in the Birmingham newspapers.²⁵⁷ Only certain types of copper were suitable for use at the Soho Mint after the refining process, due to its properties when rolled. In

²⁵³ MS 3782-12-108-27 1780-1790 General notebook.

²⁵⁴ Terms proposed by Fenton & Co to G Fox & Sons AD1583/11/80 13 Jul 1792.

²⁵⁵ J. Morton (1983) *Thomas Bolton and Sons Limited* p 14.

²⁵⁶ Cornish Copper Mines MS 3782/12/90 Items 41-50.

²⁵⁷ Boulton's General Notebooks 1789-1795 MS 3782-12-108 Item 55 1789 -1795 p 8.

particular copper from Parys Mine was considered to be excellent.²⁵⁸ Boulton was surprised to find, that despite his interests in the Cornish mining industry, he had bought between £500-600 worth of copper from the Parys Mine Company. He wanted copper that was to *'be fine, be ductile, be sound & free from flaws & in short that it be as good as that we buy of the Paris Mine Co and I must do them the justice to say it is the best I have ever used.'*²⁵⁹ Anglesey copper was also cheaper than he could find else where. Peter Northover has analysed the metallurgy of eighteenth century copper, and concluded that the uniform nature of the British copper smelting technology at the time produced copper that was similar, whether the ore came from Cornwall or Wales. He has detected variation in the rolling of the copper but noted that further research would be required to know what techniques were used and where.²⁶⁰

Copper was often ordered for the Soho Mint in 'cakes' weighing between 16 and 80lb.²⁶¹ The process of making 'cake' copper is described in great detail by Lenten in a contemporary document. Basically the molten copper was poured by the ladleful into iron boxes washed out with clay which were 16 inches long, 11 inches wide and 11 inches deep, placed in a half-circle in front of the furnace. He wrote:

While the last box is being filled, the metal in the first has solidified to such an extent that a new layer can be poured on to it without binding with the first. So

²⁵⁸ Parys Mine is often referred to in contemporary writing as Paris Mine, but for the sake of clarity Parys will be used throughout this account.

²⁵⁹ Purchasing Cornish copper. AD1583/1/16 Boulton to Wilson 26 Jan 1784.

²⁶⁰ Peter Northover has used electron probe microanalysis with wavelength dispersive spectrometry on cut cross-sections of coins bought on eBay and on large sections of ships' copper. This was coupled with optical microscopy and micro-hardness testing. Thanks to Dr Northover for allowing me to visit his laboratory and for several interesting discussions. Dr Peter Northover, Senior Research Fellow, Head of Materials Science-based Archaeology Group, Department of Materials, University of Oxford, Oxford University Begbroke Science Park, Sandy Lane, Yarnton, Oxford, OX5 1PF.

²⁶¹ 16lb = approximately 7kg; 80lb = approximately 36 kg. Mint Book 1788 MS 3782-12-108 Item 53 p 87. In the twentieth century copper was formed in sheets that were 1 cm thick, and 1 metre square, weighing about 200 pounds. F Sherwood Taylor (10th edn; 1960) *Inorganic and Theoretical Chemistry* Heinemann p 295.

the boxes are filled, one after the other, producing a number of thin cakes which are approximately 1/4 inch thick and which can be separated when they are properly cooled.

The cakes were further refined and then rolled, stamped and numbered.²⁶² These copper cakes then had to be rolled to the required thickness for coining as described in chapter three.

Coining the copper

After refining, any impurities left in the copper may reduce its toughness, and so Boulton was particularly meticulous in the type of metal used in the Soho Mint. Copper needed to be ‘tough’ so that it could be rolled accurately and blanks cut for coining.²⁶³ Arrangements for supplying copper were made with Thomas Williams in December 1787 which are further discussed in chapter three. The different sorts of copper had to be ordered well in advance so that they could be manufactured in the correct way. Orders were very specific; with different qualities, sizes and types of copper required.²⁶⁴ In May 1792 Boulton only wanted tough cake copper:

²⁶² ‘Shot’ copper was also sometimes used at the Soho Mint. To form shot or granulated copper the molten copper was poured into water, either from a height or directly, depending on whether feather shot or rounded shot was required. Dr A. Lentin from the University of Leipzig spent six years at Parys Mountain in the late eighteenth century and wrote at some length about what he found there. The Amlwch Heritage Trust has now translated the Lentin letters which provide a comprehensive account of the site. <http://www.parysmountain.co.uk> (accessed 5.9.2008).

²⁶³ In February 1796 Boulton wrote: *‘It is probable I shall want 20 Ton here for a Coinage but I shall not know ‘till next week if that will be the case, & then I will write you (what I may want must be tough).’* AD1583/9/10 Boulton to Wilson 26 Feb 1796.

²⁶⁴ *‘22nd Oct 1791 Our orders to Holbrook were as under -Sept[embe]r 29th: 10 T[o]n Tile at 16lb [pound]; 10 T[o]n Tough Cake 36 to 40; 20 T[o]n d[itto] - 36 to 40; 10 T[o]n Tile at 16 to 18; 10 T[o]n Tough Cake 36 to 40; Oct[obe]r 11th: 6 T[o]n d[itt]o 90 to 100 (which he informed me that he had ready); 14 T[o]n d[itto] - at 90 to 100 or 48 to 50, which suited him best. Any part of the above 80 Tons, that is in readiness you may order Holbrook to forward immediately to Pritchard & Co[mpany] & you may order him to go on with Tough Cake of the size & c Mr.B[oulton]. mention’d to you - (say 15½ inch long & from 48 to 50lb [pound] per Cake) until he receives new orders - Any Cake that he has ready of 48lb [pound] to 50 or 51 he will forward us.’* AD1583/4/100 Boulton & Hurd 22 Oct 1791

*As all the Copper I want, is intended for Rolling & Coining, I can only use soft tough Cake, the dry Tyle Copper will not be of any use to me. You may therefore sell ye Tile to W[illia]ms & if you can sell it the better by accompanying it with the Tough Cake you may do it provided You can send me the 47 Ton of tough Cake in the course of 3 Months.*²⁶⁵

Boulton's preparation of copper was renowned for producing better quality than most, partly due to techniques developed at the Soho Mint. He was particularly concerned that coins produced should be of a bright shiny appearance, and thus instituted specific ways of handling and rolling the metal which are discussed further in chapter three.

Organisation of the metal industries

The metal industries were run by some of the first industrial entrepreneurs and the financial arrangements were on a large scale from very early on. Richard Crawshay (1739-1810), who took over Cyfartha on Bacon's death in 1786, owned six iron furnaces by 1802 and employed over 2000 men.²⁶⁶ Mines could be initially set up at small cost, but required constant investment to keep them functioning. Often they were set up with a number of 'adventurers', including miners, land owners and entrepreneurs, taking shares in the company. Improved methods of coal and iron mining were developed towards the end of the eighteenth century, but will not be discussed, due to lack of space.

In Cornwall copper mines were run under the 'cost book' system; that is expenditure for equipment and wages was financed by 'calls' on the adventurers, who received profits in full on a quarterly basis. The ores were sold on a system of ticketing whereby buyers

²⁶⁵ AD1583/5/21 Boulton to Wilson 29 May 1792.

²⁶⁶ T.S. Ashton (1924) *Iron and Steel in the Industrial Revolution* pp 95-100.

gave a single price for each lot of ore, and the highest bid won.²⁶⁷ The ‘cost book’ system worked well when there was competitive demand but often no working capital was retained and thus mines could easily close if adventurers refused calls for operating costs.²⁶⁸ Boulton was dependent on copper sales for his engine premiums, and thus had a great interest in the profitability of the mines.

Like iron furnaces, copper smelting and manufacturing works required a high capital outlay. Most works were concentrated in the Bristol and Swansea areas where finance often came from wealthy merchants. Copper smelters became organized into combined cartels, with the larger smelters tending to absorb the smaller ones between 1737 and 1779, and it was relatively easy for them to force low prices for copper ore on the mine adventurers. Very few smelters had direct interests in mines, and could easily shut down their works when copper was not selling well. Mine Adventurers however had to sell their ore as expenses, such as fuel for steam-engines to prevent flooding, continued whether the mine was making a profit or not. Thus smelters were able to fix both the price of the ore they received, and that of refined copper, and profited most from copper sales. The smelting firms of Swansea and Bristol, known collectively as the ‘Associated Smelters’ under the leadership of the Bristol Brass Company, reacted aggressively to any incursions that threatened the status quo.²⁶⁹ When the Cornish Copper Company was set up in Hayle earlier in the century to smelt copper in Cornwall, they had resented the

²⁶⁷ J. R. Harris (1964) *The Copper King* pp 14-15.

²⁶⁸ P.G. Embrey and R.F. Symes (1987) *Minerals of Cornwall and Devon* British Museum, London p 34.

²⁶⁹ They were also known as the ‘United Companies’ or ‘Old Company’, and included the Mines Royal Company, Warrington Company, Cheadle Company and Roe and Company. Production of copper ore rose from 6000 tons per year in 1725 to 28,750 tons in 1770, but prices fell from £7 15s per ton to £6 15s respectively; M.K. Komanecky (1999) *Copper as Canvas* p 129.

competition. Boulton was concerned with establishing smelting works with Thomas Williams which is considered later.

Importance of Anglesey in the Copper Trade

From 1779, the Associated Smelters had tried to apply their normal tactics to Thomas Williams, a newcomer in the copper mining industry, but he refused to sell ore at their price. Williams managed the Parys Mine Company from 1778 and set up his own smelting and copper works at Amlwch on Anglesey, and at Ravenshead and Swansea, and from 1786 ran the smelting works associated with Mona Mine, Stanley Company, near St Helens.²⁷⁰ He also purchased the Temple Mills in South Wales and the Greenfield site at Holywell, Flintshire, with its copper rolling mills, wire mills and brass works.²⁷¹ Holywell was where the first copper penny tokens were made in 1787, as described in the catalogue.

The emergence of Anglesey came as a blow to the Associated Smelters as it was a challenge to their control over the price of copper. It was also a challenge to the Cornish Mine Adventurers as Williams was a much better salesman, and took over much of their copper sales. He made items for the slave trade and copper ingots for shipment overseas from Liverpool and London, where the East India Company (EIC) annually exported

²⁷⁰ Williams had two mines in Anglesey and by 1787 had nominal control of the Cornish Metal Company. He ran his own smelting works and copper warehouses in London, Birmingham and Liverpool. He also established chemical works in Liverpool and a bank in North Wales. The Anglesey Company also ran their own fleet of ships to transport coal to Anglesey, and ores to the smelting works. At the peak of its production in 1792 as many as 1,500 people were employed at Parys Mountain, and the population of its associated port of Amlwch had soared to 5,000. The county town of Beaumaris at that time had a population of 2,500, and Holyhead just 2,000. David Vice (1989) *The Soho Mint and the Anglesey Tokens of the Parys Mine Company* Format 38 March 1989.

²⁷¹ Williams had taken over the Greenfield site from Patten. Temple Mills was formerly run by Townsend and Co and later by George Pengree. John Morton (1983) *Thomas Bolton and Sons Limited* p16; J.R. Harris (1964) *The Copper King* p 53.

from 200 to 1000 tons.²⁷² In 1780 around 40% of copper produced annually was exported.²⁷³ Thomas Williams was also associated with Collins and Westwood in making ships' sheathing at the Greenfield works.²⁷⁴ First tried in 1761, the hulls of the wooden boats of the Royal Navy were sheathed with copper to prevent the damage caused by marine worms, and to increase the number of voyages before refitting was required. This became important in maintaining British domination of the seas. In 1780, Admiral Rodney, commemorated in a medal by Boulton, credited speed due to the use of copper bottomed ships as vital to his victory.²⁷⁵ From 1784, the Admiralty started to order copper sheathing from Williams, who claimed that he would be able to export 2000 tons of copper in sheets to a value of £180,000.²⁷⁶

Boulton and Williams

The association of Thomas Williams and Matthew Boulton has been discussed by several writers.²⁷⁷ This author has found that there was considerable co-operation between the two men during the formative period of the Soho Mint. Boulton and Williams were self-made men and like-minded entrepreneurs, with extensive knowledge of the copper industry, but they were not part of the mine-owning landed gentry of Cornwall. Both

²⁷² Brass and copper 'neptunes' (shallow dishes for salt extraction) and 'manillas' (horse shoe shaped rods with flattened ends for ornament and currency) were used in the slave trade. In 1737 there were 33 ships bound for W Africa carrying copperwares. By 1771 this number had risen to 190. Michael K. Komanecky (1999) *Copper as Canvas* p 129.

²⁷³ Around 6000 tons of copper were produced annually. It was used for making export items such as bronze Buddhas and copper stills, used for sugar boiling, were sent to the West Indies. J. R. Harris (1964) *The Copper King* pp 11-12.

²⁷⁴ Iron bolts used with copper sheathing caused considerable corrosion. Copper bolts were initially too soft to use until an improved method for making copper bolts by hot and cold rolling was patented in 1783 by William Collins and John Westwood of Birmingham. This meant that that copper sheathing could be used more extensively. John H. Morris (2003) *The Battle of the Tokens, 1789-1799: The Hibernian Mining Company v. The Associated Irish Mine Company* Mining Heritage Trust of Ireland.

²⁷⁵ 82 capital ships, 115 frigates and 102 sloops and cutters had been coppered before the end of 1781. Williams also supplied the French, Dutch and Spanish navies before the outbreak of war. P. Watts-Russell (2003) *A copper-bottomed life* The Cornish Banner August 2003.

²⁷⁶ Personal communication; P. Watts-Russell (2009) *Mona Mine Manuscripts*, University of Wales Bangor Library;

²⁷⁷ Harris discusses the relationship which altered from close friendship to active hatred with several reversals of opinion. J.R. Harris (1963) *The Copper King p xvii*. Other authors such as Selgin and Doty have also commented on their relationship.

considered copper manufacture as an integrated whole, from mining the ore and smelting it, to the production and sale of the final products. Boulton had first encountered Williams in 1780 when he had ordered an engine to work a 7-8 cwt hammer, and again in 1781 when Williams wanted to sell his copper to the Birmingham Metal Company which had recently been set up by Boulton and others to produce brass for local consumers.²⁷⁸

Together Boulton and Williams held many discussions as they tried to persuade the Cornish miners to collaborate in challenging the dominance of the smelting cartels. Williams wrote in June 1781 to confer about '*Copper Trade of this country in general & the Mineral Concerns of the counties of Cornwall & Anglesey in particular.*'²⁷⁹ But as the Cornish Mine Adventurers would not agree to cooperate with him, he started to sell his Anglesey ore to the Associated Smelters in Swansea in September 1782. He wrote to Boulton:

*I have, for my own part, long since given up the idea, I once entertained, of a conference between the Cornish Miners & the Paris Mine Company. Perhaps it was too much in us to expect that such a respectable & at the same time opulent Body, as the gentlemen of Cornwall are, should hold us of sufficient Consequence to merit so much of their attention.*²⁸⁰

²⁷⁸ The plan was that the company would purchase shares in copper mines and would work on a cooperative principle, with 200 shares of £100, with no one to hold more than four shares. MS 3782 12-73 Item 61 Thomas Williams (London) to MB (Soho) 15 May 1781.

²⁷⁹ MS 3782 12-73 Item 62 Thomas Williams (London) to MB [Soho] 20 Jun 1781.

²⁸⁰ Williams continued: '*Or perhaps, there, as in other places, prevails the Adage, what is the business of every one is the business of no one, & it may be difficult to find men willing & able to undertake a business of such difficulty as your scheme & mine may appear to be.*' MS 3782 12-73 Item 63 Thomas Williams (Paris Lodge, Anglesey) to MB [Cusgarne] 24 Sep 1782.

The spanner in the works was Sir Francis Bassett, one of the principal Mine Adventurers, who would not cooperate with joint arrangements despite the fact that it was much more expensive to raise the ore in Cornwall compared to in Anglesey.²⁸¹

Cornish Metal Company

Eventually, in 1785, Williams suggested to the Cornish Adventurers, the setting up of three smelting works, each to smelt 10,000 tons of copper ore per year, with 50 furnaces making 200 tons per week. This would need £100,000 capital but would make Cornwall free of the smelting cartels and, most importantly, increase the prices paid for Cornish copper ore. It would enable Cornwall to have 500 tons of copper '*ready to answer all calls*'.²⁸² In July 1785, in co-operation with Boulton, a second proposal was made to set up a company '*for the advantage of the Cornish mines and in order to maintain and keep the price of their copper ores at a proper standard.*'²⁸³ This resulted in the founding of the Cornish Metal Company (CMC) by 1st September 1785 with £65,500 subscribed in fifteen minutes, a contribution of £25,000 from John Wilkinson being a decisive act.²⁸⁴ In his notebook for 1785 Boulton lists around one hundred names as signatories to the CMC agreement and he was a member of the committee.²⁸⁵ The prospective division of the copper markets was agreed; with the Anglesey Copper Company to have the

²⁸¹ '*The latter cannot be out of pocket unless fine Copper falls below £50 per ton, and I am informed the Cornish Mines cannot be worked at a profit under the standard of £80 per ton.*' MS 3782 12-73 Item 62 Thomas Williams (London) to MB [Soho] 20 Jun 1781.

²⁸² MS 3782 12-73 Item 65 Thomas Williams (Llanidan) to John Martyn 18 Apr 1785.

²⁸³ Most of the copper ore in Cornwall was to be sold by the Company. A capital of £500,000 was to be raised by subscription; and thirty six directors were to be appointed. The shares were to cost £100 per share and every one with 5 shares was to have vote in election of the directors, who were '*hereby empowered from time to time to settle all regulation of trade with the Anglesea company.*' MS 3782-12-90 Items 31-40 22 Jul 1785.

²⁸⁴ A list of shareholders includes many of the important Cornish Mine Adventurers, and also both Matthew Boulton and Thomas Williams with an initial 20 shares each. A receipt date 6th Oct 1785 for £1,100 was received by the Cornish Metal Company from B&W as second payment for shares. Sir Francis Basset was appointed the Governor as he owned about one fifth of Cornish ore, with John Vivian as Deputy Governor. Boulton was a member of the committee. MS 3782-12-90 Items 41-50 July 1785.

²⁸⁵ MS 3782-12-108-27 1780-1790 Boulton's General Notebook.

Liverpool market, and Cornwall to supply Bristol. The extensive markets in Birmingham and the export trade, especially that dominated by the East India Company in London, were to be shared.²⁸⁶

The smelting cartel was initially worried by this agreement as it would affect their copper sales, so some of the major smelters raised the prices they offered for ore. The English Copper Company, Mackworth, Mowbray & Gnoll Company, Lockwood Morris Company, John Freeman Company, Bristol Brass and Wire Company and Michell, Edwards and Company all capitulated. Boulton listed how Cornish ore was to be divided between the various smelters.²⁸⁷ But some smelters, such as the Duke of Devonshire and the Macclesfield Company, would not enter the agreement and were able to sell their copper at low prices. Boulton also reported that some of the excluded companies: *'bought last year some unrefined copper from Peru which has lain at Cadiz for several years. 500 tons of their copper is brought into England.'*²⁸⁸ In April 1787 the English Copper Company had purchased *'150 Ton of Spanish Copper at £78 & have Contracted for more. Call forth your 40 Members to oppose its landing.'*²⁸⁹ It did not help Cornish copper sales to have foreign copper imported.

In 1786, Boulton, with Williams and others, planned to send copper ore for smelting to Penclawdd on the River Burry near Swansea, and to export coal to Cornwall. Boulton investigated all aspects of the proposed works, including the navigation of the river, the

²⁸⁶ Three-fifths of the copper sold was to be from Cornwall and two-fifths from Anglesey at a fixed price. The intent was for the company to pay 8% per annum profit in trade. The Cornish Adventurers were therefore able to influence the price of ore paid by the smelters. But they also agreed to buy all the copper produced by the CMC at a standard price from May 1786. AD1583/1/66 Watt (Birmingham) to Wilson 30 June 1785.

²⁸⁷ MS 3782-12-108-27 1780-1790 Boulton's General Notebook.

²⁸⁸ MS 3782-12-90 Items 31-40 Case of the Cornish Metal Company.

²⁸⁹ Cornwall had many representatives in Parliament. AD1583/2/42/1 Boulton to Wilson 10 Apr 1787.

cost of a 100 ton boat to carry the coal and other details.²⁹⁰ He calculated the costs of the whole operation, with 3000 tons of copper ore at £6 7 8d per ton yielding 375 tons of copper, with a cost of 30s-35s per ton for smelting (£4500-£5250); buildings at £4,000; coal at £200 and so on.²⁹¹ The copper could be sold for £78 per ton and Boulton estimates that a profit of 10% could be obtained on a £43,000 investment. The presence of suitable coal was important, but it was also essential to have a return cargo of coal for Cornwall or ‘*could not carry the ore at the present price.*’ He also worked out costs of a 100 ton boat in the coal trade from Swansea to Hayle with 12 trips per year.²⁹² An alternative proposal was to buy Pengree smelting works:

*Mr Williams thinks that Pengree would sell his 46 furnaces copper smelting at Swansea for £ 3000, and need further £1500 to put in good order. Which is what Wilson paid (£100) but Mr Williams says he estimated furnaces at £120 if they were to be new built. So for 40,000 tons of Cornish ore need 200 furnaces.*²⁹³

Boulton also researched the land of John Morris of Clarmont near Swansea where coal was readily available.²⁹⁴ Further information was sent in February 1786 including a plan of the coal veins at Burry River Colliery, Penclawdd.²⁹⁵ However due to inertia by the Cornish Mine Adventurers, nothing came of these plans and in 1788 these works were purchased by Williams alone. Eventually, Boulton himself set up the Rose Copper

²⁹⁰ Copper ore from Anglesey was smelted at Penclawdd on the south side of the Loughor Estuary, where the Burry enters. *Captain Dalton is a bit dubious, saying Vessels drawing 10 foot might get into Penclawd but depends on tide and wind*, but Captain Jerman’s answers were much more positive. Copper MS 3782/12/90 71-80; AD1583/1/81 Boulton to Wilson 24 Jan 1786; AD1583/1/83 7 Feb 1786 AD1583/2/29 and AD1583/2/30 1786 Morris (Claremont) to Boulton; MS 3782-12-108-27 1780-1790 Boulton’s General Notebook.

²⁹¹ Copper manuscript MS 3782-12-90 Items 71-80.

²⁹² ‘*Ship cost £700; Needs insurance £70, Master £60, Mate £42, 2 men and boys etc Food, Interest on £700 £70, wear and tear. 100 tons of coal per trip.*’ MS 3782-12-108-27 1780-1790 General notebook.

²⁹³ MS 3782-12-108-27 1780-1790 Boulton’s General Notebook.

²⁹⁴ AD1583/1/81 Boulton to Wilson 24 Jan 1786.

²⁹⁵ AD1583/1/83/2; AD1583/2/29 7 Feb 1786; AD1583/2/30 Plan of coal veins at Burry River Colliery, Penclawdd,

Company in 1793 which is discussed later. Boulton was clearly determined to be able to provide sufficient copper supplies at a reasonable price for uses such as coining contracts.

Boulton was at the centre of the copper trade at this time. It was vital to him at this stage that copper sales should be sufficient to pay the premiums for B&W steam-engines used in Cornwall. In January 1786, Williams, Wilkinson, and John Vivian, Deputy Governor of the Cornish Metal Company, were all at Soho, along with Thomas Harrison (Lord Uxbridge's agent).²⁹⁶ The meeting fixed copper prices at £86 per ton for cake copper and £88 for shot.²⁹⁷ Boulton calculated the annual consumption in Birmingham, a major user of copper, to be 1500 tons²⁹⁸, but estimated that:

*the quantity of copper ore which will be produced by the Cornish mines for the present year 1786 will be about 40,000 tons and that the produce of such ores in fine copper will be from 12 to 12½%, equivalent to 5,000 tons of copper.*²⁹⁹

That was a lot of copper to sell and extra uses for copper, such as in more coinage, had to be found. Boulton wrote to Wilson: *'I am now very busy in endeavouring to find a consumption for it [copper]. We are not so light but it will make a difference whether we are put into one Scale or the other.'*³⁰⁰ From this point a regal coinage contract became vital for the survival of the Cornish copper industry. In turn this would mean that Boulton would not only have an opportunity to recoup money from steam-engine sales, but would

²⁹⁶ Lord Uxbridge owned around half of Parys Mountain. C.R. Hawker (1996) *Druid Tokens: Eighteenth century Token notes from Matthew Boulton's letters* Brewin, Studley

²⁹⁷ AD1583/1/80/1 Boulton (Soho) to Wilson 22 Jan 1786.

²⁹⁸ This included 600 tons of brass sent to Birmingham and 200 tons made there, plus 700 tons used directly as copper. Boulton also said there were sufficient supplies for nine months in the town. Copper came from the Duke of Devonshire, the Macclesfield Company and the English Copper Company with smaller amounts from Freeman Company and others, and a possible 450 tons from Cornwall. AD1583/2/23 Boulton to Wilson 3 Nov 1786

²⁹⁹ AD1583/2/21 Boulton to Wilson 2 Nov 1786.

³⁰⁰ AD1583/2/38 Boulton to Wilson 13 Mar 1787.

also be able to provide sufficient copper coinage for the use of the growing industrial population.

The formation of the Cornish Metal Company did not solve the problem of the oversupply of copper as Boulton had hoped, and it proved ruinous to the Company to buy the amount of metal settled by the agreement of 1785. Large stocks of copper built up in Cornwall, and a meeting on 10th January 1787 tried to reduce output, but no one took effective action. There were riots by miners in February 1787 when some mines stopped production.³⁰¹ This led not only to problems for the mine adventurers in losing their profit, but also to a severe knock-on cost to the parish, with many unemployed individuals. Watt had wanted to sell all the copper that came to B&W to Williams in May 1785.³⁰² He had had enough of Cornwall, and was pessimistic about the fate of the Cornish copper industry.³⁰³ But he and Boulton, along with some of their friends, such as John Wilkinson, continued to hold mine shares and receive copper and ore.³⁰⁴

Paradoxically, despite the overabundance of copper, in May 1787 Watt wrote:

*that there was neither Tile, cake, nor shot copper in the [CMC] warehouse, indeed nothing but sheet copper... Judge also how it must appear for Mr Boulton to be obliged to send to the Dukes or Macclesfield warehouse for copper.*³⁰⁵

³⁰¹ J. R. Harris (1964) *The Copper King* p 73.

³⁰² 'Williams should buy all their Copper at a reasonable discount & dispose of it as he can & that some means should be devised, such as lowering the price in proportion as the quantity increased, to prevent more being raised than can be sold.' AD1583/1/57 Watt to Wilson 10 May 1785.

³⁰³ AD1583/1/98 and AD1583/2/16 Watt (Birmingham) to Wilson 8 Jun 1786; 14 Oct 1786.

³⁰⁴ Wilkinson, as Governor of the Mines Royal Company in June 1785, offered to smelt B&W's share of the Cornish copper ore in Aug 1785. MS 3782-12-73 Item 149 John Wilkinson (Castlehead) to MB (Chacewater) 19 Aug 1785

³⁰⁵ AD1583/2/48 Watt to Wilson 8 May 1787.

Nor was the situation better in August 1787. Watt recounted a letter from John Wyatt in which he wrote:

*I cannot help telling you that a friend of mine applied to the CMCo office and also at the agents house in order to inquire the price of Copper & to treat for £1500s worth, to go to Ostend, when he found he had no notice taken of him, he called at the Anglesea Co's office & though he found nobody but a boy in an hour afterwards he was waited upon & Contracted for the Copper.*³⁰⁶

Here Williams' better marketing skills are exemplified. Despite Boulton's efforts, no one in Cornwall took direct responsibility for copper sales as did Williams for Anglesey. Watt disliked Williams, as shown in his letter, but wrote: '*it must be acknowledged at all hands that he is a clever determinate man of business & if we can any way there promote the India sale or other disposal of copper you may be sure we will do it.*' He thought the best thing would be an alliance with Williams.³⁰⁷ He also passed on a report from Wilkinson in July 1787 that: '*all the angelsea Copper at Hanley works is sold & all at Ravenhead and that he had just learnt upwards of 900 Tons which were at Swansea are sold & it is added that they cannot get it made fast enough.*'³⁰⁸ The Macclesfield Company was also able to sell copper at £82 per ton but the price was dropping rapidly by July 1787.³⁰⁹

In September Boulton visited Anglesey and Holywell with Vivian and Wilkinson.³¹⁰ He described his visit to his son, in France at the time: '*I spent 3 or 4 days in inspecting the*

³⁰⁶ AD1583/2/66 Watt to Wilson 1 Aug 1787.

³⁰⁷ AD1583/2/49 Watt to Wilson 17 May 1787

³⁰⁸ AD1583/2/62 Watt to Wilson 16 July 1787

³⁰⁹ AD1583/2/63 Boulton to Wilson 21 Jul 1787.

³¹⁰ MS 3147-3-11 Item 6 MB (—) to James Watt (6 Green Lettice Lane) 4 Sep 1787.

Anglesey Copper Mine which is a tremendous Mine for a Cornish Miner to behold. It is not like a deep Cornish mine but is an open Work like a Quarry or a Gravel Pit & worked by open day light. Boulton detailed what was made at Anglesey and concluded: *'Hence you see what an immense profit arises from one great workSo great that I fear all the Mines in Cornwall will be obliged to give up which will be a great loss to me.'*³¹¹ He was worried about the future of his engine sales, with resulting loss of income. A contemporary account describes extensive excavations including one: *'two hundred yards long, one hundred and fifty yards broad and twenty to forty yards deep, which gives a content of nine hundred thousand cubic yards of removed natural ground.'*³¹² Even by this time the mine, over twice the size of a football pitch, was exciting interest as shown by images produced by Ibbetson and de Louthenberg at the time.³¹³

³¹¹ *'They make at Anglesey about 3000 Ton [of sulphur] (worth £10 p^r Ton = £3000 p^r year) to which add about 4000 Ton of Copper p^r Year worth in the cake about £75 p^r Ton = £300,000 & costs the proprietors about £40 p^r Ton...£160 000 to which add the profits of the Manufacturing it into Brass & and into Sheets, Wire, Nails etc. etc.'* MS 3782-13-36 Item 10 MB (London) to MRB (Versailles) 21 Sep 1787.

³¹² An account written by the Reverend Bingley is detailed on <http://www.parysmountain.co.uk> (accessed 5.9.2008). Football pitch is 100 to 130 yards long by 50 to 100 yards wide. <http://news.bbc.co.uk/sport1/hi/football/rules>

³¹³ Philip James de Louthembourg (1740-1812) (also called Philippe-Jacques and Philipp Jakob) was an English artist of French origin who pictured Parys Mountain.

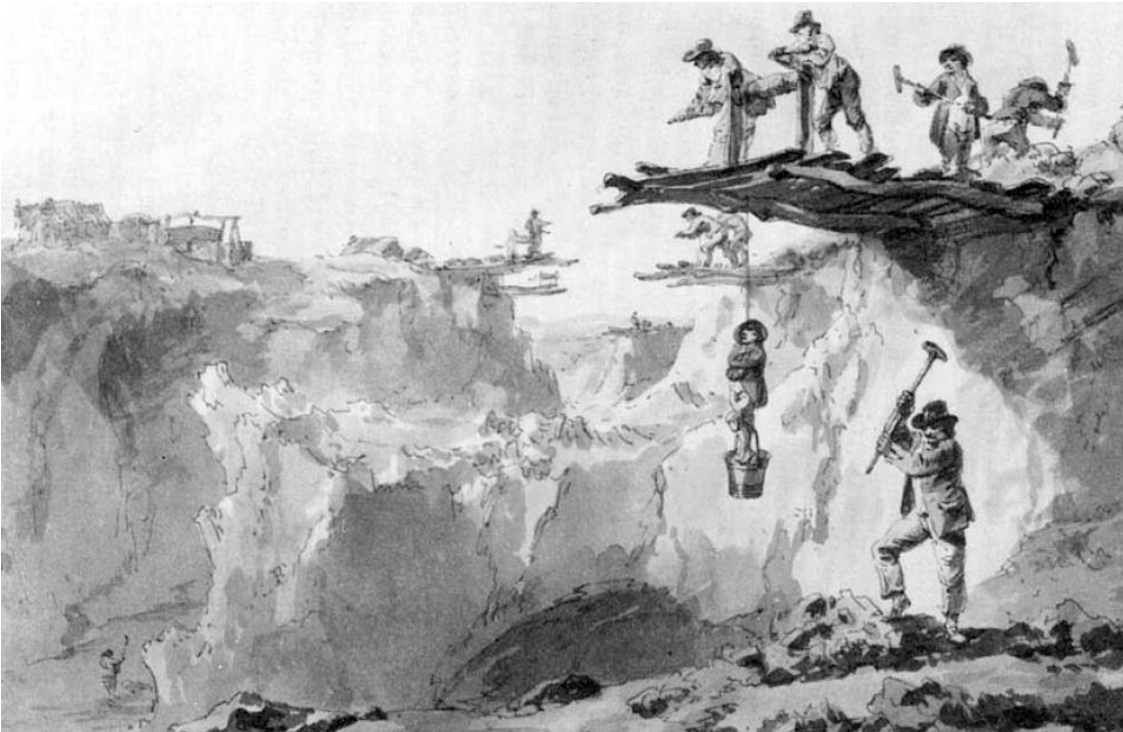


Figure 2.9: 1785 ‘The Parys Copper Mine’, Anglesey by Ibbetson³¹⁴

Williams had initially tried to help solve the problem of over-production of copper, but by August 1787 was feeling rightly aggrieved at being let down by the Cornish Mine Adventurers. He wrote to John Wilkinson stating that Anglesey had left the Birmingham market to Cornwall, had £70,000 worth of copper for them and had offered to sell their copper:

We gave them the delivery of near 200 tons of Sheathing for the Navy on the 3rd Sep last which they were to have accomplished in 3 weeks or a Month but they did not finish that delivery till Feb^y. Their sheathing was so irregular that we, as the

³¹⁴ Watercolour by J.C. Ibbetson, National Museum of Wales, <http://labspace.open.ac.uk>

*contractors, have been disgraced by them at the Navy Board in so much it will be difficult for us ever to retrieve our Character there.*³¹⁵

In addition, the Cornish Mine Adventurers did not stick to their agreements with Anglesey. Boulton wrote that Cornish ore was being sold contrary to the agreement, to some of the excluded Associated Smelters.³¹⁶ It did seem that Williams had valid grounds for complaint, and he decided that: *'we Anglesey Miners consider ourselves at full liberty to pursue the Copper Trade unrestrained by any engagements with those of Cornwall ever since their contract with the Smelting Cos. in May.'*³¹⁷ This led to further problems for Boulton in gaining any profit from his investments in Cornwall.

By summer 1787, the Cornish Metal Company was in crisis.³¹⁸ Cornwall had only sold 100 tons of the 1300 tons purchased by the East India Company that year, and had over 6000 tons of copper on hand. This copper had cost, as Boulton noted, *on average of £76 without the expense of rolling it. If W[illia]ms declares War the price will be £60 or perhaps £50* which meant a loss of £16 per ton, or around £11,000 to the Cornish Mine Adventurers, and hence a loss of the engine premiums.³¹⁹ At this point Boulton had better relations with Williams than with most of the Cornish Adventurers. He wrote from London to ask for Williams and Wilkinson's help against Bassett in solving the problems of the CMC: *I think if you were both here you might convert an evil into a good & if you do not you may depend on it that you will think yourself well off if you loose no more that*

³¹⁵ AD1583/2/76 Boulton (Chasewater) to Wilson (at Mr Holbrooks, Morrision, Swansea) 13 Oct 1787.

³¹⁶ *'It is also thought right to break the last & all those bargins made with Williams, & in future to sell the Cornish Ores to the Ex[cluded] Comp[anie]s either by the old mode of ticketing or any other that can be agreed upon.'*

AD1583/2/76 Boulton (Chasewater) to Wilson (at Mr Holbrooks, Morrision, Swansea) 13 Oct 1787.

³¹⁷ MS 3782 12-73 Item 68 Thomas Williams (Ravenhead) to John Wilkinson 28 Aug 1787.

³¹⁸ MS 3782-12-90 Items 41-50 Special committee held 20 Sep 1787.

³¹⁹ AD1583/2/76 Boulton (Chasewater) to Wilson (at Mr Holbrooks, Morrision, Swansea) 13 Oct 1787; MS 3782-12-90 Items 31-40 Case of the Cornish Metal Company.

£25,000. He had heard via Wilkinson, who was unwell with a cold that: *TW thinks he has totally done with Cornwall now.*³²⁰ However in November 1787, whilst dining with Boulton, Wilkinson and Wedgwood, Thomas Williams proposed a plan to buy 3000 tons of the CMC copper.³²¹ These proposals were eventually accepted by the Cornish Mine Adventurers with the agreement to be ratified in Parliament and various safeguards inserted. This would ensure the future of the Cornish copper industry and hence Boulton would receive his engine premiums.

Effectively for the next few years Williams had a monopoly of copper sales throughout the world. This is when his nickname “Copper King” became very relevant. By the late 1780s both Boulton and Wilkinson were very unpopular in Cornwall, as evidenced from correspondence about the closure of mines. Boulton wrote indignantly that he believed he had done more to bring about agreement between Cornwall and Anglesey than any other man. He had also been trying to find work for some of the Cornish miners in Shropshire and Staffordshire: ‘*& have mention’d my intentions to S[i]r Francis Bassett & other Cornish Gent[leme]n but I shall now decline entangleing my self with such dangerous people.*’³²² The overproduction of copper in Cornwall continued, and there were miners’ riots again as North Downs and Dolcoath mines stopped production in March 1788. But by November 1789 Boulton and friends had had enough of Cornwall, and had decided to leave the CMC, which was a pity, as prices for copper started to recover.³²³

³²⁰ MS 3782-12-73 Item 158 MB (London) to John Wilkinson [Bradley] 23 Oct 1787.

³²¹ AD1583/2/77 Boulton (London) to Wilson (Chacewater) 6 Nov 1787.

³²² AD1583/2/77 Boulton to Wilson 6 Nov 1787.

³²³ AD1583/3/102 Boulton to Wilson 10 Nov 1789.

Regal coinage

Boulton was interested in coinage reform as discussed in chapter one, but was also concerned about copper sales, which would pay for the engine premiums due from Cornwall. He thought that the surplus of copper could be used in a regal coinage contract. Initially, Boulton had considered Thomas Williams as a rival for this contract, but had found him helpful with Soho's first coining commission from the East India Company in June 1786, when 30 tons of copper were made into coins for Sumatra.³²⁴ In March 1787 Williams had started to make tokens at the Parys Mint in Birmingham, but had asked Boulton to '*coin 2 ton of pence for him and at what price.*'³²⁵ Samuel Garbett, a friend of Boulton, who was also interested in coinage reform, suggested collaboration between the two men.³²⁶ It was also suggested that Boulton could visit Holywell.³²⁷ Wilkinson visited Anglesey in May 1787 and returned with the idea that Williams should roll the metal, and Boulton would do the coining.³²⁸ Further meetings were held to discuss matters in August 1787.³²⁹ After a visit to see Williams' mines and copper works in September 1787 Boulton resolved to see Pitt again about a regal coinage contract.³³⁰ This meeting had promising results. By October 1787 Williams and Boulton were co-operating in their approaches to the Government.³³¹ At this point Boulton was proposing a consumption of

³²⁴ Williams wrote: '*It would be folly in us to give you any opposition therein, and you may be assured I shall wish no further concern in the business than furnishing the Sheet Copper that may be wanted to which I dare say you will have no objection.*' MS 3782-12-73 Item 66 Thomas Williams (London) to MB (Soho) 12 July 1786.

³²⁵ For some yet undiscovered reason, Boulton did not make tokens for Williams until 1789. MS 3147-3-11-2 MB (London) to James Watt (Harper's Hill) 15 Jun 1787.

³²⁶ MS 3782-12-62 Item 36 Samuel Garbett (London) to MB (Birmingham) 28 March 1787; Item 41 31 March 1787.

³²⁷ '*My Brother declines meddling any further about the Coinage. He is to meet Mr Williams on Tuesday next at Hollywell, & thinks it a good Opportunity for You to see those Works when any other Business may be agitated.*' MS 3782-12-73 Item 151 William Wilkinson (Bersham) to MB (Soho) 27 Apr 1787.

³²⁸ '*Respecting the Coinage [Government Copper Coin], Williams says he gives up the Copper Metal to Cornwall, he only contends for the Mill.*' MS 3782-12-73 Item 152 John Wilkinson (Chester) to MB (Soho) 5 May 1787.

³²⁹ AD1583/2/72 Watt to Wilson 27 Aug 1787.

³³⁰ Boulton had seen Pitt previously in February 1785 for discussions about taxes on iron and Irish trade. AD1583/1/47 Boulton to Wilson 10 Feb 1785; AD1583/2/73 Boulton to Wilson 1 Sep 1787.

³³¹ '*that if any agreement is made with Mr Droz by either Mr Williams or Mr Boulton for the purpose of carrying on the manufacturing of Money or Medals, that such a Manufacture shall be carried on under the inspection & management*

3000 tons of copper for a regal coinage contract which would save the Cornish Metal Company, by generating income from copper sales.³³²

Boulton's experience in all aspects of the copper industry proved important in seeking the regal coinage contract as discussed in the catalogue. He was considered as 'an expert witness' by the Privy Council for Coin, which was responsible for deciding on future coinage orders. He had considered aspects such as the smelting of copper, the sources of copper and the price to be charged. In response to questions from them in January 1788 he wrote:

*I am of the opinion that the process of smelting may be improved but the present price of smelting is about sixteen pound per ton of pure copper, on the average value of the Cornish copper. Anglesea copper can be smelted something cheaper but I do not imagine that any improvement that may be made in the process of smelting will considerably effect the price of copper.*³³³

Boulton also considered the importation of copper and concluded that it would not be cheaper as further refining processes would be required. Importantly, he emphasized that:

*The price of copper to be used in the coin must depend on the price of copper at the time the coinage is undertaken. Since writing my letter the price of copper is very much increased and the manufacturers at Birmingham pay about £10 ton more.*³³⁴

of Mr Boulton upon such particular terms as he & Mr Williams may from time to time agree upon. MS 3782 12-73 Item 69 Thomas Williams (Anglesey) to MB (Cornwall) 12 Oct 1787.

³³² *'I proposed that Gov[ernmen]t should take 3000 Tons of Copper (& I am perswaded I could accomplish that point).'* AD1583/2/76 Boulton to Wilson 13 Oct 1787.

³³³ Copper coinage and government MS 3782-12-97 Items 112a and 112b January 1788.

³³⁴ Copper coinage and government MS 3782-12-97 Items 112a and 112b January 1788.

In December 1787, the contract seemed to be imminent but problems with kidney stones prevented Boulton from attending a meeting of the Privy Council for Coin. He still hoped to coin 3000 tons of metal.³³⁵ However by January 1788 Boulton and Williams' joint approaches to the government resulted in the apparent decision by the government that a coinage contract was to be made. Further notes were made in 1788 about the cost of carriage, packing, customs, freight and insurance for 3000 tons of copper coin.³³⁶ Boulton concluded: '*I think if the gov^t would allow 1d per lb or £9 6 8d per ton for packing and carriage etc. I think I dare undertake it.*'³³⁷ By February 1788, Boulton started to build the Soho Mint as discussed in chapter three.

Buying copper for Soho Mint

Boulton was very conscious of copper prices, especially when considering the regal coinage. However, as soon as he had set up Soho Mint in 1788, the price of copper started to rise, and supplies became increasingly difficult to obtain. This was ironic considering that the low price of copper was a major stimulus to the idea in the first place, and Boulton had suggested a coinage issue to use up the copper surpluses. This price rise was in part due to Thomas Williams' excellent sales techniques once he had effectively gained control of the copper trade. There was also increasing demand caused

³³⁵ Boulton reported three letters from the Lords of the Privy Council asking him questions about coinage, and also states that his doctor will not allow him to attend a meeting on 22nd December 1787, as he is suffering from kidney stones. *They have therefore appointed me to attend them at 12 o'Clock on Tuesday ye 8 Jan[ua]ry which Summons I propose to obey. ... I have in my letters shewn them (from Mint authority) that ye Copper Coin in 1760 amounted to 400,000£ worth & that there is no possibility of stoping counterfeiting, but by putting a halfpeny worth of Copper & workmanship into every ½ penny so as to leave no Profit to Counterfeiters & then by suppressing all ye Old ½ pence It will be found necessary to coin 3000 Ton at 16d [pence] p[e]r lb [pound], will pass for 450000£ but these present ideas amount only about 500 or 600 Ton.* AD1583/2/82 Boulton (Soho) to Thomas Wilson (Truro) 28 Dec 1787.

³³⁶ Vivian's calculations: Carriage or freight circulating 3000 tons of copper coin: Packing, package cost, portorage, wharfage, Custom house & port charges in London all £1 18s per ton; Freight and insurance £2; Cellarage at 10s; Loading to ye wagon 2s; Inland carriage on average 10s; Unloading from wagon portorage and cellerage 5s total £5 5s per ton; Delivery in London at 10s; Commission on delivery of amount of 3000 tons £420,000 = £4200. Interest to bank. Total £31,553. Profit to Government on 3000 tons £56,000. Mint Book 1788 MS 3782-12-108 Item 53 p 69

³³⁷ Mint Book 1788 MS 3782-12-108 Item 53 p 69.

by war with the French, commencing in January 1793. The consumption of copper by the navy increased from 300 tons a year in the early 1790s, to around 1000 tons by the end of the decade.³³⁸ In addition, the Parys Mines were also in serious decline. So, by the time Soho Mint finally obtained the regal coinage contract in 1797, the price of copper had increased considerably. In 1788 when Boulton and others first expected a regal coinage issue, copper prices were falling, with around £73 per ton being received by the mine adventurers.³³⁹ For his first regal coinage contract Boulton paid around £108 per ton for copper, but for the 1799 contract this had risen to £121, and in 1805 the price was £169.³⁴⁰ Copper was difficult to obtain for mint contracts, especially in 1799.

The cost of copper depended on how it was purchased. In January 1788, it was possible to buy copper in small amounts, but reductions were given for larger orders. The £73 received by the Mine Adventurers was much smaller than the price of £84 per ton charged to the consumer, and did not always cover expenses.³⁴¹ Boulton became involved himself in selling copper from at least 1788, when proposals were made by Thomas Williams for Boulton and others to sell copper and brass in Birmingham at their own risk.³⁴² A warehouse was opened by summer 1789, but Boulton complained that plans were being sabotaged by the appointment of two Cornish agents: *'one of whom hath no*

³³⁸ In 1799 Banks also wrote to Boulton *'Need to prevent the enemy from being sheathed with British copper.'* MS 3782-12-56 Item 50 Sir Joseph Banks (London) to MB (Soho) 10 Jul 1799.

³³⁹ MS 3782-13-36 Item 9 MB (Soho) to MRB (Versailles) 30 Jul 1787.

³⁴⁰ MS 3782-17-4 Coinage License 9 June 1797; MS 3782-17-5 Coinage License 4 November 1799; MS 3782-17-6 License to coin 18 April 1805.

³⁴¹ Boulton wrote: *'Small manufacturers & small purchasers who buy 1-2 cwt at time pay to the Knoll [Gnoll] Co or any other large purchaser £84 [per ton]. Which Knoll Co or whole sale dealers pay to Anglesey or Cornwall £80; out of this they have an allowance of £3 which reduces it to £77 and out of that Cornwall allows commission to Williams of 30s and to other expense £2 per ton. And if sold to foreigners there is a reduction of £2 per ton. Hence Cornwall gets £73 minus the expenses of their business when it is sold to the small manufacturer at £84; also they pay 10 ½ d [per lb] for rolled copper but wholesale dealers pay 10d and have an allowance of £3 a ton.'* Mint Book 1788 MS 3782-12-108 Item 53 p 17.

³⁴² A commission of £2 per ton sold was allowed on all un-manufactured copper & pot metal and 1/2d per lb on all manufactured copper plus £100 pa for Warehouse rent etc. MS 3782-12-73 Item 132 and 133 Boulton's remarks on Boulton, Hurd, Wilkinson and Watt's agreement with Thomas Williams for the sale of copper and brass. Dec. 1788

*natural Connection with the trade & the other Contributed much to the lowering of its price.*³⁴³ These individuals were selling Irish copper at £80 per ton, while the Cornish, Anglesey and Duke of Devonshire's copper sold by Boulton cost £84 by agreement.³⁴⁴

Copper came to Soho Mint from a variety of firms. By 1790, these firms included Thomas Williams' Anglesey Company, Brass Wire Company, Freeman and Company, Macclesfield Company, Birmingham Mining Company, Fenton's Yorkshire Copper Company and Morris, Lockwood and Company.³⁴⁵ In February 1791 he received over 10 tons of copper from John Morris' Forrest Copper Works near Swansea, plus 49 tons from Michell, Trevenen and Edwards at Hayle in Cornwall and over 50 tons from Thomas Williams in April 1791.³⁴⁶

It was usual to arrange relatively long contracts for copper supplies. For example in May 1791 Boulton agreed to receive monthly amounts of copper for two years from Hayle Copper House. The total received per year was to be:

*Twenty tons of brass and battery cake at eighty pound per ton, 70 tons of tough cake at £80 per ton and more than 70 tons at £81 per ton, 60 tons of shot if they can produce so much beyond their present engagements (as above for tough too) at £82 per ton. B&H to provide casks or cases, or pay 20s per ton for the same.*³⁴⁷

³⁴³ AD1583/3/89 Boulton (Soho) to Wilson 19 Aug 1789.

³⁴⁴ AD1583/3/90 Boulton to Wilson 22 Aug 1789.

³⁴⁵ 1789 -1795 General Notebooks 1790 MS 3782-12-108 Item 55.

³⁴⁶ MS 3782-3-13 Mint day Book 8th February 1791-16th May 1795.

³⁴⁷ *Michell, Trevenen and Edwards of Hayle Copper House engage to deliver in Bristol over the ships side, to the order of Messrs Boulton and Hurd of Birmingham the undermentioned quantities of copper yearly for two years from 24th June next by equal monthly deliveries.* MS 3782-13-96 Copper trade Volume 1 Item 15. Michell, Trevenen and Edwards to Boulton 23 May 1791.

Some of this copper was for the mint and some to sell on to other customers. But by October the same year Boulton was having difficulties in obtaining copper for a Soho Mint contract for France. From this time on there were often problems with getting the correct sort of copper from Cornwall.³⁴⁸ Boulton accused Williams of withholding copper from the Birmingham markets, and was also let down by his Cornish agent, Thomas Wilson.³⁴⁹ By 1793, fed up with the intrigues of the Cornish Mine Adventurers, he set up a new company with a capital of £100,000 to buy copper and copper ore, and to smelt it under the name of the Rose Copper Company.³⁵⁰ Boulton again wrote detailed notes on the cost of smelting ores, wages, freight and port charges, coals, tools etc.³⁵¹ The Company was operational by 18th July 1793 as 533 tons of ore was bought at the Cornish ‘ticketings’ for the ‘New Birmingham Company’ to be smelted at £2 per ton.³⁵² By this time, so much time, effort and money had been invested in the Soho Mint that Boulton had to persevere in seeking a coinage contract from the government in order to recoup his investment, and to maintain his reputation.

³⁴⁸ Extracts from the Correspondence between Mr Boulton, Mr Edwards & Mr Hurd Feb 1791 to Dec 1793. MS 3782-13-96 Copper trade Volume 1 Item: 10. MB to John Edwards 7 Sep 1791.

³⁴⁹ Boulton’s son wrote to express his disappointment about lack of copper supplies that threatened Soho Mint’s contracts. ‘*The stoppage of his Works will be a very considerable loss to him, but in the eyes of Man of Honour the loss of Character is a much greater consideration & therefore you cannot be surprised that my Father should feel himself chagrined at the disappointment, which he augers from your Letter.*’ AD1583/4/104 MRB to Wilson 29 Oct 1791.

³⁵⁰ On 8th Jan 1793 the Rose Copper Company was set up with a capital of £100,000 and 1000 shares of £100 each, to buy copper ore and smelt it. It was effectively a take-over of Fenton’s, Yorkshire Company based in Swansea. The agreement features in papers registering one share to Ann Boulton in 1797. MS 3782-13-93-2 22 Aug 1797.

³⁵¹ The exact costs were detailed including the probable expenses of smelting 5000 tons of ore at £1 14s 6d per ton; Carriage 5s per ton £1250, weighing £125; freight 4s 6d £1125; insurance £625; bargains, discharging and weighing £208; 50 workmen at 8s 2d per week £1016; 12 smiths, 12 carpenters, 14 bricklayers, 9 labourers £122; Clerk at £45; Refiner £120; Second refiner £70; House rent etc for above, Coals for smelting at 8s per ton £2000, clay, sand, lime, brick, timber £1000; iron for ladles, skimmer, cramps etc £120; Keep of a Horse for the Mill £20; Dressing 500 tons of ♀ [copper] at 2s £50; Interest on £5000 £375 Total £8381 Transport cost 6s per ton from Swansea to Bristol and a further 17s from Bristol to Birmingham. MS 3782-12-108 Item 55 1789 -1795 p 11-18 Soho 12 Feb 1793.

³⁵² The Cornish agent plus assayer were to be paid £200 for buying ores, and the general superintendent (say Holbrook) £100 or £150 and a refiner £90. Boulton recommends two names as agents: Mr Christo is a good assayer & agent & was Mr Ennis chief. Morgan Bevin’s son is a good assayer & may be had & either of these it is supposed will do the business of an agent & assayer MS 3782-12-108 Item 55 1789 -1795 pp 11-18 12 Feb 1793.

Boulton had hoped to be self-sufficient in supplying copper to the Soho Mint but in February 1796 due to lack of orders, he could not use all the copper he had requested.³⁵³ At other times there was not sufficient copper for all the commissions he received. Consequently Boulton investigated the price of copper via correspondence with a network of agents as far apart as Sweden, Norway, Turkey and India.³⁵⁴ This price survey involved knowledge of the monetary values and conversion rates for the weights used in the various countries. For example, Boulton had a list of the prices of Hungarian copper as sold at the Imperial Warehouses in Trieste in 1781, and compared this to prices in twenty two other locations in Europe.³⁵⁵ Other complex price comparisons were used: for example, one concerning copper from Bussorah required converting from the local currency of sicca rupees and the local weight of mamodies.³⁵⁶ He also had a conversion table for a 100lb Viennese weight which corresponded to weights in other areas of Europe as in the table below.³⁵⁷

³⁵³ He wrote: 'You say you shall soon have 40 Ton of ♀ [copper] to deliver B&W. I think you may venter to send 20 Ton of it to Williams.' AD1583/9/10 Boulton to Wilson 26 Feb 1796.

³⁵⁴ The highest price in Calcutta was in 1793 when the cost had risen to £115 from a previous low of £77 in 1788. MS 3782-12-108-27 1780-1790 General notebook; MS 3782-12-90 Copper trade.

³⁵⁵ Trieste is now in Italy, but in the eighteenth century was part of the Austrian Empire. MS 3782-12-90 Items 71-80

³⁵⁶ Prices for Battery copper in England and in Calcutta sold by public auction, and for copper from Bussorah (Basra, Iraq) and Europe 1787-1797. MS 3782-12-90 Item 71-80.

³⁵⁷ Price current of Hungarian copper as sold at the Imperial Warehouses in Trieste in 1781. The conversion rate for Swedish to English weights and the cost of the duty paid is also given. MS 3782-12-90 Items 71-80.

Table 2.1 to show a comparison of weights in 1781 in Europe, to 100lb Viennese weight (all values in pounds avoirdupois)³⁵⁸

117 ½ great wt of Venice	155 Bologne	139 ¾ Barcelona
185 ½ little wt of Venice	176 Genoa	176 ½ Turin
165 ½ Rome and Florence	101 ½ Geneva, Switzerland	124 London
174 Naples	135 Marseilles	122 Lisbon
176 Milan	114½ Paris	108 Alicante
168 Lucca	134 Lyon	116 Hambro
164½ Leghorn	122 Cadiz and Malaga	114 Holland

This table shows, for example that 174lb in Naples would be equivalent to 124lb in London, or 134lb in Lyon, which meant that Boulton would have to be very careful in calculating costs of various contracts abroad.

It was suggested in 1793, in an interesting series of letters received from Joseph Franel of Smyrna that copper could be obtained from Turkey. He described how copper came from mines transported first by donkeys, then log rafts along the river, and then by boat, and could be shipped to Europe. Franel gave prices and also sent samples by Captain Richard Stocker of the *Sally* but unfortunately the ship sank.³⁵⁹ Boulton commented to his banker, Charlotte Matthews, that though the price was very cheap, there was import duty of ten guineas per ton plus sundry expenses which raised the price.³⁶⁰

³⁵⁸ MS 3782-12-90 Items 71-80.

³⁵⁹ Smyrna is present day Izmir in Turkey. Franel shipped a small parcel of 100 pieces of copper to England. MS 3782-12-90 Items 81-90 17 Jul- 2 Sep 1799.

³⁶⁰ The expenses raised the cost to £113 without the English duty. *'I observe in their calculations they reckon the freight from 3 to 4 £ a ton and their other charges 18 per cent. They also say that the former price of copper was at 27 pa[ras] per oke. The oke is 2lb. ¾ and 40 paras is = 2s. 2d. 40½ okes is = to 112lb. or our Cwt., or about £87 15s*

After Boulton's first regal coinage contract in 1797, copper prices rose steeply. As one of his correspondents in Stockholm commented in January 1798, the prices of good copper *'have been here these late years extremely high and almost continually rising.'*³⁶¹

Boulton was trying to obtain copper for his next regal coinage contract from a variety of sources. He reckoned that problems with copper supply were due to Williams, and commented: *'W^{ms} from a principle of revenge upon me chooses to gratify that spirit at the expense of a few thousands.'*³⁶² By November 1799, Thomas Williams and Matthew Boulton were not on good terms. Williams reckoned that Boulton had treated him unfairly when obtaining copper for the 1797 regal coinage contract, which may or may not have been true. However copper was in short supply all over Europe, and Williams was himself having problems in fulfilling contracts as the Anglesey mines were running out of easily obtainable ore. In January 1799 George Henry Busch reported from Hamburg that he *'cannot execute your commissions in copper as well as you expect'* as *'only a small quantity of copper is on market at present.'*³⁶³ By the end of the month, Busch wrote again to say he had *'some hope of contracting for monthly supply of Swedish copper.'*³⁶⁴ Westermark from Stockholm wrote in a similar vein in February 1799. They were hoping to execute 20-30 tons of cake copper for Boulton but could not guarantee it as they were: *'in daily expectations of the Royal Statute'* which might limit

per ton. Now if it could be deliver'd in England and cost no more [than] 90 when the duty was paid, it might be worth thinking about.' MS 3792-12-68 Item 46 MB (Soho) to Charlotte Matthews [London] 3 Jun 1793.

³⁶¹ MS 3782-12-90 Items 81-90 J Westermark and Co [Stockholm] to MB 30 Jan 1798.

³⁶² MS 3782-12-56 Item 124 MB (Soho) to Sir Joseph Banks [London] 29 Nov 1799.

³⁶³ *'No German copper here at present; this sort of copper is sent from Mansfeld and in general by small quantities.*

Norwegian and Smirna copper is seldom here.' MS 3782-12-90 Items 81-90 25 Jan 1799 Mr Busch [Hamburg] to MB

³⁶⁴ He wanted *'therefore be perfectly instructed by you next, upon what conditions I might enter into engagements of that nature as well as regard to the price as to the quantity most suitable for you to receive.'* MS 3782-12-90 Items 81-90 G.H. Busch (Hamburg) to MB (Soho) 29 Jan 1799.

exportation.³⁶⁵ Similarly, Gros from St Petersburg in Russia reported very small amounts available from the Siberian mines.³⁶⁶ Boulton's agent Mr Schmidt from Drontheim in Norway reported that the price of copper '*keeps fluctuating and has rose considerably since last autumn.*'³⁶⁷ Andrew Collins was responsible for the various translations of letters to foreign agents and also travelled on behalf of the firm. He kept records of exchange rates.³⁶⁸ It is amazing that the copper trade was able to continue despite war, and also despite severe weather.

³⁶⁵ He wrote: '*From the Great want of water that continued here from last autumn and present excessive cold all our iron and copper works have suffered thereby in their manufactures.*' MS 3782-12-90 Items 81-90 Westermark [Stockhom] 8 Feb 1799.

³⁶⁶ '*Tough cake copper a scarce article, and I am apprehensive the Price will not answer.If the supply from the Siberian mines is not considerable there is no doubt but that the price will go still higher.*' MS 3782-12-90 Items 81-90 E.L. Gros (St Petersburg) 25 Feb 1799.

³⁶⁷ MS 3782-12-90 Items 81-90 Connor and Company Trieste to MB 15 Feb 1799.

³⁶⁸ MS 3782-12-90 Items 81-90 Mr A Collins on foreign copper 8 March 1799.

Table 2.2 to show prices of copper ‘cakes’ 1793 - 1799³⁶⁹

Place	Date	Price per ton	Notes made by Boulton
Calcutta, India	1793	£115	risen from a previous low price of £77 in 1788
Bussorah (Basra), Iraq	November 1797	£46	plus transport and duty not listed
Spain	1798	£155 15s	
Stockholm, Sweden	January 1798	£131 4d	plus £43 16s duty
St Petersburg, Russia	August 1798	£150	plus £44 3s 8d duty
Russia	April 1799	£211 18s 8d	
Smyrna (Izmir), Turkey	April 1799	£128 7s 6d	
Hamburg, Germany	April 1799	£123 19s 3d	without freight
Drontheim, Norway	April 1799	£121 18s 0d	without freight
Constantinople (Istanbul), Turkey	August 1799	£87 12s	plus transport and duty

Mine Adventurers and smelters wanted the highest price possible for copper, but manufacturers and merchants want a low and consistent price. There were complaints that the high price of copper ‘*deprives a great part of the inhabitants of Birmingham of full Employment and fluctuations in price are prejudicial to manufactures.*’³⁷⁰ By 1799 Boulton was more involved as a consumer rather than a producer of copper, and was trying to lower prices to the annoyance of miners. He was accused by Williams of trying

³⁶⁹ Data taken from: MS 3782-12-90 Items 71-80 East India Company prices of copper for several years compared to the price from Bussorah and Europe; MS 3782-12-90 Items 81-90 Particulars of Spanish copper 1798; MS 3782-12-90 Items 81-90 J Westermarck and Co [Stockholm] to MB 30 Jan 1798; MS 3782-12-90 Items 81-90 Mr Bensusan Plough Court, London 29 Aug 1798; Recapulation of Mr Woodward’s calculations respecting copper in different countries MS 3782-12-90 Items 81-90 10 April 1799.

³⁷⁰ The general price of copper had risen from £67 per ton in 1790 to £124 per ton in 1799. *Review of the Arguments on the Copper Trade and Miners. Printed by G Woodfall, 23 Paternoster Row, London.* Printed document on the export and import of copper. MS 3782-13-97 21 1799.

to profit from this. Williams argued that the high prices were caused by war and that 60,000 to 70,000 people were dependent on the copper mines, let alone the colliers, coasters and carriers who were also involved.³⁷¹

An enquiry in 1799 was held by the Committee on the Copper Trade when Williams was blamed for the high prices. Evidence presented by John Vivian on the costs of Cornish mines showed that they were in a desperate way even when prices of copper were high. The miners needed at least £106 per ton for copper to make a profit, whereas in 1790 £76 has been sufficient.³⁷² Boulton was interviewed as an expert witness in April 1799. He wrote to his son: *'This is the eighteenth day I have attended the Committee of ye House of Commons on the copper trade and have many of those days been tied to the Stake of Examination for 3 hours at a time.'*³⁷³ Lord Hawkesbury moved a bill in Parliament to prevent the export of copper by the EIC in an effort to stop price rises. The whole problem was discussed in newspapers at the time.³⁷⁴

Compared to the 1797 and 1799 regal coinage contracts, there were no problems with copper supply for the 1805-1807 issues. By 1802 Thomas Williams had died and from 1804 on copper was provided by Thomas Williams' son, and his partner Pascoe Grenfell.

³⁷¹ *'Is it to be credited that a Contactor who at once gains upwards of £20,000 by copper, who had before acquired a very considerable fortune by Cornish concerns, and who, since May last, has been paid by them £40,000 for the use of his engines; is it to be credited that he should stand forward in a Deputation, to lessen the prosperity of those by whose means he has obtained that fortune? Should the proprietor of a steam engine, the contractors of a national coinage, the makers of buttons or the founders of brass be similarly constrained?'* MS 3782-13-97 Item 21 1799.

³⁷² 2163 tons in Cornwall had been sold in last six months for £113 per ton (£216,017). Cost in raising it was £197,333 and profit of profitable mines has been £40,291 but loss of others £21,536 which leaves a balance of £18,683 on a capital of £385,560 and a dead loss of nearly £164,789. MS 3782-13-97-25. Observations on evidence to committee to enquire into copper mines and copper trade 1799.

³⁷³ MS 3782-13-36 Item 139 MB (London) to MRB (Soho) 30 Apr 1799.

³⁷⁴ Various articles appeared in newspapers including the *Morning Chronicle*, *Gazette* and the *Morning Herald* on 19 June 1799. *Aris's Gazette* on 24th June printed further letters. MS 3782-13-97-23 Extracts from newspapers relative to the copper trade and contest with the miners 1799.

Boulton also supplied copper via the Rose Copper Company in which he had shares.³⁷⁵ In 1805 the price of copper had risen to £180 and some copper was obtained from Russia at £150 per ton.

Summary to chapter two

The copper industry was vital in supplying the raw material for the Soho Mint, but was also important for many other reasons. It was the Cornish copper industry that had provided the first major use of the Boulton and Watt steam-engine and experience with setting up reciprocating engines. This led in turn to the development of the rotative engine which could be used to apply power to the coining apparatus. In addition, most of the engineers who set up the mint had worked in the copper industry, installing steam-engines to pump water out of copper mines. There they gained experience in solving technical problems that would be essential in solving difficulties encountered in setting up the steam-powered coining apparatus at Soho. It was also the loss of the steam-engine premiums that made Boulton take a considerable interest in mining techniques, and which led him into collaboration with Thomas Williams as the price of copper fell. Between the two of them the smelting cartels were broken, and new ways of marketing copper were sought.

³⁷⁵ Grenfell's proposals to supply copper were before the Council for Coin by 19th Nov 1804. The contract was to be per ton, cake £168 (to Williams and Grenfell, and to Boulton); coining £46 13 4d (variable, dependent on number of coin to the pound, to Boulton); circulation £5 (to Boulton); carriage to Birmingham of the copper £2 (to Williams & Grenfell). Watts-Russell also claims that the copper came from Freeman & Co via Bristol rather than via Temple Mills on the Thames as claimed by Grenfell. P. Watts-Russell (2003) *A copper-bottomed life* The Cornish Banner (August 2003); *"Copper Revolution" cut short: the Cornish Metal Co, 1785-179* Trevithick Society Journal (2005); *Making Money: Pascoe Grenfell, Matthew Boulton & the copper coinage* (unpublished manuscript); *The Bank of England & its 'Parliamentary Gadfly'* (unpublished manuscript). Thanks to Penny Watts-Russell for supplying me with copies of her papers.

The over-supply of copper first brought Boulton to consider the possibility of setting up the Soho Mint, with the prospect of a regal coinage contract as a motivating force in Boulton's mind. It was his expertise in all areas of the copper industry that helped to persuade the Privy Council for Coin finally to award him the contract, rather than the Royal Mint. The copper industry also supplied the first essential customers for Boulton's new coining process, and formed the inspiration behind the design for the first steam-struck coin in the world, the Cronebane token. Experience in mining and smelting copper also enabled him to select the best type of copper to be made into beautiful coins.

Other key players in the metal industries, such as John Wilkinson and Thomas Williams were colleagues and friends who provided important help in seeking the regal coinage contract. In addition, Boulton's contacts in the iron industry provided vital for developments with the steam-engine cylinder used in his steam-powered coining presses, and also in the formation of steel. The interlocking of technologies meant that progression in one area was strongly linked to another, such as the introduction of crucible steel by Huntsman, and its use in die making at the Soho Mint. Without users, inventions are useless, and Huntsman and others were influenced by the responses of their customers. Without excellent steel, Boulton would not have been able to improve die technology, and without good steel dies it would have been impossible to produce the excellent numismatic samples made at Soho Mint. Boulton's metallurgical expertise plus his practical investigations of annealing and die hardening led to the improvements in coining dies. All these factors emanating from Boulton's connections with the iron and copper industries resulted in the Soho Mint becoming the progenitor of minting practices around the world.

CHAPTER THREE: THE TECHNOLOGY OF COINING

Matthew Boulton's reputation as an entrepreneur has overshadowed his technical achievements. In his partnership with James Watt he has been credited with the business acumen and Watt with the technical skill. More recently, he has been thought of merely as James Watt's financial backer.³⁷⁶ In his own lifetime, however, and until around 1830, his independent technical achievements in improving coining practices were given due acclaim³⁷⁷ His enterprise in bringing together a combination of new methods and in directing the team at Soho Mint was vital. Boulton used innovative new systems to control production, from the input of the raw materials to the distribution of the completed product. He was also willing to sell his new technology to the Royal Mint and others so that the *modus operandi* introduced at Soho Mint was widely distributed. This chapter will focus on technological developments and Boulton's role in introducing new coining procedures to Britain.

This chapter provides a description of the technical aspects of the Soho Mint, including the formation of the dies and the processes of coining. Innovative ideas in design were also made there, including a bimetallic coin³⁷⁸ and a hexagonal coinage for Bengal in 1792.³⁷⁹ This chapter will suggest that technical improvements in many aspects of coining were made by Boulton at the Soho Mint, in rolling copper, annealing metal, forging dies, in the preparation of coining blanks, and in striking coins. These aspects of

³⁷⁶ Watt in fact had considerable shrewdness in business which proved crucial in reducing debt in the 1780s. D.P. Miller (2007) *Scales of Justice: Assaying Matthew Boulton's Reputation and the Partnership of Boulton and Watt*. Boulton Workshop 28.11.2007.

³⁷⁷ Several contemporary newspaper articles praised Boulton's technical achievements. '*Soho Mint, which has produced the exquisitely beautiful concave halfpenny piece, is perfectly new in its principles and is more accurate in its performance and more powerful in its effect than any Mint in Europe.*' St James Chronicle, British Evening Post 10 Dec 1799 British Library newspaper archives visited 28.10.2008.

³⁷⁸ MS 3782-13-36 Item 73 MB (London) to MRB (Soho) 12th April 1792; MS 3782-12-66 Item 30 James Lawson (Soho) to MB (London) 14 Apr 1792.

³⁷⁹ S. Tungate in: M. Dick (ed.) (2009) *Matthew Boulton A Revolutionary Player* pp 189-190.

his activities have not previously been fully considered. I will argue that it was this series of improvements which enabled him to succeed, not just the introduction of steam-powered coining technology.

Matthew Boulton had both an intellectual and a practical approach to life. From an early age, he was interested in science or ‘natural philosophy’ as it was known. He wrote about investigating thermometers and electricity in 1761 and sent an electrometer to Joseph Priestley in 1792.³⁸⁰ He ordered a microscope via Dr William Small in 1765, and was discussing a new orrery in 1771.³⁸¹ He had a naturally inquisitive mind, for example, in his various notebooks and diaries, he noted the time it took for a skip of coal to rise from a pit, and how iron was made from pig iron and pit coal, the price of gold leaf, recipes for various gilding methods and for sealing joints, densities of materials, the temperature for blanking stoves.³⁸² He recognised the importance of natural philosophy in relation to technological improvements and corresponded with others who were working in the fields of metallurgy, chemistry, and astronomy.³⁸³ He was also a competent assayer of metal ores.³⁸⁴

³⁸⁰ MS 3782-12-23 Item 12 Dr. J.L. Petitt (Little Aston) to MB 25 Feb 1761; MS 3782-12-23 Item 13 MB (Birmingham) to Timothy Hollis (London) 4 Mar 1761; Boulton ordered 23 yards of wire *to prevent the bad effects of lightning* MS 3782-12-23 Item 14 E. Newton (Kings Bromley) to MB 26 Jun 1761.

³⁸¹ ‘*I sent the solar microscope you bespoke when you was in Town to the Birmingham Wagon last night. The Price is £5 10s.*’ MS 3782-12-23 Item 54 Peter Dolland (London) to Dr. Small (Birmingham) 5 Sep 1765; MS 3782-12-23 Item 209 James Ferguson (Kidderminster) to MB (Soho) 10 Aug 1771.

³⁸² ‘*Observed by my watch the neat time w^{ch} a skip of Coal as took to ascent out of one of Messr Parrot & Co pits; the depth of which is 92 ½ yards & it took 1½ m^l or 90 seconds each skip 500 pounds weight.*’ Boulton noted on the price of gold leaf in a book of 25 leaves of *strong gold* to be about 6/10 of a farthing per inch, whereas ‘*Common leaf such as is used to gilt looking glass works out to be ¼ farthing per inch. Cubic inch of fine gold weighs 4902 grains.*’ MS 3782-12-108 Item 11 Boulton’s Notebook 1775-1776.

³⁸³ ‘Science’ as a term was not used in the eighteenth century, but will be used in this thesis to denote natural philosophy. As an example of his interests; Boulton and his daughter Ann ‘*Called on Mr Hershall the astronomer at Windsor, and saw his great telescopes.*’ MS 3782-13-36 Item 9 MB (Soho) to MRB (Versailles) 30 July 1787.

³⁸⁴ E. Robinson (1963) *Eighteenth-Century Commerce and Fashion: Matthew Boulton’s Marketing Techniques* Economic History Review Second Series, Volume XVI No. 1 p 56.

Much of the information in this thesis about the technological advances at the Soho Mint comes directly from contemporary documents. Matthew Boulton himself wrote copious notes in his mint notebooks, including what had to be done to set up a mint, his reasons for doing it, and descriptions of various technical aspects of coining. In addition, memoirs of Matthew Boulton were written, including most notably by James Watt and James Keir.³⁸⁵ There are also accounts of the development of the minting technology written by James Lawson, John Southern and Peter Ewart in 1810, plus numerous letters in the Archives of Soho, which will be analysed in this chapter.³⁸⁶

Various authors have put forward differing interpretations of the ‘Industrial Revolution’, some seeing the eighteenth century as a period of gradual change and others seeing rapid growth.³⁸⁷ There were innovations in many areas, improving trade, banking, transport and the exploitation of mineral resources. Boulton was involved in the accumulation of new skills and was connected to many of the individuals making changes. He improved metal manufacturing, providing luxury goods for the home market, and then for foreign markets, and then went on to revolutionise techniques for producing coin. His Soho Manufactory is well-known for the subdivision of work, where many advances in mass production were made, using superior tools and materials rather than just relying on powered machinery. As Berg has stated: ‘*The importance of a technology of hand tools and small scale machinery and the rapid proliferation of new hand techniques and skills*

³⁸⁵ MS 3782-13-37 ‘Memorandum concerning Mr Boulton commencing with my first acquaintance with him’ by James Watt (Glasgow) 17 Sep 1809 quoted in: H.W. Dickinson (1937) *Matthew Boulton* Cambridge University Press, Cambridge p 203-208; MS 3782-13-37 ‘Memorandum for the Memoir of M Boulton’. Undated but accompanies a covering letter from James Keir to MRB 3 Dec. 1809; quoted in E. Robinson *Eighteenth-Century Commerce and Fashion: Matthew Boulton’s Marketing Techniques* Economic History Review, Volume XVI No. 1(1963) pp 39-60.

³⁸⁶ References to these will be given at the appropriate point.

³⁸⁷ For example: M. Berg (1994) *The Age of Manufacturers 1700-1820* Routledge, London; T.S. Ashton (1948) *The Industrial Revolution 1760- 1830*; W.B. Court (1938) *The Rise of Midland Industries 1600-1838* Oxford University Press, Oxford; P. Hudson (1992) *The Industrial Revolution* Arnold, London.

were just as notable as the more commonly recognised new technology of steam-powered processes'.³⁸⁸ Research for this thesis has suggested that this was so at the Soho Mint, where improvements in die-making were as important as the use of the steam-powered coining presses.

As previously mentioned, it was always Boulton's intention to use machinery to make articles cheaply and with greater precision at the Soho Manufactory, and later at the Soho Mint.³⁸⁹ Boulton may have learnt from his contacts in copper manufacturing, where there were divisions of labour in the process of casting, rolling, wire drawing and stamping, as discussed in chapter two.³⁹⁰ Roll used the Soho Foundry, opened in 1795, as an early example of mass production but has also said that '*The importance of the new coining process used at Soho is great and deserving of a detailed research*'.³⁹¹ This chapter seeks to give more details of how Soho Mint worked.

New methods always interested Boulton both from a functional and intellectual point of view. A research unit at Soho carried out experiments into various aspects of metal production. As recorded in his notebook, he considered methods for rolling platina, gilt and ormolu, and listed improvements including '*our great 2 feet rolls w^{ch} may be dress^d truer than anybody's & consequently our silver will require less work*'. He was using engines to operate battering hammers for silver-smiths, and a tilting hammer for forging

³⁸⁸ Berg suggests other authors such as Crafts and Wrigley have ignored the effect of smaller firms and metal working industries. M. Berg (1994) *The Age of Manufacturers 1700-1820* Routledge, London p 8-25; p 59; p 169.

³⁸⁹ K. Quickenden (1980) *Boulton & Fothergill Silver* Art History Volume 3 No 3 p 278.

³⁹⁰ As early as 1700 Dockwra's Copper Company employed the following categories in the pin making business: brass maker, wire drawer, polisher, pointer, headmaker, header, whitener, flicker and tyer up, and was making 24,000 pins per day. H. Hamilton (1967) *The English Brass and Copper Industries to 1800* p 103.

³⁹¹ E. Roll (1930; 1968) *An Early Experiment in Industrial Organisation: Being a History of the Firm of Boulton and Watt, 1775-1805* Nelson, London p 132.

button dies by 1773. He wanted to invest in a ‘*mill to work 50 lathes for scratching, burnishing [and] shaveing and 2 shakeing boxes for polished stones & steel work*’ and also considered how the processes of wire drawing, pressing, stamping, polishing, piercing and lapping could be improved in the manufacture of silverwares. He had an appetite for fresh ideas, personally carrying out investigations in gilding, and testing various recipes for ‘*Bradbury’s yellow couler, Riddings yellow couler*’ which were used to impart a more impressive finish to cheaper metals.³⁹²

Previous authors have focused on the use of the steam-powered mint to strike coins at Soho Mint, though Selgin has suggested that a break-through in productivity was not necessarily achieved through the use of a steam-powered coining press.³⁹³ He credits the hundreds of separate issuers of high quality tokens as responsible for ending the shortage of small change, and describes how the Anglesey tokens were made on hand presses by the Parys Mint in Birmingham. Admittedly, as Clay has estimated, over 600 tons or 46 million tokens were produced in Birmingham in a single decade, but some of the reputed 250 tons of Anglesey tokens were in fact made at Soho Mint.³⁹⁴ They were heavy substantial pieces, with an issue of around 9 million pennies and 3.5 million halfpennies, made over four years between 1787 and 1791. However, this rate of production pales in comparison with the numbers made at the Soho Mint for Bombay in 1791 when 100 tons of copper was used to produce over 17 million coins in around ten months. By 1804 more than 12 million more were made in four months, a huge improvement in the rate of

³⁹² MS 3782-12-108 Item 5 Boulton’s 1768-1775 Notebook.

³⁹³ G. Selgin (2008) *Good Money*.

³⁹⁴ R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* p 41.

striking, which was made possible by steam-powered coining techniques. In 1802, Boulton told James Watt that:

*I can strike regularly 53 of my ♀ [Copper] two penny (sic) pieces or 56 English Crown pieces per Minute & that I can also regularly strike India Copper pieces of half the diam^r at the rate of 106 to 112 per Minute or from 6360 to 6720 per hour with 1 press in Collars.*³⁹⁵

This was a very good rate for the time.³⁹⁶ By 1809 Soho Mint had struck over 600 million coins, which showed that the technology introduced by Boulton was certainly very effective.

Soho Mint was the first in the world to be powered by steam.³⁹⁷ Boulton had played an important part in making a practical reality of the steam-engine in 1775-6. In addition, both he and William Murdock had contributed to ideas about sun and planet gears used to achieve circular motion. This innovation enabled power to be applied to machines such as coining presses.³⁹⁸ But it was not merely the use of the steam-powered press to strike the pieces that improved coining techniques. That was just one of a series of operations: in 1788, Boulton wrote a list of the processes required to make the blanks: *‘Rough rolling, fine rolling, 1st anneal, pickle or boil, scour with sand, rolle to size; Anneal, scour,*

³⁹⁵ Boulton wrote: *‘I understand that it is the wish of ye French Govern^t to recoin the whole of their Gold Silver & ♀ [Copper] Moneyit would require to be Coin^d into a Thousand Million of pieces which is = to 30 piece to every man Woman & Child in the Republick. They have 13 Mints but at the rate they work the renovation of the Coin will not be completed in a great many Years & yet if they had such a Mint & such other necessary apparatus as I could direct the Erection of, I think the whole 1000 Million may be coin^d in Three Years from the time of setting to work wth. a moderate number of presses.’* MS 3219-4 Item 124 MB (Soho) to James Watt [? Frankfurt] 10 Oct 1802.

³⁹⁶ Modern presses work at over 700 per minute. Information from visit to Royal Mint, Llantrisant, South Wales 23 Nov 2009. Many thanks to Dr Kevin Clancy for arranging this.

³⁹⁷ Boulton had been making experiments with steam-engines from at least 1757. He wrote to Benjamin Franklin: *‘My engagements since Christmas have not permit^d me to make any further progress with my fire engine.* ‘The letter goes on to discuss different steam valves and whether it was better to introduce the jet of cold water in at the bottom or the top of the receiver. MS 3782-12-1 Letter Book 1766-1768 Item 2 MB to Benjamin Franklin 22 Feb 1766.

³⁹⁸ Watt was in London getting the patent extended, and also in Scotland about family business, including marrying his second wife. J. Andrew in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* p 112.

*polish; Cut out, flatten in a screw machine mill, shake in sawdust & then shake in a riddle ye dust off; Coin.*³⁹⁹ Further processes, including milling the edges and several weighings, were needed to complete an order.⁴⁰⁰ In addition the coins needed to be packed and distributed, which is dealt with in chapter four. The preparation and supply of metal was also important as shown in chapter two. The whole procedure was strictly monitored and recorded.

Comparison with Europe

Why was Britain so much more advanced technically than the rest of Europe in the late eighteenth century? This question has been discussed by several authors including Mokyr, who concluded that, from around 1750, irreversible changes were affecting Britain due to a variety of circumstances, including free trade opportunities, increased technical knowledge and an enlightened society. He suggests that inventors and entrepreneurs were able to benefit from their improvements due to restraints on the elite which prevented over-taxation. Britain was also an island where peace and stability could be maintained more easily than on the continent. The country benefited from an open market economy where collaborative acts for the public good, such as setting up canals, were carried out by private groups.⁴⁰¹ In France, industry, including the thirteen French mints, was highly controlled by the government.⁴⁰²

³⁹⁹ MS 3782-12-108 Item 53 Mint Note Book 1788 p 10-11.

⁴⁰⁰ List of operations needed for coining in Boulton's handwriting. '*[Blanks were] Sorted weighed, Mill'd weighed, Weighed below by Campbell, Boiled in Leas [dregs from brewing], Washed at fierce Cook, Rough shaken, Tubed, Annealed, Reshook, Weighed, Planished, Weighed, Milling again, Mill'd weighed, By Campbell to shakers & Annealing tubes, Boiled in vitriol. Washed clean, Shook Dry, Wiped on a Large table, Heated in Muffle, Weighed to Mint, Struck, Weighed, Wrapp^d up, Packed in Casks.*' MS 3792-13-120 Folder 7 (undated).

⁴⁰¹ J. Mokyr (2009) *The Enlightened Economy: An Economic History of Britain 1700-1850* Yale University Press.

⁴⁰² Boulton stated that he could make coins more efficiently than the French mints when he hoped again to gain a contract from the French government. MS 3219-4 Item 124 MB (Soho) to James Watt [Frankfurt] 10 Oct 1802.

By contrast in England, industrialists were rewarded, and skilled workers were able to show initiative as well as entrepreneurs. Boulton positively encouraged creativity in his employees. An important aspect of his management style was that he was willing to accept ideas from others working at Soho Mint, and this will be discussed further in a forthcoming paper.⁴⁰³ Another interpretation is that he borrowed other people's ideas.⁴⁰⁴ When the mint equipment was being installed in 1789, the whole team was involved in sorting out the technical problems of the new steam-powered presses. Other aspects of coining were not neglected: Lawson reported new methods for cleaning and preparing blanks suggested by Peter Ewart.⁴⁰⁵ Improvements made by John Busch were described by John Southern.⁴⁰⁶ All this enterprise led to the excellence of the technology at Soho Mint and will be discussed further.

⁴⁰³ S. Tungate (forthcoming) *Workers at the Soho Mint* in: S. Baggott and K. Quickenden (eds.) *Matthew Boulton-Enterprising Industrialist of the Enlightenment* Ashgate, Farnham.

⁴⁰⁴ Personal communication, Dr M. Dick, University of Birmingham

⁴⁰⁵ 'The principal improvement is in Burnishing the Blanks; Peter Ewart has the merit of it. It is by putting them between two Brushes at a small angle so that the pieces, sand and water being put in at one end come out perfectly well brushed both sides and edge.' MS 3782-12-66 Item 2 James Lawson (Soho) to MB (London) 27 Jun 1789; Item 4 6 Jul 1789.

⁴⁰⁶ MS 3782-12-66 Item 59 John Southern (Birmingham) to MB (London) 6 Jul 1789.

Espionage

Enlightenment thinking encouraged the sharing of knowledge and some individuals such as Abraham Derby, John Rennie and John Smeaton did not patent their ideas. Others had their methods stolen, despite a patent; for example, Huntsman had his method of preparing steel spied upon and disseminated. Many visitors from Europe took back accounts of British industry.⁴⁰⁷ Encyclopaedias and technical books spread information.⁴⁰⁸ Mokyr talks of the social conventions of honourable behaviour in a ‘polite society with a gentlemanly code’ which expected that individuals would respect information given and not use it for their own benefit.⁴⁰⁹ However, this could be abused. Boulton was willing to show foreign visitors around the Soho Manufactory, and would give letters of introduction to foreigners, especially when requested so to do by the government.⁴¹⁰ But in 1787, one visitor to Soho assumed a false title which, with a letter of recommendation, would make it difficult for him to be refused entry. Watt showed him and another visitor round and ‘*then shew them one of the New Steam Engines at Work upon the Birmingham Navigation, & such other Particulars as were necessary to gratify the Curiosity of Gentlemen travelling for pleasure.*’ In fact the sightseer was spying.⁴¹¹ Such behaviour caused problems for Boulton in that he wanted to maintain his position as a gentleman of the Enlightenment, but also did not want to have his original ideas stolen.

⁴⁰⁷For example Angerstein’s Travel Diary gave a description of industry in England in 1753-1755. R.R. Angerstein (2001) *R.R. Angerstein’s Illustrated Travel Diary, 1753-1755 Industry in England and Wales from a Swedish Perspective* translated by Torsten and Peter Berg, Science Museum, London.

⁴⁰⁸Boulton owed a copy of John Smeaton’s book which is located now at the Avery Weighing Museum and is signed on the frontispiece in Boulton’s handwriting. John Smeaton (1797) *Reports of the late John Smeaton, F.R.S. made on various occasions, in the course of his employment as a civil engineer*, S. Brooke, London.

⁴⁰⁹Joel Mokyr (2009) *The Enlightened Economy: An Economic History of Britain 1700-1850* Yale University Press pp 368-375.

⁴¹⁰For example Boulton introduced ‘*Mr Deriabin a Gentleman of Letters from Siberia ... & is most particularly & justly recommended to me by the Ministers of the Emperor of Russia.*’ Boulton had been ‘*honour^d with a letter under the hand of his Imperial Majesty, & I have been requested By his Britanick Majestys Ministers to shew all proper attention to the desires of the Emperor.*’ AD1583/10/26 Boulton to Wilson 28 Mar 1798.

⁴¹¹Boulton complains of this visitor’s behaviour in spying on his works. MS 3782-12-56 Item 86 MB (Soho) to Sir Joseph Banks [London] 13 Feb 1787.

Loss of technology abroad could be a serious worry. In Britain, laws were passed banning the export of certain classes of workers in 1719, as the French government was actively encouraging the emigration of British workers to sponsored new industries.⁴¹² A British refugee from the Jacobite revolution of 1745, John Holker, was appointed Inspector General of Manufactures in France in 1755. He set up metal manufactories, and also tried to import the process of making sulphuric acid in 1769, but found it difficult to scale up production to a level comparable to that in Britain due to a lack of suitable managers. Holker's view was that there was no spirit of competitiveness in France, and a lack of will to replace manual labour.⁴¹³ Gabriel Jars (1732-1769) investigated iron production at Carron, and coal, lead, tin and copper mining in 1764 for the French government, as discussed in chapter two.⁴¹⁴ He proposed to install a large industrial centre at Le Creusot where eventually William Wilkinson, brother of John Wilkinson, became ironmaster in 1776. Further legislation, for example the 1785 Tools Act, was another attempt to prevent technological transfer.⁴¹⁵ However despite the involvement of British managers, technologies did not take off in the same way in Europe as in Britain.

Boulton was ambivalent about the export of technology. He had initially recommended Wilkinson to work in France but was unhappy by 1787, as Le Creusot works was making engines.⁴¹⁶ Count Wilhelm Friedrich von Reden, head of the Prussian mining administration, visited Boulton while touring Britain in 1790, intending to take

⁴¹² For example, John Holker set up a cloth works near Rouen in 1753. J. R. Harris (1998) *Industrial Espionage and Technology Transfer: Britain and France in the Eighteenth Century* Ashgate, Aldershot pp 460-461.

⁴¹³ J. R. Harris (1998) *Industrial Espionage and Technology Transfer* pp 67-68.

⁴¹⁴ Jean-François Belhoste (2007) *Steel in Britain in the age of Enlightenment* Colloquium held in Cardiff 7-8 December 2007.

⁴¹⁵ J. R. Harris (1998) *Industrial Espionage and Technology Transfer* p 276.

⁴¹⁶ William Wilkinson worked at Le Creusot works. 'S[i]r F. Bassatt [Francis Bassett] saw the works of some of Mr Wilkinson's Pupils at Paris in which they have all Wilkinson's new Machines for boreing &c & are making many Engines.' AD1583/2/33 Boulton to Wilson 27 Jan 1787.

information back to his own country, as did Baron Stein. Wilson at Chacewater was warned not to allow them access.⁴¹⁷ However Boulton was willing to sell his coining equipment, with its cutting-edge technologies, abroad when no orders were received from the British government.⁴¹⁸ But once the Soho Mint was fully operational, he was eager to maintain the secrets of his coining processes as problems with infringements of the steam-engine patent had already been experienced. Boulton and Watt had taken a series of legal actions against engineers in Cornwall as mentioned in chapter two.⁴¹⁹ With improvements in coining he needed to be able to make a profit himself, rather than others to benefit, especially the Royal Mint.

The diagram of the rolling press, seen later in Figure 3.6, illustrates the problems that Boulton and others had with industrial espionage.⁴²⁰ The drawing was by Jon-Matthias Ljunberg, a Swede working for the Danish government, who had made a series of observations of the technology in use by Wedgwood, Boulton, Crawshay and others, over a period of fourteen years. Josiah Wedgwood tried hard to prevent the export of this technical information.⁴²¹ In addition, Samuel Garbett had written to Mr Rose at the

⁴¹⁷ Boulton wrote: *'The King of Prussia hath sent over to this Country Baron Stein who is the director of the Kings Mines in Silecia. His errand is to learn to make the improved Fire Engines, that he may erect them upon the Copper Mines in Silecia. This s[ai]d Baron is a rascaly Character & quite suitable for ye dirty business he is come upon.'* AD1583/2/33 Boulton to Wilson 27 Jan 1787.

⁴¹⁸ Boulton asked his son to obtain a translation in *'elegant language'* as he intended to publish an account in the German papers as it is *'one of the most ingenious, most Mechanical & most Philosophical I ever invented; and the most perfect, and I doubt not but in time it will be adopted by all the princes on Earth who coin money as it will save great Expenses, much time & much risk.'* MS 3782-13-36 Item 36 MB (Soho) to MRB (Germany) 26 Oct 1789.

⁴¹⁹ *'I am persuaded one of them is a spy. I must beg you send a Note to Crane Engine desireing they will not admitt any french men & the same to the Whim Engine.'* AD1583/1/40 MB (Gloucester) to T. Wilson (Chacewater) 20 Nov 1784.

⁴²⁰ J.M. Ljunberg technical drawing from Mynt Arkivet, State Archives, Stockholm, Sweden. Thanks to Professor Peter Jones for this information.

⁴²¹ Among the places Ljunberg visited were the Potteries, Cornwall, Birmingham, Coalbrookdale, Derby, Manchester, Leeds and Matlock and elsewhere. Wedgwood wrote in August 1789 about *'five boxes of Tools, raw Materials, Drawing Descriptions etc which are stopt at the Customs House & which appear to have belonged to Mr Ljungberg, a Dane who had been spying'*. He continued: *'What I am now principally anxious for is, the detention of the Manuscript Volume of Drawing & remarks, which, it seems, has been 13 or 14 years in composing.'* Wedgwood was worried that Ljungberg would be allowed to proceed to Denmark, *'unless the Manufacturers immediately interfere & shew the danger of such a measure.'* He suggested that it would be useful to get the manuscript translated so that they would

Treasury and to Mr Stiles, the Commissioner of the Customs, but, despite a promise of help, the diagrams and notes did go to Sweden.⁴²² But in a letter to Watt in 1789 Boulton described how John Wilkinson had personally shown Ljunberg over his works.⁴²³

Industrial espionage continued to be a problem. In the 1790s, Boulton was worried that Royal Mint officials would try to steal the secrets of his new coining apparatus and that they were preparing for another copper coinage without him. James Morrison, the deputy Master of the Royal Mint, had accompanied Boulton to Soho in November 1799 and for ten days appeared to be poking his nose into everything.⁴²⁴ Boulton commented to Banks: *'though 3 different officers of the Tower Mint have examined mine as well as their Inspector of the Money presses, yet I do not believe they are quite Master of the subject.'*⁴²⁵ Foreign spies also tried to view the coining processes. In 1803, he wrote:

*I have been visited by 5 different Mechanical Spies in the course of the last Year for the express purpose of Stealing my Mint, & 'though I have shewn it to most of them, I have reason to believe they are not much the Wiser, & without it, they will never be able to recoin all the Money of France in Bonaparties Life time not even with their 13 Mints.'*⁴²⁶

know what damage could be caused. MS 3782-12-74 Item 178 Zaccheus Walker (Birmingham) to MB (Manchester) 26 Aug 1789. This included a transcript of a letter from Joshua Wedgwood (Etruria) to MB dated 24 Aug 1789.

⁴²² *'Mr Garbett says Mr Rose will do all he can in the matter of Ljungberg.'* MS 3782-12-74 Item 179 Zaccheus Walker (Birmingham) to MB (—) 28 Aug 1789.

⁴²³ Wilkinson was complaining about visitors stealing all his inventions but Boulton wrote: *'I remember we all 3 (Watt, Boulton and Yungburg [Ljunberg]) went together & Mr W showed the works himself.'* MS 3147-3-13 Item 14 MB (Soho) to James Watt (6 Green Lettice Lane, London) 6 Oct 1789.

⁴²⁴ Cheshire wrote to say: *'Mr. M. not contented with the accounts given him at the Mint Office and with having the books laid open to him at all times, is sifting, with odious and unmerited suspicion, every subordinate channel of information.'* MS 3782-12-59 Item 197 William Cheshire [Soho] to MB [Soho] Nov 1799.

⁴²⁵ MS 3782-12-56 Item 124 MB (Soho) to Sir Joseph Banks [London] 29 Nov 1799.

⁴²⁶ MS 3782-12-81 Item 131 MB (Soho) to Ambrose Weston [London] 8 Sep 1803.

Boulton's worries proved true: as after 1807, very few contracts for copper coin were received at Soho and the new regal coinage of 1821 was made at the Royal Mint on equipment he had designed.⁴²⁷

Security was not only important to prevent industrial espionage, but also to prevent theft of the valuable goods and materials used at Soho. Orders in the Soho Mint records show payments for items such as bars for cellar windows, bolts for doors, and plates for window shutters, bought from William Whitmore in 1789.⁴²⁸ There were also monthly expenses for guard dogs.⁴²⁹ Thomas Jordan was paid for making an alarm machine in 1797.⁴³⁰ Boulton was concerned that trusted workers should be used in specific areas to prevent theft and some workers were dismissed for pilfering.⁴³¹ Walker wrote in 1788, worried about 20 tons of copper coming from Mr Vivian in Cornwall.⁴³² He also reported accounts of an attempted robbery in 1792.⁴³³

⁴²⁷ Soho was supplying parts to the Royal Mint as late as 1844. There are many items (MS 3782-3-116 to MS 3782-3-124) in the Archive of Soho, concerning the setting up of the Royal Mint from 1805-1822. These have not been examined due to lack of time.

⁴²⁸ A bill for items bought from William Whitmore in 1789 included scales and weights, and as well as security items. MS 3782-13-96 Copper trade Volume 1 Item 1.

⁴²⁹ Between April 1789 and Sept 1792 '*the expenses of patrols and yard dogs this month 3s 3d*'; 8s 4d and 7s 2d etc. These expenses continue for the whole period. Phillips was paid 10s 6d '*for a new Dog*' and Hanley £2 11s 6d for locks. MS 3782-13-96 Copper trade Volume 1 Item 2.

⁴³⁰ '*An Allarm Machine to be fixed in a Building at Soho Mint paid for: materials 6s, Thos Jordan's work 8 ½ days at 5s and Own work in making patterns & afterwards at the Machine, & 2 Journeys to Soho to determine about construction, fixing etc 7 days Total £2 9s.*' MS 3782-6-195-22 Bills from Sept 1797 to Nov 1797.

⁴³¹ '*If he [Kellett] could not employ Tom Bromley or some of the Bedford boys in lieu of some of his men; there will be less risk in thieving.*' MS 3782-13-36 Item 84 MB (Truro) to MRB (Soho) 3 Sep 1792.

⁴³² Walker worried: '*as it requires a place of considerable safety to prevent it being stolen by a sett of thieves that make a considerable practise of breaking into Houses and Shops to Steal Metal and I am doubtfull it will be difficult to find a place that can be had in Birmingham that will be safe in this particular.*' MS 3782-12-74 Item 159 Zaccheus Walker (Birmingham) to MB (London) 24 Jan 1788.

⁴³³ MS 3782-12-75 Item 25 Zaccheus Walker (Birmingham) to MB (London) 20 Mar 1792.

The Technology of coining

In order to appreciate the improvements introduced at the Soho Mint, it is important to understand how coins were made previously. Coins are one of the oldest forms of mass production, and the skills needed to make them have been around since at least the sixth century BC.⁴³⁴ For thousands of years coins were made using relatively simple technology. Generally metal was cast into billets, and flattened into rough strips using hammers. Round discs were cut out with scissors, resulting in coins with irregular edges and surfaces, and struck on a coining anvil by engraved dies. This process was laborious. Hammered coins were issued from the Tower of London from 1279, but hammered silver coins were officially demonetised in 1697. Hammered gold coins remained in circulation until the recoinage of the 1770s.⁴³⁵

One technical improvement, first in use in Augsburg in 1571, was to use a rolling mill both to flatten the metal, and to coin. Designs were engraved onto rolls which were turned manually, and strips of metal were passed through. The images on the dies were oval to overcome distortions, but were very difficult to engrave. It was also difficult to cut out the coins from the imprinted strips.⁴³⁶ Later 'Taschenwerk' dies were fitted into rolls with square axles. Nicholas Briot partly mechanised production at the Paris Mint around 1617, and was brought over from France by Charles I to introduce rotary coining

⁴³⁴ Electrum coins were made for King Croesus in 561-549 BC. P. Grierson (1975) *Numismatics* Oxford University Press p 25.

⁴³⁵ At the same time the possession of a coining press except at the Royal Mint was made illegal. H.W. Dickinson (1937) *Matthew Boulton* p 13. D. Sellwood (1986) *The Trial of Nicholas Briot* British Numismatic Journal 1986 Volume 56 p 108-123; P.H.J. Goldman *Eloye Mestrelle and the Introduction of the Mill and screw press into English coining around 1561* British Numismatic Journal 1976 Volume 46 p 422.

⁴³⁶ The Holy Roman Emperor encouraged this method as it was cheaper than hammering techniques. D. Sellwood (1994) *Early Austrian and German machine minting* Metallurgy in Numismatics 4, Royal Numismatic Society Special Publication, London p 108-111.

to England with presses based on the 'Taschenwerk' type.⁴³⁷ But the introduction of mechanical methods was greatly resisted by the moneyers at the Royal Mint, who thought that the series of operations required were too complex and time consuming.⁴³⁸ Rotary coining presses were used until the eighteenth century in parts of Europe, but not in England, as they were superseded by the more efficient screw press.⁴³⁹ Another technical advance, first used in 1416 in juice extraction and printing, was the use of the hand operated screw press, also known as a fly-press. This was a machine for multiplying manual effort by use of a lever attached to a vertical threaded screw supported by an open framework.⁴⁴⁰ It was worked by a heavily loaded lever, such as a bar with metal spheres on the end, which was pivoted centrally to increase the force of the blow.⁴⁴¹ The upper die was attached to the end of the shaft by a swivel device and could be brought down onto the lower die with sufficient force to strike a coining blank. The lever had a counterweight system to return the die up.⁴⁴² The lower die was fixed to a bench and guides were added to move the screw and dies up and down accurately, and to prevent the

⁴³⁷ E. Besly (1994) *Rotary Coining in Britain* Metallurgy in Numismatics 4, Royal Numismatic Society Special Publication, London pp 118-129.

⁴³⁸ A series of ten operations were listed including annealing, cutting, weighing, adjusting, cleaning, striking etc. The first process was to smelt and cast strips in sand 1½ inch by 15 inches long. The first machine (instrument a ciseau) was for slicing the metal, another was a strip roller (laminoir) to reduce strips to the required thickness, and a punch (coupoir) was used to cut blanks. D. Sellwood (1986) *The Trial of Nicholas Briot* British Numismatic Journal 1986 Volume 56 p 108-123.

⁴³⁹ D.R. Cooper (1995) *The development of coinage dies from bronze to steel* Newcomen Society for the study of the history of engineering and technology Transactions Volume 67 1995-1996 p 99.

⁴⁴⁰ A screw press uses the principles of conservation of energy and conservation of momentum to amplify an applied force. A small force moving through a large distance, can generate a large force which is exerted over a small distance, as in a lever. Also a small force acting for a long time can build up momentum, which results in a large force when a mass is abruptly stopped, for example as with a hammer. GCSE Science taught by author.

⁴⁴¹ Benvenuto Cellini is credited with the first description of screw presses used for coining in around 1535. D.R. Cooper (1988) *The Art and Craft of Coin-making* p 51.

⁴⁴² The counterweight was lifted by the descending column of the screw and, when the motion was reversed, would drop to lift the die up.

upper die from twisting with the shaft.⁴⁴³ The force was provided by men pulling on the bar which was tiring, and could be uneven.⁴⁴⁴

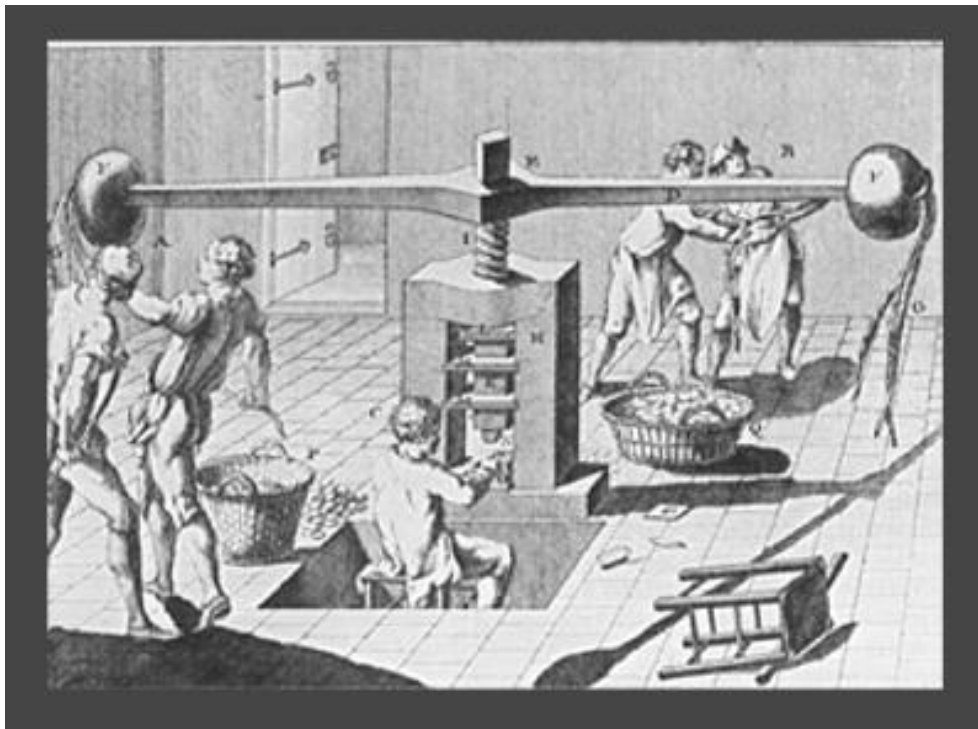


Figure 3.1: Screw press for coining⁴⁴⁵

The screw press was first used in England in around 1561 by Eloye Mestrelle but without success.⁴⁴⁶ However it was successfully introduced by Peter Blondeau to the Commonwealth Mint in 1651, and later improved in 1662 at the Royal Mint, to be used

⁴⁴³ D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 96.

⁴⁴⁴ J. F. Sanders (1970) *Matthew Boulton and the Copper Coinage of Great Britain* Seaby's Coin and Medal Bulletin 1970 Seaby London p 233.

⁴⁴⁵ Image from Denis Diderot's *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers* (Encyclopedia, or a Systematic Dictionary of the Sciences, Arts, and Crafts) published in France between 1751 and 1772, with later revised editions, and translations. <http://www.valuable-coin-stories.com/screw-press.html>.

⁴⁴⁶ Speed trials between Eloye Mestrelle's new method and the old hammered coining method were carried out at the Royal Mint, but the hammer-men won. He was expelled from England in 1572 and executed for counterfeiting in 1577. Paul H.J. Goldman (1974) *Eloye Mestrelle and the Introduction of the Mill and screw press into English coining c 1561* Numismatic Circular November 1974 Volume XXXII Number 11p 422; A Avery and P. Gaspar (1989) *Mestrell's Minting Methods* Numismatic Circular July/August 1989 Volume XCVII Number 6 pp 187-188.

along with a rolling mill, and cutting and stamping presses. By 1676 the screw press could strike a blow every two seconds.⁴⁴⁷ Blondeau also introduced milled edges by rolling the coin between thin strips of engraved steel.⁴⁴⁸ Boulton wrote an account of the ‘*arts of coining*’ mentioning Briot and Blondeau in a letter to Samuel Garbett in 1790.⁴⁴⁹ Later, the screw press was also used for the mechanical reproduction of punches and dies.⁴⁵⁰ By the time Isaac Newton was in charge of the Royal Mint, it had eight rolling mills, eleven coining presses and twenty-two blank cutting presses, all hand-operated.⁴⁵¹

No further improvements were made by the Royal Mint, where some of the machinery in use in the late eighteenth century had been installed in 1662.⁴⁵² They were not the only mint to be unwilling to introduce mechanical methods: screw presses were not used in the Austro-Hungarian Mint until 1750.⁴⁵³ New technology was often resisted due to fears of loss of employment and privileges. Inefficient and expensive local methods of coining were a motivating force in the EIC contracts that Boulton carried out for India.⁴⁵⁴ Hammered coins were still being made in 1792 in Calcutta, and as late as 1895, by

⁴⁴⁷ J. Craig (1953) *The Mint* p 164.

⁴⁴⁸ Blondeau first came to England in 1651, but left due to violent opposition from the moneyers. He was asked to return in 1661. He introduced the edge lettering: DECUS ET TUTAMEN which was copied by the French. D.R. Cooper (1988) *The Art and Craft of Coinmaking* pp 48-49.

⁴⁴⁹ MS 3782-12-62 Item 82 MB (Soho) to Samuel Garbett (—) 14 Jan 1790.

⁴⁵⁰ P. Gaspar (1994) *Coining and Die Making Techniques in the seventeenth century* Metallurgy in Numismatics 4, Royal Numismatic Society Special Publication, London pp 130-143; P.P. Gaspar and G.P. Dyer (1980) *The Striking of Proof and Pattern Coins in the 18th Century* Vol. 50 (1980) pp 117-127.

⁴⁵¹ Newton was Warden of the Mint from December 1699 until March 1727. J. Craig (1953) *The Mint* pp 198-222.

⁴⁵² John Rennie (an engineer, and one of Boulton’s associates) reported that: ‘*The Machinery at present in use at the Mint was introduced by Royal Warrant in the Reign of King Charles the Second in the Year 1662 as the most perfect improvement upon the Ancient mode of Coining by the Hammer, at which time their new Machines and no others were ordered to be used for the purpose of coining alone, and conformably with that Order, the same Machinery has continued in use at His Majesty’s Mint ever since.*’ MS 3782-13-112 Item 85 John Rennie’s report to the Committee of Coin 8 Jan 1805.

⁴⁵³ D.R. Cooper (1995) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 99.

⁴⁵⁴ Other methods of coining were used in some areas. The sway press and the hammer press were used in the sixteenth century in the country now known as Germany. Until 1776 tilt hammers were necessary for the large Swedish plate money which could weigh as much as 20kg per piece. D.R. Cooper (1988) *The Art and Craft of Coin-making* p 25.

coiners of the Nizam of Hyderabad's Mint.⁴⁵⁵ Boulton's new coining machinery had the advantage of producing coins more cheaply and more uniformly. He was responsible for installing new equipment at the Royal Mint from 1805, and introduced new methods of coining to many areas of the world.⁴⁵⁶

Boulton and coinage

Matthew Boulton had thoughts about improving the coinage from early in his career. Dickinson claims that he wrote to Lord Dartmouth on 10th November 1772 to suggest that Legislature should consider the poor condition of coined and paper currency.⁴⁵⁷ As previously mentioned in chapter one, he was certainly considering coinage by 1773.⁴⁵⁸ A correspondent wrote in August of that year:

*When I saw you last winter in London you told me of a thought you had for preventing the filing of the Guineas or diminishing them by aqua regia [concentrated nitric and hydrochloric acid] which was by adding a steel rim round them & making the alloy of copper instead of silver. I beg you will let me know whether you ever mentioned it to Lord North or to the Master of the Mint.*⁴⁵⁹

Watt recorded a conversation with Boulton in 1774 regarding applying steam power to coining and also wrote: *'When the new coinage of gold took place in 17[73] Mr. B was*

⁴⁵⁵ A drawing, now in the Ashmolean Museum, shows coining at the Calcutta mint in 1792 where the assistant is holding the top die with tongs over the blank on an anvil die, ready to be struck by a hammer. D.R. Cooper (1995) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 96; p 101.

⁴⁵⁶ For a full history of the Royal Mint see J. Craig (1953) *The Mint*; C.E. Challis (ed.) (1992) *A New History of the Royal Mint*, and for Boulton's part in setting up the Royal Mint see R. Doty (1998) *The Soho Mint and the Industrialisation of Money*.

⁴⁵⁷ H. W. Dickinson (1936; reprinted 1999) *Matthew Boulton* TEE Publishing, Warwickshire p 135.

⁴⁵⁸ Freeman continued: *'as I think it a very good expedient & if you will send me the particulars of the expense etc. It shall be laid before him when I next go to London.'* MS 3782-12-23 Item 282 Sambrook Freeman (Fawley) to MB (Soho) 1 Aug 1773.

⁴⁵⁹ Freeman continued: *'as I think it a very good expedient & if you will send me the particulars of the expense etc. It shall be laid before him when I next go to London.'* MS 3782-12-23 Item 282 Sambrook Freeman (Fawley) to MB (Soho) 1 Aug 1773.

*employed to receive & exchange the old coins which served to revive his ideas on the subject of coinage, which he had considered as capable of great improvement.*⁴⁶⁰



Figure 3.2 Worn coin and forgery: George II and George III halfpennies⁴⁶¹

Boulton considered that the Royal Mint produced coins of inferior quality so that counterfeiting was a distinct possibility. He and his team had sufficient technical expertise to improve the coining process so that coins of the same denomination would have the same size and weight, with high-quality images.⁴⁶² These improvements would make coins much more difficult to counterfeit. He also thought that the prices charged by the Royal Mint were too high and calculated that it cost £42 per ton to coin ‘*copper of such thickness that 46 halfpence or 92 farthings make a pound avoirdupois*’, listing the amounts due to the various mint officials.⁴⁶³ Boulton researched the cost of making coin

⁴⁶⁰ J. Watt, *Memoir of Boulton* in: H.W. Dickinson (1937) *Matthew Boulton*.

⁴⁶¹ Personal collection of author.

⁴⁶² Boulton’s doubts proved correct. When John Rennie inspected the Royal Mint on 27th April 1798 he found the following problems in coin production: the castings were thin and lacked ductility, sand molds incorporated flinty particles hence damaged rolling mills, the mills themselves were feeble and uneven with fluctuations in revolutions therefore accuracy of coin blank thickness was impossible, the blank cutting press was worked by hand as was the coining presses, with variable force, therefore impressions on coins varied accordingly and finally he found bullion in discarded melting pots J. Craig (1953) *The Mint* pp 268-9

⁴⁶³ ‘*To coining the fillets (allowed £42 per ton or 4 ½ d per lb). The division of the £42 per Ton is made; To the Master £9 2s 4d; Moneyer £25 13s 4d; Engraver £2 6s 8d; Die forger £2 6s 8d; Deputy master £1; Assay master 5s; Deputy warden 16s; Weigher 5s; Delivering 5s.*’ MS 3782-12-108 Item 53 Mint Book 1788 p 5.

from a variety of sources.⁴⁶⁴ He noted the need to add the costs of the metal, which was selling at £82 per ton in 1788, and the costs of rolling copper, both hot and cold.⁴⁶⁵ By this time, Thomas Williams was striking Anglesey tokens and Boulton kept abreast of his prices, and also researched into how Williams' presses worked.⁴⁶⁶ He thought he could make a regal coinage much cheaper if he used a steam-powered press.

Methods for coining gold were also being considered. Boulton wrote:

*It should be coined in a collar so as to be perfectly round with cord or indented inscription, perfectly of the same diameter, perfectly concentric in ye work of it & consequently of the same thickness so that a slit in a steel gage will detect bad gold. There should not be more than 4/10 of a grain allowed for wear.The letters, arms etc. should be indented instead of relief and the head should not rise above, so that 20 guineas when put together should be close on ye edge and look like a solid gold cylinder.*⁴⁶⁷

These were important improvements which may not seem much to a modern audience, but have been described as vital by Doty who talks of '*the total newness and immensity of what Matthew Boulton accomplished.*' Prior to the Soho Mint, coins were not all perfectly round, they were struck with designs that could vary, and they were most

⁴⁶⁴ 'Mr Williams says they give 1s 6d per cwt for cutting out Anglesey pence & one man keeps the tools in order.' MS 3782-12-108 Item 53 Mint Book 1788 pp 10-11.

⁴⁶⁵ 'Expense of making Coin will be in the following ratios: Copper, rolling, scouring, shakeing (sic) as per weight; Cutting out, milling and dyes as per number and diameter; Pressing 3 men to one penny, two men to halfpenny, one man to a farthing; Dye forger, dye turner, dye presses & engraver dye hardener & polisher.' MS 3782-12-108 Item 53 Mint Book 1788 p 5.

⁴⁶⁶ 'W^{ms} pays for striking Druid pence £3 per ton and for striking Wilkinson halfpence £8 per ton over and above the expense of dies and graving.' p 54 'The flys of Williams presses are about 5 feet diameter the rims are about 6 inches broad and 3 ½ to 4 inch thick. Hancox says he can work them so as to strike ½ pence with ¼ of a turn.' MS 3782-12-108 Item 53 Mint Book 1788 p 89

⁴⁶⁷ MS 3782-12-108 Item 53 Mint Note Book 1788 p 84.

certainly very difficult to stack.⁴⁶⁸ Boulton introduced standardization for the first time in coinage. In the opinion of Mokyr: *'Standardization may be the most under-rated technological development of the industrial revolution which needed both technological and institutional breakthroughs.'*⁴⁶⁹ The precision of Boulton's coins has had far reaching effects, introducing standard methods of production in other areas of industry. For example, without his improvements we might not now have coin operated machines such as parking meters or vending machines which need uniform coins.

Boulton's Mint

Boulton's first experience of coining had been during the 1786 and 1787 contracts for the East India Company's Sumatra issues. Boulton had just *'built a new [rolling] mill and had then no customer for it.'* The price, he wrote later to Williams, was *'much against my judgment'* and he had lost considerably by coining the small, low value coins, which were mainly issued at 140 to the lb, instead of 16 to the lb as were Anglesey pennies.⁴⁷⁰ But he had learnt a lot from the experience and by September 1787, Boulton and Williams were working together towards a regal coinage contract as discussed in chapter two.

Hand operated coining presses had been used in London to make the Sumatra issues. Boulton intended from early on to make his mint steam-powered. The invention of the rotary engine in 1781 meant that its power could be used to move a modified screw press; in fact the 16-inch engine used to power the coining press was the third rotary engine

⁴⁶⁸ R. Doty (2009) *Who Was Matthew Boulton? And Why Should We Care?* Talk at Boulton Conference 4 July 2009

⁴⁶⁹ J. Mokyr (2009) *The Enlightened Economy: An Economic History of Britain 1700-1850* Yale University Press p 341.

⁴⁷⁰ Boulton said that the prices he had charged were lower than was economic as *'1. I considered you my rival & was unwilling to lose the job. 2. Had just built a new mill had then no customer for it.'* He had charged £9 per ton for cutting out and annealing the blanks; £10 for dies. MS 3782 -12-3 Item 64 p 70 MB to Thomas Williams 3 Jul 1788.

installed at Soho.⁴⁷¹ Boulton wrote to Jean-Pierre Droz in April 1787 to say: ‘*Je suis d’Intention de faire marcher les grandes presses par un Machine a feu.*’⁴⁷² Droz from the Paris Mint had been engaged in December 1786 to engrave dies for a new regal coinage issue but did not arrive at Soho until nearly two years later.⁴⁷³ Droz had promised a new and improved design for a screw press and a better method of multiplying dies. But in fact he returned to France in June 1790 taking Soho’s new technological ideas with him. Boulton complained that: ‘*He [Droz] is a quack and hath been only learning at Soho and not teaching; his only value is as engraver.*’⁴⁷⁴ In a letter to Banks in February 1791 he wrote:

*I foresee that Droz will carry back to France my coining mill and other improvements learnt here, and then the French authors will write as Mr Proney hath done in his book of Hydraulics and give the hour of the invention of the double steam engine to those who only thought of it 7 or 10 years after we had executed it.*⁴⁷⁵

He was to be proved correct, as in 1802 Droz claimed to have invented what Boulton considered his own techniques, as discussed in the catalogue.⁴⁷⁶ This was a subtle form of espionage, and one that Boulton was unable to prevent. Fortunately the mint was not in its completed form when Droz left, and subsequent engravers at the Soho Mint did not take other technological improvements with them when they left. Therefore Boulton’s

⁴⁷¹ G. Demidowicz in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* p 123.

⁴⁷² ‘*I have the intention of making the large presses work by a steam engine.*’ MS 3782-12-6 5 May 1783-25 Aug 1788 Item 67 23 April 1787

⁴⁷³ More details about Jean-Pierre Droz can be found in the catalogue pp 251-256.

⁴⁷⁴ Boulton wrote: ‘*Here I have been plagued by that dishonourable, ungrateful scoundrel Droz, who hath not finished one pair of Money dies since he came to England & he has got from me Eleven hundred £ in hard Money (Sterling) He is the vainest and most conceited Charlaton I ever knew.*’ MS 3782-13-36 Item 47 MB (London) to MRB (Amsterdam) 13 July 1790.

⁴⁷⁵ ‘*he [the Bishop of Autans] mentions the ingenuity of Mr Droz who I find hath sent him some halfpence struck from my dies in French bell metal.*’ MS 3782-21-6 MB to Sir Joseph Banks 4 Feb 1791.

⁴⁷⁶ Boulton produced a medal to counteract these claims as described on page 425.

supremacy in minting equipment was not challenged by others, as it was too difficult to replicate without knowing all the details involved.

In February 1788 it was thought that a contract had been obtained from the government to make regal coinage and Boulton started to set up the Soho Mint as described in chapter one. He wrote to his son in Paris: ‘*Pray go to Mr Droz & see & tell me exactly what state he is in with my Sous [halfpennies]*’.⁴⁷⁷ But by the time Droz arrived at Soho in October 1788 Boulton was having doubts, and sought advice from Williams writing: ‘*The copper coinage has been long been festering on my mind & I have often wished I had never taken up the subject.*’⁴⁷⁸ He still had no regal coinage contract and after mid 1790 the prospect of coining for the government disappeared until 1797 as discussed in more detail in the catalogue.

The first steam-powered mint in the world was built as a single storey building about 110 metres from the principal buildings of Soho Manufactory. A schematic diagram drawn by George Demidowicz shows its position, effectively in Boulton’s garden, behind buildings which included a menagerie, tea room, fossil room and laboratory, as shown in Figure 3.3.⁴⁷⁹

⁴⁷⁷ MS 378-13-36-19 MB (London) to MRB (Paris) 8 February 1788.

⁴⁷⁸ *Long looked for has come at last Mr Droz is arrived & I must now fulfil my engagement with him or abandon the plan altogether which I cannot do without the loss of a couple of thousand.* MS 3782 -12-3 Item 71 MB (Soho) to Thomas Williams 8 Oct 1788.

⁴⁷⁹ Soho House was in Handsworth, two miles from the centre of Birmingham. Handsworth became part of Birmingham in 1911. A. Briggs (1952) *History of Birmingham Volume II* Oxford University Press, London p 155. Soho House was modern for the age with eldorado metal windows, a warm air heating system and a steam heated bath as well as a Bramah water closet. It remained Boulton’s home until his death in 1809. R. McLean (1993) *Restoration of Matthew Boulton’s House* Numismatic Circular September 1993 Volume CI Number 7.

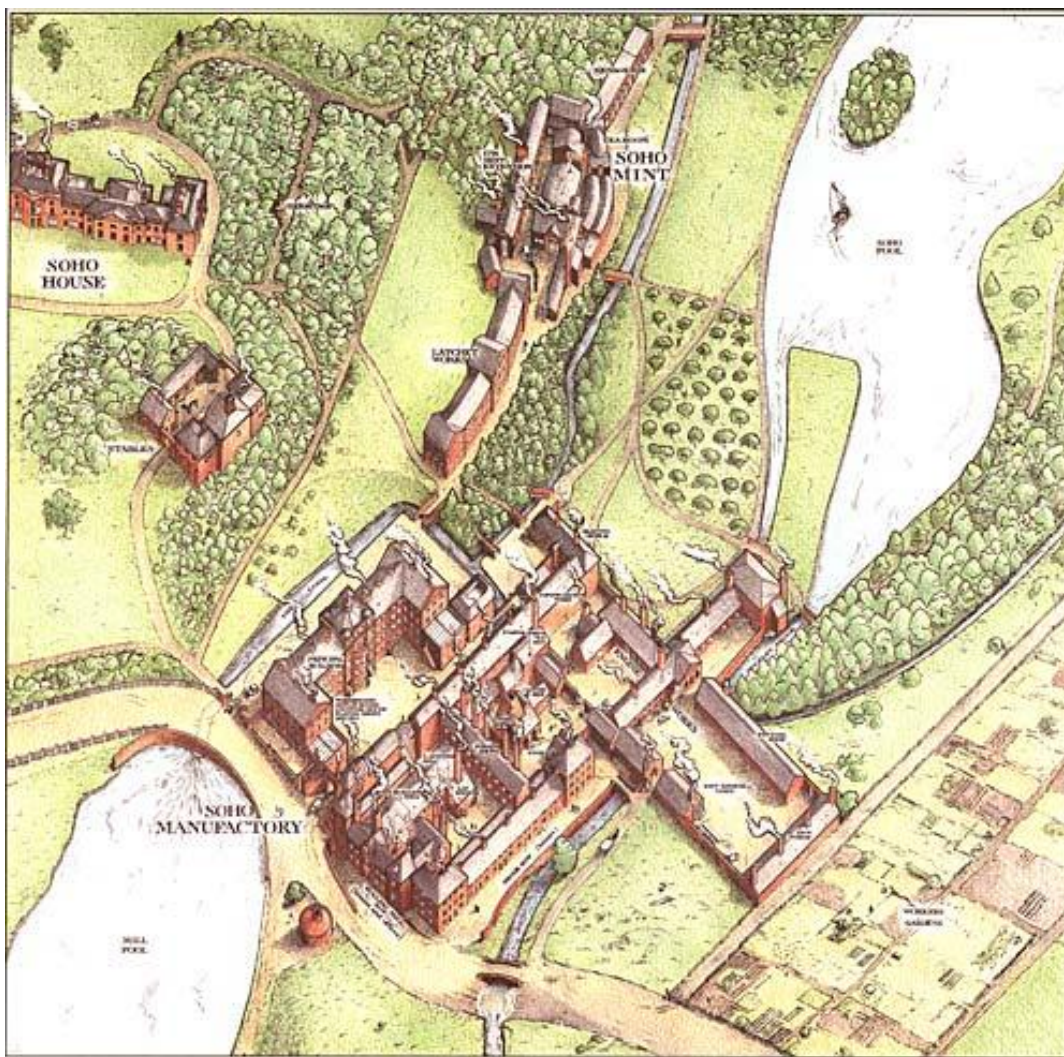


Figure 3.3: Axonometric projection of the Soho Mint and Manufactory⁴⁸⁰

This location was chosen for reasons of security against industrial espionage, but also to protect the valuable copper and coin made at Soho Mint. John Rennie was involved in providing drawings and estimates for the new building and it was under construction by January 1788.⁴⁸¹ The building work was supervised by Peter Ewart (1767-1842).⁴⁸² The

⁴⁸⁰ This diagram, based on archive evidence and contemporary views, was drawn by George Demidowicz; copyright Bremner & Orr Design Consultants Ltd. 2006. Thanks to George Demidowicz for permission to use this diagram in talks and in this thesis.

⁴⁸¹ The first mint building was 44 x 27 feet. G. Demidowicz in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 122-123.

engine house was constructed at the end of the yard and held an eight horse power double acting sun & planet engine in 1788.⁴⁸³ All the coining operations at Soho were concentrated on one site.⁴⁸⁴ This gave Boulton the opportunity to control all aspects of coining from the rolling of the metal, to the final packing of the products.

Letters detail progress of the early Soho Mint and show the contributions of various members of the team. By January 1788 John Roberts wrote that one of the large presses was ready and benches in the forge plus an additional press would soon be completed; *'the lathe is up & the hearth is built.'*⁴⁸⁵ By February, Zaccheus Walker Junior was drawing plans of the mint buildings, William Harrison was involved in coppering the roof, Anthony Robinson was making the screw for the large press and Bullock the smaller ones, to designs sent by Droz. The large screw should have been cast at Eagle Foundry in Birmingham, but they were unable to complete the job, which went to Wilkinson's works at Bradley. This meant further involvement by Wilkinson in the development of the mint, and he also rolled some of the copper supplied.⁴⁸⁶ In April 1788, Boulton visited Bradley to inspect their rolling processes, which took the copper cake from 2 inches to 1/5th inch thick. It still needed four more rollings at Soho.⁴⁸⁷

⁴⁸² Unfortunately in January there was a lack of bricks as the *'Navigation company have been buying up all they could lay their hands on.'* MS 3782-12-66 Item 106 John Roberts (Soho) to MB (London) 27 Jan 1788.

⁴⁸³ There are detailed plans of the Soho Mint showing a curved site with a coal vault at one side, plus designs for the proposed machinery, the Mint engine at ½ inch to the foot, and a diagram showing eight presses in two rows slightly off set with a complex mechanism to rotate a rod. Later plans dated 22nd July 1788 show the presses powered by an overhead wheel. There are also views of the exterior of the building. MS 3147-5-714a Soho Mint Plans 1788-1789.

⁴⁸⁴ Stebbing Shaw noted that: *'all the operations are concentrated on the same spot; such as rolling the cakes of copper hot into sheets; 2ndly fine rolling the same cold in steel polished rollers; 3rdly cutting out the blank pieces of coins....; 4thly the steam engine also performs other operations, such as shaking the coin in bags; and 5thly it works a number of coining machines with greater rapidity and exactness'* S. Shaw (1798) *History of Staffordshire* Birmingham.

⁴⁸⁵ *'I have this day sent for one of the large Presses & I hope the other will be ready by Saturday.The benches are nearly ready in the forging shop in the Hotel [de Monnaie; ie the Mint].'* MS 3782-12-66 Item 105 John Roberts (Soho) to MB (London) 22 Jan 1788.

⁴⁸⁶ MS 3782-12-66 Item 108 John Roberts (Soho) to MB (London) 5 Feb 1788.

⁴⁸⁷ *'Went to Bradley with Joseph Harrison and Wm Murdock to see a ton of copper cake rolled from 2 inches to 1 and 6/10th inches thick. Each cake weighs about 80 lb.[It is] Heated in a furnace full of coals & took about 10 minutes to*

Droz and Matthew Robinson Boulton in Paris had been kept up to date with progress at the Mint in a series of letters. In April 1788, Boulton wrote:

*Let Mr Droz come as soon as he will he will find one of the New large Presses completed agreeable to his last Model & I believe we shall be able to compleat one per week after the first is finished. ... I now wait for his opinion respecting the best mode of casing the female screw in Brass which I beg he will not delay to write to me if not already done.*⁴⁸⁸

Boulton was expecting technical help from Droz as detailed earlier, but by June 1790 Droz had returned to France, and had no further involvement in technological developments at Soho Mint.⁴⁸⁹

By June 1788, Roberts was able to report that:

the Boiler for little engine is set, the chimneys built. The cistern is nearly fixed in its place, the Nozzles are fitted, the working gear forged, and other work forging. The cylinder is ready. John Smith is making the pattern of the rotative wheels which will be ready tomorrow; The pattern for the frame of the Shears is gone to Bradley; Four cutting out presses are fitted, & fixed in the gallery; One fly is come home, the fifth press will soon be finished; Three large presses, according to model are come home; Four screws for presses are brought home. I expect

make them red hot, and then each cake took about 4 minutes to roll to 1/5th inch which required heating only once. so can roll half a ton per hour at Bradley Mill so could pay per hour, would be 4 guineas per ton. It may now be finished at Soho by rolling 4 times through and annealing once and scaling once. But when Williams rolls it he must sent it ready annealed and scaled and cut into breadths. MS 3782-12-108 Item 53 Mint Book 1788 p 87.

⁴⁸⁸ MS 3782-13-36 Item 24 MB (Soho) to MRB (Paris) 24 April 1788.

⁴⁸⁹ Droz had left Soho Mint by June 1790. MS 3782-12-66 Item 7 James Lawson (Soho) to MB (London) 8 Jun 1790

Anthony [Robinson] will finish two more in a few days; Each screw will cost about £22.⁴⁹⁰

By January 1789 it was James Lawson, originally employed as an engineer in Cornwall, who was reporting almost daily to Boulton in London. The progress made in January 1789 was listed:

Monday: Fixing the pin wheel to the proper height & Mr Southern marked out the place for the press Mill. Mr Harrison & J Webb Turning the large piece of Wood for fixing the rolls. John Smith fixed the cistern in its place. Tuesday: John Smith in the Mint fixing the large press Mill. Mr Harrison & Webb turning for the Rolling Mill. Wednesday: Mint J Smith finished fixing the press. Millwrights put on the arms for the great cogwheel. Mr Harrison & Webb about Turning for the Mill. Thursday: Mint Millwrights fixing the Cog Wheel. Harrison & Webb finished the piece of wood for fixing the rolls. Peploe on Tuesday in chipping the Bottom of Cutting Out press hurt his eye & has not been able to do much bifer [sic] this day but is now able to work.⁴⁹¹

This meant that Boulton could be kept up-to-date and was able to suggest plans for further development of the equipment.

By November 1789, Boulton had a functional mint and claimed that he had perfected:

at very great expense, such an apparatus of machinery as he is persuaded will enable him to make coin, not only superior in beauty and workmanship to that of any nation in Europe, but also so manufactured that the counterfeiting will be

⁴⁹⁰ MS 3782-12-66 Item 110 John Roberts (Soho) to MB (London) 18 Jun 1788.

⁴⁹¹ MS 3782-12-66 Item 1 James Lawson (Soho) to MB (London) 22 Jan 1789.

effectually prevented'. My metal is rolled, cut out and coined and the whole operation done by a new Fire Engine.

He told his son that he was expecting to *'receive orders for 1500 Ton of my new Copper half pence for which I have prepared superior Dies'* but was ready to furnish anyone with minting equipment or to coin one hundred million pieces per year *'whereas the officers of the English Mint are very much hurried to make 3½ million per Year.'*⁴⁹² This was a huge amount of coin to produce unless the new equipment worked well.

The new steam-powered press was tested out during 1789 and 1790 on a variety of token orders rather than a regal coinage contract, to the relief of most of the engineers at Soho who realized that a lot of work still needed to be done to make the Mint more effective. At this point, Soho Mint made tokens for Macclesfield and Company for their Cronebane mine, for John Wilkinson, and Anglesey tokens for Thomas Williams. Boulton was also starting a large order for Bombay Presidency. Further small orders for tokens were received in 1791 for Cornwall, Southampton and for Glasgow. Modifications were made to the mint in 1791 when it was rebuilt in anticipation of a large coinage order for the French government which did not materialise, and then again in 1798 after Boulton's first regal coinage contract. Details of these versions of Soho Mint will be discussed later in this chapter.

Boulton's mint was intended to make possible greater efficiency, economy and speed in coining and also to prevent counterfeiting of the regal coinage. The advantages of the new steam-powered mint were listed in many versions, including in his Mint Notebook,

⁴⁹² MS 3782-13-36 Item 37 MB (Soho) to MRB (Germany) 12 Nov 1789.

in letters to his son and in various papers sent to correspondents who might promote a regal or other coinage contract.⁴⁹³ The improvements included the fact that the force of the blow was more uniform compared to coining presses powered by men, and could be worked by a boy. This meant that the coins were perfectly round and of equal diameter which had not previously been the case, and an account of the number struck was kept automatically. This enabled Boulton to assess the efficiency of its operation.

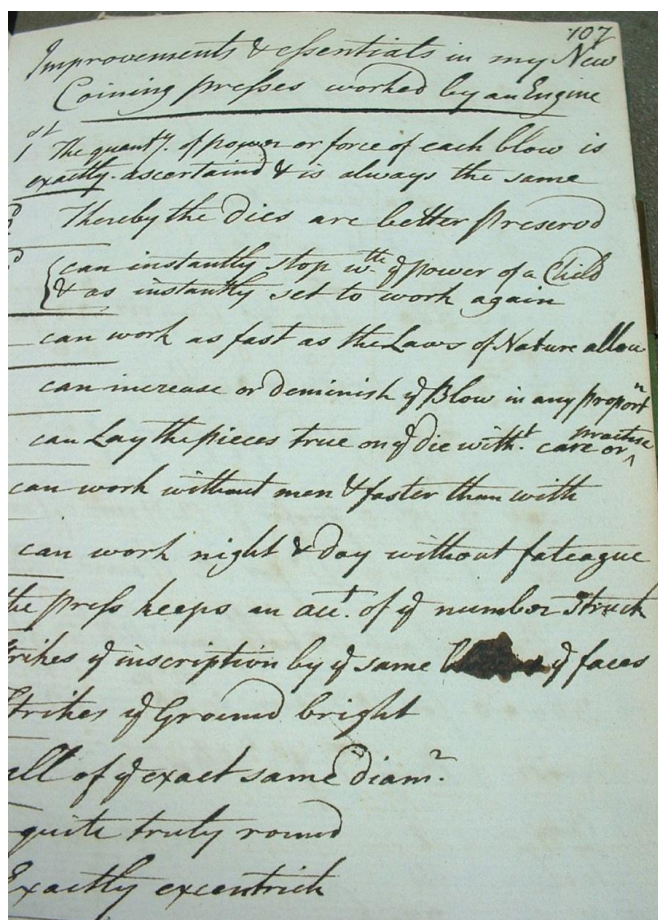


Figure 3.4: Boulton's notebook 1788. List of improvements at Soho Mint⁴⁹⁴

⁴⁹³ 'His Coins are perfectly round. They are all precisely equal in diameter. The work is exactly concentric to the edge. An inscription or ornament is put round the edge wither indented or in relief, or partly one, and partly the other, and this inscription is to be struck by the same blow that gives impression to the faces, whereas the common mode of making ornaments on the edge is by a separate well known operation called milling, and which is much more easily imitated. The Ground of his coin is smooth, and of a bright polish. Much greater quantities of money with all perfections may be coined in less time, with less persons, and with more exactness and ease employed than by any mode hitherto intended.' MS 3782-13-36 Item 37 MB (Soho) to MRB (Germany) 12 Nov 1789; Boulton's Mint Note Book 1788 MS 3782-12-108 Item 53 p107.

⁴⁹⁴ Boulton's Mint Notebook 1788 MS 3782-12-108 Item 53 p10.

However initial production at the Soho Mint was not always completely accurate, as can be seen in the mis-strike of the Cronebane halfpenny below. This sort of problem was soon remedied however with the introduction of a collar in the coining press.



Figure 3.5: 1789 Cronebane halfpenny mis-strike⁴⁹⁵

Processes used at the Soho Mint

Boulton had considered the whole process of coining before the Soho Mint was set up, not only improving the quality of the metal used but also thinking about the whole economic viability of the mint. Many processes were required apart from striking the metal blanks with the steam-powered coining press. In his 1788 notebooks, he detailed what needed to be done, including cutting blanks and engraving dies.⁴⁹⁶ He also listed all

⁴⁹⁵ 1789 Cronebane Halfpenny double strike D&H 21 BMAG: 1967N702

⁴⁹⁶ One such book is entitled '*Coining Money 1788*'. The notebook contains observations, calculations, and accounts relating to coinage. At the beginning of the notebook there is a table of costs for coining money. Pages of notes have

the things he had to pay for including a new building, tools, administration and carriage of materials.⁴⁹⁷ He estimated that he could coin two tons per day or 600 ton per year, but these figures were highly optimistic.⁴⁹⁸ The staff needed, were listed along with their prospective wages:

*5 presses will require 5 persons at 18s; Milling 4 persons, one each for tools, press and harden dyes, engrave, polish, assistant engraver, superintendent, repair presses, weigher, packer, fire and furnaces, annealing pans, boil, dye forger & steel book keeper total £45 12s.*⁴⁹⁹

An inventory of Soho Mint, taken in December 1790, specifically mentions the Great room with four presses for coining and one old press for experiments, the Fire [steam] Engine in the adjoining building, Busch and Harrison working in Busch's shop, a Smiths shop with room adjoining, and room above, the Multiplication Shop known as 'la Bastille', and the Cutting out shop on the rolling mill premises, Peploe's shop adjoining cutting out shop, the Mill Gallery, the Shaking shop, the Annealing shop with the separate little annealing shop, and a Melting shop.⁵⁰⁰ All these aspects of the Soho Mint were important in making a copper coinage and will now be discussed.

headings such as; 'Steel die forging, turning, hardening and tempering' and 'Presses and other mechanical inventions relative to coining.' MS 3782-12-108 Item 53 Mint Book 1788.

⁴⁹⁷ 'Finding at my own expense: 1. New Building 2. Tools, Machines & Repairs 3. New invention & the expence it hath cost me much money & also with Droz etc 4. Wast (sic) of copper 5. Loss by thieving 6. Carriage from the canal to the Manufacture 7. Unloading & Weighing 8. Carriage of the casks when packed to the canal or wagon 9. Clarks & assistants 10. Guarenteeing all things & running all risks. Papering in 2/6 parcels.' MS 3792-13-120 Folder 7

⁴⁹⁸ '1 press worked by a mill 48 blows per minute night and day and losing 1/3 of time will coin 1000lb or 9 cwt per day x 5. Rotative press cut out 2 per second = 115, 200 per day given minus one third = 800 gross; Milling by one person & a double milling machine 4 per second 240 per min. One press worked by a mill 48 per min 320 gross.' MS 3782-12-108 Item 53 Mint Book 1788 pp 7-9.

⁴⁹⁹ MS 3782-12-108 Item 53 Mint Note Book 1788 p 14.

⁵⁰⁰ Inventory of Property belonging to Coinage Account taken 31st Dec 1790 MS 3782-13-120 Folder 6 31 Dec 1790

Rolling metal

Rolling metal was an important part of the processes used at the Soho Manufactory and in making coins at the Soho Mint. Boulton had originally moved to the Soho site in the 1760s due to the availability of water power. A water wheel provided the motive force for a rolling mill which made silver plate for various decorative wares, and also to turn laps for grinding and polishing. This rolling mill could also be used to roll copper for coins and other metals such as gold and silver for medals.⁵⁰¹ Interestingly, it was the lack of water power for the rolling mill that had first interested Boulton in James Watt's improvements to steam-engines, and the first functional B&W steam-engine set up in 1774 was used to pump water back up to the mill pool.⁵⁰² The success of this engine led to Boulton's involvement in the Cornish copper industry as discussed in chapter two.

In May 1780, John Hodges, the manager of the Plated Works, had pointed out that a new rolling mill was needed.⁵⁰³ In April 1782 he again urged that: '*one great hindrance in the punctual or timely execution of orders in general is owing to being obliged to wait for the rolling of metal.*'⁵⁰⁴ Finally, a new water-powered mill, run by John Kellett, was erected in 1785 to roll metal and power laps.⁵⁰⁵ Later a new steam-engine was installed in the Manufactory, when the Soho Mint was built in 1788, to power the laps and cutting out

⁵⁰¹ Boulton had originally rolled metal at Sarehole Mill, but also rented another, Hafford Mill, and bought ready rolled metal from other suppliers. K. Quickenden (2009) 'Boulton and Fothergill's Silversmiths' in: *Boulton Silver and Sheffield Plate* Silver Society, London p 342.

⁵⁰² In 1778, after a fire, a new larger engine, known as 'Old Bess, was installed and pumped water until the late 1840s. G. Demidowicz in M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 120-121

⁵⁰³ 'it wou'd be a great convenience.... was there a Roling Mill at hand. The hindrances and losses this branch has suffered lately for want of one plainly demonstrate the usefulness and peculiar advantages that wou'd be derived from it.' MS 3792-12-63 Item 15 John Hodges (Soho) to MB (London) May 1780.

⁵⁰⁴ MS 3792-12-63 Item 28 John Hodges (Soho) to MB (Soho) 6 Apr 1782.

⁵⁰⁵ A broad two-storey building was rebuilt with the assistance of John Rennie at the start of his career. The mill was turned round ninety degrees and the rolls were connected to large metal cogs, which were powered by a 20 foot water wheel. G. Demidowicz in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 121-123.

presses, leaving the water wheel free to roll metal.⁵⁰⁶ Boulton calculated that rolling capacity could easily be increased to 900 tons per year.⁵⁰⁷ This would enable him to complete a regal coinage contract and use up excess copper supplies from Cornwall for a regal coinage as discussed in chapter two. Ironically, it had been lack of work for the mill built in 1785, which had led Boulton to seek the East India Company coinage contract of 1786, as discussed in the catalogue, and hence part of the reason for him becoming involved in coining.⁵⁰⁸ Initially Boulton was also worried that Williams was competing with him for a regal coinage as discussed in chapter two, particularly when Thomas Williams set up the Parys Mint in Birmingham, with four cutting-out presses and one coining press.⁵⁰⁹ But by April 1788 Williams had stated: *'In short my uniform Place shall be only to supply the copper & get the coin done by you.'*⁵¹⁰ John Wilkinson was an important instigator of their cooperation and suggested that Boulton took over Williams' coining presses.⁵¹¹ This was eventually accomplished by July 1789 though the agreement had been made earlier.⁵¹²

⁵⁰⁶ This 18-inch rotary steam-engine was the first to use the centrifugal governor, and was at work until 1840. It is now in the Science Museum. It was also used to power a new machine with eight presses that cut out coining blanks. G. Demidowicz in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 122-123.

⁵⁰⁷ Boulton wrote *'It appears that Soho Mill can Rolle (sic) 6 ton of gilt Metal per week working 10 hours per day and that the present engine can raise enough water to work it. Dobbs has an 18 inch double engine which he says with a little water will roll 6 ton a week. If my present engine of 33 inch cylinder with 6 ½ ft stroke was made into a rotative engine I have no doubt but it wd roll 12 tons per week. Working 16 hours a day and in the other 8 hours would return all the water necessary for the water mill by which it is probable that both mills may rolle 18 tons per week.'* MS 3782-12-108 Item 53 Mint Book 1788 p 28.

⁵⁰⁸ Due to increased capacity the price of rolling copper dropped from £12 to £6 per ton and so new contracts were sought. MS 3782 -12-3 Item 64 MB to Thomas Williams 3 Jul 1788 p 70.

⁵⁰⁹ *'The report is that [Thomas] Williams is going to serve the town of Birmingham with Gilding Metal altogether and for that purpose he has engaged both Dobb's and Westwood's Mills to roll for him. Charles Wyatt is engaged in the late Mr. Welch's place [Anglesea Warehouse in Birmingham] at £200 per an. Westwood is going to make some addition to his Mill at Whitton on account of his engagement with Williams.'* MS 3782-12-72-3-66 John Scale (Soho) to MB (London) 18 Jun 1787.

⁵¹⁰ MS 3782 -12-73 Item 74 Thomas Williams (London) to Matthew Boulton (Soho) 5 Apr 1788.

⁵¹¹ *'Cannot you take of his Coining Press Stock & make some arrangements as to rolled Copper that will be convenient to both?'* MS 3782-12-73 Item 166 John Wilkinson (Chester) to MB (Soho) 2 Dec 1788.

⁵¹² Williams wrote: *you & I settled that you sh^d give up the rolling to me & that I sh[oul]d entirely extinguish the coining with my presses to you.* MS 3782 -12-73 Item 80 Thomas Williams (Bristol) to MB (Soho) 19 May 1789; MS 3782 -12-73 Item 85 Thomas Williams (Temple) to MB (Soho) 27 Jul 1789.

Other rolling mills in Birmingham were run as rival concerns by John and Obediah Westwood and by Charles Dobbs.⁵¹³ However in 1789, Boulton was subcontracted by the Westwoods to strike tokens for Roe and Company, which meant that the Cronebane tokens became the first made by a steam-powered mint in the world. The rolling mill at Soho was used to roll metal for other businesses when the mint was not busy.⁵¹⁴ But when increased rolling capacity was required for large coinage orders, such as in 1797, other local mills were used.⁵¹⁵ This meant that Boulton was able to be flexible in his working practices, using resources to the maximum potential.

Copper was ordered from suppliers in a variety of forms, as discussed in chapter two, and was sometimes hot-rolled elsewhere, such as at Bradley as mentioned earlier, and then fine-rolled at Soho. Specific arrangements were made with Thomas Williams in December 1787 for the proposed regal coinage contract. Williams also correctly predicted price rises in copper.⁵¹⁶ Later Williams agreed to supply copper to Boulton for the Bombay coinage issue but said:

I will not undertake the polished Rolling or the adjusting to exact weight, on any account. To finish all to that is for more troublesome than other work. ..At best you must be charged for manufacturing three tons when you use but two.

⁵¹³ Westwood had problems with his rolling mill. 'Mr Westwood's rolling mill pool dam hath given way at the bottom and hath carried the Earth away ten or twelve feet below the bottom of the Pool which is now quite dry.' MS 3782-12-74 Item 154 Zaccheus Walker (Birmingham) to MB (London) 31 Oct 1787.

⁵¹⁴ 'Consult with Kellet about getting more rolling from Birmingham.' MS 3782-13-36 Item 84 MB (Truro) to MRB (Soho) 3 Sep 1792.

⁵¹⁵ 'Been to Aston about the rolling mill and seen the person who now has the premises. Not been used for rolling since he came to it 2 years ago but he has no objection to letting it for that purpose for a good rent. You had given £50 pa for Alford Mill before Mr Dalloway bought it. But he wants £150. Would take £30-40 to put into repair two water wheels, one for grinding corn and one for rolling or grinding. Good water supply 8 months in the year.' MS 3782-12-42 Item 44 J. Kellett (Soho) to MB (London) 9 Mar 1797.

⁵¹⁶ Williams wrote: 'But would not undertake to deliver you more under 12d [per lb]. From my knowledge of the copper trade in Europe I will not hesitate to say, neither you nor I will, after this next year, ever see sheet copper under 12d; it is from the present appearances much more likely to be at 14 or 15d as we have seen in not many years back.' MS 3782-12-73 Item 72 Thomas Williams (Anglesey) to MB (Soho) 29 Dec 1787.

*Therefore going to charge at least 11¼d. At this rate I would furnish you with 100 to 150 Tons in the course of the next 8 or 9 months.*⁵¹⁷

Copper ordered for this coinage was wanted in particular sizes. Boulton claimed that the cold-rolling was done at a loss but it would normally cost ‘£11 13s 11d Per Ton of Sheet Copper for Hot & Cold rolling’, quite a considerable expense in a coining contract.⁵¹⁸

The rolling process ensured that metal was in a suitable form before coining blanks were cut. To make coins, the metal was usually rolled hot to a certain thickness and then cold-rolled to the exact thickness required, using steel rollers. Previous experience of making coin weights, sold at the Assay Office in Birmingham from 1773, had given Boulton’s workmen experience in accurate rolling and weighing metal.⁵¹⁹ In the mass production of coins, the methods were improved, with the introduction of a calliper to measure the thickness of the metal. Boulton wrote:

Copper, when hot, rolls very soft & easy, in comparison to what it doth when cold. It is sufficiently hot roll’d when it becomes equal to twice the thickness of the coin intended to be made.I shall rolle [sic] it twice in fine polished rollers, ... rolle it again twice in finer rolls, ... but previous to the last rolling, I guage [sic] it by my new invented calliper & in the last time passing the rolls bring it very exact to the proper thickness.

⁵¹⁷ MS 3782-12-77 Item 100 MB (Soho) to Thomas Williams (—) 24 Jan 1791.

⁵¹⁸ *The sizes wanted of Roll^d Copper for the East India Co are 5lb & 6lb to the Square foot, say 60 Ton[of] 6lb to the foot & 30 Ton [of] 5 [lb] to the foot. The price I undertook the Rolling at was 5 farthings Pr lb including both hot Rolling & fine Cold Rolling to an exact size say £11 13s 11d Per Ton of Sheet Copper for Hot & Cold rolling. Now Sr. I am willing to allow you that sum or even as far as 8 Guineas for the Hot Rolling & content my self with doing the Cold Rolling for nothing although it must be reduced to half the aforementioned^d thickness by me.’ MS 3782-12-77 Item 100 MB (Soho) to Thomas Williams (—) 24 Jan 1791*

⁵¹⁹ The raw material (usually brass) was rolled into sheets of uniform thickness, and flans of the correct size were cut from the sheet, and adjusted to the correct weight by filing. John Whitehurst, a friend of Boulton’s became Keeper of Weights at the Royal Mint on 15th November 1774. James Jackson, who became Birmingham’s Assay Master in 1773, and the Westwood brothers, also made coin weights. Until then Portuguese coins were used. N. Biggs (2004) *Provincial Coin Weights in the Eighteenth Century* British Numismatic Journal Volume 74 pp 102-120.

He emphasised that: *The cold rolling is not only absolutely necessary to obtain a fine surface but it is also necessary to bring it exactly to a proper thickness which cannot be done with sufficient accuracy by hot rolling.*⁵²⁰

This accurate rolling of metal was vital to the success of the Soho coining enterprise, as it enabled uniform coins to be made.

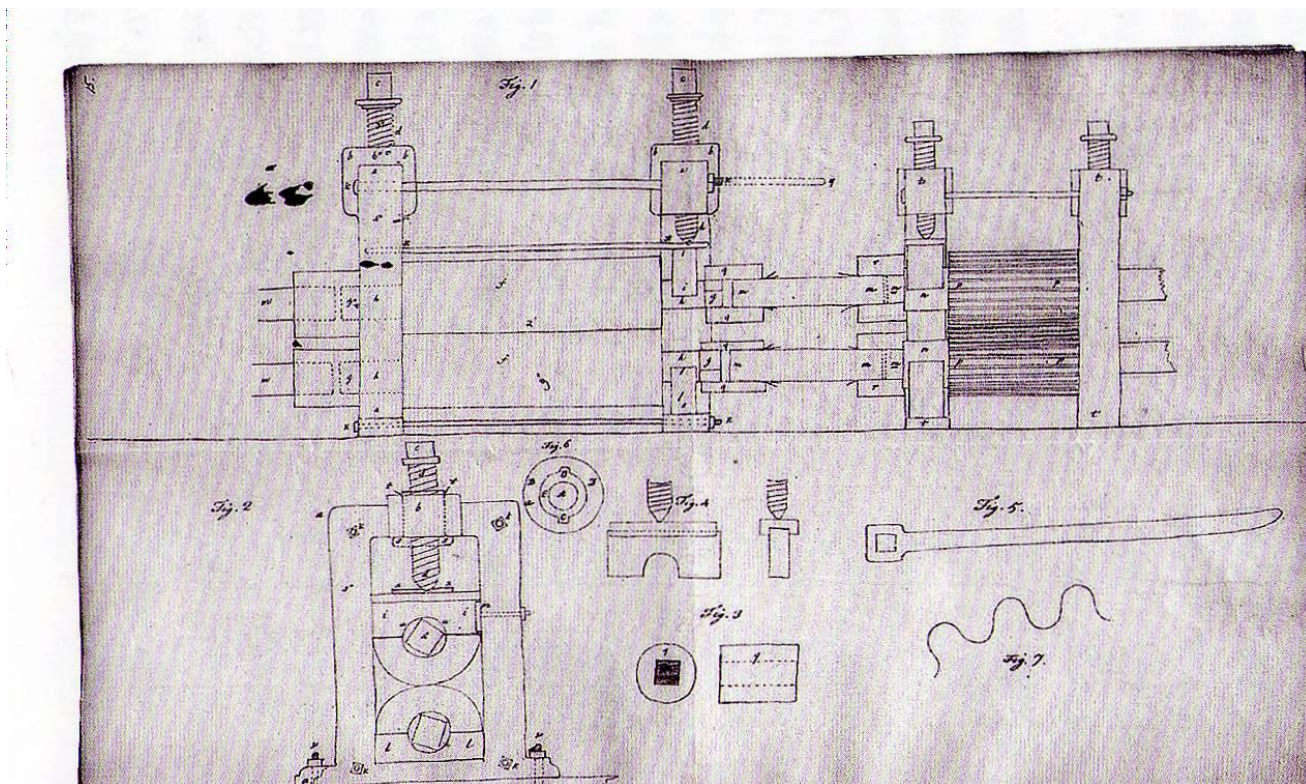


Figure 3.6: Rolling press drawn by Ljungberg in the 1780s⁵²¹

As rolling was carried out, the copper was also cleaned and annealed. It was a laborious and complicated process. In the presence of air and other substances, copper is slowly attacked and forms various compounds, so correct treatment was important to maintain its lustre. The copper ‘cakes’ were ‘pickled’ or ‘scoured’ in urine or aqua regia

⁵²⁰ MS 3782-13-120 Mint Inventions and Improvements Volume 1 Folder 7.

⁵²¹ J.M. Ljunberg technical drawing from Mynt Arkivet, State Archives, Stockholm, Sweden. Thanks to Professor Peter Jones for this information.

(concentrated hydrochloric and nitric acid) to remove scale (copper oxide). A scraper fixed to the rolls also helped. Boulton described the whole process in his 1788 Mint Notebook:

*The strips cast by Ryley are about 7lb each and are before rolling about ¾ inch thick. Rolled 1st time from 17 inches to 24 inches long, and 2nd time to 30 inches long, then annealed, ... then rolled third time to 39 inches, annealed 2nd time, rolled 4th time to 50 inches, 4th time to 58 inches. Annealed 3rd time, rolled 6th time to 72 inches and 7th time to 82 inches, then annealed 4th time, scoured.*⁵²²

He also noted that the workers should be careful when handling the metal. Boulton wrote: ‘Take care in the finish rolling not to handle the surface with dirty greasy fingers as it rolls in that dirt & tarnishes the metal.’⁵²³ Gloves were ordered for the workers by the dozen from Robert Blood.⁵²⁴ Boulton also recorded:

*I think if the metal was well brushed on both sides between 2 rotative brushes and sand and then rolled in fine rolls and clean water, then brush or polish it dry with whiting, and then cut out without touching, and to fall into tubes and then anneal of a slow red heat and then taken to the mint and as wanted, pickled in weak pickle and shook out and coined directly.*⁵²⁵

⁵²² When copper was rolled the following procedures were carried out: ‘Dip the cakes in urin (sic) & heat them hot so as to Scale them as they come through the 1st rolls & throw off scale in the rolling as much as possible by scraping the roles as they turn by a fixed scraper. Do it the 2nd and 3rd roll. Being now cold dip in urin, anneal very hot in reveratory (sic) so as to Scale then pickle it. Then brush it clean and scrape and pick out all black then rolle it. Anneal in reveratory not very hot, quench, pickle, brush with ruff and & then perhaps with pounded pumice & then pass the rolls twice to finish it. Dried by some means, brushed off with lime. Coiled up & wrap^d in paper and if to lye by, put it into close dry barrels or boxes.’ MS 3782-12-108 Item 53 Boulton’s Mint Note Book 1788 p 16; pp 30-32

⁵²³ MS 3782-12-108 Item 53 Mint Book 1788 p 32.

⁵²⁴ For example a dozen pairs of gloves were ordered from Robert Blood on 24th December 1793 for the cutters out; 2½ dozen more on 22nd March 1794. MS 3782-3-13 Mint day Book 1791-1795; 6 dozen gloves were ordered on 18th February 1797 price £2 8s and more on 6th January 1798 and 20th June 1798. MS 3782-3-14 Mint day Book 1795-1798

⁵²⁵ MS 3782-12-108 Item 53 Mint Book 1788 p 100.

He described a similar process to clean the metal in 1791 and noted that it could '*be done with fewer hands than at present.*'⁵²⁶ Not only could the metal be kept in excellent condition, but the whole process was done more economically than elsewhere, for example at the Royal Mint.

Size of coins

One of the triumphs of Soho Mint was that it continued to maintain a very uniform standard of production for large coinage issues, which had not been possible using previous methods. Boulton planned to make coins and tokens with '*the intrinsic value of all money equal to its nominal value, deducting the expenses of coining.*'⁵²⁷ This, he believed, would take away the temptation of counterfeiting light-weight money. Once tokens were made from 1787 by industrialists such as Williams and Wilkinson, it became especially important to ensure that good quality pieces were made, so that the issuers would not have to redeem counterfeits for regal money. This was not an important consideration, however, for the Royal Mint.

Most token issues were made at 28-29mm in diameter for the halfpenny size and 33mm for the penny size. Coins were generally prepared at so many per pound avoirdupois (lb) or to a specified weight in grains.⁵²⁸ The Anglesey Druid halfpennies were much heavier than those produced at the Royal Mint, initially weighing half an ounce or 32 per pound

⁵²⁶ '*As soon as the Metal comes out of the Rolls (which it should do without being bent) it should be placed endways almost perpendicular for the water to run off & then wiped with dry hurds & when so dried it should be put into a tub of Dryd Whiteing or burnd & from thence brushd dry between two brushes [see diagram] all which may be done with fewer hands than at present.*' MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 Jun 1791.

⁵²⁷ MS 3782-13-36 Item 37 MB (Soho) to MRB (Langensalz, Germany) 12 Nov 1789.

⁵²⁸ 1 grain = 0.0648 grams; 1 gram = 15.43 grains; 1 ounce (av) = 28.35g; 16 ounces (oz) = 1 pound (lb). In general details will be given as numbers of pieces per pound (lb). A grain was originally the weight of a grain of barley except in the case of money where a grain of wheat was used. Three grains of barley weigh the same as four grains of wheat. This system had remained constant through many different systems of British weights. The pound avoirdupois was equal to 7000 grains. C.R. Chapman (1995) *How Heavy, How much and How Long?* Lochin, Dursley p 51

avoirdupois, and one ounce for the penny size. Boulton researched the sizes and weights of various coin issues including the Anglesey penny, weighing in at a heavy 437 grains, to the smallest 50 grain East India Company coin, and the size of shillings and sixpences both old and new.⁵²⁹ This enabled him to have an idea of the demand for different size coins and the economics of making them.

The image shows a handwritten notebook page titled "English & Coin". The page contains a list of coin types and their weights in grains. The entries are as follows:

pieces	grains
28 in 1 lb avoirdupois	250
32 in 2 ^o anglesey	218 $\frac{3}{4}$
34 in 2 ^o	
36 in 2 ^o Edinb ^g , Mack. Glasgow	194, 444
38	
40	
42 in 2 ^o Southampton	166 $\frac{2}{3}$
44	
46 in 2 ^o English Town	152, 17

Figure 3.7: Boulton's research into sizes of coins and tokens struck⁵³⁰

Most tokens were gradually made at a lighter weight and Boulton was often instructed by his customers as to the weight wanted.⁵³¹ By the time he struck his first commercial token, the 1789 Cronebane token, the price of copper had increased, which meant they

⁵²⁹ 35,840 Anglesey pennies were made per ton but 313,600 Sumatra one keping coins. MS 3782-12-108 Item 53 Mint Book 1788 p 12

⁵³⁰ The weight of the coins were given in grains, where 15 grains equaled approximately 1 gram, and also as number per pound (lb = 454g). MS 3782-12-108 Item 54 Mint Book 1789 p 44.

⁵³¹ Most halfpennies retained a 28-29mm diameter but were of lighter weight at around 11g; for example the Inverness halfpenny. The Wilkinson tokens were made at 42 per pound in 1792 and 1793, but the 1793 Leeds halfpenny still maintained the 36 per lb standard. In the samples seen some tokens are very uniform in weight and others are not. By 1802 the Enniscorthy halfpenny tokens were made at 55-60 per lb. and weighed 7.6-8.2g each, nearly half the weight of the 1787 Anglesey halfpennies. The only tokens which were not a standard 28-29mm were for different values such as the later Arnold tokens and Penyardren tokens worth 5s, 2s, 1s, 6d, 3d and the Charleville thirteen pence piece.

were made at 36 per lb.⁵³² The 1791 Anglesey Druid halfpenny tokens were similarly reduced in weight, as was the first batch of the 1791 Glasgow tokens, and later issues were made at 46 per lb. However, the 1791 Cornish tokens were made at the original 32 per lb and, as the inscription stated, contained half an ounce of Cornish copper. The Monneron issues for France were also substantial pieces, made at 15-16 per lb for the 5 sol tokens and 24-26 per lb for the 2 sol pieces (see Appendix 2 for details). These heavy tokens were technically difficult to make, and led the team to make improvements to the coining process.

Pattern regal coins were made as samples to distribute to prospective customers, not as a currency issues. The first pattern halfpennies made at Soho Mint in 1788 and 1790 were slightly larger than tokens, at 30-31mm diameter, as was the 1795 pattern halfpenny, and varied in weight between 11-17g. The 1797 regal issue from the Soho Mint were very substantial coins. The heaviest was the 1797 two pence piece at two ounces (56.7g) or 8 per lb. The 1797 currency pennies seen in this study varied in weight by less than 0.5g from the standard one ounce (28.35g). This is a high degree of consistency considering the time at which they were made and the accuracy of the weighing available then. At Soho Mint Boulton was reliably able to produce millions of standardized coins. This in turn meant there was less likelihood that they would be counterfeited successfully, and that his coins would be acceptable as a national currency.

⁵³² As seen from samples examined during research, the genuine Cronebane tokens are usually around 12.65g and it is easy to tell counterfeits as they generally weigh around 9-10g. Similarly counterfeit and evasive Anglesey tokens can be distinguished by their lighter weight and often smaller diameter.

For the next regal coinage in 1799, as copper prices had again risen, halfpennies and farthings were made at 36 and 72 per lb respectively, but most of the eleven halfpennies seen during research were slightly heavier than the required standard. Perhaps Boulton was deliberately ensuring that the coins were of full weight, so that he could not be accused by the Royal Mint of cheating the government. By the time the 1805-6 Irish coins were made, the weight standard had again decreased to 26, 52 and 104 per lb for pennies, halfpennies and farthings respectively.⁵³³ The 1806-7 British coins were slightly heavier at 24, 48 and 96 per lb. The samples seen during research were again very uniform in weight.⁵³⁴

⁵³³ A total of seventeen Irish currency coins were weighed by the author and averages calculated. 1805 Irish Penny (6 samples) 34mm 17.5g; 1805 Irish halfpenny (4 samples) 27mm, 8.6g; 1806 Irish farthing (7 samples) 20mm 4.3g.

⁵³⁴ A total of twenty four 1806 and thirteen 1807 currency coins were weighed by the author and compared. Details can be seen in Appendix 2.

Table 3.1 to show different sizes of East India Company coins (1786-1809)

	Weight for Diameter 30mm	Weight for Diameter 28mm	Weight for Diameter 25mm	Weight for Diameter 20mm	Weight for Diameter 11mm
1786 Sumatra three, two and one keping	not issued	150 grain	100 grain	50 grain	not issued
1787 Sumatra three, two and one keping	not issued	150 grain	100 grain	50 grain	not issued
1791 Bombay 2, 1½, 1, ½ pice	200 grain	150 grain	100 grain	50 grain	not issued
1792 Bengal pattern coins	not issued	not issued	not issued	20 grain **15mm	5 grain **10mm
1794 Bombay 2, 1½, 1 and ½ pice	200 grain	not issued	100 grain	50 grain	not issued
1794 Madras 1/48 and 1/96 rupee	206 grain **31mm	not issued	103 grain **24.5mm	not issued	not issued
1797 Madras 1/48 and 1/96 rupee	206 grain **31mm	not issued	103 grain **24.5mm	not issued	not issued
1798 Sumatra three, two and one keping	not issued	150 grain	100 grain	50 grain	not issued
1802 Ceylon 1/48, 1/96 and 1/192 rix dollar	166 grain 30mm	not issued	75 grain **23mm	35 grain **18mm	not issued
1803 Madras twenty, ten, five and one cash	200 grain **31mm	not issued	100 grain	50 grain **21mm	10 grain
1804 Sumatra four, two and one keping	200 grain	not issued	100 grain	50 grain	not issued
1804 Bombay two, one and half pice	200 grain	not issued	100 grain	50 grain	not issued
1808 Madras twenty and ten cash	144 grain **31mm	not issued	72 grain	not issued	not issued
1809 Bengal pattern one and half pice	not issued	130 grain **27mm	not issued	65 grain **21mm	not issued

For East India Company coins there was a system of measurement based on the number of grains expected per coin. Boulton's first coinage for Sumatra in 1786 was for coins of 150, 100 and 50 grains weight.⁵³⁵ With the addition of a 200 grain coin for the 1791

⁵³⁵ 9.75g, 6.50g and 3.25g for diameters of 28mm, 25mm and 20mm.

Bombay issue, these continued to be the standard size for most EIC coin issues made at Soho Mint.⁵³⁶ The exceptions were pattern coins for Bengal and coins for Madras, which were slightly heavier, and in 1803 an extra small coin, valued at one cash, which weighed only 0.65g.⁵³⁷



1804 Sumatra (4, 2 and 1 keping)



1804 Bombay (2, 1 and ½ pice)



1803 Madras (20, 10, 5 and 1 cash)



1802 Ceylon (1/48, 1/96 and 1/192 rupee)

Figure 3.8: Different sizes of East India Company coins

It was not important to maintain the uniformity of medals, as they were in general collector's items and valued for their design and artistic beauty, not as a medium of currency. They were much more varied in weight but most were of a standard 48mm diameter. An exception, at 56mm diameter, was a medal made to commemorate Gustav III of Sweden in 1793. A medal in 1809 for John of Portugal was of particularly high relief and had a diameter of 51mm. Smaller gold medals were made for the Manchester

⁵³⁶ The 200 grain coin weighed 13g and was 30mm diameter, similar to the Wilkinson halfpenny at 36 per lb. 'Pray tell Mr. Lawson to proceed as fast as possible in preparing cutting out tools, dies, and die holders for East India bits of 50 grains, of 100 grains, and 200 grains.' MS 3782-13-36-52 MB (London) to MRB (Soho) 13 Jan 1791.

⁵³⁷ Details can be seen in Appendix 2.

and Nottingham Volunteer Associations. If it had been struck, the Anton Schaeffer medal would have been the largest at 79mm in diameter, but only the die has been seen. A memorial medal for Matthew Boulton was made at 64mm.

Blank cutting

The processes to make blanks at Soho Mint were similar to those used in the modern Royal Mint, except for being powered by water or steam, rather than electricity.⁵³⁸ Once the dimensions of a coin, token or medal had been specified, the metal strips were rolled to the correct thickness and inspected, and blanks were cut out to a predetermined diameter on the cutting presses. If the proper size-to-weight ratio was not exactly correct, the coins made would either be too light and the order refused, or too heavy, when Boulton would be charged for the extra metal used, so it was important to get this process correct.⁵³⁹

Boulton had installed powered blank-cutting presses as one of his first improvements in coining techniques when the lap engine was installed in 1788.⁵⁴⁰ He was returning to a technique similar to that used to make medieval coins, where sharp-edged blanks or ‘flans’ had been cut from silver sheets rather than hammered flat. Because of the shearing action of the punches, the blanks had rough edges or burrs which were removed by abrasion in shaking bags, powered by the steam-engine at the Soho Mint. The blanks were then cleaned, sometimes with vitriol (sulphuric acid) or whiteing (lime) and dried

⁵³⁸ The blanking presses have steel bedplates with holes corresponding to banks of punches (or rams) which punch out blanks from a sheet of metal on each downward cycle, leaving scissell which can be re-used. The cut blanks are placed in a special vibratory finishing machine and tumbled against each other, with thousands of tiny ball bearings, suspended in a solution of soap and warm water, to smooth out any remaining rough spots. Then they are dried by forced hot air. Information from visit to Royal Mint 23 Nov 2009.

⁵³⁹ (anon)(1913) *Boulton's Copper Coinage* Numismatic Chronicle 1913 pp 379-80.

⁵⁴⁰ G. Demidowicz in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 122-123.

with sawdust.⁵⁴¹ Defective pieces were eliminated over a gauge and re-melted along with the scrap metal, the scissell, in the two reverberatory furnaces at Soho.⁵⁴² The scrupulously cleaned, dried and polished blanks were then ready to be struck on the mint's steam powered coining presses.

Usually blanks were of copper for currency issues, but could also be made from gold, silver, lead, tin, brass or white metal.⁵⁴³ Some gilt and bronzed blanks, prepared with a variety of special finishes before striking, were also used for medals and presentation proof coins and tokens.⁵⁴⁴ Boulton knew the capabilities of his workforce well, and used workers from other areas of the Manufactory, who had experience in gilding and bronzing. Thus, he was able to utilise skills already present at Soho in new areas of manufacture, but also to use workers to their full economic potential rather than allowing them to be unemployed.

Boulton wrote: *'Pray tell Mr Hodges & Mr Chamberlain [from the Plated Works at Soho] that I request they will spare John Middlehurst to Bronze four or 5 Ton of Medals for me.'* It was left to the specialist worker how the task was carried out, thus encouraging initiative, but Boulton provided the facilities: *'It would be well to have such a hearth as he might approve built up in the room over the Shakeing shop.'*⁵⁴⁵ Middlehurst was

⁵⁴¹ Reference is made for example on 29th Sep 1791 *'For Richard Skeldon for shaking bags £ 4 2s'*; and 30th June 1792 *'20 bags of sawdust from T Lucas £2 10'*. Boulton's friend, Samuel Garbett, provided both *'Silver and Vitriol £41 15 8d'* on 16th Feb 1792, MS 3782-12-108 Item 53 Mint Day Book.

⁵⁴² Boulton to Wilson regarding man required for melting scrap copper. AD1583/4/44 19 Jan 1791.

⁵⁴³ Quickenden discusses the variety of metals used at the Soho Manufactory in candlestick manufacture, button making and so on. These metals were also available to make pattern coins, tokens and medals. K. Quickenden (2009) *'Silver and its substitutes'* in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* p 156.

⁵⁴⁴ Proofs are coins struck in a special press with meticulously polished dies as examples of a new coinage. They are virtually flawless in appearance, retaining a satiny-smooth character and bright lustre.

⁵⁴⁵ Boulton suggested that *'if something like a stew hearth with a p' of hand bellows would not do as well or better than a small forge. I presume an Iron plate will not answer so well as a Coal fire, but please to consult John about the best*

asked to produce bronzed blanks for a large order of Monneron tokens in March 1792. He used copper blanks, baked in bronzing powder, freely available in London, to produce tones varying from yellow to dark chocolate.⁵⁴⁶ Boulton fully understood all the processes at the mint and was able to suggest that: *‘Medals may be given to Nelson to Gild as he may fill up his Gilders time Perhaps 2 or 3 Doz of Medals may be done at once by laying then on a Copper Riddle and give them a little motion to change the points in Contact.’*⁵⁴⁷ The gilding hearth was set up in a dedicated room with facilities to gild and bronze medals.⁵⁴⁸

As an employer, Boulton took care of his skilled employees, realising that it was important that they understood the purpose of the new technologies introduced, so that they could benefit from the improvements. He was fully aware of the dangers of mercury poisoning and wrote:

When the Gilders are Slovenly & do not wash their hands clean, particularly about the finger Nails, before they eat their Dinners, or if the Gilding Chimney doth not properly draw off the Mercurial Vapour, the party will very soon grown

means of Bronzing 40 gross per day for which he must have a proper set of hearths & some Careful persons to assist him whether Women or big boys. In order to try the hearths he may make trial at the Gilt Button Coulering hearth or he may try Mr Lawson’s hardening hearth underground or hearths for trial may be built with Bricks without Mortar.’ MS 3782-13-36 Item 64 MB (London) to MRB (Soho) 21 Mar 1792.

⁵⁴⁶ D. Vice (1997) Conder Token Newspaper Volume 1 No 3 15 Feb 1997

⁵⁴⁷ MS 3782-13-36 Item 64 MB (London) to MRB (Soho) 21 Mar 1792. Boulton was expecting to make a Lafayette medal and also one for Mirabeaux. MS 3782-13-36 Item 71 MB (London) to MRB (Soho) 9 April 1792.

⁵⁴⁸ Boulton wrote: *‘Pray get the Room Cleared out over ye Shakeing Shop. Get some dale boards smoothed & put up the whole length as a table; get a hive built by Glover with a Chymney so as not to set fire to the Wood work & under that hive let there be some stoves or hearths built like the hearth in the Gilt Button Coulering Shop which will do for Bronzing & for Coulering & perhaps Middlehurst would mix up the drugs for the Bronze Couler & set a Man or Womⁿ to Bronze them & then a Dozⁿ hands may be set to Brush them & to paint them & to fire them but it will require Room & a large table Those w^{ch} are Gilt should have the bad ones picked out & non Struck but what are well Gilt.’* MS 3782-13-36 Item 66 MB (London) to MRB (Soho) 25 Mar 1792.

*paralitick. To use the Gilders language they will very soon get the Shakes & I have seen Women equally as bad as the Men.*⁵⁴⁹

He personally designed a gilding hearth which would draw off mercury vapours.⁵⁵⁰ Not only did this prevent danger to the workers, but also the improved technology saved expensive mercury for reuse.

Edge marking, on the third side of the coin, medal or token, was initially used in the manufacturing process to prevent counterfeiting and to protect against clipping. Edges could be milled with vertical or diagonal stripes known as graining, or ornamental patterns. In addition, many of Boulton's earlier tokens have lettered edges, such as an inscription saying where the token could be redeemed. Medals usually have plain edges but some, such as Boydell's Shakespeare medal, were individually engraved for each recipient. A special dedication is found on the edge of the Trafalgar medal. Milling was often done in a separate operation before coining. In modern mints, if the blank is edge marked, the rim serves to work-harden the edge and shape the blank for a better feed at the press.⁵⁵¹ In the eighteenth century, the edge was embossed by rolling the blanks in a milling machine between parallel reciprocating dies.⁵⁵²

⁵⁴⁹ MS 3782-12-46 Item 109 MB (Soho) to Charles Hatchett (Hammersmith) 26 Mar 1801.

⁵⁵⁰ S. Tugate (2009) 'Matthew Boulton's Mints: Copper to Customer' in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires* p 84.

⁵⁵¹ Information from visit to Royal Mint. 23 Nov 2009.

⁵⁵² A milling machine had two steel bars, one stationary and the other moved by a rack and pinion. The blank was squeezed and force to roll in the grooves between the parallel bars. As the blank rotates its edge is thickened and impressed with a design. P.P. Gaspar (1976) *Simon's Cromwell Crown: Dies in the Royal Mint Museum and Blondeau's Method for the Production of Lettered Edges* British Numismatics Journal Volume 46 1976 p 55-63



Figure 3.9: Edge marking machine from Paris Mint Museum⁵⁵³

Such a machine was used during Boulton's first coinage for Sumatra in 1786,⁵⁵⁴ and Peplow had made a new version by May 1791,⁵⁵⁵ which was modified in 1792 to be fed with blanks from both sides, as the cutting-out presses were working so efficiently. This was a practical improvement which was made by engineers working directly on the job.

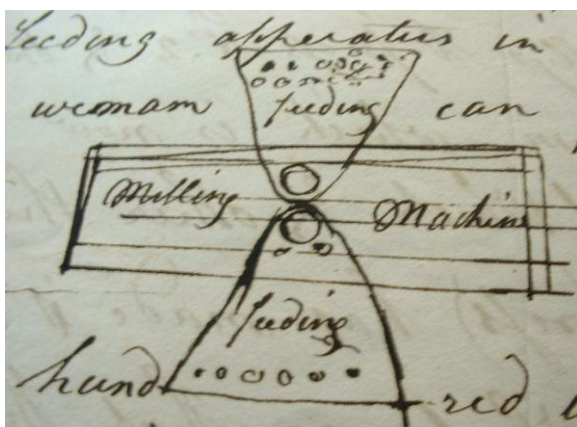


Figure 3.10: Diagram of suggested improvement made to milling machine.⁵⁵⁶

⁵⁵³ Image courtesy Professor Peter Jones, taken at Paris Mint Museum, Hôtel de la Monnaie, Paris, France.

⁵⁵⁴ 'I also saw the Milling Machine, and saw it work.' MS 3782-12-74 Item 121 Zaccheus Walker (Birmingham) to MB (Chacewater) 28 Sep 1786; B.M. Gould (1969) *Matthew Boulton's East India Mint in London 1786-88* Seaby's Coin and Medal Bulletin No 612, August 1969 pp 270-277.

⁵⁵⁵ MS 3782-12-66 Item 11 James Lawson (Soho) to MB (London) 27 May 1791.

⁵⁵⁶ 'The Cutting Out Presses are now in good order. The Milling Machine cannot keep up with them, so we are arranging to supply it by feeding at both sides.' MS 3782-12-66 Item 22 James Lawson (Soho) to MB (London) 21 Jan 1792.

Edge marking was described in September 1789 by Boulton:

*The old crown and half crown pieces had letters mill'd on their edges by passing the pieces between two parallel rules (called a milling machine) and by this machine, either letters indented or in relief may be put on the edges before the pieces are struck but they unavoidably become deformed by the striking of the piece, whereas mine are struck at the same blow.*⁵⁵⁷

Once all these operations were completed, the blanks could be struck on the steam-powered presses. These presses are seen on the 1790 patent diagram, as shown, and new drawings were made in 1797 which show the position of the dies and the levers.⁵⁵⁸

Further diagrams of the coining presses installed in 1799 were also made.⁵⁵⁹

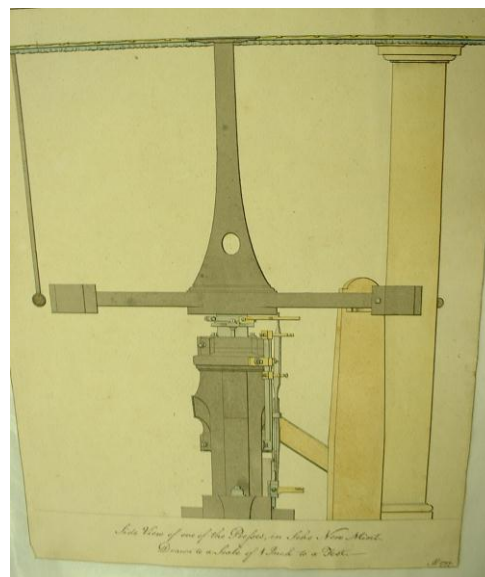
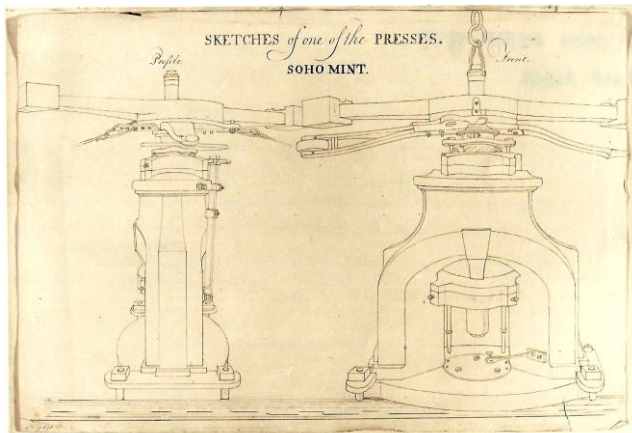


Figure 3.11 1797 Steam-powered press

1799 Steam-powered press⁵⁶⁰

⁵⁵⁷ MS 3782-21-1 MB (Buxton) to Joseph Banks (Soho Square, London) 10 Sep 1789.

⁵⁵⁸ *The drawings are made of the new coining apparatus except the working gear which however I have in my head.* MS 3782-12-66 Item 80 John Southern (Soho) to MB (London) 22 May 1797; Phillp album BMAG 2003-0031-184a.

⁵⁵⁹ Side view of coining press for New Mint, drawn by John Phillp in 1799. Phillp album BMAG 2003-0031-149.

⁵⁶⁰ Views of Steam-powered press drawn by John Phillp in 1797; Phillp album BMAG 2003-0031-184a. Side view of coining press for New Mint, drawn by John Phillp in 1799; Phillp album BMAG 2003-0031-149.

Boulton was able to strike both sides and the edge at the same time, due to the steam-powered coining press which struck with sufficient force to expand the blank into a collar. The collar, originally designed by Droz, did not work efficiently for large coinage orders and was later modified by Lawson as detailed later.

Die making

A very important part of the coining process was making the dies which imprinted the image onto the metal blank. The team of workers at the Soho Manufactory would have used dies and stamps to make products such as buttons, candlesticks and ‘toys’.⁵⁶¹ Boulton had made medal dies for Captain Cook’s expedition in 1772 and for two other orders in 1774 and 1781, before he undertook his first coinage in 1786 for the EIC. However these dies had cracked in use. The Sumatran coins previously mentioned had been made from simple dies made from punches. Boulton wrote: ‘*there is no head upon it, or anything but letters or such things as are put in with punchions. I have therefore had no occasion to make any dies by means of an original.*’⁵⁶² Therefore he needed an improved method of making dies before he could progress into larger scale coining.

The technological advances in steel making which enabled Boulton to make improved dies are discussed in chapter two. Most knowledge of the metallurgical characteristics of coining dies had been built up from practical experience. For thousands of years money was made by using a hard material, an engraved die, to impress an image into a softer material. The metal blank had to be compressed and expanded sufficiently to ensure that

⁵⁶¹ Quickenden describes the process of die-making for candlestick manufacture. K. Quickenden (1980) *Boulton and Fothergill Silver: Business plans & miscalculations* Art History Volume 3 No 3 pp 274-294.

⁵⁶² MB to Droz 5 April 1787 quoted in: J.G. Pollard (1968) *Matthew Boulton and J.P. Droz* Numismatic Chronicle 1968 Volume 8 University Press Oxford pp 241 -265.

it spread into all the hollows of the die. Because silver and gold are relatively soft, the first coining dies from around 600 BC were probably made of bronze held in an iron holder.⁵⁶³ Steel, produced from around 500 BC, was better able to withstand the stresses of striking, so that later coining dies were made with a wrought iron body and hammer welded steel tip. However slag inclusions in the steel often caused breakage of engraving tools, and had a grinding action on blanks.⁵⁶⁴ As early as 1535, Bienvenuto Cellini realised the importance of selecting good iron and steel for dies.⁵⁶⁵ Steel suitable for a die had to be soft enough to be engraved, but then made hard enough to transfer the design. It also needed to be tough and elastic to withstand the shock of the coining blow without distortion. Several blows might be necessary, especially if blanks were struck cold, as high mechanical pressures were needed to move metal. So in ancient mints, metal blanks were often heated.⁵⁶⁶ However, when a large scale coining was undertaken, for speed and economy, a single blow on cold metal blanks should be used, as was the practice in Boulton's Soho Mint.

Dies were engraved by a skilled engraver using tools such as gravers, punches and files to shape and move the metal.⁵⁶⁷ The steel die was held on a sheepskin bag filled with sand,

⁵⁶³ D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 93.

⁵⁶⁴ To make a die, a length of iron was doubled and steel tip welded to the outside part, as the impurities tended to run up middle of a bar. The end was heat-treated to increase the carbon content, engraved with the image, and then hardened at red heat at about 750°C and quenched in cold water. D.R. Cooper (1988) *The Art and Craft of Coinmaking* p 19; p 25.

⁵⁶⁵ The steel was annealed in a muffle furnace before engraving and cooled slowly. The tip was carburised by placing the surface in a mixture of chimney soot, glass and red earth mixed into a paste. He also described putting each die in a lump of lead weighing 100 pounds, and the surface to be engraved was dressed using a soft polished stone. D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 99.

⁵⁶⁶ W. Breen (1970) *The Minting Process: How Coins are Made and Mismade* American Institute of Professional Numismatists p 13.

⁵⁶⁷ Tools were bought on various dates as listed in the Mint Day Book; for example 1st Feb 1792 J Bissell for files of various types and prices 'Cutting 8 fine smooths at 6/- each & 12 smooths at 6d; 14s; Cutting 8 doz. sorted Files at 4/-

or by a chuck or clamp. To sharpen the tools, they were ground slowly on emery or corundum wheels, and the sharpening process was finished with fine sandpaper or a bench stone such as the smooth oilstone. At Boulton's mint a variety of grindstones were ordered.⁵⁶⁸ The dies were cut on workbenches which would provide a sturdy non-vibrating work surface large enough to accommodate tools and accessories.⁵⁶⁹



Figure 3.12: Die engraver's bench from Paris Mint Museum⁵⁷⁰

per Doz and a new fine Smooth File dec^d to J Lawson 2s, costing a total of £2 18 8d' and again on 27th March 1792 and so on. MS 3782-3-13 Mint Day Book 1791-1795.

⁵⁶⁸ Boulton noted in June 1791 that *I shall not forgett to buy some pollishing Stones* MS 3782-13-36 Item 60 MB (London) to MRB (Soho) June 1791p 8; Along with his wages Dumarest was paid 5s for an oilstone in August 1791. MS 3782-3-13 Mint day Book 8th February 1791-16th May 1791.

⁵⁶⁹ Inventory of Property belonging to Coinage Account taken 31st Dec 1790 MS 3782-13-120 Folder 6 31 Dec 1790

⁵⁷⁰ Image courtesy Professor Peter Jones, taken at Paris Mint Museum, Hôtel de la Monnaie, Paris, France.

For coining, two dies were used at the same time, one for the obverse and one for the reverse of a coin, each engraved with a unique design, and possibly a third die or collar for the edge.⁵⁷¹ The master die would be engraved with an image by a master engraver from the best possible steel available. Once hardened this first die, known as a ‘matrix’, could be used to make a series of positive working punches, sometimes known as puncheon dies or working hubs, which were in turn used to make working dies.

Dies were essentially a reverse or incuse image. While most ancient coin dies used engraving very heavily, early medieval coins were produced from dies made mostly from punches. Punches, which had a positive or relief image, were cut from soft steel shaped at the tip to achieve the desired effect, and hardened before use. They were used for adding textures and shapes.⁵⁷² Elaborate punches might be made for larger elements in a design such as a crown.⁵⁷³ Gradually more uniform coining dies were made using a series of punches, with fine details added later by hand to each individual die. In 1717, Newton estimated that it took an engraver at the Royal Mint six weeks to make a series of punches for a halfpenny, one punch featuring the bust, others for the inscription and so on. Only one set per denomination was retained at the Royal Mint for future dies.⁵⁷⁴ By

⁵⁷¹ Die positions can be both in same orientation (known as an axis at 0°), or opposite (180°) so that as the coin is turned, the reverse image is the opposite way up.

⁵⁷² Cellini in 1535 described the making of punches which were hammered in to displace the metal instead of removing it. Gravers remove the metal. D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 99.

⁵⁷³ W. Breen (1970) *The Minting Process: How Coins are Made and Mismade* American Institute of Professional Numismatists p 13.

⁵⁷⁴ Two halfpenny punches survive which were used to make 760 obverse dies and 632 reverse dies to produce 33 million halfpennies between 1744 and 1760. G.P.Dyer (1993) ‘Punches and Dies in the Eighteenth Century’ in: M.M. Archibald, M.R. Carrell (eds.) (1993) *Metallurgy in Numismatics* 3, Royal Numismatic Society Special Publication 24, London, pp 160-168

1775, the most important parts of the design could be duplicated as a single impression.⁵⁷⁵

When Boulton first started coining, he used dies produced mainly from punches, with details added by hand-engraving. Punches for the 1786-7 Sumatra coinage were engraved by William Castleton in London and sent to Soho where the die sinker made sufficient dies to strike the issue.⁵⁷⁶ The dies for the 1789 Cronebane halfpenny were made by John Gregory Hancock, working independently, with the legend and details such as the crosier, date, and windlass added individually to working dies, as can be seen by the numerous varieties listed in D&H.⁵⁷⁷ His punches were also reused to make dies for the 1791 Leeds halfpenny tokens where St Patrick has turned into Bishop Blaise.



Figure 3.13: St. Patrick and Bishop Blaise on Cronebane and Leeds halfpenny⁵⁷⁸

⁵⁷⁵ The issue of the 1787 shilling at the Royal Mint was a transition in minting techniques where obverse inscriptions were made with individual letter punches, but reverses from fully lettered punches engraved by Lewis Pingo. H. Manville and P. Gaspar (2004) *The 1787 Shilling; a transition in minting technique* British Numismatic Journal 2004 Volume 74 pp 84-101.

⁵⁷⁶ 'I sent to Mr. Castleton about the puncheons. They were not then finished; he had three of them incompleat, but promised to have them done and to send them to Mr. Marsden tomorrow night.' MS 3782-12-59 Item 2 William Chippindall (London) to MB (Truro) 12 Sep 1786.

⁵⁷⁷ Dalton and Hamer list around thirty varieties of the Cronebane halfpenny plus around twenty four counterfeit versions. Dalton and Hamer (1915) *The Provincial Token Coinage of the Eighteenth Century Illustrated Volume III Wales Scotland, Ireland and Addenda Part XI Anglesey and Wales*.

⁵⁷⁸ 1789 Cronebane Halfpenny D&H 15 BMAG: 1967N970; 1793 Leeds Halfpenny D&H 38 BMAG: 1885N1541.27.

Letter punches were often made for Boulton by the specialist engraver Richard Phillips of London.⁵⁷⁹ Hancock also provided dies for the Anglesey tokens and the Wilkinson token issues of 1787-1790 and became very annoyed with Boulton when they were duplicated at Soho by Wyon or Dumarest.⁵⁸⁰

Boulton had hoped that Droz would provide dies for a regal coinage contract, and numerous pattern halfpennies were produced, but very few of his dies or punches were used commercially. Droz would not make dies for token issues and so, by August 1790, the engraver Rambert Dumarest had come to Soho to supply dies for the 1791 Southampton and 1791 Glasgow halfpenny tokens, and for many of the tokens and medals made for the Monneron brothers, and possibly for the 1791 Bombay issues. Dumarest also engraved a die for a proposed Anglesey token issue which was rejected by Williams and reused for the 1791 Cornish halfpenny token.⁵⁸¹



Figure 3.14: Druid heads from Anglesey penny (left) and Cornish halfpenny (right)⁵⁸²

⁵⁷⁹ 'I have received the Letter Punches from Phillips.' MS 3782-12-66 Item 9 James Lawson (Soho) to MB (London) 23 May 1791.

⁵⁸⁰ MS 3783-12-35 Item 73 John Gregory Hancock (Birmingham) to MB [Birmingham] 12 Apr 1790.

⁵⁸¹ This is discussed further on pp 304-305.

⁵⁸² 1788 Anglesey Penny Token D&H 174 BMAG: 1968N368; 1791 Cornwall Halfpenny D&H 2 Assay Office 110

By spring 1791, however both Droz and Dumarest had left Soho and their place was taken by Noel-Alexandre Ponthon who worked for Boulton from 16th June 1791 to September 1795. He had been recommended by both Augustin Dupre and Francis Swediaur.⁵⁸³ The main engraver at Soho, from 1793 until his death in 1810, was Conrad Heinrich K uchler but Thomas Wyon, John Phillip and G.F. Pidgeon were also employed to make both coin and medal dies.

Dies came in a variety of shapes and sizes, and the steel needed to be forged by the smiths at Soho Mint into the correct shape.⁵⁸⁴ Originally the lower die often had a spike to insert it into some form of holder and could be hexagonal with bevelled edges to allow access of the moneyer's fingers.⁵⁸⁵ The upper die, known also as the trussel or hammer die, was often shorter than the anvil or pile die, so that the moneyer could place it accurately over the blank. But longer dies cushion the force of the blow more effectively, so the hammer dies tended to fail more quickly, with an estimated life of 20,000 pieces struck per die rather than 45,000 for the anvil die.⁵⁸⁶ Therefore, the more important image, often the portrait of a monarch, was engraved on the anvil die and used as the obverse image as less dies needed to be engraved.

⁵⁸³ The French engraver Augustin Dupre worked at the Paris Mint. Francis Swediaur was Boulton's agent in Paris. MS 3782-12-91 Item 117 Francis Swediaur to 'Andrew Smith' pseudonym for MB 27 Feb 1791.

⁵⁸⁴ *The expense of a pair of original Dies it is necessary you should know and therefore ask Hodgets the Forger about the Cost of Forging ask Bush or Lawson or Bill Harrison about the Turning and ask Dumarist what you should charge for Engraving a pair like the Southampton pair & how much for the retouching the punches.* MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 Jun 1791.

⁵⁸⁵ G.P.Dyer (1993) 'Punches and Dies in the Eighteenth Century' in: M.M. Archibald, M.R. Carrell (eds.) (1993) *Metallurgy in Numismatics* 3, Royal Numismatic Society Special Publication 24, London, pp 160-168.

⁵⁸⁶ Records of the Royal Mint in 1640 show 2408 trussels and 1496 piles made for all denominations at a cost of 15-20 pence per pile die, and half this for trussels. D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 96.

There was an increasing demand in the seventeenth century for larger coins. As they were up to 35mm diameter, they were difficult to produce, as larger hammers were needed. So the screw press was introduced to mechanise coining, and this meant that square shaped dies were more convenient. Both dies could be made of equal size as forces were more evenly spread. In general the practice was to engrave dies with a camber of 1mm in 25mm so that the centre was pressed first and the outside of the blank acted as a hoop to protect the design.⁵⁸⁷ Boulton had, however, concluded, after experimentation, that a cylindrical shape was best for dies since they were least likely to crack.⁵⁸⁸ Most of the forty or so dies and punches from Soho Mint examined during the course of this research were in the form of a cylindrical steel block weighing between 500g-1000g with a base diameter of between 58mm and 64mm, and a height of between 47 and 52mm.⁵⁸⁹

The Soho dies seen during this research generally have a complete mirror image and inscription on their flat upper surface, except for one EIC die where the date is unfinished. On most coining dies there are slits in the form of a cross, which may have helped with alignment, or allowed the die to be fixed in the press. This feature is not generally found in the medal dies or in punches, or in dies made after 1860, which are much more varied in diameter and height. Several of the coining dies have 'necks'; a cylinder on which the engraving was made which could protrude into the collar. 'Necks'

⁵⁸⁷ D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 pp. 96, 101, 102.

⁵⁸⁸ 'Determine by expt what degree of conecality and form of dye should be used for making the best impressions for punches and for matrices and dies, cold and hot. I think one hot blow and all the rest cold will be surer than 2 hot blows but I would try cylindrical dies as they would not be so liable to burst outwards and I would the instant of striking put a cold steel coller round it to prevent bursting outward.' MS 3782-12-108 Item 53 Mint Note Book 1788 P 87 21 April 1788.

⁵⁸⁹ Twenty seven Soho Mint dies or punches were examined during the course of my research. These are located at the Assay Office, Avery Museum, Birmingham Museum and Art Gallery, Soho House and Think tank in Birmingham. They were made between 1792 and 1845. For comparison fourteen dies made at the Soho Foundry Mint, set up in 1860, were also examined. Gunstone described some of these dies briefly in 1982. A. Gunstone (1982) *Coinage Dies in the Museum of Science and Industry, Birmingham* Numismatic Circular April 1982 Volume XC Number 3 p 87.

were only possible if homogenous crucible steel was used, as a welded tip would break off.⁵⁹⁰ The length of the ‘neck’, on the Soho dies studied, does not seem to be related to the diameter of the completed coin, nor to its thickness. Generally the Soho medal dies have a flat top and no neck as the design does not need to protrude very far into a collar. Eighteenth century dies in the Royal Mint collection do not necessarily have flat tops. Gaspar and Dyer discuss the important production techniques indicated by the presence of a neck, which indicates the use of a collar to prevent the fishtailing of the inscription. Collars were generally used to produce proof and pattern coins, and not in an ordinary coining press ‘*in which the upper die was attached to the descending screw*’ since it was doubtful if the movement of the screw could have been controlled accurately enough to allow the descent of the upper die into the collar without frequently smashing the die against the collar.⁵⁹¹



Figure 3.15: Dies for 1802 Ceylon and 1792 (dated 1791) Sierra Leone coinages⁵⁹²

⁵⁹⁰ D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 103.

⁵⁹¹ P.P. Gaspar and G.P. Dyer (1980) *The Striking of Proof and Pattern Coins in the Eighteenth Century* British Numismatics Journal Volume 50 1980 p 122.

⁵⁹² 1804 Ceylon 1/192 rix dollar Obverse Die BMAG: 1951S00088.0003; 1791 Sierra Leone 50 cent Obverse Die BMAG: 1951S00088.00095.

As illustrated in the catalogue, dies, such as for the Marriage medal and Trafalgar medal, have the image in reverse. Punches, such as that for the Nile medal, have the image the correct way round. Several smaller punches have been found, possibly for pattern guineas.



1798 Nile punch

1805 Trafalgar die

Figure 3.16: Dies for 1798 Nile medal and 1805 Trafalgar medal⁵⁹³

A collar die, known as the Droz collar, from the Assay Office, was examined, which struck an inscription onto the edge of the pattern halfpennies.⁵⁹⁴

Figure 3.17: Droz collar die⁵⁹⁵

⁵⁹³ 1798 Davidson's Nile Medal Reverse Punch Assay Office 2049; 1805 Boulton's Trafalgar Medal Obverse Die Assay Office 2050A

⁵⁹⁴ This example has been described as unique, as it has a specific inscription only found here Phyllis Benedicz (1998) *The Droz Collar* The Anchor, Autumn 1998, The Assay Office, Birmingham

⁵⁹⁵ 1788 Droz collar die Assay Office 2074

Specialist engravers were needed to make the dies but, as Boulton wrote, any die sinker could engrave the ‘nuts’ to make the edge markings. ‘*Nichols or Bush or any Die sinker can put the letter puncheons into the nut particularly as Bush hath made a machine for that purpose.*’⁵⁹⁶ Brian Gould has discussed a workman who may have come from France with Droz to make ‘plateau’ i.e. the flat circular steel case housing the sexpartite collar.⁵⁹⁷ Dies were also made to cut out blanks, though these were not seen during my research. The use of convex dies to make the blanks may have been suggested by Busch and aided in the prevention of fraud.⁵⁹⁸ Busch was also responsible for the production of the working dies for the regal coinage orders in 1797 and 1799.⁵⁹⁹

Steel suitable for dies was a difficult substance to obtain as there was not much demand for it in the eighteenth century. Tool steel was usually bought in round, square, hexagonal or octagonal rods. Tapered cylinders of special steel were used for matrices, dies and punches. Boulton had spent a lot of time investigating sources of steel as discussed in chapter two and from early on in his career he was fully aware of the importance of homogenous steel to make dies. He used a variety of suppliers, including Benjamin Huntsman, whose steel, when annealed, was relatively soft for engraving or hubbing (multiplying dies), and could be struck without excessive work-hardening. Correspondence with Huntsman began from January 1757 or earlier, just one year after

⁵⁹⁶ MS 3782-13-36 Item 56 MB (London) to MRB (Soho) 27 May 1791.

⁵⁹⁷ B. Gould (1969) *Monsieur Duret: Craftsman at Soho* Numismatic Circular September 1969 Volume LXXVII Number 9 p 278.

⁵⁹⁸ ‘*Herewith you will receive 3 specimens of the new Guinea, 2 gilt metal & 1 gold. I am sorry not one is perfectly up on the outside ring. Bouch thinks that they would strike well from Blanks first struck in convex plain Dies.*’ MS 3782-12-66 Item 14 James Lawson (Soho) to MB (London) 5 Jun 1791.

⁵⁹⁹ ‘*Mr. Busch is greatly oblig’d by your friendly advice, which he will pay attention to; as well as to the objects you recommend respecting the good order of the mint business in general, and the state of the working dies in particular.*’ MS 3782-12-59 Item 176 William Cheshire (Soho) to MB [London] 19 Nov 1798; *Mr. Kückler and Mr. Busch have received their instructions respecting concave half penny dies and promise immediate attention to your commands.* MS 3782-12-59 Item 190 William Cheshire (Soho) to MB (London) 30 May 1799.

he had first made crucible steel, when Boulton ordered a pair of steel rolls for rolling silver and copper, and a bar ‘*sufficiently large to forge into some fine dies.*’⁶⁰⁰ Further orders were sent in July 1769.⁶⁰¹

Boulton had also corresponded with George Laidler from 1762 and with William Allen in 1764 discussing sources of steel.⁶⁰² Allen said that he was able to supply iron imported from Philadelphia which ‘*will make excellent steel, is very ductile and malleable, and at the same time is of a very strong body.*’⁶⁰³ Baron Gedda wrote from Stockholm in 1768 about collecting various iron ores and orders for 100 tons of iron.⁶⁰⁴ Boulton had also contacted Benjamin Franklin in 1766 describing experiments on annealing dies.⁶⁰⁵

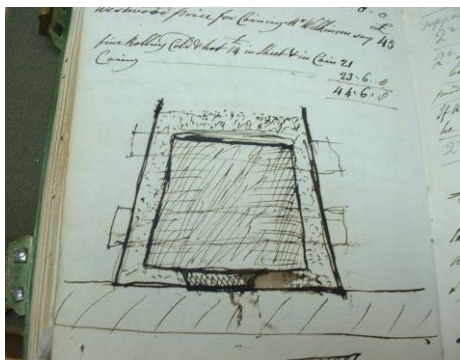


Figure 3.18: Notes on annealing dies⁶⁰⁶

⁶⁰⁰ Barraclough quotes a letter dated 19th Jan 1757 with a reference to a previous order. In a letter dated 9th Aug 1764 Boulton ordered steel and dies, with a further order of six dozen dies in 1774 K.C. Barraclough (1984) *Steel Making before Bessemer Volume 2: Crucible Steel the growth of technology* pp 3-4.

⁶⁰¹ ‘I will send you the steel on Monday fortnight & my son will send you answer.’ MS 3782-12-23 Item 132 Benjamin Huntsman (Sheffield) to MB (Soho) 7 Jul 1769.

⁶⁰² By 1763 Laidler had three steel furnaces, and was training his own apprentices. MS 3782-12-23 Item 26 George Laidler Jr. (London) to MB [Soho]. 30 Oct. 1762; Item 27 2 Mar 1763.

⁶⁰³ MS 3782-12-23 Item 33 William Allen (London) to MB (—) 2 Apr 1764.

⁶⁰⁴ ‘Went to Iron fair at Carlstadt and found Mr Torngren, partner to Englishman Mr Bellenden, who will order iron (not less than 100 ton) for MB at £10 per ton. Not the best but good. Will try with Sir John Goodricke to get some Oregrunds Iron.’ MS 3782-12-23 Item 119 Baron Gedda (Stockholm) to MB [Soho] 25 Oct 1768.

⁶⁰⁵ ‘Having occasion to anneal a steel dye about 6 lb. weight the other day, I put it (when moderately red hott) into some wood ashes, which I consider’d as the best incombustible non conductor of heat I know. These ashes were contain’d in a wooden barrrell, which I wrapt up in some woolen blankets, and left it in a cold garret (then cover’d with snow) were it remain’d for 30 hours, and than open’d it in the presence of Dr. Small. I found a good deal of steam condens’d upon the barrrell and blankets, which shew’d they were not dry enough for the experiment; yet nevertheless the dye was nearly as hot as boiling water.’ MS 3782-12-1 Letter Book 1766-1768. Item 2 MB to Benjamin Franklin 22 Feb 1766

⁶⁰⁶ MS 3782-12-108 Item 53 Mint Book 1788 p 114.

Once the Soho Mint was set up, specific orders for steel dies were made with Huntsman Junior. Boulton wrote in April 1789:

I am about to undertake the striking of some millions of copper pieces which will require a hard blow in hardened steel dies. I have tried various kinds of steel but am not yet satisfied with any of them. I am of opinion that the best cast steel you are capable of making will answer the best and therefore I must request the favour of you to send me a few bars by way of tryal of such firm strong nerved steel as you know how to make out of the best bar. NB it must be the best you can possibly make without any regard to price or expense that being a trifling object in comparison to the quality of the steel. I presume that 8 solid bars will be the best form as they are to be forged into round dies with a coat of iron like the drawing. The steel I have hitherto tried will crack in the hardening or breaks afterwards in the striking or is so soft as to sink in the middle and become hollow, both which extreams I wish to avoid. He also asked Huntsman's advice in: the management of the said steel both as to the forging, annealing, hardening and tempering of it.⁶⁰⁷

Boulton knew from practical experience exactly what he required from Huntsman, and it was this experience which enabled him to perfect die making at the Soho Mint. In his letter to Huntsman he drew diagrams to illustrate what he needed.

⁶⁰⁷ MS 3782 -12-3 Item 114 MB (Birmingham) to Benjamin Huntsman [Junior] 24 Apr 1789 p 112.

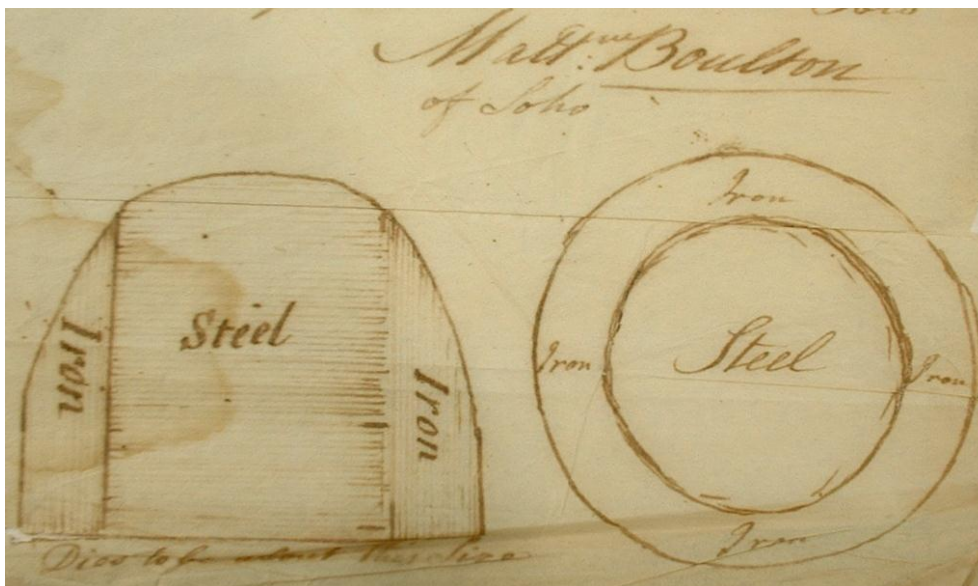


Figure 3.19: Diagram of die in letter to Benjamin Huntsman [Junior] 24th April 1789

Huntsman's reply, sent with ten pair of dies, recommended that they should be case hardened.⁶⁰⁸ In January 1790, Boulton sent 'an exact sketch for the size of the dies and the manner in which the steel should be forged' as none of the dies sent were fit for use at the Soho Mint. But he still wanted three to four cwt of best steel and intended to have the dies forged under his own supervision.⁶⁰⁹ However not many moneying dies were able to do much work. Boulton therefore suggested making dies in a different way:

*I therefore wish to try to make them from bars of steel which are forged square or rather oblong square & then the engraving will be done on one of the forged sides whereas it is now done on the unforged end as we cut the round bars you sent me into short lengths.*⁶¹⁰

⁶⁰⁸ MS 3782-12-34 Item 83 Benjamin Huntsman [Junior] (Sheffield) to MB (Soho) 22 May 1789.

⁶⁰⁹ Boulton wrote: 'None of the dies sent are finished in that manner nor are they at all like the sketch but nearly twice the size and weight. Therefore they are not fit for my use.' MS 3782-12- 8 Item 36 MB to William Huntsman (Sheffield) 23 Jan 1790.

⁶¹⁰ 'I must beg of you to take the very best marks of the Swedish iron to make the steel & that you will cast it into short thick square bars. Suppose 4 inches square bars and then forge it down into bars about 2 ¼ inch by 1 ½ inch which we cut into proper sized pieces. I prefer casting it into thick bars in order that it may take the more forging for the more it

This was an important improvement in die technology and Boulton's own idea. He used his own observations, his quick intelligence and his practical experience to change die making practices.

Samples of steel were also obtained via the Soho agent Richard Chippindall in London.⁶¹¹

Another supplier was Rennie as seen in a letter of 1791:

*I receiv^d some large size Cast Steel from you which proved good. I now beg of you to pick out one Ton of the best hoop L or double Bullett & Cast it, in your best manner into large Ingots & forge it down to size. This Steel is for fine Medal Dies & must be the best possible or it will be worth nothing to me I will not limit you in Price, charge it what you please so that it be as good as ever you made.*⁶¹²

Without good steel it was impossible to make good dies, and without good dies high quality coins were impossible to strike.

A variety of heat treatments were required during die making and also during the formation of coining blanks. Annealing and hardening are heat treatments which change properties such as strength and hardness of a metal. In the cases of copper, steel and brass this process is performed by substantially heating the material, generally until glowing, then maintaining a suitable temperature for a specific time, followed by cooling rapidly in a water or oil quench bath, or allowing it to cool slowly. The metal is 'frozen' into a particular state of crystallisation. Dies needed to be annealed so that they could be

is forged the better is the steel as appears by your small rods being so much better than your large round bars. As we find our dies subject to crack in the strikeing of the impressions into them I recommend that the steel be as ductile as possible.' MS 3782-12- 8 Item 31 MB to William Huntsman (Sheffield) 21 May 1790.

⁶¹¹ MS 3782-12-59 Item 17 Richard Chippindall (London) to MB (Soho) 9 May 1789.

⁶¹² MS 3782-13-49 Item 90 MB (Soho) to John Rennie 26 Sep 1791.

engraved with the appropriate image, and then were hardened by rapid cooling to make the die hard and durable, in order to be able to withstand the forces of the coining press. After hardening, the steel may be brittle and so may need further tempering by gradual heating. Similarly coining blanks may become work-hardened and needed to be annealed.

To harden dies, they were often placed in a cast-iron pot, completely embedded in animal charcoal, chiefly made from leather. The pot was placed in an air furnace, in which coke was burned to give an even heat. Once the die had reached the correct heat, judged by the colour of the flame and metal, it was withdrawn and immersed in a large cistern of water, the temperature of which kept constant by continuous flow of cold water. At this point, the dies often cracked and the whole work of the engraver was lost.⁶¹³

Boulton carried out experiments in annealing and hardening dies, and testing various types of steel and how to forge it, which take up many pages of his 1788 Mint books.⁶¹⁴ He employed various recipes for hardening dies including using ‘phlogistick’ powder; he tested the use of Wedgwood’s thermometer to measure the degree of heat, and how to cool the dies in pots of oil over a long period.⁶¹⁵ Sometimes iron was case hardened, that is locally heated with additional carbon absorbed at the surface to make a steeled layer. Boulton used some interesting recipes. For example one involved making charcoal from beech, willow, burnt ox horns and burnt shoes with various other ingredients.⁶¹⁶

⁶¹³ A description of die making is given in the appendix. R.C. Bell (1964) *Commercial Copper Coins 1811-1819* Corbitt and Hunter, Newcastle.

⁶¹⁴ MS 3782-12-108 Item 53 Mint Note Book 1788 p 56 on.

⁶¹⁵ MS 3782-12-108 Item 53 Mint Note Book 1788 p 63.

⁶¹⁶ Another recipe involves ‘*Coals twelve pounds; horns ten; shoes, vine soot, and pomegranate, of each equal quantities three pounds all well mixed together. To make one hundred pounds weight of steel, there is required one hundred and twenty pounds weight of good, soft Spanish iron, not streaky; to which if you give the aforementioned dose of the said powders, prepared as directed, and put to the fire, for the space of forty-eight hours, you will get the best*

Amazingly, similar ingredients are incorporated in a commercial mixture made from burnt shoe leather or bones to harden modern dies used to stamp specialist items.⁶¹⁷ As Eimer has noted:

*It is not surprising that in an atmosphere of innovation and inventiveness, which the collaboration of Boulton, Küchler and Watt must have created, much experimentation occurred in the preparation of coin and medal dies as well as in their design and manufacture.*⁶¹⁸

This experimentation was seen during research, though Watt did not have much involvement with any part of the Soho Mint except for his initial input into setting up the steam-powered coining apparatus.

By the time the 1797 regal coinage order was received, Boulton had a much better understanding of die making. Steel ingots were normally cast with the long axis vertical so that the slag and other impurities settle on the top. Boulton had found that if these ingots were turned at right angles, the impurities would be on the side of the bar and not on the top, where they would interfere with the engraving. The method of forging the dies across the grain suggested by Boulton was introduced at the new Royal Mint from 1811 and was used for the next 150 years.⁶¹⁹

Boulton asked Huntsman to make dies from bars of 2½ inch by 1½ inch. These were then forged into a conical shape. He wrote:

steel which can be had. Other recipes involved pounded garlic, juniper wood and a series of heating in a reverberatory furnace which all add carbon to the iron. MS 3782-12-108 Item 53 Mint Note Book 1788 p 56 on.

⁶¹⁷ Personal communication from Mark Andrew Powell, die engraver. www.eligius.co.uk.

⁶¹⁸ C. Eimer (1983) *Medals of Matthew Boulton and the Soho Mint* Numismatic Circular April 1983 Volume XCI Number 3 p 78.

⁶¹⁹ D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 103.

*These dies are steeled quite through & take from 1 ½ lb to 1 lb 10 oz of steel. They are for striking penny pieces of the size I have sent with the Die but as they are struck in Collers they may require a very hard blow and if not steel^d through the dies would sink in the middle.*⁶²⁰

Again Boulton's practical experience counted in perfecting his methods.

More die steel arrived in 1802, but was not as good. Boulton wrote to request that the best type of Swedish iron should be used as *'my Mint is almost at a stand for want of better dies I must beg the favour of you to instantly prepare the 2 specimens aforementioned & send them by the most expeditious conveyance, even ten or 12 lb of each might be send by the coach & the remainder.*⁶²¹ Sufficient high quality dies were absolutely essential to the functioning of the coining process, which is why Boulton's improvements were so vital.

Once the steam-powered coining presses were established, a more efficient method of multiplying dies was needed. The blow imparted was more uniform than that of the man-powered press so that dies did not wear so much, but due to the faster speeds of working the dies needed to be changed more regularly. Hundreds of working dies were made for a large coinage issue. At the Paris Mint in 1787, twelve engravers were employed to duplicate dies, but Soho Mint at that time had no experienced coin engravers. Boulton had employed Droz in the belief that he had mastered the multiplication of dies but in this

⁶²⁰ MS 3782-12-42 Item 165 MB (Soho) to Benjamin Huntsman (Sheffield) 6 Jul 1797.

⁶²¹ *'Some years ago you supply'd me with cast steel forged to the size of 2¾ inches by 1½ inches for the purpose of making coining dies which proved very good. But the last quantity I had of you doth not prove so, & being now obliged to use it for want of better I experience a great loss from it as few of the dies will strike one hundred weight of copper coin before they break & many of them break before they have struck ten pounds weight.'* MS 3782-12-47 Item 379 MB to Benjamin Huntsman (Sheffield) 19 Nov 1802.

he was greatly deceived.⁶²² But by at least June 1791, a screw press, known as the multiplying press, was used to provide the force needed to strike annealed blank dies.⁶²³ This is known as hubbing (or hobbing) and may be done several times, with annealing between each strike, and gradual cooling of the dies.⁶²⁴ The process of duplicating identical dies was kept secret, and carried out in the Multiplication shop at Soho⁶²⁵ Dies were kept in a special locked mahogany cabinet.⁶²⁶

Boulton insisted that the dies were changed frequently, for example when Soho Mint was striking a large order for the East India Company in 1791: *'Pray request Mr Lawson to consult with Nichols about supplying the mint constantly with perfect neat sharp well polished dies which I think should be changed after striking every 30 or 40 thousand pieces.'*⁶²⁷ He suggested that:

There must be always be 3 times the number of Dies that there are working presses viz one sett in work a 2^d sett standing by the side of the Pres ready for changing the instant any one fails & a 3^d sett in the hands of the Examiner & polisher & it would be better if there was a 4th Sett as I think they should be changed every 5 or 6 hours for I am not satisfied with the perfection of our money. I must have the metal of a better couler & freer from tarnish & finer

⁶²² Boulton wrote a list of instructions on Droz's proposed method of multiplying dies, but came to the conclusion that it was no different to the normal method previously in use. MS 3782-12-108 Item 54 Mint Note Book 1789 p 27.

⁶²³ *'We thought of immediately moving the multiplication press into the mint but as the order you expected to do is given up whether it will not be better to fit up the new press first.'* MS 3782-12-66 Item 16 James Lawson (Soho) to MB (London) 11 Jun. 1791.

⁶²⁴ As the heated blank die was compressed by the press, the molecules of the steel are forced closer together making the hubbed die stronger and denser. Cooling slowly better retains the crystalline structure. The Royal Mint was hubbing complete dies by 1787. P.P. Gaspar and G.P. Dyer (1980) *The Striking of Proof and Pattern Coins in the 18th Century* British Numismatics Journal Volume 50 1980 pp 117-127.

⁶²⁵ Inventory of Property belonging to Coinage Account taken 31st Dec 1790 MS 3782-13-120 Folder 6 31 Dec 1790

⁶²⁶ MS 3782-13-36 Item 93 MB (London) to MRB (Soho) 15 Jan 1793.

⁶²⁷ MS 3782-13-36 Item 55 MB (London) to MRB (Soho) 17 May 1791.

*polish befor tis cut out & No dies must be worked after loosing their Sharpness & polish.*⁶²⁸

This constant striving for perfection in coining was what made Soho Mint unique at the time. Boulton insisted that his team kept to standardised principles of production which produced uniform results.

Selgin thinks that Boulton was able to duplicate the whole of a die by 1791 rather than only the central part of the design as most other coiners.⁶²⁹ Young, however, believes that for the 1797 twopence entire dies were not reproduced completely.⁶³⁰ Other authors conclude that by the end of the eighteenth century the whole die could be hubbed.⁶³¹ My research has shown that Boulton had understood the principle of die multiplication and was certainly making experiments to multiply dies, using his press and two air pumps in 1788.⁶³² Multiplication of dies at Soho was certainly better than at the Royal Mint, as even in 1811 the Deputy Master of the Royal Mint was complaining about lack of dies.⁶³³

⁶²⁸ MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 Jun 1791.

⁶²⁹ G. Selgin (2008) *Good Money* p 284.

⁶³⁰ He concluded that there was only one true variety of the 1797 cartwheel twopenny but a multitude of minor variations. K.R. Young (1990) *1797 Twopence* Numismatic Circular July 1999 Volume CVII Number 6 p 177.

⁶³¹ D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 103; P.P. Gaspar and G.P. Dyer (1980) *The Striking of Proof and Pattern Coins in the 18th Century* British Numismatics Journal Volume 50 1980 pp 117-127.

⁶³² 'Take 3 dies of the same steel well annealed in 'old old' shoe hardening. Cold: Expt 1 give a blow with all ye force of 2 pumps. Expt 2 give one blow with one air pump and a 2nd blow. Expt 3 Give blow with air pump and then anneal in 'old old' give 2nd blow and anneal again and so on until finished.' Boulton repeated the experiment with hot dies. 'Hot: one blow with 2 air pump (same as above) but can give more blow with cold if wanted. I think a hot die should be more pointed than one cold.' MS 3782-12-108 Item 53 Mint Note Book 1788 p 89.

⁶³³ A letter dated 1811 states that: 'exertions in the other departments is rendered (as formerly) entirely ineffectual owing to the insufficiency of the dies.' (J.W Morrison, Deputy Master of the Mint, complaining to Earl Bathurst, Master of the Mint, about Lewis Pingo). G.P.Dyer 'Punches and Dies in the Eighteenth Century' in: M.M. Archibald, M.R. Carrell (eds.) (1993) *Metallurgy in Numismatics* 3, Royal Numismatic Society Special Publication 24, London, p.164

Reducing machine

A master die could be engraved with an image such as Britannia, which was then used for a series of coins of different sizes such as a penny, halfpenny and farthing. Modern methods of die reduction use a pantograph which enables a design to be transferred from a larger model to the die, though this has now been replaced by computer operated die-cutting methods.⁶³⁴ The pantograph principle was used at Soho Mint but at what point is not certain.⁶³⁵ Boulton wrote in a letter dated 31st March 1788 ‘*I have sometimes though it possible to turn in a lathe one die from another, as I have a lathe in which I have turned medals in ivory and pearl from medals of hard metal, but this lathe is not strong enough for steel*’⁶³⁶ He also noted that ‘*Droz says a lathe with two points must be had.*’⁶³⁷ This may possibly be for reducing an image. In November 1789 Boulton’s Paris agent, Foucault, found a mechanic, Jean-Baptiste Dupeyrat (1759-1834) who could turn a steel die on a lathe from a model or a medal. This was known as a *tour à médailles* or portrait lathe, and Boulton ordered one in spring 1790 which was received in September of the same year.⁶³⁸ Possibly this was the engraving lathe mentioned in 1792.⁶³⁹ However, a reducing machine was certainly in use by 1799 when pattern coins were made for Denmark in five sizes.⁶⁴⁰ This enabled dies to be produced with the same design

⁶³⁴ Information from visit to the Royal Mint. 23 Nov 2009.

⁶³⁵ A diary entry mentioned a die lathe. ‘*Lawson told him the dies were forged & ready for him [Droz]. I told him the die lathe was wanted.*’ Boulton’s diary 1790 MS 3782-12-107 note opposite Sunday 12 September 1790.

⁶³⁶ J.G. Pollard (1968) *Matthew Boulton and J.P Droz* Numismatic Chronicle 1968 Volume 8 pp 246-250.

⁶³⁷ MS 3782-12-108 Item 53 Mint Note Book 1788 p 112.

⁶³⁸ A reducing machine, also known as a portrait lathe, or pantograph, is based on a ratio principle. A pattern or template, larger than the die being cut, was used as a guide to reproduce a design in the die. As a stylus follows the pattern, a cutter is repeating the same motion in the steel die. J.G Pollard (1971) *Matthew Boulton and the Reducing Machine in England* Numismatic Chronicle 1971 Volume XI p 314.

⁶³⁹ ‘*I wish he would set James to make the little water wheel intended for the little new Building at ye front of ye Menagery in order to turn the Engraving lathe.*’ MS 3782-13-36 Item 87 MB (Truro) to MRB (Soho) 15 Sep 1792.

⁶⁴⁰ Danish pattern coins were 17mm, 21mm, 27mm, 34mm, 39mm in diameter ie one twelfth, one sixth, one third, two thirds and one specie-daler. The largest die was engraved by Kuchler and then reduced. D.Vice (forthcoming) p 12.

in different sizes much more efficiently.⁶⁴¹ The Royal Mint had lagged behind. Boulton's reducing machine was used by Pistrucci at the Royal Mint for the 1816-17 recoinage.⁶⁴²

Soho Mint coining machinery

Once the blanks had been prepared and the dies made, the coins, medals or tokens could finally be struck by the steam-powered press at the Soho Mint. Boulton was the first to develop the technology for an automated coining press. An automatic feed system to Boulton's own specifications was introduced at an early stage.⁶⁴³ The scrupulously cleaned and polished blanks were loaded into tubes.⁶⁴⁴ They were fed by gravity into the coining press and placed onto the dies by a laying-in tool.⁶⁴⁵ The lowest blank was pushed forward by a metal fork to drop into a circular steel collar, in which the lower die was recessed. This collar had been modified by James Lawson, who used a steel ring and a triple spring fitted around the bottom die. Levers kept the ring level with the surface of the die until the screw descended with the upper die. Then the spring allowed the ring to rise, so that as the blank was struck, it was surrounded by the collar. Once the upper die

⁶⁴¹ A detailed numismatic study could determine if the dies and punches for the 1797 coinage were produced on a reducing machine. Information from Dr Kevin Clancy, Royal Mint.

⁶⁴² Kevin Clancy (1999) *The recoinage and exchange of 1816-17* PhD Thesis, University of Leeds, December 1999; Kevin Clancy (2000) *The Reducing Machine and the last coinage of George III*. British Numismatic Journal Vol. 70 pp 118-123.

⁶⁴³ Comelli, a clock maker from Bologna, manufactured a screw press in 1786 which could strike and eject a coin from the collar with one swing of the press arm. Cooper also mentions Gengembre who had developed a feed mechanism for the coining press. D.R. Cooper (1996) *The development of coinage dies from bronze to steel* Newcomen Society Transactions Volume 67 1995-1996 p 103.

⁶⁴⁴ There are many references in the Mint record books to making tubes. '22nd Dec 1791 A Note in Favour of Mo Smith (the German) for tubes.' Smith continued to make them till at least April 1792. John Middlehurst took over the job by Nov 1793; 24th Dec 1793 'Middlehurst making 4 doz tubes £1 14s.' MS 3782-3-13 Mint day Book 8th February 1791-16th May 1795; 22nd Oct 1796 'J Middlehurst more tubes 9 doz & 2 doz £2 18s.' By 1797 both Pemberton and Middlehurst were associated with making tubes. MS 3782-3-14 Mint day Book May 23rd 1795 1795-16th June 1798; Middlehurst continued making tubes until at least 26th Jan 1799. In December 1799 two tons of tubes were reported present in a mint inventory. MS 3782-3-15 Mint book 28th Nov 1798 to 30th June 1803 pp 61-64.

⁶⁴⁵ 'Jos Harrison showed me the effects of that Machine that is to lay the Pieces upon the Dye, it appeared to me to do the business perfectly well, and I believe it answers to the full of what was expected of it. Mr Harrison says you need not be in any pain about that machine.' MS 3782-12-74 Item 121 Zaccheus Walker (Birmingham) to MB (Chacewater) 28 Sep 1786; B.M. Gould (1969) *Matthew Boulton's East India Mint in London 1786-88* Seaby's Coin and Medal Bulletin No 612, August 1969 pp 270-277.

rose, the collar could be made to fall so that the struck coin could be removed by the layer-in and a fresh blank placed on the die. The struck pieces were then automatically removed into a suitable container. This enabled Boulton to develop the steam-powered press with increased speeds of striking which would not have been possible if the blanks had to be fed in by hand.⁶⁴⁶ A modern coining press uses a very similar method to that used by Boulton, but is powered now by electricity.⁶⁴⁷

How the steam-powered coining press worked

The whole team at the Soho Mint was involved in the huge technological advances made there. Various engineers including Peter Ewart, William Murdock, John Southern, James Watt, James Lawson and Boulton himself set up the equipment, along with workers such as John Peploe and Joseph and William Harrison. Joseph Harrison had been in charge of the mint set up in London to make the Sumatran coinage in 1786. Specialist blacksmith Anthony Robinson, under the direction of John Busch, was responsible for making the screws for the presses which were cast roughly elsewhere.⁶⁴⁸ But, if Boulton had actually obtained the regal contract as he had expected in 1788 or 1789, he would not have been sufficiently prepared. Various early orders were important in gaining experience of coining and allowing modifications of the steam-powered press, which was eventually used for large coinage orders for the British government and for the East India Company.

⁶⁴⁶ David Vice and Richard Doty have disputed when the layer-in was introduced. The Conder Token Newspaper Volume 1 No 3 15th Feb 1997 and Volume 1 No 4 15th May 1997.

⁶⁴⁷ Information from visit to the Royal Mint. 23 Nov 2009.

⁶⁴⁸ *'You must therefore get a Proper Wood Pattern made for to Cast the Brass female Screw from by Dearman or Wilkinson & four of them should be Cast on a Core. And then bored straight and true and then given to Anthony Robinson to turn out the Screw and also the Blank male Screw should be given to him to turn.'* MS 3782-13-36 Item 58 MB (London) to MRB (Soho) 4 June 1791; *'Mr Bush must give Anthony all the Particular directions about the Turn of the Male Screw & must attend it as much as he can.'* MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 June 1791. Later parts from this mint, including 3 tin stamps, 2 pewter burnishing wheels, a crank for a lathe, and a lathe were sent to Soho. *'But have so little room for lumber here, I thought best to send them down being articles so much in use with you they will surely pay carriage.'* MS 3782-12-59 Item 21 Richard Chippindall (London) to John Hodges (Soho) Redirected to MB 27 Jan 1790.

Boulton was able to produce mint machinery that others found difficult to replicate and his coining technology was exported throughout the world.⁶⁴⁹

Full descriptions of the various incarnations of the Soho Mint were written by Ewart, Lawson and Southern in 1810 at Matthew Robinson Boulton's request.⁶⁵⁰ Many experiments were carried out to impart motion from the steam-engine to the fly of the coining press and thus to provide power for the blow on the die. The equipment was modified many times. Ewart recollected that when he first came to Soho in August 1788 the first design had a horizontal rod connecting the presses in rows, with '*the strokes of the presses produced by the alternate opening & shutting of the communications of the air pump with the engine & with the atmosphere.*' He thought the idea was Murdoch's. He himself claimed only the idea of varying the force of the blow and designing a catch to prevent the press from going into gear at the wrong time.⁶⁵¹ The ingenuity of Boulton's planning is manifest here as the engine was not only to work the sliding rods but also to turn the scouring barrels, and sawdust could be dried on top of the hollowed out boiler.⁶⁵² James Lawson, who later installed Boulton's new steam-powered coining apparatus at the new Royal Mint on Tower Hill in 1810, began to assist at the mint in September 1788.

⁶⁴⁹ The export of mint machinery from Soho Mint has been discussed by Doty and will not be covered here. R. Doty 'The Industrialisation of Money' in: M.M. Archibald, M.R. Carrell (eds.) (1993) *Metallurgy in Numismatics* 3, Royal Numismatic Society Special Publication 24, London.

⁶⁵⁰ Minutes were made at a meeting of the Soho team in January 1810. This was possibly intended by Matthew Robinson Boulton to be used for a memorial about his father's work, but this was never produced. MS 3782-13-120 Mint Inventions and Improvements 7 Jan 1810.

⁶⁵¹ Ewart left Soho Mint in 1790. MS 3782-13-120 Folder 4 Peter Ewart to John Southern 12 Dec 1809.

⁶⁵² The plan shows a curved site with coal vault at the side. A note on the bottom '*The engine 16 inch lb = 8 Horse is not only to work the 2 slideing horizontal rods but must also turn 2 or more scouring barrels & the Sawdust to be dried on the top of the boiler which may be made hollow instead of round to hold it*'. In pencil under: '*to work also 1 small pump to work 4 turn barrels.*' MS 3147-5-714 a Plan of Soho Mint 1788-1789.

He recollected being shown some samples of Droz pattern coins in Cornwall, and that the sliding rod connected to the condenser had already been abandoned before he came to work on the mint.⁶⁵³

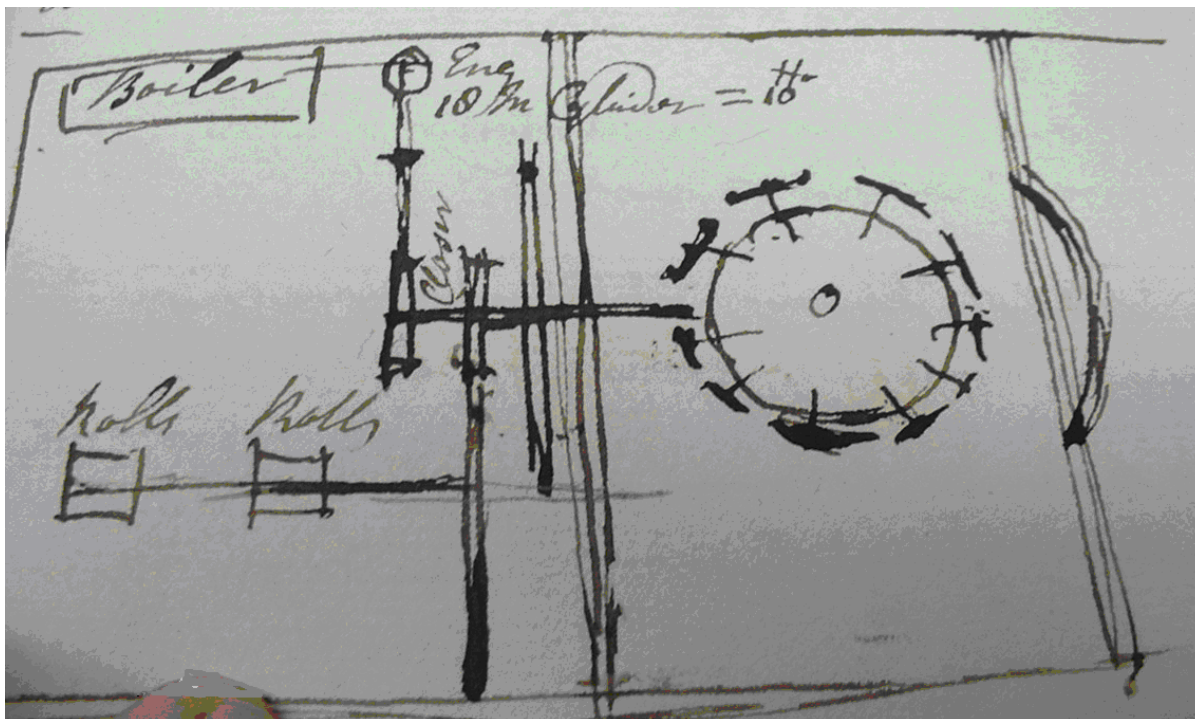


Figure 3.20: Sketch of coining press and engine plan from Boulton's notebook⁶⁵⁴

By November 1788 there were major changes in the layout of the coining apparatus. The steam-engine drove a horizontal and then a vertical shaft, via a 'sun-and-planet' crank, which moved a flywheel above eight coining presses arranged in a circle.⁶⁵⁵ The blow on the screw press was made by a weight falling when a curved arm reached a certain point. The horizontal flywheel eventually worked when modified by Watt's suggestion to

⁶⁵³ MS 3782-13-120 Folder 5 Mint Inventions: Memorandum by James Lawson 27 Nov 1809.

⁶⁵⁴ MS 3782-12-108 Item 54 Mint Book 1789 p 22.

⁶⁵⁵ G. Demidowicz in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 122-123

reverse the action of curves.⁶⁵⁶ Like Ewart, Lawson remembered the series of experiments which were carried out to make the presses work and Watt's suggestion:

*I perfectly recall both Bouch & Joseph Harrison were with us ie your father & Mr S[outhern] in the tower shop under Bouch's first shop. I further know that the wooden arm was my suggestions – and many iron ones were broke before it was adopted. This plan was after many expts adopted --- and continued to be improved by making a loose Arm & air pumps instead of Weights --- this was chiefly in the year 1789 & 90.*⁶⁵⁷

The weights were replaced by air pumps from at least April 1789. In writing to Watt Boulton explained:

*I find from experience that I must work my coining press with air pumps & apply the great wheel to wind them up by which means I can reduce my blow to a certainty whether the engine goes fast or slow & I have reversed the curve on the fly bringing the stroke nearer the centre & ending it at the extremity of the fly with a contrivance to make the balls approach or recede from the centre of the press & thereby adjusting the time of the vibration of the fly so exactly that the Cam will catch the Curve in the right place & the right time & thus the fly will work as fast as gravity & nature will allow & that without bringing it to stop and to catch at each stroke.*⁶⁵⁸

⁶⁵⁶ Peter Ewart recalled: 'After many trials I very well recollect Mr Watt coming into the Mint on a Sunday morning & reconsidering the plan, to be reversed by removing Presses from the wheel to the arm of the press and by fixing a curve upon the wheel which were turned contrary way round, would elevate the press & the blow was to be made by the descent of two weights.' MS 3782-13-120 Folder 4 Peter Ewart to John Southern 12 Dec 1809.

⁶⁵⁷ Mint Inventions: Memorandum by James Lawson MS 3782-13-120 Folder 5 27 Nov 1809.

⁶⁵⁸ MS 3147-3-13 Item 5 MB (Soho) to James Watt (London) 1 Apr 1789.

This shows that Boulton had engineering and technical skills himself, as well as leading the team who set up the mint apparatus. He is not often credited with such skills by modern authors.⁶⁵⁹

Lawson wrote that the first press was

*got to work sometime in the year 1789 & the others followed as fast as they could be made. At this time we were all schemers & one press was made with contrivances by Joseph Harrison, another by Mr Busch, and also by Mr Droz and myself. That by Mr Droz never worked, and that by Mr Harrison did not work well and was altered but those called Busch's & mine were long worked together as rivals.*⁶⁶⁰

A patent was granted in August 1790, and describes with the aid of a detailed diagram how the coining press works. The diagram shows the circular arrangement of the eight coining presses.

⁶⁵⁹ Jim Andrew discusses Matthew Boulton's technical ability in: 'Was Matthew Boulton a Steam Engineer?' in M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 108-115.

⁶⁶⁰ MS 3782-13-120 Folder 5 Mint Inventions: Memorandum by James Lawson 27 Nov 1809.

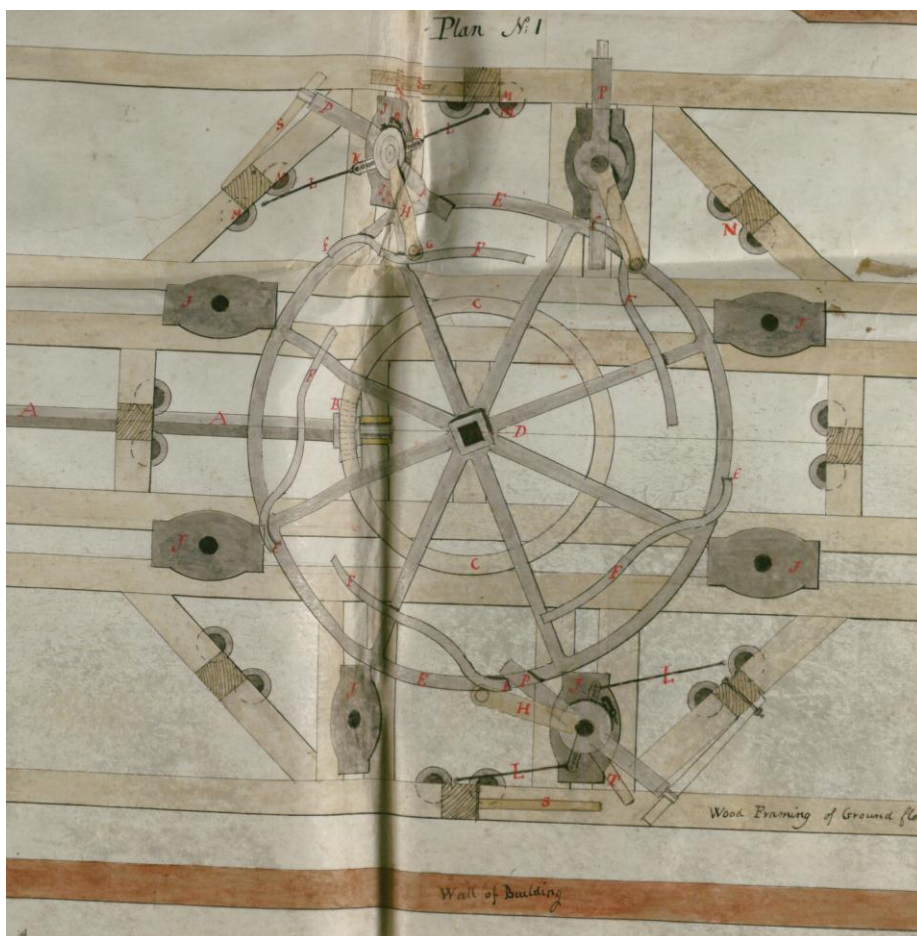


Figure 3.21: Diagram of coining press arrangement from 1790 patent application⁶⁶¹

By spring 1791, as there seemed to be plenty of orders as seen in Appendix 1, it was decided that the Mint should be modified and a new building erected.⁶⁶² Boulton was convinced that expansion was essential as *'I have blanks ordered, as well as Coined pieces & I must Coin 4 Ton per Day.'*⁶⁶³ Contracts may possibly have been expected from the French government or from America, which did not materialise, but a contract for the Monneron brothers of Paris was received, as described in the catalogue. Eighteen detailed resolutions were sent to Boulton's moneying committee consisting of Zaccheus Walker,

⁶⁶¹ Coining apparatus patent specification for *The Application of Motive Power to Stamping and Coining* (Patent Number 1757) MS 3782-17-2 5Aug 1790.

⁶⁶² *'For I want the East India order done by Oct next; 2nd the 16 ton of Anglesey done in one month; 3rd one two or three tons of Southampton directly and then 24 ton of halfpence about 39 to ye lb every week for one year.'* MS 3782-13-36 Item 58 MB (London) to MRB (Soho) 4 Jun 1791.

⁶⁶³ MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 Jun 1791.

James Lawson and Matthew Boulton Junior, who was now twenty one and fully involved in the business. Boulton described how the rooms should be arranged, how the metal should be rolled, cleaned and dried by two shaking frames and double brushes, how the dies should be forged, engraved and so on.⁶⁶⁴ Glover was to ‘*drive on with the building 2 stories high from as near the end of the Mint yard.*’⁶⁶⁵

Further details and plans were sent in June.⁶⁶⁶ Boulton wanted a carpenters shop, counting house, store room and ‘*2 Necessary Houses & Coal Vaults*’ plus a smiths shop and a room for four coining presses and room for shaking machines. He also specified that spring water should be used in the pickling shop to clean blanks, rather than canal water, ‘*which will not tarnish the bits so bad as the canal water in which AF. [Aqua fortis; i.e. nitric acid], & all sorts of nastyness hath been mixed in it.*’ It was also suggested that the Lap Engine was removed to the Mint.⁶⁶⁷ When all these improvements were made, all the processes of coining could be done in one building, except for the rolling of the metal.

By September, Boulton was already thinking of further improvements to his Mint, so that he could make small coins more easily. He wrote:

*I wish I had one of Williams presses mount with such a Fly as to be able to make
100 Blows per minute. The screws of the Large presses are too large in diameter*

⁶⁶⁴ MS 3782-13-36 Item 54 Resolutions on the Mint sent from MB to MRB 26 May 1791.

⁶⁶⁵ MS 3782-13-36 Item 58 MB (London) to MRB (Soho) 4 Jun 1791.

⁶⁶⁶ ‘*The yard should be left about 14 feet wide, I think the Shops may do if they are 13 ½ ft inside clear wide & the walls may be thick at the foundation to one foot above ground & then 9 inches thick will do for the front & the Cross walls.*’ MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 Jun 1791.

⁶⁶⁷ ‘*If the Lap engine was remov’d to the Mint then I could fix all the turning Lathes over the Shaking shop & fix a larger circle of cutting out presses in the present smiths & turning shop by continuin the axis of ye Sun Wheel under the Centre of the great fly of Coining Mill. When the Shakeing is removed to the Mint then the present Shaking Shop may be taken for the Scouring of the Metal and the double Brushes.*’ ‘*The Mint Engine should not be less than 12 Horse or the Lap Engine less that 15 or 16 Horse.*’ MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 Jun 1791.

*to admit of that speed but if they were ¼ smaller in diameter and worked with a short light fly without collars I think 100 or 105 blows per minute might be accomplished & then I could undertake to make the very small India or very small French money.*⁶⁶⁸

Boulton was looking ahead to future orders and had an appreciation of what would be marketable. He also included details of obtaining staff:

*I must have 16 persons for the 8 Coining presses & therefore I must beg of Mr Tyson if he is return^d to spend a few days at Handsworth, Bromwich, Smethwick, Litchfield, Yoxall or where ever he thinks some uncorrupted boys from 14 to 20 years of age can be found Make my Comp^{lts} to him & to Mr Scale & beg their assistance & advice in respecting the aforesaid & likewise an addition of 8 or 10 Cutters out for I had rather have too many than too few.*⁶⁶⁹

The difficulty in finding and retaining sufficient experienced workers for the Soho Mint is dealt with in a forthcoming publication.⁶⁷⁰

A further series of letters detail the progress made in January 1792. This new mint was being used for the Monneron coinage but the large five sol pieces were giving problems as they were ‘*too wide for the other Machines.*’⁶⁷¹ The chief delay was caused by ‘*adjustments of the layer inn spring collers which Bu[s]ch has now got in good order and they go at present very well.*’⁶⁷² A third press was installed by 23rd January 1792.⁶⁷³ A lot

⁶⁶⁸ MS 3782-13-36 Item 87 MB (Truro) to MRB (Soho) 15 Sep 1792.

⁶⁶⁹ MS 3782-13-36 Item 60 MB (London) to MRB (Soho) 7 Jun 1791.

⁶⁷⁰ S. Tungate (forthcoming) *Workers at the Soho Mint* in: Sally Baggott and Ken Quickenden (eds.) *Matthew Boulton-Enterprising Industrialist of the Enlightenment*.

⁶⁷¹ MS 3782-12-66 Item 22 and 23 James Lawson (Soho) to MB (London) 21 Jan 1792; 23 Jan 1792.

⁶⁷² MS 3782-12-66 Item 21 James Lawson (Soho) to MB (London) 20 Jan 1792.

⁶⁷³ The great wheel which powered the presses was stopped in order to install a third press which was completed by 23rd January. MS 3782-12-66 Item 22 and 23 James Lawson (Soho) to MB (London) 21 Jan 1792; 23 Jan 1792.

of accidents and failures of equipments were reported but each incident led to improvements in the coining process; the use of recoil air pumps were used to lessen destruction caused by the blow of the coining press, but also saved power.⁶⁷⁴ However, the new press was not really required as the Monneron coinage came to an end by January 1793 when war with France broke out.⁶⁷⁵ Apart from 1794 when over 22 million coins were made for the EIC Bombay and Madras settlements, Boulton had no large coinage contracts until 1797. He did make several token issues, plus medals and items for collectors, and a small issue for the ‘Gold Coast’ as discussed in chapter four.⁶⁷⁶ A final snapshot of this incarnation of the Soho Mint is seen in an inventory taken in August 1795 which showed a cutters shop, polishing shop, soldering shop, mounting shop, leather room, warehouse, counting room, reading room and dye [die] room on the premises.⁶⁷⁷

After the national coinage contract was gained in 1797, Boulton decided to build yet another version of the Soho Mint, housed in a broad curving building which stood lower than the original. An order for mint apparatus bought between October 1798 and October 1799 came to over £300, and more expenses would be involved in the actual building.⁶⁷⁸

It was useful that Matthew Robinson Boulton was able to collect the premiums owed for

⁶⁷⁴ ‘Accidents such as chains breaking, air pump arms breaking, pulleys heating & flying to pieces, in short, almost everything trifling though hindering accident has happened that might have been expected of an entire new machine. The force is so great that the parts have failed partly from that cause and again others from causes not discovered.’ MS 3782-12-66 Item 65 John Southern (Soho) to MB (London) 30 Jan 1792.

⁶⁷⁵ Famine followed feast, and soon there was insufficient private coinage business to keep the complete mint building fully occupied. The Latchett Company, run in conjunction with James and Benjamin Smith, took over some of the unoccupied mint buildings around 1793-4. G. Demidowicz in M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* p 125.

⁶⁷⁶ Details of what was made can be seen in the time line, Appendix 1.

⁶⁷⁷ MS 3782-3-14 Mint day Book 1795-1798 August 1795.

⁶⁷⁸ The bill for mint apparatus ordered from Boulton and Watt between October 1798 and October 1799 came to £314 12s 10d and included items such as large air valves, pipe for cutting out press, shoe stove, variety of pins, nuts, hooks, chains, spanners, springs for exhaustion rod, sheets of iron, solder, brass cranks etc. The final page lists the more expensive items which include turning valves, drilling and fitting pumps. MS 3792-13-120 Folder 6.

steam-engines as discussed in chapter two. But Boulton had the foresight to realise that he could not rely on the apparatus set up ten years earlier, as it did not incorporate the latest ideas in coining technology. He also wanted to make the presses more efficient. John Southern, back at Soho after a tour promoting the 1797 coinage, was in charge of the new mint.⁶⁷⁹

An entirely new method of working was installed in the 1798 Soho Mint, as the coining presses were worked in line by pistons and cylinders attached to a vacuum tube, known as a 'spirit pipe,' Levers connected with a hollow elongated cast-iron 'trumpet', broad side down, attached to the top of the screw and fly of the press. The motion of the pistons downwards was due to the expansion of air let into a partial vacuum, which imparted motion to each coining press screw. A heavy balance beam returned the screw to the upper position and reduced the violence of the recoil, as it was connected to another small piston and cylinder.⁶⁸⁰ Southern claimed that he had suggested the idea of vacuum pumps in 1789, and produced a letter from Boulton in support of this.⁶⁸¹ Lawson agreed that the idea had been mentioned but said too much had been invested in the original plan so no changes could be made until the new mint was built in 1797-8. However he could not remember who suggested the matter: *'Mr Southern, Mr Ewart or myself at the time never thought of whose scheme it was – We were however all convinced it would have been the best and I should think some sketches may be found among the old Mint schemes in the*

⁶⁷⁹ John Southern worked at Soho in charge of the drawing office from at least 1788 till his death in 1815.

⁶⁸⁰ G. Demidowicz in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* p 127.

⁶⁸¹ *'I approve of the plan you have suggested for working of coining presses by means of a partial vacuum. I am willing to be at the expense of trying one machine made under your direction and if upon trial it shall appear to your and my judgment to be a better mode of working coining presses than that which I now practise; I in that case offer to purchase of you the said invention and to pay you five hundred pounds for the same exclusive of my promise to allow you one hundred pound a year for your occasional attention and superintendence of all my coining machinery.'* MB to John Southern 17 Jan 1798, included in Southern's statement. MS 3782-13-120 Folder 3 4 Jun 1810.

end of 1789 or 1790.⁶⁸² Lawson said that: ‘I left the Mint in 1792, no more coinage then being wanted, and being seldom at Soho I knew nothing of Mint concerns, except going into the Mint on my visiting Soho at the time the first money for Govt was making.’⁶⁸³

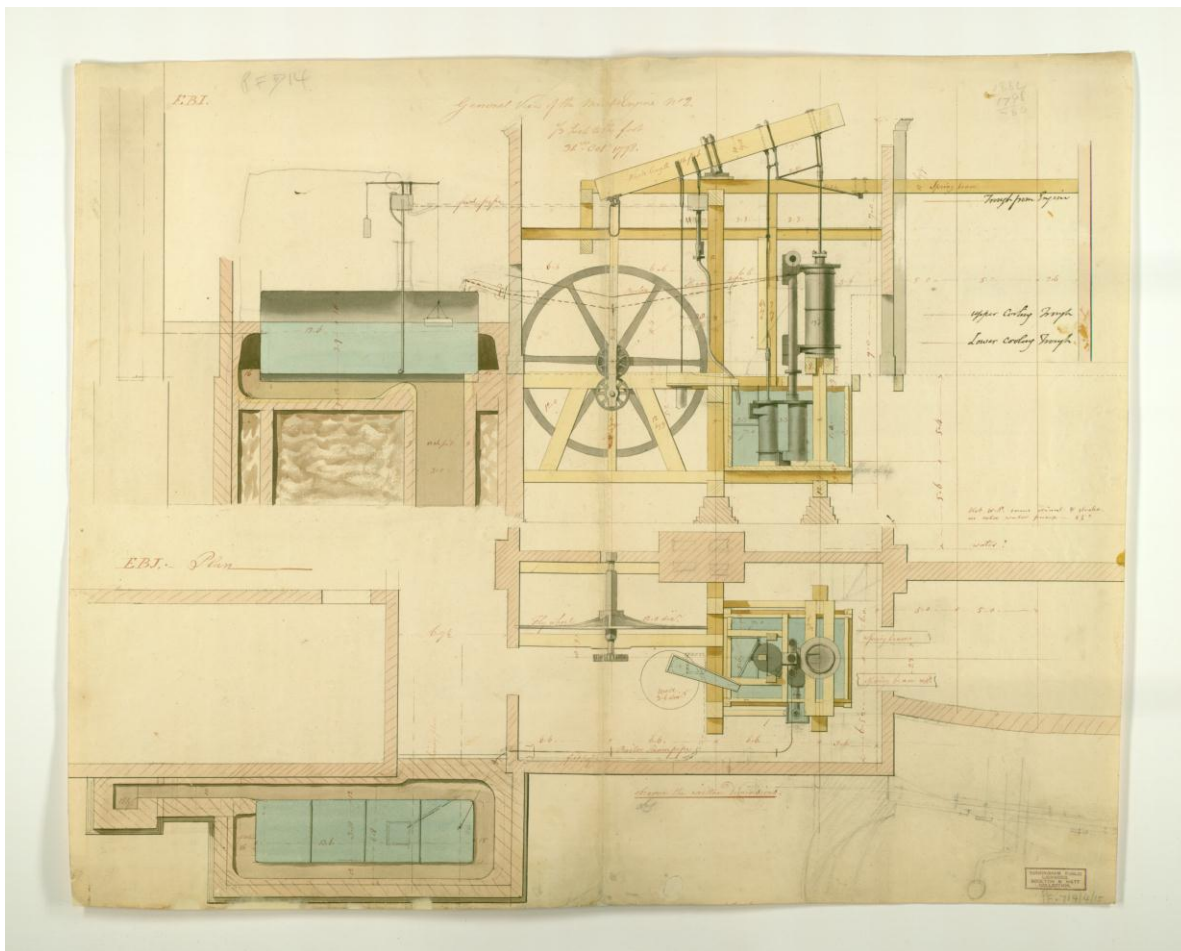


Figure 3.22 1798 Plan of Mint engine⁶⁸⁴

The original 1798 Mint plan did not allow enough room for the coining presses and so was modified.⁶⁸⁵ Cheshire reported on progress in April: ‘the cutting-out machinery will

⁶⁸² MS 3782-13-120 Folder 4 Mint Inventions 1809 Lawson (London) to MRB (Soho) 12 Dec 1809

⁶⁸³ MS 3782-13-120 Folder 5 Mint Inventions: Memorandum by James Lawson 27 Nov 1809.

⁶⁸⁴ MS 3147-5-714-4-10 31st Oct 1798 Plan of mint engine; reproduced courtesy Birmingham Archives and Heritage.

⁶⁸⁵ Southern wrote in April 1798: ‘By the sketch of the proposed new mint it appears you have designed 8 presses to be put but allowing 6 feet 6 for each (which gives 51 feet) there will not be room (that being barely 50) and I think you will want a road between some two to get behind them to fetch away the money.’ MS 3782-12-66 Item 90 John Southern (Soho) to MB (London) 25 Apr 1798.

*be compleated this afternoon ... Mr. Busch has just set two presses to work on 2d pieces, and is ready to begin the penny pieces as soon as they can be brought forward.*⁶⁸⁶

Building continued slowly during the summer but was not complete in November 1798 when Boulton requested a new doorway and windows.⁶⁸⁷ Southern, worried about industrial espionage, reminded him that the spirit pipes were intended to be put in that position but suggested alternative routes.⁶⁸⁸ A fortnight later he sought reassurance: *'My wish is to put down the spirit pipes and the pumps before the erection of the engine is completed but that will in some degree expose the latter (the pumps) to the people concerned in the erection of the engine.*⁶⁸⁹ The new presses could strike faster than the old ones but in addition were quieter and more efficient.⁶⁹⁰ By February 1799, Boulton, who had been busy with court actions over steam-engine patent infringements, was able to tell his old friend Sir Joseph Banks of his victory in the case and at the same time report that:

*I have now finished & set to work the Leviathan which turns out to be equal in perfection to all my hopes, wants & wishes. You will probably remember that my first Coining machine struck about 42 pence per minute with each press & made an unmusical noise. The present works 60 pence p[er] minute p[er] press & is perfectly silent. I declare it to be a beautyfull harmonious simple & perfect Machine.*⁶⁹¹

⁶⁸⁶ MS 3782-12-59 Item 166 William Cheshire (Soho) to MB (London) 18 Apr 1798.

⁶⁸⁷ MS 3782-12-59-172 William Cheshire (Soho) to MB [London] 6 Aug 1798.

⁶⁸⁸ *'I beg to remind you that the spirit pipes were intended to be taken in there and if that intention be maintained, the door had better be left and made up after the pipes are put in. But if you think the pipes could be brought with sufficient secrecy into the yard between the old mint and the shaking shop) the distance would be much shorter.'* MS 3782-12-66 Item 91 John Southern (Soho) to MB (London) 8 Nov 1798.

⁶⁸⁹ MS 3782-12-66 Item 92 John Southern (Soho) to MB (London) 21 Nov 1798.

⁶⁹⁰ MS 3782-12-59 Item 182 William Cheshire (Soho) to MB (London) 22 Feb 1799.

⁶⁹¹ MS 3782-12-56 Item 96 MB (Soho) to Sir Joseph Banks (—) 1 Feb 1799.

Boulton was exaggerating a little about the silence of the machine, but it was certainly an improvement on anything that had gone before. Four new presses were operating successfully by April and all eight presses on 1st May 1799.⁶⁹²

Banks had been a great help with the regal coinage contract, being a member of the Privy Council Committee on Coin as discussed further in chapter four. Five months later Boulton was able to write with pride to his son, who was in Cornwall collecting the steam-engine premiums owed:

*I expect Lord Hawkesbury (the present master of the mint) at Soho tomorrow with some others of the P[rivy] Council to dinner. They come down expressly to see my new mint which is singularly beautiful and in high order; eight presses have struck 40,000 pieces of money of 1 inch diameter (which is rather larger than a guinea) per hour and in other respects is the ne plus ultra of coining.*⁶⁹³

Further contracts were made for the government in 1805 to 1807, and Soho Mint was to provide the machinery to re-equip the Royal Mint with new technology.⁶⁹⁴ The team at Soho had solved most of the technological problems of coining, and was able to produce five hundred million coins for various contracts in the next ten years.

⁶⁹² Southern reported: 'all the 8 presses have been at work together for a considerable time this morning, 6 on pennies, 1 on halfpennies, 1 on farthings. The farthings at 72 per minute, the ½ pence at upwards of 60 but the balls for this press are not yet finished so that we have temporary ones only. The engine at 19 strokes per minute worked all these together and we had spare blast.' MS 3782-12-66 Item 101 John Southern (Soho) to MB (London) 1 May 1799.

⁶⁹³ MS 3782-13-36 Item 140 MB (Soho) to MRB (at Mr Thos Wilson, Truro) 7 Jul 1799.

⁶⁹⁴ This included a rotative engine, eight coining presses and twenty four layers-in, twelve cutting out presses, six double milling machines, iron work for four annealing furnaces for annealing blanks, press and apparatus for multiplying dies, iron work for six furnaces for annealing and hardening dies, two lathes for turning dies, and a steam apparatus for warming the coining room. Details of the Materials, Machinery to be furnished by Matthew Boulton for the Establishment of a Mint. MS 3792-13-120 Mint Inventions and Improvements Volume 1.

Summary to chapter three

Research for this thesis has shown that credit for the improvements in many areas of coining technology in the eighteenth century was due to Matthew Boulton. He was responsible for most of the technological advances at Soho Mint and this led in turn to improvements in coining practises throughout the world. He set up a completely new project despite many set backs, including unpredictable events such as the madness of George III, the French Revolution and war. He survived lack of orders, problems with copper supply and difficulties with engravers. He trained a team of engineers and technicians in a completely new technology and succeeded in producing over 600 million coins for countries throughout the world.

All members of the Soho team admired Boulton's skills as a team leader and manager acknowledging that *'the first idea of applying the power of the steam engine to the purposes of coining originated with Mr Boulton.'*⁶⁹⁵ Southern also said that all improvements in *'making & hardening dies and in annealing were MB's own.'*⁶⁹⁶ Both Ewart and Lawson commented that without Boulton's perseverance the Soho Mint would not have succeeded. Lawson concluded: *'no one I have ever known has had that continued & unwearied Perseverance to accomplish the object as your Worthy Father.'*⁶⁹⁷ This was repeated in his memoir of Matthew Boulton for his son: *'to the great perseverance of your Father everything is to be attributed.'*⁶⁹⁸

⁶⁹⁵ Minutes were made at a meeting of the Soho team in January 1810. This was possibly intended by Matthew Robinson Boulton to be used for a memorial about his father's work, but this was never produced. MS 3782-13-120 Mint Inventions and Improvements 7 Jan 1810.

⁶⁹⁶ MS 3782-13-120 Mint Inventions and Improvements 7 Jan 1810.

⁶⁹⁷ MS 3782-13-120 Folder 4 Lawson (London) to MRB (Soho) 12 Dec 1809.

⁶⁹⁸ MS 3782-13-120 Folder 3 James Lawson to MRB (Soho) 30 April 1810.

Peter Ewart summed up for all of them in attributing the success of the Soho Mint to Matthew Boulton and wrote:

He possessed above all other men I have ever known the faculty of inspiring others with a portion of that ardent Zeal with which he himself pursued every important object he had in view, and it was impossible to be near him without becoming warmly interested in the success of his enterprises.

Ewart also attributed many of the technological improvements to Boulton:

His judgement in the selection of objects to which machinery might be applied with the greatest advantage & in suggesting not only the leading points, but the subsidiary part also, to which the chief attention ought to be directed, was most conspicuous; and amidst a variety of different plans for attaining the same object, he had a quick perception of that which was most likely to succeed, and great promptitude in his determination to carry it into effect. In none of his enterprises were these qualities more conspicuous than in the prosecution of his favourite object, the bringing to perfection the Mint Machinery.⁶⁹⁹

Boulton's experience in the many related areas of metal manufacture, including die-making, and the selection and treatment of the correct metal for coins was important in improving the technology of coining. His leadership skills and determination to succeed enabled him to change minting practises, and export them around the world.

⁶⁹⁹ Ewart continued: *'The urbanity of his manners and his great kindness to young people in particular, never failed to leave the most agreeable impression on the minds of all around him; and most truly may it be said that he reigned in the hearts of those that were in his employment. ...In other hands, and without his unwearied perseverance, which was only increased by the obstacles he had to surmount, that machinery would probably never had arrived in the state it now is.'* MS 3782-13-120 Folder 5 Mint Inventions Peter Ewart (Manchester) to MRB (Soho) 9 Nov 1809.

CHAPTER FOUR: TRANSPORT, CUSTOMERS AND DESIGN

Matthew Boulton and the team at Soho Mint issued over one hundred and fifty designs of coins, tokens and medals in different languages for customers in more than twenty countries. This meant that he had a huge influence around the world on both the design and the techniques of coining. In order to do this, metal had to be transported to Birmingham, and completed pieces to their final destination. This chapter uses the records in the Archives of Soho to detail what was made at the Soho Mint, when and where pieces were sold, and how they got to the customer. No overall survey has previously been carried out to see what influence Boulton had on the design of the large range of products of the Soho Mint. In addition to the large coinage orders for the East India Company and the British Government, Soho Mint produced tokens for British customers, coins for other foreign countries, and around sixty medals with some excellent designs. In addition the efficient distribution of regal coins and other issues complemented the technological improvements at Soho Mint, and illustrates Boulton's managerial abilities.

This chapter seeks to analyse how commissions were sought and how objects were designed, and to clarify the nature of the market for Soho Mint products. It explores the economics of the mint which depended not only on the costs of copper and striking the coins, as discussed previously, but also on the added costs of transport, and administration including taxes, port fees, customs, wharfage, and clerical work such as writing letters, dealing with invoices and bank drafts. Not only did the mint workers have to be paid, but also the designers and engravers. The whole affair needed an efficient

approach to administration, especially considering the Soho Mint operated mainly during wartime. This chapter will consider how Boulton dealt with all these problems.

Transport, that is how orders, raw materials and coins were moved, rather than distribution in general, has not previously been considered an issue in connection with coining but was an important consideration in the overall running of the Soho Mint. I will consider what problems could be encountered en route. The main purpose in establishing the Soho Mint was to obtain a regal coinage contract, but until this contract appeared, Boulton had to seek alternative work for his mint. This involved a variety of tactics which will be discussed in this chapter. Designs had to be made, and approved by the customer, and had not only had to satisfy aesthetic aspects but also incorporate the practical needs of coining.⁷⁰⁰ In addition to his metallurgical and technological skills discussed in chapters two and three, Boulton was also interested in both the artistic and the technical aspects of coins. I will discuss how designs were decided and the sort of issues involved. Details of individual items have previously been considered by Symons and others.⁷⁰¹ I will discuss his influence on other engravers, and on coin designs world wide. A list of what was made can be seen in the time line in Appendix 1, with details of amounts produced in Appendix 3.

⁷⁰⁰ This topic has been discussed in a previous publication. S. Tugate (2009) 'Technology, Art and Design in the Work of Matthew Boulton: Coins, Medals and Tokens produced at the Soho Mint' in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 185-200.

⁷⁰¹ D. Vice (forthcoming) *A Numismatic History of Soho Manufactory and Mint 1772-1850* British Numismatic Society Journal, special publication; D. Symons (2009) in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires*; R. Doty (1998) *The Soho Mint and the Industrialization of Money* British Numismatic Society Special Publication No 2 London.

Transport

Transport issues were vital to the running of the Soho Mint, not only for obtaining raw materials and distributing the finished products, but also for maintaining the networks by which Boulton obtained his orders. As discussed in chapter one, from the 1760s, Boulton had cultivated good relationships with local aristocracy, members of parliament and royalty. He had had many contacts with British ambassadors, such as Lord Cathcart who went to Russia, William Hamilton, ambassador to Naples from 1764 -1800 and others, plus foreign ambassadors to Britain such as Moussin Pushkin and Count Woronzow.⁷⁰² These connections, and those with trading companies such as the Honourable East India Company, were actively pursued by Boulton, in search of commissions. His ability to maintain his network of contacts was helped enormously by improvements in the postal system. Until 1784 the mail was robbed regularly, and it would take at least three days for a letter to reach London from Birmingham. John Palmer of Bath organised a faster and more reliable system, and by the 1790s it was possible to receive post daily from London, taking around sixteen hours per trip.⁷⁰³ Soho Mint actually provided tokens for Christopher Ibberson which advertised ‘MAIL AND POST COACHES TO ALL PARTS OF ENGLAND’ as described in the catalogue.

A regular daily box was sent by the mail-coach to Soho’s London agents, taking letters, drafts and small orders such as medals.⁷⁰⁴ This meant that Boulton was able to respond quickly to satisfy his customers. Regular letters were sent to and from his agent, Thomas

⁷⁰² List of patrons. N. Goodison (1974; 2002) *Matthew Boulton Ormolu* pp 404-426.

⁷⁰³ Palmer’s solution was a special mail coach with armed guards, and he became Controller General to Post Office by 1786. A.F. Amann (1985) *John Palmer and His Mail Coach* Seaby Coin and Medal Bulletin April 1985 no 799 p113
Thomas Mynd, Boulton’s brother-in-law, manufacture a token to celebrate the establishment of the Mail coach. H.A. Parsons (1905) *Mail Coach and its Halfpennies* British Numismatic Journal Volume 2 (1905) pp 359-68.

⁷⁰⁴ Many examples can be seen in the Archives of Soho, especially in Boulton’s correspondence.

Wilson, in Cornwall. In 1787 Zaccheus Walker, Boulton's warehouse manager and brother-in-law, informed him that '*an Express from Birmingham will be in Truro in 48 hours*'.⁷⁰⁵ This was a great improvement in postal delivery, as it still took Boulton personally at least five days to get to Cornwall.⁷⁰⁶ He kept up a correspondence with individuals such as Wilkinson, Williams and Banks, and was able to arrange meetings with them regularly in Birmingham, Cornwall, London and elsewhere. Similarly he retained a regular contact with members of the Lunar Society.⁷⁰⁷ Post could also be received from the Continent, as Boulton noted in his 1786 diary '*the pack[et]s with mail sets out from Calais every Wednesday and Saturday to England*'.⁷⁰⁸ Surprisingly even later during the Napoleonic wars, the links with continental Europe were maintained, at least until Boulton ceased active involvement with the Soho Mint.

Through a widespread network of agents Boulton was able to communicate with places as far apart as India, Sumatra, Russia, France, the United States and Canada despite the problems caused by war, as can be seen from the list of products made at Soho Mint seen in Appendix 1. He was able to respond to a global market for coins and, eventually for coining machinery. Much correspondence and book keeping were required when considering a contract made in a foreign market. Restrictions on trade, exchange rates and competition from rival concerns had to be considered as well as the credit worthiness of foreign agents and factors. There was also the clerical work involved in translation of

⁷⁰⁵ The letter would travel at '*6 miles per hour. Reckon distance at 260 miles as they take the nearest Post Road. Costs £3 15 and needs an hour notice.*' MS 3782-12-74 Item 132 Zaccheus Walker (Birmingham) to MB (Soho) 5 May 1787.

⁷⁰⁶ Boulton details various journeys in his diaries. MS 3782-12-107-14-16 Boulton's diaries 1786-1788.

⁷⁰⁷ The Archives of Soho provide evidence of correspondence with many individuals. Members of the 'Lunar Society' are discussed in Uglow's publication. Jenny Uglow (2002) *The Lunar Men: Friends who Made the Future* Faber and Faber, London.

⁷⁰⁸ MS 3782-12-107-14 Boulton's 1786 Diary.

letters. Boulton had several clerks who were able to speak and write in a variety of languages.⁷⁰⁹ This is indicative of the sophistication with which Boulton worked.

Communications had been gradually improved during the eighteenth century due to increasing prosperity.⁷¹⁰ There had been more investment in projects, including roads, shipping and canals, and Boulton was interested in all aspects of transport, including ballooning.⁷¹¹ It was costly to move goods overland, and difficult, due to the state of the roads.⁷¹² One of the reasons that Boulton had been instrumental in establishing the Birmingham Assay Office in 1773 was so that valuable goods from his Soho Manufactory would not be damaged in transit to and from the assay office at Chester.⁷¹³ He had campaigned with others for improved turnpike roads, but despite progress, the cost of land transport remained high.⁷¹⁴

Boulton himself travelled extensively in the 1780s while simultaneously trying to sort out the problems of the Cornish copper industry and attempting to gain a regal coinage contract. In 1786, he was in London between February and May and then travelled to

⁷⁰⁹ MS 3782-12-75 Item 3 Zaccheus Walker (Birmingham) to MB (London) 7 Jun 1790.

⁷¹⁰ By 1777 there were 52 coaches, each carrying six passengers, from Birmingham to London per week, with 16 to Bristol, and 4 to Sheffield. M.J. Wise (1967) *The Influence of the Lunar Society in the Development of Birmingham* University of Birmingham Historical Journal Volume 9; pp 79-93.

⁷¹¹ The first balloon flight in England by Lunardi was on 15th August 1784. W.H. Chaloner (1948) *New Light on John Wilkinson's tokens* Seaby Coin and Medal Bulletin 1948 pp 306-308.

⁷¹² In the mid-eighteenth century it had been cheaper to ship goods to Lisbon by sea freight than to transport goods from London to Norwich by land. E. Hopkins (1989) *Birmingham: the First Manufacturing Town in the World 1760-1840* Weidenfeld and Nicholson.

⁷¹³ S. Baggott (2009) 'Real Knowledge and Occult Mysteris': Matthew Boulton and the Birmingham Assay Office' in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 201-216.

⁷¹⁴ The total expenses for a journey to Bristol in February 1787 for Boulton, Wilkinson and Nehemiah Lloyd were £14 14s. He noted that the journey to Bath cost £4 4s, and that he had paid £2 14s at the Bush Inn in Bristol for John Wilkinson, Nehemiah Lloyd and himself, plus 6s for breakfast and supper, and 5s for other services at the inn, for his horse, the chambermaid, the toll gates and even the purchase of a fish and two pencils. The return journey with John Hurd was cheaper. MS 3782-12-107-15 1787 Notebook 25 Feb 1787.

Cornwall, London again on several occasions, and to Paris.⁷¹⁵ In September 1787, a particularly energetic trip for the fifty-nine year old Boulton involved travelling, in one week, from Birmingham to visit Thomas Williams' copper mine, rolling mills and copper works, and John Wilkinson's iron empire, plus conferring with Lord Uxbridge at Bangor en route.⁷¹⁶ These were important journeys, cementing the relationship between Williams, Wilkinson and Boulton. They were establishing who was to bid for a regal coinage contract, which was becoming vital to the survival of the Cornish copper industry.⁷¹⁷ Immediately after this trip, Boulton spent three days with Droz in Birmingham and returned with him to London on 17th September and was off to Cornwall again by 23rd October.⁷¹⁸ This travelling was also to have a long lasting effect on Boulton's health, as detailed in his letters. The kidney problems, which were to trouble him for the rest of his life, appear to have started while travelling to Cornwall by the new patent mail coach.⁷¹⁹ He was again ill, after attending the Cornish Metal Company Committee.⁷²⁰ He was also unfit for a meeting with Wilkinson and Williams at Soho House in December 1787 and unable to attend a Privy Council meeting with them to decide on the regal coinage

⁷¹⁵ Boulton left London for Birmingham on 8th May; returned to London on 19th May, was back in Birmingham on 24th June; was in London 12th to 18th July, and again on 23rd August. He set out for Cornwall on 29th August from London, arriving on 2nd September. He left Cornwall for home on 12th October, sleeping at Tavistock 13th, Exeter 14th and Taunton 15th October 1786. By the start of November he set off for Paris, arriving at Dover on 10th November 1786 but was delayed by contrary winds until 15th when he arrived at Boulogne. He was at Amiens on 16th, Chantilly on 17th, arriving in Paris on 18th November 1786. MS 3782-12-107-14 Boulton's 1786 Diary.

⁷¹⁶ Boulton left for Broseley, Shropshire on 4th September, went on to Holywell, Flintshire on 5th September. He arrived at Parys Mountain, Anglesey on 7th September and returned to Bersham by 12th September. Notes written by Boulton as a diary and cash book. MS 3782-12-107-15 1787 Boulton's Notebook.

⁷¹⁷ A series of letters detail the riotous state of the miners. MS 3147-3-11 Item 7 MB (Truro) to James Watt (Harper's Hill) 26 Sep 1787; Item 8 29 Sep 1787; Item 11-14 5 Oct, 6 Oct, 7 Oct, 8 Oct 1787.

⁷¹⁸ MS 3782-12-107-15 1787 Boulton's Notebook.

⁷¹⁹ *'The Coach was the most uneasy I ever rode in. I got no sleep & my back hurt. Breakfasted at Wicket Inn, Dined upon Broth at Dorset, my pain increased in my back and at Charmouth I became very ill and vomited & could go no further than Axminster where I was obliged to abandon the coach & go to bed.'* MS 3782-12-107-15 Boulton's 1787 Notebook 25 Oct 1787.

⁷²⁰ MS 3782-12-107-15 Boulton's 1787 Notebook 28 Oct 1787.

contract.⁷²¹ Thus transport issues had a big effect on Boulton personally and indirectly on the future of the Soho Mint.

Apart from transport by road, a lot of goods in the eighteenth century were transported by water as it was much cheaper, and many goods were shipped by coastal vessels and along navigable rivers. By 1758, there were regular trips from Bristol to Bewdley and Bridgnorth along the River Severn. Severn trows could carry 50 tons as this was the limit to be pulled by a horse. Between 1771 and 1786, coastal shiploads increased from between 15-70 tons to 60-95 tons, but sea going ships could be much larger.⁷²² However Birmingham had no river transport nearer than the River Severn, and was many miles away from the sea.⁷²³ Canals were constructed because it was costly to ship heavy goods by land, and the first, the Bridgewater canal, was opened in 1761. This was swiftly followed by others, especially in the Midlands.⁷²⁴ Transport by canal was much cheaper than by land transport. It cost 2s per ton per mile to move coal by mule to Birmingham from the south Staffordshire coalfield, three miles away, before the town was linked to the canal system in 1772. Boulton had been heavily involved in the extension of the emerging canal system to Birmingham, and remained interested in its progress.⁷²⁵ Even

⁷²¹ '9th December 1787. Wilkinson and Williams dined and slept at Soho. Voided 12 stones about ye size of vetches. 11th Dec voided 19 stones like ye last. 12th Dec voided several stones, some larger.' MS 3782-12-107-15 1787 Notebook.

⁷²² The Staffordshire and Worcester canal opened in 1770. This was navigable to Newhall Wharf in Birmingham by 1772. It connected with the Birmingham and Fazeley Canal to Tamworth by 1784 and to the Coventry Canal by 1789. A combined canal company known as Birmingham Canal Navigations (BCN) operated from 1794. S. Holland (1992) *Canal Coins* Baldwin, Cleobury Mortimer.

⁷²³ Navigable rivers included the Avon to Stratford, the Severn to Bridgnorth, the Thames to Oxford and the Trent to Burton. M.B. Rowland (1975) *Masters and Men in the West Midlands Metal-ware Trades before the Industrial Revolution* Manchester University Press, Manchester p 99.

⁷²⁴ Boulton started to make a medal featuring Francis Egerton, Duke of Bridgewater in 1803 but it was not completed due to Francis Egerton's death (see catalogue).

⁷²⁵ A public meeting was held on 24th January 1767 in Birmingham, attended by Boulton and a number of prominent Birmingham businessmen and the canal engineer James Brindley. A letter details a payment of £200 to James Brindley from a series of subscribers including Boulton, Garbett, Wilkinson and others. MS 3782-12-23 Item 113 Peter Bottom (Cornhill) to MB (Birmingham) 8 Mar 1768; Boulton's 1771 diary includes notes on lock sizes, and the number of

while in London he was kept informed of committee meetings discussing canal business.⁷²⁶

The canal system was essential in the industrialisation of the eighteenth century and to the development of the Soho Mint. Without the canals it would have been very difficult to transport the heavy loads involved in providing 6000 tons of copper over twenty years to Soho Mint and distributing the equivalent amount of coin.⁷²⁷ Canal narrow boats, due to limitations in the size of locks, were restricted to loads of around 25 tons, pulled by one horse. This was a considerable improvement as to move the same amount by land would need two hundred horses.⁷²⁸

Many engineers, including James Watt, gained experience working on canal construction, and the B&W reciprocating steam-engine he developed was used to pump water back up the canal system, as well as to pump water in mines; the Smethwick engine on the Birmingham canal was in operation from 1779. John Smeaton and John Rennie, who both worked with Boulton, were also involved in canal building. A young Rennie helped to rebuild the Soho rolling mill in 1785 and also inspected the Royal Mint machinery in 1798.⁷²⁹ The engineers that Boulton employed at the Soho Mint were experienced in solving problems on canal construction, and were able to apply their experience to

boats using the canal per day: '22 boats were locked down to Birmingham on Aug 6th 1771'. MS 3782-12-107 Boulton's 1771 Diary.

⁷²⁶ Dr William Small wrote in 1772 about a committee consisting 'of Lord D[artmouth], Dr Ash, Mr Lloyd junr, Wm. Taylor, Mr Palmer, Mr Wilkinson, Mr Rabone, Mr. Francis, Mr Farquharson, Mr Kettle, Mr Henn, Mr Galton, Sam^l Steward, Mr Lee & himself.' Some of these individuals were influential and helped in later coinage issues. MS 3782-12-23 Item 232 William Small [Birmingham] to MB (London) 17 Apr 1772.

⁷²⁷ Weight measurements in the eighteenth century consisted of tons, hundred weights (cwt), quarters (qtr), stones (st), pounds (lb), ounces (oz), and grains. For a rough conversion an eighteenth century ton is the equivalent to a metric ton. 1cwt = 50.8kg.

⁷²⁸ On average a pack-horse could carry one eighth of a ton, but could haul up to seven times as much if the load was in a wagon riding on iron rails.

⁷²⁹ G. Demidowicz and D. Symons in: M. Dick (2009) *Matthew Boulton; A Revolutionary Player* p 122; p 180.

making the coining equipment work. Hugh Henshall, who had taken over as an engineer on the Trent and Mersey canal, after James Brindley's death in 1772, later became an important haulage contractor for Boulton's Soho Mint products.

Due to the difficult terrain and ample coastal provision of shipping, improvements in land transport had not reached the Cornish mining district. This meant that it was difficult to transport both copper ore and coal in Cornwall. Ports had been developed at Hayle, Copperhouse, Portreath and Devoran to transport copper ore to smelting works near Swansea, South Wales as there was no suitable local coal for smelting. The bulk of the ore was usually transported by mule to the ports, as mine roads and track-ways were often unsuitable for wheeled transport. Coal was also shipped to the mines in a similar way. It was needed to fuel the steam-engines, which pumped water out of the mines. Boulton estimated that there were 1,000 mules at a time in Hayle in 1780, and 2,500 in 1800, used in transporting the copper ore and coal. Each mule could carry up to 90kg on average, and travel 30 km or more per day in summer, but in winter or rainy periods, the tracks became virtually impassable.⁷³⁰ It was the expense involved in transporting coal to the mines which led to the need for the more efficient B&W steam-engine, and hence to Boulton's interest in the Cornish copper industry as discussed in chapter two.

⁷³⁰ J. Griffiths (1992) *The Third Man: the Life and Times of William Murdoch (1754-1829)* Deutsch, London p 105.



Figure 4.1: Amlwch harbour, Anglesey, August 2009⁷³¹

In Anglesey, on the other hand, copper ore could be taken approximately two miles down hill from the Parys Mountain mines to the port of Amlwch, and be transported to the Warrington Copper Company or to Swansea for smelting.⁷³² Coal could also be easily imported to smelt ore at the port. There was a huge amount of traffic at Amlwch. Records for 1792 show 327 ships with a gross tonnage of 13,287 tons visiting Anglesey. This compares with Swansea which received 96 ships and 5521 ton gross in the same year.⁷³³ Cheaper transport costs were one of the reasons why Anglesey copper could be produced at a lower price than in Cornwall. The refined copper from Swansea could then be transported via the river Severn to Stourport, and subsequently by canal to Birmingham,

⁷³¹ The sailing boat in Amlwch harbour is HMS Pickle which brought the news of the battle of Trafalgar to Britain.

⁷³² A visit to Parys Mountain confirmed the ease of transport in the area. The remains of old copper ore stores are still in evidence at Amlwch. Records, as detailed below, show the shipping of ore and coal to Warrington and Swansea.

⁷³³ In 1771 twenty three different vessels, each less than 30 tons, took a total of 2236 tons of ore from Amlwch. But by 1786 when the Amlwch Shipping Company was formed, around seventy vessels were involved in the copper trade between Amlwch and Swansea. By 1792 eight purpose-built vessels, much larger than those used previously, had been commissioned in the previous two years for the copper trade. <http://www.amlwchhistory.co.uk>.

to be used at Soho Mint. Boulton was able to organise the transport of shipments to and from Soho by certain trusted carriers.



Figure 4.2: Map to show distribution of rivers and canals in the Midlands around 1800⁷³⁴
Striped lines indicate canals built after the start of Soho Mint

⁷³⁴ Map from www.jim-shead.com adapted by S. Tugate, using a variety of sources on canal development.

When the Soho Mint was first set up, not all of the canals marked on Figure 4.2 were fully completed, and it was not possible to go directly to London from Birmingham by canal. A variety of routes were used, depending on how fast a delivery was required. For fast bulky deliveries Boulton regularly used Thomas Sherratt, who operated ‘Sherratt’s Flying Waggon’, and delivered items to London in less than a day.⁷³⁵ Other shipments went by water. Regular payments for haulage were made to Thomas Toye, Hugh Henshall, Charles Broadley and Edward Doughty.⁷³⁶ Toye took consignments the short distance from Soho Mint to and from the Birmingham Wharfs. Doughty shipped items from the south, along the River Severn and the canal from Stourport, where copper arriving from Swansea could be exchanged for orders to the south-west. Henshall’s firm moved orders north, along the Staffordshire and Worcester canal and the Trent and Mersey canal north-west to Liverpool. Or items could be taken north-east via Gainsborough and the River Trent, to Hull, where Broadley would take goods on to London or to France by sea.⁷³⁷ This route was used for 183 tons of tokens, consisting of 8 million coins in 1100 casks, sent between 1791-3 for the Monneron Brothers in Paris.⁷³⁸ The more south-easterly canal route to London had not then been fully completed, but was available by the time of the 1797 regal coinage orders. Cartwheel pennies could then travel to London via the Oxford canal and the river Thames.⁷³⁹

⁷³⁵ ‘*Twelve Casks of Coin have been this day forwarded, pursuant to ordr, per Sherratt, to go by land from Oxford, for Mrs Matthews.*’ MS 3782-12-59 Item 169 William Cheshire to MB 26 April 1798.

⁷³⁶ Payments can be seen in the Mint record books from at least 1792 for Henshall and Toye and from January 1793 for Broadley. Doughty moved cargoes south to Bristol from 1794. MS 3782-3-13 Mint day Book 1791-1795.

⁷³⁷ The Monneron orders were sent to Calais or Rouen to the care of Bourdieu and Company. ‘*Charles Roe & Co pr Toye (W Tomkison Boatman) p Henshall & Co Boat from Windson Green Wharf to be deliv^d at Red Bull Wharf in the Pottery. 473 Cakes of Copper 20 ton exact at £102 13 4d for £2053 6 8d; May 30th 1792 Credit Chas Broadly for Freight 7 charges paid on 111 casks of copper medals from Gainsboro on the Friendship Wm Bennett consigned to Mess Brothers De Bauque of Dunkirk.*’ MS 3782-3-13 Mint Day Book 1791-1795 26 Dec 1792.

⁷³⁸ The many references seen in the Mint Book total around 183 tons. For example: ‘*18th Feb 1792 Forwarded this day par Henshall & Co Boats to be delivered at Gainsboro to the Order of Mr C E Broadly of Hill 49 cask of 5 sol pieces for him to ship for Dunkirk or Rouen for Monnerons.*’ MS 3782-3-13 Mint day Book 8th February 1791-16th May 1795

⁷³⁹ The Coventry Canal was opened to Oxford by 1790. The Grand Canal to London was not fully opened until 1811. R.A. Pelham (1955) *The Worcester and Birmingham Canal* Birmingham Historical Journal Volume 1 (1955) pp 60-82.

For orders to America or Ireland, items could be sent south to Bristol along the Severn, or to Liverpool, depending on port charges and sailing times.⁷⁴⁰ For example an order consigned to the Philadelphia Mint of 103 casks, each containing 130-150 kg of copper blanks, was forwarded to Liverpool to be shipped on board the *Swanwick*.⁷⁴¹ For other foreign orders Boulton was dependent on vessels such as those belonging to the East India Company. Orders for India and Sumatra had to reach St Botolph's Wharf London, in time for the regular spring or autumn sailings to South East Asia on East India Company ships. The ocean going ships could be much larger than coastal vessels which carried copper ore, and thus Boulton was able to ship his coins to Europe, India, South East Asia, Africa and America as part of their cargoes.⁷⁴²

Problems of Transport

Copper was a valuable cargo and needed secure storage both during and after transport. One of the reasons that Boulton wanted to run his own copper company, as discussed in chapter two, was to avoid problems in obtaining and transporting copper. Between 1789 and Boulton's death in 1809, Soho Mint produced around 600 million coins, medals and tokens. This meant that over these twenty years Boulton had to organise the delivery of an average of six tons of copper per week and the distribution of a similar amount of coin, to countries as far apart as Canada and Ceylon, although there were times when orders were plentiful and others when they were sparse. This was an impressive feat of

⁷⁴⁰ In 1799 65 casks of US blanks with a total weight of 198 cwt (20 ton) were sent with 3cwt (150kg) in each cask. It cost £1 6s per ton for transport; a total of £1052 12 8d. '*We shall write to Bristol for Information respecting any Vessels that may be going soon from thence to Philadelphia, but if you have no particular Motive for wishing them ship'd at that Port, Mr Brown suggests that Liverpool would be preferable as the Port charges are much higher at the former than at the latter place*' MS 3782-12-59 Item 186 William Cheshire to MB 4 Mar 1799.

⁷⁴¹ This order, costing £2903 10 8d, was sent on 1st July 1799. MS 3782-3-15 Mint Book 30th June 1798 to 24th December 1799 p 206.

⁷⁴² Captain Cook's three-masted 'Endeavour' was 97' long, 29' broad and 11' deep carrying 360 tons (see catalogue). A frigate could be 120' long and carry 600 ton.

administration, given the transport and financial structures in place at the time. It is even possible, using information from the Archives of Soho, to give detailed information about the exact number of coins made for many of the issues made at Soho Mint. The number of coins struck, and the weight of copper used for each order were recorded.⁷⁴³ This is another example of Boulton's professional approach to Soho Mint's accounts.

Boulton preferred to have items shipped in casks so that there was less risk of pilfering, and consignments could be traced.⁷⁴⁴ However, this was expensive; casks alone could be one twentieth of the cost of coining.⁷⁴⁵ That was without the charges for transport which added considerable expense.⁷⁴⁶ Though several attempts at robbery were made at the Soho site, only one theft during transport of coin was reported.⁷⁴⁷ Boulton was concerned enough to suggest that cargoes were shipped in locked barges.⁷⁴⁸ When valuable silver tokens were sent to Ireland in 1804 they had an escort of twelve armed soldiers.⁷⁴⁹

⁷⁴³ There are a series of ledgers, daybooks, packing books, consignments and weight books, order books and notebooks. The total records for the Soho Mint held in Birmingham Archives of Soho consist of 183 volumes of various sizes and 25 archival boxes. MS 3782-3 The records of Soho Mint 1791-1850.

⁷⁴⁴ MS 3782-3-13 Samuel Glover 23 Dec 1769 quoted in S. Tungate (2009) 'Matthew Boulton's Mints: Copper to Customer' p 85.

⁷⁴⁵ Costs can be calculated from mint books. For example orders for Thomas Williams in 1791 and 1792 give a ratio of 0.056 for 12 tons of coins sent; 0.043 for 16 tons and 0.054 for 19cwt comparing price of coining to price of casks. '31 March 1791: 12 tons 13 0 14lb at £16 6s 8d per ton. Total £206 14s 4½d; 5th Sep 1791 Invoice for copper coined for T Williams Esq & del^d to Mr Hurd for his account 16 tons 1 0 10lb £176 12s; Charge T Williams for coining as per acc^t sent to him £491 13s 10d at £11 per ton; 16th July 1792 Thomas Williams to coinage coining 19cwt of Penny Blanks at £16 6s 8d; 16th July 1792 T Williams to cooperage Total £27 10s 8d: 93 cask with 12 ton 13 0 14lb of sundry coin at 2s 6d; 60 casks with 16 ton 1 0 10lb of Anglesey; 7 casks 19cwt of Pennies.' MS 3782-3-13 Mint day Book 1791-1795.

⁷⁴⁶ Many examples can be seen of freight charges in the Mint books. For example: '24th Nov 1792 Hugh Henshall for freight to Gainsbro £60 3s 5d on 6 occasions from June 16th to July 31st 1792 52 tons 6 1 27 at 23s [per ton].'

⁷⁴⁷ R. Margolis (2005) *Those Pests of Canals: A theft of Monneron Tokens intended for France* British Numismatic Journal Volume 75 pp 121-131.

⁷⁴⁸ F. Tait (2009) in: S. Mason (2009) *Matthew Boulton: A Revolutionary Player* p 89.

⁷⁴⁹ D. Vice (1994) *The 1804 Bank of Ireland Six Shilling Token* Format 50 1994.

Apart from the obvious dangers of travel during a time of war, another problem of sea transport was shipwreck. An interesting artefact is a copper ingot, rescued from the wreck of the EIC ship *Colebrooke* which sank off Cape Colony in 1787, en route to China.⁷⁵⁰



Figure 4.3: Copper ingot from 1787⁷⁵¹

A letter details the *'loss of the Rose, Captain Cooper, a vessel on board of which Messrs. Doughty & Co. had shipp'd 23 casks of coin for sundry correspondents at Plymouth'*. It was reported initially that *'13 whole casks, and about a cask and a half of loose pieces, had been dug out of the sand'* at Bigbury Bay. But another report said that only a small proportion of the coins sent would be saved.⁷⁵² Another loss was reported from the wreck of the Fife packet in January 1798. Boulton did carry insurance for some of these losses but it meant disruption and trouble at the Soho Mint.⁷⁵³

Transport was also affected by the weather, not only by frosts and snow, but also by floods. When international shipping was involved, this caused added complications, as completion of orders at Soho Mint had to be in line with their shipping dates. Sometimes Boulton was concerned that orders would not be finished in time, as seen in February

⁷⁵⁰ Personal communication from Dr Peter Northover. He used this ingot for copper analysis.

⁷⁵¹ Copper ingot in possession of Dr Peter Northover, Department of Materials, University of Oxford, Begbroke Science Park, Sandy Lane, Yarnton, Oxford, OX5 1PF.

⁷⁵² MS 3782-12-59 Item 180 William Cheshire (Soho) to MB [London] 5 Dec 1798.

⁷⁵³ MS 3782-3-14 Mint day Book 23 May 1795 -16 June 1798 p 183.

1788 for the Sumatra order, and in 1791 for Bombay.⁷⁵⁴ Again in February 1795 Boulton was very worried about 120 tons of coin for Madras. He wrote from London to say that *'the time now grows very short for the delivery of the remainder of the East India Coin'*.⁷⁵⁵ Matthew Robinson Boulton wrote back:

*the floods having put a stop to Land as well as Water Carriage, the copper coming in the wagons have been detained upon the Road & this disappointment in the supply of Metal will much retard the coinage. I am sensible this delay will cause you some vexation & yet I do not see any way of preventing it.*⁷⁵⁶

In addition Sherratt was letting him down, by sending casks of coins by the slower canal route rather than by road. Boulton requested that *'Wallis the carrier'* could take some *'as every ton that is not shipped will be a loss of more than 40 Guineas to me.'*⁷⁵⁷ Boulton could not do anything about the weather, but he could change his haulage contractors.

Transport problems involved a lot of forward planning on Boulton's part. At the start of his coining career some orders were delivered late, but he was able to respond quickly to requests when conditions were favourable. In 1791 designs for the Bombay coinage were approved by 18th February, and four weeks later the first shipment of eighty casks left Soho for London. Further shipments were sent in April to be sent on the spring sailings

⁷⁵⁴ Boulton wrote: John Harrison *'promised me that all the [copper] pieces for the India co would be finished by 31st Jan and though we have worked night & day for a fortnight, have yet 8 ton to coin and the last day of receiving it is on Fryday ye 29th'* MS 3147-3-12 Item 9 MB (London) to James Watt (Harper's Hill) 20 Feb 1788. In 1791 he wrote: *'I have upward of eighteen million of pieces to coin in 60 days. Hodgetts must forge a number of dies for there must be a great stock beforehand.'* MS 3782-13-36 Item 52 MB (East India House) to MRB (Soho) 13 Jan 1791.

⁷⁵⁵ Boulton asked: *'I beg you will call Messrs Brown, Kellet & Hodgets together & jointly make a report of the present state of it Noteing: What is already Coined; What quantity of Copper is yet wanted at Soho to compleat the 120 tons of Coin; What steps are taken to obtain the remainder; When it is probable the last Cask of ye 120 Ton will be sent off.'* MS 3782-13-36 Item 116 MB (London) to MRB (Soho) 2 Feb 1795.

⁷⁵⁶ *I am afraid it will be some time before you receive advice of the last Ton of E.I Coins; there is yet 8 Tons to strike.* MS 3782-13-36 Item 174 MRB (Soho) to MB (London) Feb 1795.

⁷⁵⁷ Sherratt was: *'sending them by Oxford boats instead of Wagons & thereby made a profit to himself at the risk of a great loss to me.but instead of Land car[ria]ge I find there are 60 casks lying at Oxford & 100 in his warehouse all which I could have had a certainty of being in London by this time.'* MS 3782-13-36 Item 121 MB (London) to MRB (Soho) 26 Feb 1795.

and the rest in November; in total 17 million coins.⁷⁵⁸ Eventually coins from Soho Mint were distributed around the world.

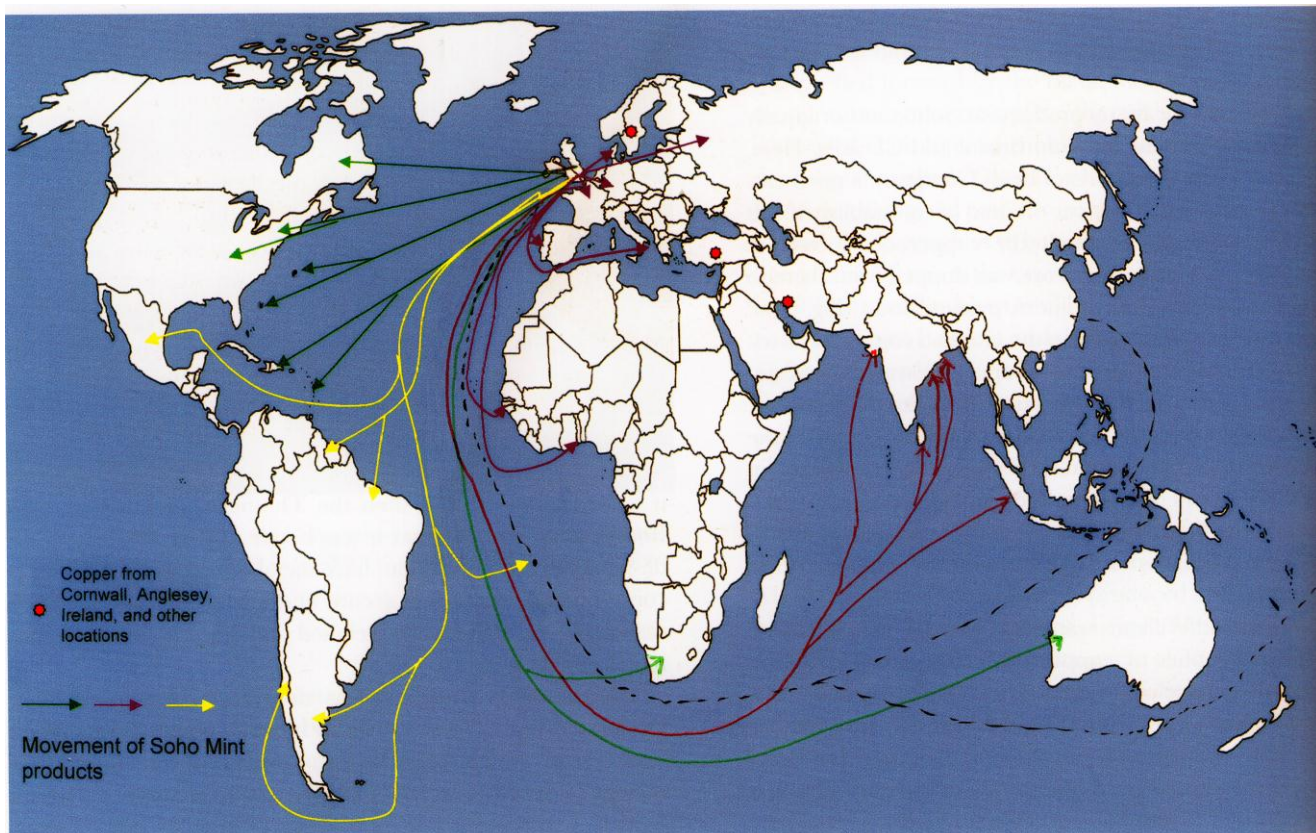


Figure 4.4: Map to show worldwide distribution of Soho Mint products⁷⁵⁹

Red arrows, indicating sales to the EIC, and green arrows sales indicating sales elsewhere, show distribution of Soho Mint products during Boulton's lifetime. Yellow arrows show distribution after 1809. Dotted lines show objects sent on the 1772 Captain Cook expedition and the 1793 Lord Macartney expedition to China

Regal coinage distribution

By the time Boulton gained the regal coinage contract in 1797, he insisted that distribution was included as part of the contract. Previously, new coins were only available at the Royal Mint located at the Tower of London, issued in 5s or 10s packets

⁷⁵⁸ R. Doty (1998) *Soho Mint* pp 305-306.

⁷⁵⁹ This map was drawn by S. Tungate and appears in S. Mason (2009) *Matthew Boulton: Selling What All The World Desires* p 86 but a mistake was made in the printing.

collected personally. No arrangements were made for distributing them, though coins from the Royal Mint did spread around the country, but not as effectively as they should have.⁷⁶⁰ According to the original 1797 coinage licence Boulton was to be allowed 17s for delivery no matter how near or far.⁷⁶¹ This was increased to £4 for the 1799 contract.⁷⁶² He planned to deliver coins to bankers or other individuals in each town, who would pay for £25 worth of coins at a time, with free delivery. Some of these customers were known to Boulton personally from prior orders for Soho Mint products; for example, for tokens ordered in Glasgow, Leeds, Inverness, and Southampton. He also suggested that coins could be distributed through government run organisations such as dockyards, where large numbers of workers were employed.⁷⁶³ This meant that Soho Mint products could spread across the country unlike coins from the Royal Mint.

Before the first issue of the 1797 coins Boulton sent agents, such as James Lawson and John Southern, to travel around the north of England promoting sales of the coins. From Leeds, Southern told Boulton: *'I have been to 3 banks as being most likely to promote the circulation. ... By the payment in bills at 2 months on the receipt of the money on these terms they will each take £500 worth as soon as you please to send it'*.⁷⁶⁴ As the customer was not paying for delivery, Southern advised that: *'The carriage to different parts of England is a very serious matter & I think your attention should be directed to those parts of the kingdom only where water carriage can be employed.'* It cost, for example,

⁷⁶⁰ D. Symons (2009) in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* p 171.

⁷⁶¹ MS 3782-17-4 Coinage License 9 Jun 1797.

⁷⁶² MS 3782-17-5 Coinage License 4 Nov 1799.

⁷⁶³ *'I therefore hope their Lordships will honour me with their Commands as to the quantity intended for Dockyards & such other establishments as are under their influence & they shall be send directly. I conceive this coin should be deliverd in every great Town in the Kingdom from whence it will spread into the small towns & Villages ... I proposed to send to each Town a quantity in the proportion of 1 Ton to every ten thousand inhabitants.'* MS 3782- 12-42 Item 171 MB (Soho) to Stephen Cottrell [London] 14 Jul 1797.

⁷⁶⁴ MS 3782-12-66 Item 84 John Southern (Leeds) to MB (Soho) 5 Jul 1797.

more than £10 per ton to get coin by road to Newcastle but less than £2 by water.⁷⁶⁵

Three out of the four banks there were willing to take £200 each, and Southern also saw ‘*some of the principle shopkeepers who are extremely glad to hear of the new coinage & will give it every support.*’⁷⁶⁶ This prior ‘advertising’ by Boulton made it easier to introduce the new coins to Britain, and his innovative marketing skills led to the success of Soho Mint’s new regal coinage issue.

As part of the 1797 regal coinage distribution Boulton wanted to send as many coins to London: ‘*as the Lords of Council will undertake to put into circulation*’, but then to use his own agents to circulate the rest. He thought it would be:

*bad Policy as well as bad oeconomy to deposit the whole of the Coinage in any place previous to putting any of it into circulation. Moreover it would be laying a Burthen of £70,000 upon my shoulders which is more that I can bear. Whereas if it is distributed & paid for as fast as it is made (say 20 Tons per Week) it will support itself & be a burthen to no party.*⁷⁶⁷

In this way Boulton could afford to pay for the transport of coin to all parts of Britain before he was reimbursed for his efforts by the Government. Pennies were sent to Mrs Matthews, Boulton’s banker in London and to Somerset House along the newly opened Oxford canal and on to London via the Thames:

Sent from here by canal to Oxford, thence to be send by ye oxford [canal] to the order of the Right Honourable the Lord Company of his Majesties Treasury to be

⁷⁶⁵ ‘*The carriage by land hither from Birmingham is 10/8d per cwt = £10 13s 4d per ton; by water it would not be more than £2. Land carriage can be reckoned at 1/- per ton per mile.*’ MS 3782-12-66 Item 86 John Southern (Newcastle) to MB (Soho) 16 Jul 1797.

⁷⁶⁶ MS 3782-12-66 Item 86 John Southern (Newcastle upon Tyne) to MB (Soho) 16 Jul 1797.

⁷⁶⁷ MS 3782-12-42 Item 171 MB (Soho) to Stephen Cottrell [London] 14 Jul 1797.

*deposited in a Warehouse at Somerset House, Freight to be paid by Matthew Boulton by whom the same was coin^d & forwarded.*⁷⁶⁸

Boulton was paid £10,000 on 26th July 1797 via Mrs Matthews and a further £4,000 was sent as 160 casks of penny pieces. The first two pence cartwheel coins were sent to Mrs Matthews for the Treasury on 2nd February 1798.⁷⁶⁹ In the Mint Record books lists of customers all over the country can be seen for the new coinage issue. Penny pieces at 16 per lb were wrapped in paper packets with a value of 2s, with each cask containing 6000 coins worth £25 and weighing 375lb. Customers were charged the face value for the order.⁷⁷⁰

It was an enormous task to keep track of all the orders coming in, and dispatch of the coins all over the country, as recorded in the Soho Mint books.⁷⁷¹ The scope of this study did not allow a detailed analysis of the list of orders, but most of the important industrial and financial organisations in Britain in the 1790s are seen in the lists. For example Benjamin Huntsman [Junior] from Sheffield ordered £50 of cartwheel pennies in August 1797, as did Richard Crawshaw of Cyfartha Iron works.⁷⁷² Boulton wrote that:

I have not principle assistance in my Coinage, which has open'd a new field of trouble & correspondence. I have the pleasure to say it is going on rapidly yet nevertheless the demand is more rapid at present, and the reflux of money after so

⁷⁶⁸ MS 3782-3-15 Mint Book 1798-1799 p 74.

⁷⁶⁹ '2nd Feb 1798 Mrs Matthews for the Treasury p Deykin 1 cask of £20 two-penny and £5 penny £25.' MS 3782-3-14 Mint day Book 23 May 1795-16 June 1798 p 181.

⁷⁷⁰ MS 3782-3-15 Mint Book 1798-1799 p 75 on.

⁷⁷¹ These books were kept by a variety of individuals including Boulton himself, his son, Matthew Robinson Boulton, James Lawson, John Southern, and Zaccheus Walker, as seen in the various documents in the Archives of Soho.

⁷⁷² 17,500 casks of coins were distributed. 2654 casks were sent to Lancashire, 1141 to Yorkshire, 1212 to Staffordshire (£33,972), 1204 to Warwickshire, 1452 (£48,787) to London. P. Matthias (2004) *Official and Unofficial Money in the Eighteenth century* British Numismatic Journal Volume 74 (2004) pp 68-83.

*great an outlay is very agreeable, but I am sorry to say that no addition has been made to my order which does not exceed 500 tons although I wish it did.*⁷⁷³

The Birmingham bankers, Taylor and Lloyd had £25-worth of pennies by Soho Cart on 4th September as did Spooner and Attwood, and Gotwaltz at the Post Office. By 14th September orders totalling £1875 were sent to places as varied as Nottingham, Darlington, the Bank of Scotland, Edinburgh, Glasgow, North Shields, Bedford, Perth, Sunderland and Market Drayton.⁷⁷⁴

Further regal coinage orders were received in 1799 which irritated the Royal Mint. They hindered the operations as inspectors would not come down frequently enough to check the completed coins. It meant that Boulton was losing money on undistributed stock lying around, and there were consequent problems of safe storage. Banks had suggested a warehouse nearer to the centre of London, but Boulton replied that this was unnecessary as: *‘I deliver the coin in new Casks free of all expense & trouble at the house of the person who order it, whether they live at one end of the Town or the other or at one end of the Kingdom or the other.*⁷⁷⁵ This distribution was an important improvement in the supply of small change in Britain.

⁷⁷³ MS 3782-12-42 Item 206 MB (Soho) to George C. Fox & Sons (Falmouth) 25 Aug 1797.

⁷⁷⁴ MS 3782-3-14 Mint day Book 23rd May 1795-16th June 1798

⁷⁷⁵ *‘One penny post letter adres^d to Mrs Matthews No 13 London St Fenchurch St with an order for any quantity & a Bill for amount will produce the delivery on the same or next day.*’ MS 3782-12-56 Item 124 Matthew Boulton (Soho) to Sir Joseph Banks [London] 29 Nov 1799.

Customers

The Soho Mint needed to be a profitable business. Boulton had spent considerable sums setting it up, only to find that his original plan to produce a regal coinage was no longer viable. He was facing rivalry from the Royal Mint, and from numerous other token producers in Britain; abroad, often the mints were effectively subsidised by their governments. He emphasised the cheap price he could charge at the Soho Mint in order to gain coining contracts. As well as the cost of copper and coining, freight, insurance, customs duties and shipping had to be included in the price for an order, both for the raw materials and the finished pieces. Sometimes Boulton underestimated the costs, and at other times he did not get paid, thus some issues were made at a loss. So it was vital to gain sufficient customers for the Soho Mint.⁷⁷⁶

Boulton is well known for being a consummate salesman. In fact his reputation as an entrepreneur has outstripped his skills in technology and design, as discussed in chapter two. There were many strands to his marketing including the development of Soho Manufactory and showroom as a destination for industrial tourists, London auctions, and sales through agents, both at home and abroad. By 1772 *'every country in Europe was doing some business with Boulton'*.⁷⁷⁷ Val Loggie has examined the way in which images of the Soho Manufactory and Boulton's own name and personality formed part of the marketing strategy of Soho's products as he looked to differentiate himself from other

⁷⁷⁶ How the Soho Mint was organised by individuals in charge of different departments such as sales and marketing has been discussed by the author in a forthcoming publication. Various individuals were responsible for running the Soho Mint at various times. These included John Roberts, Matthew Robinson Boulton, James Lawson, John Southern, and Zaccheus Walker, as can be seen in the various documents in the Archives of Soho. Several key workers such as John Busch, John Peplow, Thomas Kellett and members of the Harrison family were also important. However Matthew Boulton himself kept overall control of the business. S. Tungate (forthcoming) *Workers at the Soho Mint*

⁷⁷⁷ A letter from Fothergill to Boulton in 1764, already quoted in chapter one, shows the range of his customers. E. Robinson (1963) *Eighteenth-Century Commerce and Fashion: Matthew Boulton's Marketing Techniques* Economic History Review Second Series, Volume XVI No. 1 p 42.

manufacturers.⁷⁷⁸ He continued to use influential friends such as Sir Joseph Banks to lobby for a regal coinage contract, producing pattern coins for presentation to important individuals.⁷⁷⁹ As discussed earlier, the first coining order that Boulton made for the East India Company came via his personal acquaintance with John Motteux. Business connections were again important in gaining the orders for the first tokens made on the steam-powered press, the 1789 Cronebane, Anglesey and Wilkinson tokens. William Roe, Thomas Williams and John Wilkinson were all involved in the copper industry, and in addition, the latter two were personal friends. The 1791 Cornish halfpenny token was made for individuals involved in the Cornish Metal Company, again all well known to Boulton. This meant that important contracts were gained because of trust in Boulton as an individual, which enabled him to produce the first pieces at Soho Mint. His reputation for quality then led to further commissions. A very important early order was from the Monneron brothers in Paris, gained possibly via his contact with Balthazar-Georges Sage, the chemist, mineralogist and assayer who held a post at the Paris Mint. Initially Boulton had hoped to coin for the new French government, and had sought the Monnerons' support in the French assembly; but in fact he received a series of orders for tokens from the brothers, culminating in a total of over 11 million pieces being produced between 1791 and early 1793, using over 197 tons of copper.⁷⁸⁰ This showed Soho Mint's ability to produce large orders, with interesting and varied design.

⁷⁷⁸ V. Loggie (2009) 'Picturing Soho: Images of Matthew Boulton's Manufactory' in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires* Yale University Press, London pp 22-30.

⁷⁷⁹ Banks and Boulton corresponded about a huge variety of topics; about visitors to Soho, steam-engines, hurricanes in Barbados, wings for a manned flight, industrial spies such as Baron Stein; Hershel's planet and scientific experiments of Prof Gadolin from Finland. There was also a fascinating series of letters about sheep's earrings! See MS 3728-12-56; MS 3782-21 and <http://www2.sl.nsw.gov.au/banks/series> 84.

⁷⁸⁰ P. Jones (2009) 'Trading in Libert : the Commercial Tokens and Medal Coinage for the Monneron Fr res' in: R. Clay and S. Tugate (eds.) (2009) *Matthew Boulton and the Art of Making Money* pp 24-38.

There were a huge range of customers for Soho Mint products, ranging from private individuals who wanted a few medals, to commissioners of large issues consisting of millions of coins. They came from many walks of life and included merchants, shopkeepers and industrialists, kings and governments, as can be seen from the list in Appendix 1. Items were made in tin as cheap medals, or in gold, as exclusive pieces, and ranged from truck tokens for use at Penyarden Iron works, to coins and medals for reigning monarchs. Selected examples from the catalogue accompanying this thesis illustrate the details involved in a particular order.

Initially it was not always possible to complete a contract for a variety of reasons. This meant that some customers had to be disappointed. A lack of engravers meant that no tokens were made for Sir Richard Arkwright, as Droz was unwilling to make dies, and there was too much work for Dumarest, who arrived in August 1790.⁷⁸¹ At other times other orders took preference. In January 1794 Lawson wrote:

*Mr Marshall (who has the Engine here) was asking me some days ago if you now coined halfpence as he thought of having some made but I suppose the quantity would only be small. If you are in the way of coining I can let him know otherwise if will not be worth your attention.*⁷⁸²

At the time a large order for Madras was under commission, and it was not cost-effective to make this small token issue. Smaller manufacturers were able to take up the slack and offer cheaper prices.⁷⁸³

⁷⁸¹ There was a request in 1790 for terms for halfpenny and penny tokens for Sir Richard Arkwright, Cromford (to be a bust of Arkwright and a crest); and also from a Mr Steel for 4,000 copper 'Play House' tickets. D. Vice (forthcoming).

⁷⁸² MS 3782-12-66 Item 44 James Lawson (Leeds) to MB (Soho) 28 Jan 1794.

⁷⁸³ A correspondent wrote: '*your terms happening to be higher than he was able to afford Kempson of Birmingham was employed .who, though he could not engrave so nicely as your superior artists does work cheaper & more disposed to such small undertakings.*' MS 3782- 12-42 Item 215 James Wright Jr. (Dundee) to MB (Soho) 1 Sep 1797.

With foreign orders there was an extra risk, and Boulton was unwilling to enter markets where he was unsure of payment. He had experienced problems in obtaining money from Russia for example.⁷⁸⁴ He also had several opportunities to supply America, but a request in 1788 was not followed up.⁷⁸⁵ He wrote later to his son in 1793: *'I must observe that although I wish to serve them with goods of Soho Manufactory, yet as I am not in the way of supplying American markets I think I had better decline a general dealing with them as the Cred^t is long.'*⁷⁸⁶ By 1797, however, he was supplying blanks for the Philadelphia Mint and continued to do so in considerable amounts. Blanks were also made for Portugal, and in total 22 million blanks were sent from Soho Mint up until 1809, as can be seen in Appendix 3: Table 1.

One of the advantages of the Soho Mint was its ability to make large regular coinage orders as Boulton himself described to John Motteux in 1791:

*As I am concerned in many of the copper mines of this country & in copper smelting works as well as in rolling mills & as I have now invented & completed a steam mill for coining which is worked by the power of our steam engine, with many late improvements, working upon a new principle ...with more regularity & precision than can be done by human hands, I am enabled to offer to supply copper coin in almost any quantity of the quality of the 2 pieces inclosed which you'll observe are lettered upon the edges with letters in relief or indented & from them being struck in collers are round & of equal diameter.*⁷⁸⁷

⁷⁸⁴ Boulton had a claim for £680 plus interest on Michailo Ivanow Samoyloff. Collins had contacted the Russian ambassador Count Woronkow but no-one was willing to undertake the task of pursuing him in the St Petersburg courts. MS 3782- 12-42 Item 272 Andrew Collins (Birmingham) to MB (London) 28 Nov 1797.

⁷⁸⁵ MS 3782-12-108 Item 53 Mint Book 1788 p 68.

⁷⁸⁶ MS 3782-13-36 Item 101 MB (London) to MRB (Soho) 14 June 1793.

⁷⁸⁷ MS 3782-12-91 Item 1 MB Sketch to John Motteux 3 Jan 1791.

An important part of his sales pitch was the cost. Boulton wrote that the EIC could: *‘obtain any quantity of fine copper coin they may please to order at the above rates which I am persuaded is cheaper than it has ever been made at Paris.’*⁷⁸⁸ Similar letters were sent to other prospective customers. The resultant order for Bombay, which was made from February 1791, was a vital contract for Soho Mint, as should it succeed, Soho Mint would have a pedigree in making a large coinage issue. This could then be used to promote further deals, including the all important regal coinage contract. Boulton’s next coinage order for the EIC was not until 1794, but they proved one of his most loyal and long-lasting customers. A total 220 million copper coins, weighing 1341 tons, were made for the EIC during the last 23 years of Boulton’s life, as can be seen in Appendix 3.

The Soho Mint was advertised both at home and abroad. By June 1790, accounts of his new steam-powered press were translated into French and German.⁷⁸⁹ Letters were also translated into other languages as Boulton had an acquaintance *‘who writes and speaks every language in Europe gramatically, being born in Sweden, and have lived for some time in Spain, Italy, and Russia’*. This paragon also had beautiful neat handwriting!⁷⁹⁰ Boulton’s agents in various parts of the world also sought work for the mint. This resulted eventually in orders for pattern coins from Denmark, Russia, and Württemberg, and currency orders from the Gold Coast, Sierra Leone, Bermuda, and the Bahamas.

⁷⁸⁸ MS 3782-12-91 Item 1 MB Sketch to John Motteux 3 Jan 1791.

⁷⁸⁹ *‘The Papers respecting Coinage that you left with Mr Stieglitz have been copied in English, also translated & Copied in French & German But what should be done with copies. ... presume you cannot readily find a printer in England possessed of a proper quantity of German Types.’* MS 3782-12-75 Item 3 Zaccheus Walker (Birmingham) to MB (London) 7 Jun 1790.

⁷⁹⁰ Unfortunately this individual is not named. MS 3782-12-8 Letter Book May 1789-Dec 1791 Item 64 MB to Henry Stieglitz 2 May 1790.

At times the Soho Mint was very busy. The initial burst of small orders of tokens for Anglesey, Southampton, Cornwall and Glasgow and the order from the EIC were complemented by further large orders from the Monneron brothers of Paris between 1791 and January 1793.⁷⁹¹ Boulton wrote: *'I want the East India order done by Oct next; 2nd the 16 ton of Anglesey done in one month; 3rd one two or three tons of Southampton directly and then 24 ton of halfpence about 39 to ye lb every week for one year.'*⁷⁹² But things did not always go smoothly. Progress in several early contracts was hindered by a lack of copper and failure of the mint apparatus. An anxious Boulton wrote to his son: *'I have lost an immense sum by the coinage and now an opportunity offers by which I may in a great degree refund myself. Your interest and happiness depend much upon this opportunity not being lost.'* He urged that: *Everyone concerned in the Management of the coinage should study morning noon and night how to vanquish difficulties rather than raise them.*⁷⁹³

Boulton was worried that if this order failed he would lose not only his reputation and the chance to make a profit, but also be pursued for breach of contract. The team at Soho were able to respond to this call, as they did not want to let Boulton down. His workforce respected him as an enlightened employer, as can be seen in various documents in the Archives.⁷⁹⁴ Medical men were employed regularly to care for the employees at the Soho Mint.⁷⁹⁵ Boulton certainly had a patriarchal attitude, but on the whole he was also fair and

⁷⁹¹ The various issues for the Monneron brothers have been discussed in a publication by P. Jones (2009) 'Trading in Liberté: the Commercial Tokens and Medal Coinage for the Monneron Frères' in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* pp 24-38.

⁷⁹² MS 3782-13-36 Item 58 MB (London) to MRB (Soho) 4 Jun 1791.

⁷⁹³ MS 3782-13-36 Item 58 MB (London) to MRB (Soho) 4 Jun 1791.

⁷⁹⁴ BA&H MS 3147-3-6-17, MB to J. Watt 12 March 1782; BA&H MS 3782-12-5 Letter Book 26 December 1780-19 August 1783 Items 164 and 172, MB (Soho) to James Watt [Cusgarne] 26 March 1782 p 273; 6 & 10 April 1782 p 289.

⁷⁹⁵ MS 3782-12-59 Items 174 and 180 William Cheshire (Soho) to MB [London] 8 November 1798, 5 December 1798.

treated his workers well.⁷⁹⁶ This attitude was partly profit driven and self-interest, but made for a good working atmosphere at Soho.

Outside events, over which Boulton had no control, also could have serious effects on Soho Mint production. The Monneron contract was fraught with problems caused by events of the unfolding French revolution, and by August 1792, Boulton was worried that *'the times are now so horribable [sic] in France that I fear I can't get drafts negotiated.'*⁷⁹⁷ Issues were eventually abandoned by January 1793. The idea of coining for the French government reoccurred in 1802 when the Peace of Amiens was declared. This would have been a great coup for the Soho Mint as a correspondent had told Boulton that a *'Thousand Million of pieces'* would be required. Boulton wrote to James Watt, who was travelling on the continent, to say that, even with thirteen mints, it would take the French many years to make that amount, but Soho Mint could coin the entire order in three years. Several parties were interested but none had authority from the French Government, so Boulton did not proceed further.⁷⁹⁸ When war recommenced in 1803, the opportunity was lost.

At other times the Mint lacked orders and workers had to be laid off. After the busy period in 1791 and 1792, only small token orders for Leeds and Inverness followed, plus

⁷⁹⁶ John Griffiths talk at Talk at Boulton Conference 5 July 2009. Boulton's relations with his workers is analysed further in a forthcoming publication. S. Tungate (forthcoming) 'Workers at the Soho Mint' in: S. Baggott and K. Quickenden (eds.) *Matthew Boulton- Enterprising Industrialist of the Enlightenment* Ashgate, Farnham.

⁷⁹⁷ *'The wickedness, the madness, the folly, the outrageous conduct of the French deserves severe punishment, and from this time I declare war against [them] myself, at least the Jacobines. I hereby appoint all the crown heads of Europe (except the Russian bear) commissioners to hold the said office untill the heads of the Jacobines are taken off and peace, order, perminent government, and wholesome laws prevail over the present anarchy that reigns in Paris.'* MS 3792-12-68 Item 9 MB (Soho) to Charlotte Matthews [London] 15 Aug 1792.

⁷⁹⁸ Boulton would not deal with *'men whose warmth of imagination is greater than their Judgments or Funds & who are neither Experienced in all those Arts that are requisite in Coinage, nor in the Conduct of Great Manufactories, or in the Commercial Part appertaining thereto.'* MS 3219-4 Item 124 MB (Soho) to James Watt [Frankfurt] 10 Oct 1802.

pattern coins for Barbados, Bengal and a complex order for Sierra Leone coins. These commissions kept the mint ticking over but were not big enough to warrant the steam-powered press, and could have easily been carried out elsewhere. By 1794 there were plenty of other coin manufacturers in Birmingham who could make small orders on hand-powered presses, as discussed in the catalogue. The steam-powered press had been designed for large coinage issues. Small orders for tokens were produced at Soho, such as those for Bishop Stortford, Penryn, Lancaster and Hornchurch, as seen in Appendix 1.

The most productive period at the Soho Mint was reached between 1797 and 1804 when finally Boulton was commissioned to make a regal coinage issue, which is discussed further in the catalogue. In 1797, the mint was fully employed making and distributing 500 tons of copper coins, and this was continued in 1799 with contracts for halfpennies and farthings.⁷⁹⁹ The steam-powered press finally was used for its intended purpose. The amounts made can be seen in Table 4.1.

Soho Mint made over 320 million copper coins for the British Government in ten years using over 4,200 tons of copper. This is a huge quantity. Previously, it had taken the Royal Mint around seventy years to make a quarter of that amount, as they were never given sufficient orders for copper coin from the Government.⁸⁰⁰

⁷⁹⁹ This aspect is further discussed in the catalogue and by D. Symons (2009) in: S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires*.

⁸⁰⁰ 818 ton of copper coins, mainly halfpennies, were struck between 1729 and 1754, with a further 234 tons between 1762 and 1775. C.E. Challis (ed.) (1992) *A New History of the Royal Mint* p 436.

Table 4.1 Regal coinage production at the Soho Mint (1797-1807)⁸⁰¹

Date of issue	Number of coins made	Weight of copper in tons	Price of copper	Price for coining	Number per pound weight
1797 British two penny	722,972	40.29	£108	£37 6s 8d	8
1797 British penny	43,969,204	1227.84	£108	£37 6s 8d	16
1799 British halfpenny	42,481,116	526.78	£121	£42	36
1799 British farthing	4,225,428	26.17	£121	£42	72
1806 British penny	19,355,480	360.03	£169	£42	24
1806 British halfpenny	87,893,526	817.46	£169	£46 13s 6d	48
1806 British farthing	4,833,768	22.48	£169	£46 13s 6d	96
1807 British penny	11,290,168	210.01	£143	£42	24
1807 British halfpenny	41,394,384	384.99	£143	£46 13s 6d	48
1807 British farthing	1,075,200	5.01	£143	£46 13s 6d	96
1805 Irish penny	8,788,416	150.93	£169	£44 6s 8d	26
1805 Irish halfpenny	49,795,200	427.54	£169	£49	52
1806 Irish farthing	4,996,992	21.45	£169	£49	104
Total	321,107,133	4,224.99			

⁸⁰¹ Numbers for this table were taken from a variety of sources, including measurements made by the author, details from archive sources, and from Vice and Doty.

Items for Collectors

Another approach, to keep Soho Mint in the public eye and to gain customers, was to produce medals and proof coins for collectors.⁸⁰² Medals had been made at Soho, as part of Boulton's toy trade on a speculative basis as well as on commission, long before the Mint was set up. Medallists could exhibit and sell medals at a variety of eminent societies in London and several retailers were already selling coins to collectors.⁸⁰³ In the 1760s Thomas Snelling (1712-1773), a printer in Fleet St., had the largest numismatic shop in London. He published plates featuring designs of English medals of various illustrious personages.⁸⁰⁴ Another was Christopher Pinchbeck, a licensed dealer in precious metals, and John Kentish who had a shop opposite the Royal Exchange. Henry Young, with a shop on Ludgate Hill, was dealing with Boulton by 1793.⁸⁰⁵ The first mention of medals in the archives of the Soho Mint, found during research, came in an enquiry sent to Matthew Boulton as early as 1766, but this item has not been identified.⁸⁰⁶ Later pattern coins were sent from Soho Mint to those holding influence with the government to promote a regal coinage contract. These became eagerly sought after by collectors. It took time and effort to strike proof pieces as the dies needed be polished between each

⁸⁰² Proofs are struck in a special press with meticulously polished dies and blanks as examples of a coinage, and should be virtually flawless in appearance, with a brilliant mirror like finish. The details of the designs are sharply defined. Pattern pieces are used to evaluate proposed designs and may not go into production. P.P Gaspar and G.P Dyer (1980) *The Striking of Proof and Pattern Coins in the Eighteenth Century* British Numismatic Society Journal Volume 50 1980 pp 117-127.

⁸⁰³ From 1760-1782 the Pingos exhibited items at various places such as the Royal Society of Arts, the Society of Artists, Mr Moreings Great Room, Maiden Lane and the Free Society of Artists. The Royal Society of Arts instituted a system of premiums for work in arts, manufacturing and commerce, including for medals. Thomas Hollis and James 'Athenian' Stuart sat on the committee for medals in the 1750s and 1760s. C. Eimer (1995) *The Pingos and the development of Engraving Techniques in the second half of the Eighteenth century* University of Leeds M Phil thesis.

⁸⁰⁴ Illustrations start with medals of William I and by Plate 33 covers individuals such as Hans Sloane and the Duke of Marlborough. T. Snelling (1792) *Plates of English Medals 1776*.

⁸⁰⁵ MS 3782-12-108 Item 69 Medal ledger.

⁸⁰⁶ 'I hope Mr. Fothergill wrote you last night concerning the medals.' MS 3782-12-23 Item 67 John Cantrell [London] to MB 27 Feb 1766.

strike.⁸⁰⁷ This meant that key workers could be retained in employment at the Soho Mint in addition to Boulton having a potential market to exploit.⁸⁰⁸

Medals and collectors

Soho Mint products, such as medals, provide a valuable historical record of the eighteenth century and are still popular with collectors today, as can be seen by their prices in various sales.⁸⁰⁹ Medals have no monetary value in terms of legal tender but are images struck onto metal. The medal was an art form, with obverse and reverse images which could be related to each other, often accompanied by short inscriptions.⁸¹⁰ Pomian writes that this allows the viewer to recognise the figures or the scene represented there and ‘*consequently to prolong the visual pleasure with an activity of the mind.*’ They form testimonies to the ‘*most powerful moments of history*’.⁸¹¹ Medal production enhanced Boulton’s status and provided ‘*a tasteful medium for the assertion of allegiance.*’⁸¹²

Collecting medals and coins was a royal pursuit. New royal collections were assembled from the reign of Charles II on, after their dispersal during the puritan purges. George III’s father, Frederick, started a personal coin collection which was passed on to George III, and was enlarged by the purchase of the collection of Joseph Smith, the consul of Venice in 1762. Queen Charlotte and Augusta, Princess of Wales were also keen

⁸⁰⁷ For example in 1795 Boulton requested ‘*Mr Bush to provide two pair of East India Dies as perfect as possible ... & at the same time to get 100 or 200 clear copper pieces bronzed by Jno Middlehurst & struck by Bush or they may be 100 Bronzed of each & 100 Copper of each which pieces are intended to be presented to the directors.*’ MS 3782-13-36 Item 116 MB (London) to MRB (Soho) 2 Feb 1795.

⁸⁰⁸ This is discussed further in: S. Tungate (forthcoming).

⁸⁰⁹ For example sales of Soho Mint coins are detailed by Bill McKivor thecopperman@thecoppercorner.com

⁸¹⁰ Pisanello (1380-1455) and Benvenuto Cellini (1500-1571) struck medals during the late Renaissance. M. Jones (1979) *The Art of the Medal* British Museum Publications Ltd, London.

⁸¹¹ K. Pomian (1987; trans 1990) *Collectors and Curiosities 1500-1800* Polity Press, Oxford pp 127-129.

⁸¹² P. Jones (2004) ‘*England Expects*’ *Trading in Liberty in the Age of Trafalgar* in: M. Crook, W. Doyle, A. Forest (eds.) *Enlightenment and Revolution* Ashgate, Aldershot p 188.

collectors.⁸¹³ Other eminent eighteenth-century coin and medal collections included many in private hands, plus one bequeathed by Hans Sloane to the British Museum.⁸¹⁴

The collection of Soho Mint items became increasingly fashionable in Boulton's lifetime. An enthusiast was Sarah Sophia Banks, sister to Sir Joseph Banks, who was a great friend of Boulton, and who had ordered a medal for Captain Cook's expedition in 1772. Banks wrote that: *'She is a keen collector & has her coins in better arrangement than any I have ever seen.'*⁸¹⁵ Two years later in 1791, he wrote jocularly to Boulton:

*My sister is a great pusher she has seen your 5 sous piece & has not got one of them. If you fear a lady's resentment or wish to Court her favor I would advise you to furnish her with one as speedily as convenient and if you add to it any other new tokens it may be well as the sight of them will certainly work favourably in her eyes.*⁸¹⁶

By 1804, Sarah Sophia thought that she had most examples of Soho Mint's EIC coinages but asked to be sent any new coins struck and enclosed a catalogue of her collection for Boulton.⁸¹⁷ He was particularly proud of his regenerated Spanish dollars and wrote: *'If Miss Banks deposits the dollar in her cabinet she should also deposit a copy of my letter or explanation to Lord H^y [Hawkesbury] otherwise the merit of the piece will be*

⁸¹³ The Royal Collections were given to the British Museum in 1838, to add to that of Sarah Sophia Banks which was acquired on her death in 1818. Some of these items were viewed during research for this thesis. *Royal Treasures: A Golden Jubilee Celebration* (2002) Royal Collection Enterprises Ltd. London.

⁸¹⁴ The British Museum was opened in 1759. Snelling, the largest retailer of medals and coins in the 1760s, was recommended to catalogue its collection. Other important collectors included the Earl of Pembroke from 1726, and William Hunter (1718-1783) in Glasgow. The 2nd Marquis of Rockingham bought the collection of John Montagu, 4th Earl of Sandwich in 1771. Horace Walpole, James 'Athenian' Stuart and John Murray, 3rd Duke of Atholl, were also collectors. William Marsden started the EIC collection by 1782. There was also a collection at the Bodleian Museum, K. Sloan (ed.) (2003) *Enlightenment: Discovering the World in the Eighteenth Century* British Museum Press p 171.

⁸¹⁵ MS 3782-12-56 Item 13 Sir Joseph Banks (London) to MB (Soho) 27 Aug 1789.

⁸¹⁶ MS 3782-12-56 Item 22 Sir Joseph Banks (London) to MB (Soho) 19 Dec 1791.

⁸¹⁷ *She thinks she has a compleat collection of your coins struck for the EI Company.* MS 3782-12-56 Item 69 Sir Joseph Banks (London) to MB (Soho) 28 Mar 1804.

*overlooked.*⁸¹⁸ She continued to receive samples through out her life.⁸¹⁹ Part of her collection now forms the basis of the current Royal Mint museum collection for pre-1815 coins.⁸²⁰

Boulton was eager to impress Banks, who was influential both within government and at Court, and was also responsible for passing many of Soho Mint's proof coins to George III. In July 1797, Banks wrote to report that:

*The King did me the honor yesterday to accept from me one [penny] for each of the Royal Family & more than that he took another which in my Presence he gave to the Keeper of his Medals saying "Take Care of this. I like one struck for Common use better than a Fine one."*⁸²¹

Banks also passed on a request from the Duke of Portland for a two-pence and a penny bronzed proof, along with his own request for a guineas worth of the new farthings in November 1799.⁸²² In 1803, Chippindall wrote: *'Mr Wilkins of the EIC wanted a set of the EIC coinage and Seringapatam for the Library at India House and one of MB's likeness for their own museum.'*⁸²³ These were all important individuals to impress and a potential source of new contracts for Soho Mint.

⁸¹⁸ MS 3782-12-56 Item 105 MB (Soho) to Joseph Banks (London) 23 Jan 1804.

⁸¹⁹ Some of the items in Sarah Sophia Banks collections were unique. In 1795 Boulton wrote: *'If things become more valuable for being unique please to tell Miss Banks that ye medal of Lord How which I sent her is the only one that exists or ever will from that dye as your remarks upon ye word Thessaliarcha is so justly founded that I have ordered the die to be destroyd as being impossible to alter the word without making a new dye. It arose from a slip of Mr Planta's pen.'* MS 3782-21 Item 8 MB (London) to Sir Joseph Banks (London) 11 Jun 1795.

⁸²⁰ Some examples from Sarah Sophia Banks' collection were included in the exhibition associated with this thesis. R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money*. The Royal Mint Museum is now located at The Royal Mint, Llantrisant, Pontyclun, CF72 8YT. <http://www.royalmint.com>

⁸²¹ Banks also requested *'some specimens for my sister's use both of the accepted & the Rejected Coin.'* MS 3782-12-56 Item 34 Sir Joseph Banks [London] to MB (Soho) 26 Jul. 1797.

⁸²² *'John King, the Duke of Portland, undersecretary of state, is in great anxiety to procure a two pence & a penny bronzed proof.'* MS 3782-12-56 Item 53 Sir Joseph Banks (London) to MB [Soho] 23 Nov 1799.

⁸²³ MS 3782-12-59 Item 135 Richard Chippindall (London) to MB (Soho) 3 Feb 1803.

Marketing of medals had to be focused directly on the audience intended, and initially at Soho Mint this was not achieved very well. In 1789 Chippindall had been approached by three retail firms, who wanted items to sell during the procession to celebrate George III's recovery from madness.⁸²⁴ Boulton decided to use dies produced by Droz, but they cracked and medals were not completed in time. Chippindall wrote that he was:

*almost mad with vexation at the misfortune in the dyes. I fully thought all was hardend & ready or I would not have scuffled so to get its advertisement in two papers today & it will be in one more tomorrow, & leave you to judge of the confusion it will make. The grand consumption would have been on Wednesday next - as after Thursday it will be a flat piece of business.*⁸²⁵

Time was of the essence in selling such a fashionable consumer item. Boulton had also included an explanation of the medal, but Chippindall thought that it was too detailed as it would insult the intelligence of the connoisseur.⁸²⁶ Boulton learnt from this and four years later, when Soho Mint was fully functional but lacking orders, he made the decision to sell specially struck proof and pattern pieces to collectors, as it was more profitable than coining small orders of tokens. He wrote:

Nothing can be got by coining unless a very great number of Tons are coined of the same die & even then more may be got than is possible, by specimens although they are charged at 12 times the price of current money. So soon as I

⁸²⁴ These were Messrs Jeffery & Jones; Thomas Gray; and Messrs Green & Ward of Ludgate Hill. 'Mr Gray is anxious for their arriving, as he says the Queen has given him a commission to find all those devices for her Inspection & as such he thinks a few should be struck in Gold ..I have got copys of the advertisements out to three papers the World, Herald and Diary, some of which I hope will appear on Monday. Tuesday & Wednesday but I much fear their inserting them in time without a Bribe on account of so much advertising at this confounded procession.' MS 3782-12-59 Item 13 Richard Chippindall (London) to MB (Soho) 19 Apr 1789.

⁸²⁵ MS 3782-12-59 Item 14 Richard Chippindall (London) to MB (Soho) 20 Apr 1789.

⁸²⁶ Chippindall wrote: 'in giving the explanation of the designs which I suppose you meant only to be given to the venders as a key for them--- indeed it would have been a poor comp[limen]^d to the enlighten^d part of the publick as well as to the artist - and as to the vulgar part - perhaps its paying a comp^t to the shopkeeper & his men by giving them an opportunity of displaying their learning for I have omitted the explanation in the advertisement & will send a copy of it to each shop.' MS 3782-12-59 Item 14 Richard Chippindall (London) to MB (Soho) 20 Apr 1789.

*have wrote a short paper and printed it I will send you a hundred setts or as many as you can find the means of selling, they being already made- as fast as I can get other dies engraved I shall send you specimens of them to add to the collection.*⁸²⁷

Early sets included twenty one items: two types of British halfpenny, the 1789 Kings Recovery medal and Cronebane Halfpenny, the 1791 Anglesey Halfpenny, Cornish Halfpenny, Wilkinson Halfpenny, Southampton Halfpenny, Glasgow Halfpenny, and four sizes of coins for Bombay and the Sierra Leone penny, along with the Monneron 2 sol Liberte, 5 sol Hercules, 5 sol Pacte Federatif and medals featuring Rousseau, Lafayette, Serment du Roi and Respublica Gallica. Sets of proof coins and tokens were sold from 1793.⁸²⁸ By the end of 1793, they also included Ibberson and Inverness halfpennies. The coin collector, Samuel Birchall, ordered coins on five different occasions between July 1793 and 1st November 1794.⁸²⁹ He also ordered over 2 tons of tokens for Leeds in 1792, as discussed in the catalogue. Charles Pye, who wrote a book for collectors, had several sets of Soho Mint products in 1795.⁸³⁰ Further items were added to Soho Mint's output: pattern Kentucky silver coins were sold by 1796, although they did not go into general production. A total of 346 sets of Soho Mint coins were sold between 1793-1803 with most sold up to 1797.⁸³¹ Boulton's client list included a range

⁸²⁷ MS 3782-12-59 Item 48 MB (Soho) to Richard Chippindall [London] 12 Mar 1793.

⁸²⁸ By February 1793 Boulton wrote to Chippindall: '*I am making Collections of the medals and the coin I have struck & mean to sell them in full sets through your hands.*' MS 3782-12-59 Item 46 MB (Soho) to Richard Chippindall [London] 16 Feb 1793.

⁸²⁹ Boulton asked that '*Miss Mynd would carefully pack up in a Box one of each sort of the halfpence & French Medals & sent 'em by the Coach to Leeds or Sheffield directed to Mr Samuel Birchall Merch' in Leeds.*' MS 3782-13-36 Item 94 MB (London) to MRB (Soho) 18 Jan 1793.

⁸³⁰ Charles Pye was sent 2 sets plus 6 medals on 23rd Nov 1795, and more on 9th May 1795 and 27th June 1796. MS 3782-12-108 Item 69 Medal ledger pp 74-75.

⁸³¹ There was a regular price list for coins for collectors, which varied according to the importance of the customer, for example Samuel Birchall, who ordered two tons of Leeds tokens, would have had a favourable price. Birchall was the author of an early book on tokens published in 1796. He is recorded as buying coins from Boulton on 1st July 1793, 13th July 1793, 1st February 1794, 1st November 1794 and 29th November 1794. The largest order was the first for £9 1s 10d and the orders reduced in value from 18s 6d to 8s 3d. MS 3782-12-108 Item 69 Medal ledger.

of collectors, and a special record book of medal sales was kept, with requests being recorded till 1816.⁸³²

Medals, though sold in small numbers, proved good advertising and again kept key mint workers occupied. They were produced in a variety of metals, such as silver, gold, brass, bronzed copper, or gilt, but cheap versions in tin and white metal were also sold. Boulton was catering for a wide market. While in London dealing with patent infringements in 1795, he would write for medals to be sent for sale or as gifts, perhaps for George III.

*Pray send me all the silver medals of the K[ing] and 2 of France, Lord Cornwallis & the King of Denmark that are already struck and Bush must go on with more in Silver and in Tin when the Frogmore medals are done.... I want a Silver Medal of Lord How for the King.*⁸³³

The Frogmore medal was made in very short time for the Queen's birthday in order to impress the king, as detailed in the catalogue. Sales to collectors induced Boulton to employ Conrad Heinrich Kuchler from 1793 on a freelance footing, to engrave medals on a speculative basis, and between 1793 and 1799 he was responsible for around fifteen different medals. This work ensured that he was available to make dies for the regal coinage contract should it ensue. A total of around fifty-five different medals were eventually made at Soho Mint. Usually not more than three to five hundred copies of any given medal were struck, an exception being the 14,000 Trafalgar medals made in 1806. With small numbers, time and care could be taken in their production. Some

⁸³² The notebook lists sales of silver, bronzed and tin medals, sales of sets and individual coins to dealers and individuals, plus presents to various people including Lord Aylesford, Mr Brickwood, Lord Bagot, the British Museum, Samuel Garbett, Lord Hawksbury, Mr Lyson for Sarah Sophia Banks, the Empress of Russia, Captain Stephenson, Mr Dr Withering, R Wissett and Mrs Watt. MS 3782-12-108 Item 69 Medal ledger *Ledger of Medals, coins etc furnished to Sundry Persons from the Soho Mint within the above dates* 1793-1816.

⁸³³ MS 3782-13-36 Item 130 MB (London) to MRB (Soho) 16 May 1795.

commissioned medals were even made in single figures over a period of years, for example, Agriculture Society prize medals, which were individually engraved, as discussed in the catalogue.⁸³⁴

Even when the regal coinage contracts were undertaken, items for collectors were still produced, to impress future customers. In February 1799, Boulton was sent:

*6 dozen copper farthings—struck from the new dies; plus a further 4½ dozen gilt; 6 dozen each of gilt, copper halfpennies and 5 dozen bronzed; plus 6 dozen bronzed farthings, plus three pieces from Raikes’s dies, [Claude Martin pieces] viz. 1 each silver, bronzed, and copper.*⁸³⁵

Boulton’s box was also replenished with an assortment of penny and two penny specimens to use as advertisements.⁸³⁶ In May 1799, Cheshire wrote:

*Herewith you will receive five sets of bronzed medals, which I believe exceeds your order, but as I am not quite clear how many sets you wished, I have thought it best to err on the safe side. You have also herewith six bronzed Nelsonian medals and a packet of coins and medals to compleat Mr. Bailey’s order.*⁸³⁷

30 sets of specimen coins ‘each set consisting of 6 pieces, viz. a gilt, bronzed, and ♀ [copper] halfpenny; a gilt, bronzed, and ♀ [copper] farthing’ and 12 boxes of halfpence and farthings were sent in October.⁸³⁸ This enabled Boulton to satisfy important individuals who could use their influence on behalf of further orders for the Soho Mint.

⁸³⁴ MS 3782-12-108 Item 69 Medal ledger 1793-1816

⁸³⁵ MS 3782-12-59 Item 182 William Cheshire (Soho) to MB (London) 22 Feb 1799.

⁸³⁶ MS 3782-12-59 Item 182 William Cheshire (Soho) to MB (London) 22 Feb 1799.

⁸³⁷ MS 3782-12-59 Item 189 William Cheshire (Soho) to MB [London] 27 May 1799.

⁸³⁸ MS 3782-12-59 Item 194 William Cheshire (Soho) to MB [London] 31 Oct 1799; A further 110 sets were sent in November. MS 3782-12-59 Item 195 and 196 William Cheshire (Soho) to MB (London) 7 and 10 Nov 1799.

Design

The driving force of Enlightenment culture was improvement in all things, and Boulton was a prime example of this ethos.⁸³⁹ Thus perfecting the design of the products of Soho Mint was a very important aspect of his work. He needed to produce items that would could be sold in their millions as coins, and thus had to have designs suitable for coining on his steam-powered press, but he was also very aware that they also needed to be aesthetically pleasing. From early times coins and medals had been seen as vehicles for artistic expression, ‘*unmutilated by time*’.⁸⁴⁰ Brewer has written about the new and growing audiences for the ‘culture of politeness’ in the eighteenth century, with big increases in the number of pictures and etchings sold.⁸⁴¹ The church and court were no longer pre-eminent, and centres of taste ranged from academies, public exhibitions, books and magazines to public areas of sociability such as cafes and Vauxhall Gardens.⁸⁴² Drawing was an indispensable part of self education but industry and technological advances were valued, as well as art and literature. The Royal Society actively encouraged the practical applications of science.⁸⁴³ Artists and poets treated industry as an acceptable part of their environment and celebrated it with engineers such as John Rennie, Thomas Telford and others ‘*accepted not only as great engineers but as great artists*’.⁸⁴⁴ Boulton was able to seize upon this and provide designs which not only expressed ideas of the ancient world, but also commemorated modern events.

⁸³⁹ K. Sloan (ed.) (2003) *Enlightenment: Discovering the World in the Eighteenth Century* British Museum Press p 168.

⁸⁴⁰ H.A. Parsons (1906) *Art and the Coins of England* British Numismatic Journal Volume 3 1906 p 291-310.

⁸⁴¹ 50,000 pictures and half a million etchings were sold; Handel’s firework music performances drew a 12,000 audience. Medals were popular. ‘*Old Masters enjoyed pride of place in aristocratic collections while a piece of sculpture, gems or medals were more prominently displayed than works of British art.*’ J. Brewer (1997) *The Pleasures of the Imagination; English Culture in the Eighteenth Century* Harper Collins, London pp 222-256.

⁸⁴² M. Snodin and J. Styles (2001) *Design and the Decorative Arts: Britain 1500-1900* V and A Publications, London.

⁸⁴³ A. Boime (1987) *Art in an Age of Revolution 1750-1800* University of Chicago Press, Chicago and London p 203.

⁸⁴⁴ *Art and the Industrial Revolution* (1968) Manchester City Art Gallery, Manchester p 1.

A classical education was seen as essential for a cultured gentleman in the eighteenth century, and sensitivity to the arts was increasingly perceived as marking a morally virtuous person.⁸⁴⁵ The discoveries of Herculaneum in 1709 and Pompeii in 1748 had stimulated interest in Roman and Greek antiquities, such as coins. Their collection and arrangement by connoisseurs was driven by a strong desire to illustrate the histories of Greek and Roman authors.⁸⁴⁶ Taste was linked to social status, and the appreciation of medals and coins was a sophisticated cultured activity, as much a sign of an eighteenth-century gentleman as his collection of natural history, sculpture, drawings and paintings ‘enabling him with his extensive knowledge of the classics, to reconstruct ancient history through the coins and to picture its gods and heroes through the gems and commemorative medals’.⁸⁴⁷ Boulton was able to provide suitable designs that would appeal to such individuals who would perhaps commission a coinage issue. Later the passion for antiquity and Greek and Roman ideas of beauty led on to ideas on liberty, which became a possibility for a time, with the initial events of the French Revolution. Tokens featuring ‘Liberty’ were produced at Soho Mint for the Monneron brothers as discussed in the catalogue.

Boulton knew that fashionable items, such as medals, needed to appeal to a culturally sophisticated audience. He also knew that producing high quality designs would make it more likely that coin orders would be commissioned. For articles made in the Soho Manufactory Boulton had incorporated ideas from a variety of sources; for example, he

⁸⁴⁵ M. Dick and R. Watts (2008) *Eighteenth-century education: discourses and informal agencies* Midland History Volume 37, No 4, July 2008 pp 509-512.

⁸⁴⁶ Discoveries led to research of non-textual information such as coins and medals. William Stuckley investigated Avebury in 1730; there was increasing knowledge of ancient civilisations and ancient and modern religions. K. Sloan (ed.) (2003) *Enlightenment: Discovering the World in the Eighteenth Century* British Museum Press p 171; J. Brewer (1997) *The Pleasures of the Imagination; English Culture in the Eighteenth Century* Harper Collins, London p 256.

⁸⁴⁷ K. Sloan (ed.) (2003) *Enlightenment: Discovering the World in the Eighteenth Century* p 23

was influenced by James Wyatt, James (Athenian) Stuart and William Chambers, architect to King George III. He had also made visits to collections and had borrowed items from the Earl of Shelburne, Lord Dartmouth, Mrs Montagu and others as design sources.⁸⁴⁸ Sir Nicholas Goodison has written about the styles reflected in the design of Soho products, where Boulton's work showed a move from rococo, the 'French style' to 'antique taste' by the 1780s, which is evident in the designs for the Soho Mint products.⁸⁴⁹ Often though, design ideas came from his customers, some of whom preferred ornate images. However, Boulton insisted that whatever the style, '*whether it be French, Roman, Athenian, Egyptian, Arabask, Etruscan or any other, I would have elegant simplicity the leading principle.*'⁸⁵⁰ The sort of designs used can be seen in examples shown in the catalogue. Many of his mint products can still be appreciated as works of art today.⁸⁵¹

Boulton himself made a collection of medals and books which he used for design ideas. He also bought prints via an agent in Rome, who asked if he wanted antique medals as well.⁸⁵² Images came from John Boydell by the 1760s, and Boulton also purchased illustrations of Hedlinger's medal collection and other important books of printings and engravings from his bookseller Peter Elmsley.⁸⁵³ In 1791, impressions of Hedlinger's

⁸⁴⁸ K. Quickenden (1980) *Boulton and Fothergill silver* Art History Volume 3 no 3 p 278

⁸⁴⁹ Boulton preferred a '*light, simple attenuated form of neoclassicism*'. N. Goodison (1974; 2002) *Matthew Boulton Ormolu* Christies, London pp 64-124

⁸⁵⁰ Letter from MB to the Earl of Findlater 20 Jan 1776; quoted in N. Goodison (1974; 2002) p 66

⁸⁵¹ Richard Clay has argued that Boulton and the Soho Mint made important contributions to the 'massification of art'. R. Clay (2009) in: R. Clay and S. Tungate (eds.) *Matthew Boulton and the Art of Making Money* pp 39-55.

⁸⁵² '*If you will have some antique medals & money let me know.*' MS 3782-12-23 Item 95 P.J. Wendler (Rome) to MB (Birmingham) 14 Apr 1767.

⁸⁵³ Johann Karl von Hedlinger (1691-1771) was a Swiss engraver and a friend of Roettiers. *Complete de toutes Les Medailles de Chevalier Jean Charles Hedlinger* E. Robinson (1953) *Matthew Boulton: Patron of the Arts* Annals of Science 9 pp 368-373.

medals were also requested.⁸⁵⁴ A group of eight figures, including a small statue of ‘Prudence’ and ‘Mars’ for use in the engravers room was paid for in January 1799.⁸⁵⁵ Models were ordered from John Flaxman Senior from at least 1770.⁸⁵⁶ A bill in 1804 from Flaxman Junior lists sixteen different models, and he was concerned that particular attention should be given to unpacking them.⁸⁵⁷ Flaxman Junior also assisted the drawing master G.F. Pidgeon in designing medals for Soho Mint.⁸⁵⁸ In May 1803, Boulton requested that ‘*some proper person to purchase at reasonable Prices al the octavo, quarto & folio Books upon the Subjects of Coins & Medals which are in the first Lots of the first Days Sale*’, part of the late Mr Barker’s collection.⁸⁵⁹ Boulton was also well acquainted with Russian medallic art. John Phillip, visiting London in June 1802, wrote in his diary:

*Went with Mr Chippendall to Mr Young the medal seller in Ludgate Hill. He has a fine and well chosen collection of medals of all descriptions. ... I saw a collection of Russian medals, the same, as Mr Boulton had presented to him from the Emperor of Russia. He asks 50 [guineas] for the set.*⁸⁶⁰

These were used as sources for portraits of such Russian personalities as Suvarov, or Catherine the Great. The eclectic range of designs used by Boulton can be seen as examples in the catalogue.

⁸⁵⁴ ‘Return my thanks to Mr Striglitz & tell him I wish to have the red Sulphur impressions of all Hedlinger’s medals but not the Russia ones.’ MS 3782-13-57 Item 47 MRB (Soho) to MB (London) 23 May 1791.

⁸⁵⁵ The total bill came to £1 8s 6d which was paid to Mr Kuchler. MS 3782-3-267 Item 39 List of figures purchased for the use of the Engravers room.

⁸⁵⁶ MS 3782-12-23 Item 185 John Flaxman Sr. (London) to MB (Soho) 12 Dec 1770.

⁸⁵⁷ Flaxman’s bill for £47 1s 9d included payment for a variety of models of antique subjects such as the Venus de Medici and Apollo. MS 3782-6-195 Item 57 4 Feb 1804.

⁸⁵⁸ D. Bindman (1979) *John Flaxman (1755-1826)* Thomas and Hudson, London p 25

⁸⁵⁹ NADM Charles Roberts Autograph Letters Haverford College Library, Pennsylvania, USA MB (Soho) 4 May 1803.

⁸⁶⁰ Personal communication; Olga Baird, Curator, Wolverhampton Art Gallery; Phillip’s Diary 1802.

Boulton was clear that the audience intended for a particular product was important. As early as 1772, he wrote to his friend and social promoter Elizabeth Montagu that fashion had a lot to do with sales, and he was content to copy styles: *'makeing new combinations of old ornaments without presumeing to invent new ones.'* He also knew that: *'it is not necessary to attend to elegance in such articles of my manufacture as are destin'd for Siberia and America, or even some parts of Germany.'*⁸⁶¹ Russian tastes were not fashionable enough for other markets. Boulton had problems in selling items produced for that country in 1793, due to an edict *'lately published by the Empress of Russia'* which prohibited the import of various goods.⁸⁶²

According to Francis Klingender, a visually educated audience was ready to receive Soho Mint products by the end of the eighteenth century, and he says that they demonstrate a *'combination of intellectual vigour, social consciousness and imaginative design'*, a *'blend of classical symbolism and contemporary reportage'* and are *'masterly in their clear and harmonious presentation'*.⁸⁶³ Even the mint apparatus was embellished beautifully.⁸⁶⁴ Boulton was very concerned to maintain the reputation of Soho as a *'hallmark of excellence'* and his artistic workshop had trained a body of highly skilled craftsmen and competent draughtsmen.⁸⁶⁵ However, he was constantly in search of

⁸⁶¹ MS 3782-12-23 Item 215 MB [Soho] to Elizabeth Montagu [Sandleford] 16 Jan 1772.

⁸⁶² Boulton had £600 of goods for Daser, Pierling & Co of St Petersburg in his warehouse: *'the taste of goods ordered annually for past 20 years[is] not suitable for others.* MS 3782-12-75 Item 59 Zaccheus Walker (Birmingham) to MB (London) 4 Jul 1793.

⁸⁶³ F.D. Klingender (1948; 1968) *Art and the Industrial Revolution* Kelley, New York pp 41-43; p 46.

⁸⁶⁴ John Phillip drew the suggested embellishments for the coining apparatus. Phillip album BMAG 2003-0031-68

⁸⁶⁵ E. Roll (1930; reprinted 1968) *An Early Experiment in Industrial Organisation: Being a History of the Firm of Boulton and Watt 1775-1805* Nelson, London p 1- 23

skilled engravers and designers for the Soho Mint, who were often brought in from mainland Europe, as were those at the Royal Mint.⁸⁶⁶

Boulton believed that: '*simplicity of device is the greatest beauty of Money or medals.*'⁸⁶⁷

He wrote down the principles of design at the Soho Mint as follows:

*The first thing to be done is to express a good design in Words; the 2^d is to make a good drawing of the Idea; the 3^d is to make a correct Model in Wax w^{ch} may be alterd to y^e tast of the Committee; & the 4th is to Engrave it in a Steel Die at Soho & lastly to strike y^e medal in Gold, Silver, or Copper in my improvd Press.*⁸⁶⁸

Boulton had a deep interest in the artistic aspects of the products of Soho Mint, as well as in the technical side of design. In many letters ideas for designs are described, though few drawings of Soho Mint products survive.⁸⁶⁹ An example can be seen in Droz's designs for a pattern coin from 1787.⁸⁷⁰ This shows an image of Britannia that Boulton thought suitable for a new regal coinage issue, but does not resemble final version on the pattern coins made.

⁸⁶⁶ Johan Croker was chief engraver at the Royal Mint until 1741 and was replaced by Johann Sigismund Tanner, as chief engraver (1741-1768). Richard Yeo (1768-1779) and Lewis Pingo (1780-1815) were also important engravers there. J. Craig (1953) *The Mint (London Mint AD 287-1948)* p 232.

⁸⁶⁷ MS 3782-12-39 Item 140 MB (Soho) to Captain Charles Stevenson (London) 29 May 1794 quoted in: B. Gould (1970) *Mottoes and some designs for Boulton's medals* Seaby's Coin and Medal Bulletin 1970 Seaby London p 39.

⁸⁶⁸ MS 3972-12-48 Item 131 MB (Soho) to Ambrose Weston [London] 8 Sep 1803.

⁸⁶⁹ These letters will be discussed at an appropriate point in the accompanying catalogue..

⁸⁷⁰ This image from the British Museum was used in the exhibition *Matthew Boulton and the Art of Making Money* at the Barber Institute. British Museum: 1982;1002.3.



Figure 4.5: Drawing of Britannia by Jean-Pierre Droz for 1787 pattern halfpenny⁸⁷¹

Some ideas for medals came from published prints, such as the proposed Bridgewater medal, which is based on a drawing of 1788.⁸⁷² Francis Egerton, 3rd Duke of Bridgewater (1736-1803) was responsible for the expansion of water transport by canal as the commissioner of the Bridgewater canal, completed in 1764. Boulton had visited Bridgewater's developments around 1762.⁸⁷³ The only mention of the medal in the archives is a note to Kuchler in November 1802 when Boulton wrote to say that he wanted various busts engraved including '*The Duke of Bridgewater with his aqueduct for the reverse*'.⁸⁷⁴ However original designs, probably by John Phillip, and trial strikes have been found during research. This medal was not completed, possibly due to the Duke's death in March 1803.

⁸⁷¹ Design for a pattern halfpenny by J.-P. Droz, c 1787. pen and grey ink and grey wash on grey paper. BM:1982, 1002.3. Nathaniel Dance Holland was responsible for the initial design ideas. Personal communication from K. Clancy

⁸⁷² Duke of Bridgewater Archive <http://www.library.salford.ac.uk/DBA/1/8d>.

⁸⁷³ H.W. Dickinson (1936; republished 1999) *Matthew Boulton* p 50

⁸⁷⁴ MS 3782-12-59 Item 130 MB (Soho) to Richard Chippindall [London] 28 Nov 1802; MS 3782-12-59 Item 132 Richard Chippindall (London) to MB [Soho] 2 Dec 1802



Figure 4.6: Design for Duke of Bridgewater medal and trial strike⁸⁷⁵

Once a drawing was prepared corrections to the design could be made. On the 1793 Board of Agriculture medal Boulton commented on various aspects of the inscription. The engraver [Küchler] was told to delete FR ET HIB which was usually used for George III, 'as it is only in the capacity of King of Great Britain that he is founder of the Board of Agriculture'.⁸⁷⁶



Figure 4.7: Drawings made for the Board of Agriculture medal in 1797⁸⁷⁷

⁸⁷⁵ 1. Duke of Bridgewater Archive <http://www.library.salford.ac.uk/DBA/1/8d>; 2. MS 49 Reference 82934 Timmins Volume 1 Item 33; 3. 1803 Duke of Bridgewater trial strike obverse BMAG: 1976N22.

⁸⁷⁶ MS 49 Reference 82934 Timmins Volume 1 Item 34; Board of Agriculture designs.

⁸⁷⁷ MS 49 Reference 82934 Timmins Volume 1 Item 34; Agricultural Medal.

Similarly corrections were made to the welsh inscription on the Hafod medal.



Figure 4.8: Drawing made for 1798 Hafod medal by John Phillp showing corrections⁸⁷⁸

Trial strikes might be made to test aspects of the design before the piece was completed. A trial strike for the Tullamore token shows the inscription around the rim, but not elsewhere, and two figures are roughly sketched out on either side of a shield without detail. The completed token can be seen in the catalogue.



Figure 4.9: 1802 Tullamore token trial strike⁸⁷⁹

There are also designs for coins made for Claude Martin, and for a variety of orders which were not completed, plus some preliminary sketches by Kuchler from 1807/8

⁸⁷⁸ MS 49 Reference 82934 Timmins Volume 1.

⁸⁷⁹ 1802 Tullamore 1s 1d trial strike obverse BMAG: 1976N24.1.

annotated with his handwriting.⁸⁸⁰ More designs were made than could be engraved, but each was carefully discussed.

Boulton had set up a school of industrial design at Soho for apprentices who showed any talent, and they were trained to draw.⁸⁸¹ They practised with allegorical figures such as Hymen, the god of marriage, and Victory holding a flaming torch, which appear on various pieces. But Boulton's designers also produced positive images of industry and commerce, and scenes from contemporary life, as on tokens for Daniel Eccleston of Lancaster discussed in the catalogue. One such can be seen in the figure below:

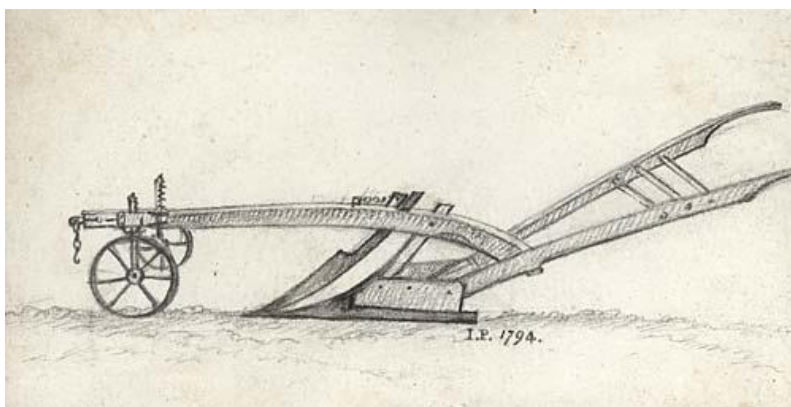


Figure 4.10: Drawing of plough by John Phillip, and part of an image on the 1794 Eccleston token⁸⁸²

⁸⁸⁰ The diagrams, although unlabelled, have notes in German, in handwriting similar to that seen in a letter by Kuchler. MS 3782-12-39 Item 265 Kuchler to Boulton 24 Sep 1794; MS 49 Reference 82934 Timmins collection, Volume 1.

⁸⁸¹ For example, John Phillip, who produced many interesting views of the surrounding of Soho Mint, and of mint apparatus, was taught to draw at Soho. MS 3782-6-195 Item 7 To instructing J Phillip in Architectural Drawing 4 Quarters at 15s per quarter £3 W. Hollins Bills 1795.

⁸⁸² Pencil drawing of plough dated 1794; 70 x 140mm. BMAG 2003-0031-14 Phillip album; 1794 Lancaster Halfpenny D&H 57 Assay Office 116.

Three dimensional wax models or plaster impressions could be prepared to allow judgments about the composition of the design, for example with the Anglesey tokens as discussed in the catalogue. Such models were often used by several engravers. Then the dies were engraved, but before hardening, trial impressions were taken in a soft material such as wax or sulphur to check for mistakes. Sometimes an initial trial strike can show an image which is scored with circular or vertical lines to enable the positions of inscriptions to be planned. At this stage it was often possible to alter minor details such as a date. This can be seen on the EIC die and trial strikes.⁸⁸³ Once the final design was agreed with the customer, the die could be hardened and used to produce millions of images. Boulton became in effect a mass-producer of certain motifs such as Britannia.

Peck states that the design eventually used for the 1797 regal coinage showed a ‘combination of intellectual vigour, social consciousness and imaginative design’.⁸⁸⁴ For the initial design Boulton sought help from a variety of eminent artists, including Benjamin West, whose pictures proved popular with the public.⁸⁸⁵ West had introduced contemporary dress in his historical painting of General Wolfe’s death in 1770, which George III had refused to buy.⁸⁸⁶ West however became an influential presence at court. Via Boulton’s agent Chippindall he agreed to support Boulton’s style of design for coins. Chippindall wrote to say that: *‘If you would be at the expense of striking two dies, one in the common style & the other in the new style which he [West] would suggest, he would*

⁸⁸³Examples are the EIC die BMAG: 1951S00088.00099; Tullamore trial strike 1976N24; Nelson trial strike BMAG 1976N10.

⁸⁸⁴C.W. Peck (1970) *English Copper, Tin and Bronze Coins in the British Museum 1558-1958* Trustees of the British Museum, London p 133.

⁸⁸⁵Boulton used West’s paintings in his ‘mechanical painting’ process. ‘*Mr. Barney has sent from Wolverhampton a large painting of General Wolfe.*’ MS 3782-12-63 Item 20 John Hodges (Soho) to MB (Plangary Green) 30 Nov 1780.

⁸⁸⁶Benjamin West came to London from America in 1763 and remained during the American War of Independence. He became historical painter to the King from 1772. A. Boime (1987) *Art in an Age of Revolution 1750-1800* University of Chicago Press, Chicago and London p 123.

*accompany it with a letter to the privy council & risk his own reputation on its success.*⁸⁸⁷ West was also willing to help Droz, either in person or from a portrait he had drawn.⁸⁸⁸

A later letter, enclosed a sketch of the King, in which: '[West] *has left the hair flowing because he supposes it will be best for a medal, & instead of his close blue coat (the garb his last is drest in) he has given you a dress more approaching to a court dress.*'⁸⁸⁹ This enabled Droz to engrave dies for the proposed regal coinage which gave a realistic likeness of the monarch. However it was Kuchler's portrait of the King which was used on the 1797 issue, and updated in 1799.⁸⁹⁰ In 1806 Boulton again wanted a likeness of the king '*which will serve for a large or small Medal or for Money when wanted.*'⁸⁹¹ The reverse of the regal coinage showed 'Britannia', used on regal coins from at least 1672.⁸⁹²

Boulton was assimilating taste into a form that could be sold profitably, and other eminent artists were pressed into service to make designs for medals. He used Carl von Breda, who collaborated with Kuchler on a medal of Gustav III in 1793. Sir William

⁸⁸⁷ '*In all probability he [West] will herein enforce an opinion he entertains of the extreme impropriety of our present taste in the dress of coins, medals etc ... He pays you many very handsome compliments & says it is only from men of your well known eminence we are to expect to see this barbarous practice refused & he finds himself so much interested in it that he will point out & assist in putting into execution everything which may second your present pursuit.*' MS 3782-12-59 Item 10 Richard Chippindall (London) to MB [Soho] 24 Nov 1788.

⁸⁸⁸ West had sent a portrait that was ten years old, but was also able to send a sketch which '*is sure a most striking likeness & being of so recent a date almost inestimable. & tho between these two Mr Droz should come neat to the original, yet I think you must feel the force of Mr West's argument when he observes that even with these Mr Droz will not make a perfect likeness without having the originals to model from.*' MS 3782-12-59 Item 10 Richard Chippindall (London) to MB [Soho] 24 Nov 1788.

⁸⁸⁹ MS 3782-12-59 Item 11 Richard Chippindall (London) to MB (Soho) 1 Dec 1788.

⁸⁹⁰ '*I handed Mr Kuckler the Print of his Majesty, which I had receiv'd a few Minutes previously.*' MS 3782-12-59 Item 186 William Cheshire (Soho) to MB [London] 4 Mar 1799.

⁸⁹¹ '*I am desirous of obtaining as good a likeness & as fine a head of the King as possible (of the size of Miss Andrass' Model) and this can be prepared without consulting Kuckler & will save time hereafter as well as amuse me.*' MS 3782-13-36 Item 168 MB (Soho) to MRB (London) 15 June 1806.

⁸⁹² Katharine Eustace has examined some of the artistic and political factors involved in the design of coins bearing an image of Britannia. K. Eustace (2006) *Britannia: Some Highpoints in the History of the Iconography on British Coinage* British Numismatics Journal Volume 76 2006.

Beechey also produced a notable medal of Boulton with the modeller Peter Rouw.⁸⁹³ In 1798, the Privy Council for Coin wanted: *‘the highest quality liberal art by the most senior RAs and in the form of designs that communicated patriotic meanings’*. They held a competition *‘to perfect the coinage of this country as a becoming work of art & taste.’*⁸⁹⁴ However the Privy Council for Coin chose designs from the Soho Mint over those submitted by Royal Academicians.⁸⁹⁵ This meant that Boulton and his team had judged the taste of the time correctly.

Personal input from Boulton often modified a design. For example, he suggested changes to the details of various inscriptions on medals and on the 1804 Irish regenerated dollar:

it is unusual to place the date at the top neither will it read so well in the dollar because it will read (according to the Sketch sent to me) BANK of 1804 TOKEN nor do I think the word TOKEN should be conspicuously larger than the rest (as in the sketch). I have sent sketches of sundry different ways of placing the words.

His modifications would: *‘not impede the progress of Madame Hibernia’* as the inscription could be added after the figure was engraved.⁸⁹⁶ This attention to detail is what made Soho Mint products stand out as artistic designs, and one of the reasons they are still popular today. Boulton himself thought that *‘Medallick art is less cultivated & Encouraged in England than in any other European Nation; although the most durable record of Facts, & of the tast of the times.’* He wanted his lawyer Ambrose Weston to

⁸⁹³ E. Robinson (1953) *Matthew Boulton: Patron of the Arts* Annals of Science 9 p 368.

⁸⁹⁴ J. Craig (1953) *The Mint (London Mint AD 287-1948)* p 269.

⁸⁹⁵ Richard Clay discusses this in detail, including reference to a letter from Joseph Farington of the Royal Academy. in: R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money*, Brewin, Studley p 54.

⁸⁹⁶ Figures, he wrote, took up 19/20th of the time to engrave a die. Inscriptions added by letter punches could be added later. MS 3782-12-56 Item 118 MB (Soho) to Joseph Banks [London] 23 Apr 1804.

suggest some ideas for ‘*Patriotick Medals with apropriate inscriptions*’ and thought that ‘*in general the divise should not consist of more than 2 figures.*’⁸⁹⁷

Images on coins and medals could be used as tools of propaganda. Medals made by Boulton celebrated military and naval victories, such of those of Lord Howe in June 1794 and Admiral Nelson in 1798, General Suvarov and Seringapatam in 1799. Apart from generating sales and interest in the Soho Mint, these medals also bolstered patriotic spirit. Boulton also commemorated events such as the marriage of the Prince and Princess of Wales, Queen Charlotte’s birthday and the Preservation of the King from Assassination. Further details of all these medals can be found in the catalogue.

East India Company designs

For his large coinage issues for the EIC Boulton produced coins with a combination of recognisable icons. The design initially incorporated the EIC heart-shaped balemark on one side.⁸⁹⁸ This motif was established before the first issue was struck by Boulton in 1786, and was used in 1786, 1787 and 1798 on Sumatra coins but also on the 1791 and 1794 Bombay issues, and on the 1792 hexagonal pattern Bengal and the 1794 and 1797 Madras coins. The design showed slight variations depending on the area and date of issue. For example the Sumatra design shows a rosette of dots in 1786, which is missing on the 1798 issue and also on the Bombay and Bengal design. The 1794 Madras coin also introduced the inscribed raised rim round the balemark, which was later used by Boulton in the 1797 cartwheel issues. However all used the unifying design of the balemark.

⁸⁹⁷ MS 3972-12-48 Item 131 MB (Soho) to Ambrose Weston [London] 8 Sep 1803.

⁸⁹⁸ The design of the Sumatra copper coins had been established in 1783 by John Marsden, the elder brother of the orientalist William Marsden, who supplied the denominations, their proportions and the inscriptions. F. Pridmore (1975) *The Coins of the British Commonwealth of Nations Part 4 India* p 220.



Figure 4.11: Balemarks on East India Company coins⁸⁹⁹

The EIC had been granted a coat of arms in 1698. This was first used as the obverse for 1794 Madras coins, and again in the 1797 issue, with the reverse being the balemark. The standardized theme was consolidated from 1803, when this coat of arms design was applied to all EIC coins made for India and Sumatra, and on EIC medals. However the broad rim was replaced with a small raised beaded rim and the inscription altered.⁹⁰⁰ The

⁸⁹⁹ For details of individual coins see Appendix 2.

⁹⁰⁰ The inscription AUSPICIO REGIS & SENATUS ANGLIÆ (under the auspices of the King and the English Parliament) was abbreviated for the smaller value coins to (AUSP: REGIS & SENAT: ANGLIÆ in 25mm coins and AUSP: REGIS & SENAT: ANGL: in 20mm coins. One cash coins had the heraldic crest only.

iconography was designed to be consistent, so that the coins would be easier to recognise throughout India and Sumatra; a bit like the modern symbol used on the reverse of all Euro coins, with the obverse bearing a different design for each member state. The dies for the EIC coinage were initially made from punches made by William Castleton, and supplied by the EIC. Later issues were engraved by Noel-Alexandre Ponthon, and Conrad Heinrich Kuchler engraved the dies from 1798 on.⁹⁰¹



1794 Madras



1794 Madras



1797 Madras



1803 Madras



1804 Sumatra



1804 Bombay



1808 Madras



1809 Bengal



1809 EIC Medal

Figure 4.12: Versions of the East India Company Coat of Arms⁹⁰²

⁹⁰¹ Information from a variety of archive sources, see catalogue and appendices for details.

⁹⁰² For details of individual coins see Appendix 2.

The reverses of the various EIC coins were simpler, and in general showed the date and value in a variety of languages. On Sumatra coins the inscriptions used for 1786, 1787, 1798 and 1804 give the value of the coin and the Hegira date.⁹⁰³ Translations were done by William Marsden, the language expert at the EIC and punches sent to Boulton.⁹⁰⁴ For the reverses of Bombay issues of 1791 and 1797, and the 1791 hexagonal pattern coins for Bengal, a pair of scales with an Arabic inscription *Adil* [Peace] between them, was used. The design is sketched in a letter of 28th January 1791.⁹⁰⁵ Only the size of the coins gave an indication of value.⁹⁰⁶ The Hegira date was added on the 1804 Bombay issue as for the earlier Sumatran coins. However the 1809 Bengal pattern reverse was very different with its inscription in three languages.

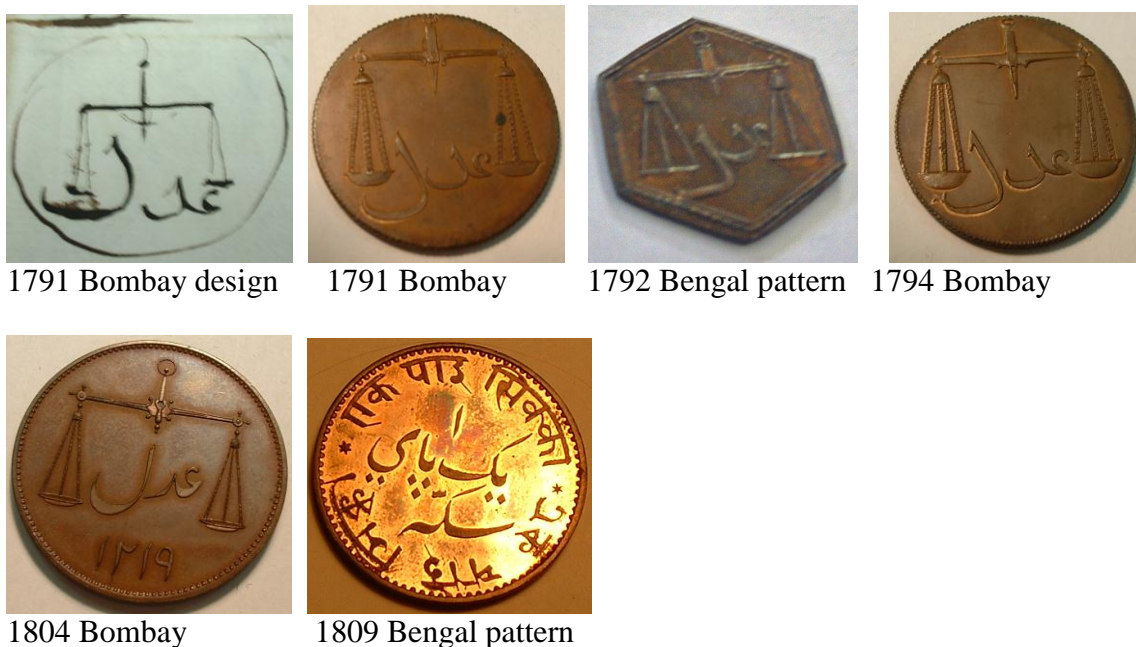


Figure 4.13: Bombay and Bengal Reverses⁹⁰⁷

⁹⁰³ For example the Hegira/Hejira (or Islamic year) in 1804 was AH 1219 and commenced on 12 April 1804. The Islamic calendar dates from the flight of Muhammad from Mecca to Medina in AD 622.

⁹⁰⁴ 'William [William Gibbs, Chippindall's assistant] shall call on Mr. M. tomorrow to desire him to look them [the punches] over with all possible expedition.' MS 3782-12-59 Item 2 William Chippindall (London) to MB (Truro) 12 Sep 1786.

⁹⁰⁵ MS 3782-12-59 Item 30 Richard Chippindall (London) to MB (Soho) 28 Jan 1791.

⁹⁰⁶ Four different sizes were made, worth double pice, one and a half pice, one pice, and half pice. The one and a half pice was only issued as a pattern coin in 1797 and dropped in the 1804 issue.

⁹⁰⁷ For details of individual coins see Appendix 2.

The balemark was initially used on the Madras reverses as shown above, similar to the obverses of other EIC coins, but from 1803 the reverses showed the values of twenty, ten, five and one cash written in both Persian, and English with roman numerals. Ten and twenty cash were also issued in 1808. These relatively simple designs were used at Soho Mint on over 220 million coins for the East India Company.



Figure 4.14: Madras Reverses⁹⁰⁸

Coin, medal and token design

Boulton expected his images would be understood and appreciated by his customers, though the connotations of allegorical figures have lost much of their meaning for a modern audience.⁹⁰⁹ Lots of factors, political, social, economic and artistic, played a part in the design of coins, medals and tokens from Soho Mint. Many of the more than one hundred and fifty designs featured portraits, including those of reigning monarchs of various countries.⁹¹⁰ Individuals portrayed also included revolutionary heroes, admirals

⁹⁰⁸ For details of individual coins see Appendix 2.

⁹⁰⁹ David Solkin says that it cannot be assumed that any work of art 'possess an inherent timeless meaning which is therefore automatically accessible to our comprehension.' D.H. Solkin (1982) *Richard Wilson: The Landscape of Reaction* Tate Gallery p 11.

⁹¹⁰ This has been discussed in a previous publication. S. Tungate in: M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* pp 194-196.

and generals, merchants and industrialists.⁹¹¹ A variety of other representations including allegorical figures, images of agriculture, commerce and industry, ships, shields, coats of arms, saints, buildings, and symbols, such as cornucopia and national emblems, the Irish harp, Scottish thistle and Britannia, can be seen in the catalogue.

Increasing interest in other cultures was shown by many in the late eighteenth century.⁹¹² At the Soho Mint inscriptions, an important part of a design, were written in at least fourteen languages, including Latin, English, Sumatran, Arabic, Persian, Welsh, French, Italian, and Sanskrit. Experts in a particular language were used for advice, such as William Marsden of the EIC, who was responsible for most of the translations on their coins. Sometimes an image might be merely an inscription, giving information such as the value of the coin or token or where they could be exchanged, or an advertisement of services available, as with the Ibberson token discussed earlier. But for Soho medals it was necessary to get suitable texts that were historically and linguistically accurate, so that they would appeal to connoisseurs. This was an important market for the Soho Mint while Boulton was awaiting large coinage orders, as it kept his business in mind with important and influential collectors such as George III. Inscriptions were often in Latin and nowadays may only be translated by a few individuals, whereas most eighteenth-century gentlemen would be expected to be able to quote the classics and therefore could understand them easily. Boulton's engraver, Noel-Alexandre Ponthon, did however

⁹¹¹ More than twenty five individuals were portrayed on Soho Mint products, including the Duke of Bridgewater, Lord Nelson and Lord Howe, and generals such as Earl St Vincent, Lord Cornwallis and Alexander Suvarov. Rousseau and Lafayette were depicted by Dumarest on medals made for the Monneron brothers of Paris. Ponthon portrayed merchants such as Isaac Swainson and Daniel Eccleston on tokens, and John Wilkinson appeared on a token engraved by John Gregory Hancock. Royal individuals included George III, Queen Charlotte, the Prince and the Princess of Wales, Ferdinand of Naples and Sicily, Gustav III of Sweden, Christian of Denmark, Alexander of Russia, Catherine the Great, Frederick of Württemberg, John of Portugal, Louis XVI and Marie Antoinette. See time line in Appendix 1.

⁹¹² Charlotte Matthews wrote to Boulton in 1780 to let him know that: '*I am learning Arabic of the Turks.*' MS 3782-12-67 Item 46 William Matthews (London) to MB (Redruth) 16 Nov 1780.

suggest that Latin should not be used on designs for revolutionary France, and most of the inscriptions on Monneron tokens were in French.⁹¹³ On the other hand, the initial EIC issues had inscriptions in the local language, but later Latin inscriptions appeared on one side. Boulton was able to choose appropriate inscriptions and images for the products of the Soho Mint for both collectors and bulk orders, and further details can be seen in the catalogue.

Letters from various correspondents discussed the design on Boulton's coins. For example, in 1789, one wrote concerning the specifics of the lettering:

*I observe that you make use of the round U upon the halfpenny and the sharp V on the medal. All Roman Coins and Latin Inscriptions have the sharp V but at this time o' Day & upon English money the round U may be equally as proper, & also to reduce the diphthong A/E in Cesar to plain E is more concise and elegant.*⁹¹⁴

These details would have been very important to Boulton's customers. The issue of how lettering can be used as an image continues to be debated in modern times.⁹¹⁵

Many of Boulton's friends such as Priestley and Keir supported the French Revolution initially, as it was thought to be similar to the Glorious Revolution of 1688 in Britain.⁹¹⁶

The events of the French Revolution were quickly reproduced in visual form, as low quality engravings, within weeks, and it brought about profound changes in attitudes

⁹¹³ MS 3782-12-58 Item 16 William D. Brown (Soho) to MB London] 10 Jan 1793; also cited by Brian Gould (1970) *Mottoes and some designs for Boulton's medals* Seaby's Coin and Medal Bulletin 1970 Seaby London p 396.

⁹¹⁴ Hylton also commented on the motto: '*Felicitas Publica is very properly adapted to the recovery of the King's Health, altho' it is applied generally on Roman Coins to indicate the increase of Plenty & Commerce.*' MS 3782-12-34 Item 185 John Scott Hylton (Halesowen) to MB (Soho) 9 Oct 1789.

⁹¹⁵ Talk by Stephen Raw, lettering artist. 'The Visual Language of Coins' at *Art In Coinage*' The British Numismatic Society and The Royal Numismatic Society Conference, Caius College, Cambridge, 5 July 2008. Another example is the many different fonts available on computer word programs.

⁹¹⁶ Peter Leather 'A Sorry End: the Priestley Riots of 1791' in M. Dick (ed.) (2005) *Joseph Priestley and Birmingham*, Brewin, Studley p 82.

towards design. David Bindman discusses how the familiar stock of classical allusions was used to represent revolutionary ideas. The female figure of ‘Liberty’ was seen as an active and energetic proponent of the principle she embodied. The figure of Hercules ceased to symbolise the power of kings, and became a symbol of the strength and unity of the French people.⁹¹⁷ After the start of the Revolution, in 1791 and 1792, Boulton produced a series of tokens and medals for the Monneron brothers in Paris, which featured revolutionary emblems such as ‘Liberty’ and ‘Louis XVI accepting the Constitution’. He tried to respond in his Monneron pieces to the rapidly changing events in France. But as the French revolution progressed and became less popular in Britain, the visual culture of radicalism started to disappear around 1793.⁹¹⁸ Boulton wanted to repair the damage done to authority by revolutionaries, by rehabilitating the figures of Louis XVI and Marie Antoinette. On three medals made in 1793-1794 at Soho Mint, much was made of the unity of the French royal family, in particular by portraying Louis as father figure, and showing Marie Antoinette as a mother torn away from her children.⁹¹⁹

Apart from on the Monneron issues, revolutionary symbols were not frequently used in Soho designs. The only other apparent use was on tokens made for Arnold Works, near Nottingham, in 1802, where the obverse shows a golden fleece (*toison d’or*) suspended from an apple tree, and the reverse shows the Roman fasces with the axe, spear and cap

⁹¹⁷ D. Bindman (1989) *The Shadow of the Guillotine: Britain and the French Revolution*. British Museum, London pp 12-28.

⁹¹⁸ D. Bindman (1989) *The Shadow of the Guillotine* p 54.

⁹¹⁹ The ‘*Final Interview*’ image was engraved by Charles Benazech and published by March 1794. D. Bindman (1989) *The Shadow of the Guillotine* pp 22-23; p 54.

of liberty.⁹²⁰ Interestingly the wearing of short cropped hair instead of wigs became a sign of radicalism during the last years of the century, but by 1806 even George III's image had short hair on the 1806 coinage issue.⁹²¹ Boulton was keeping up-to-date with fashionable trends in order to increase sales from the Soho Mint.

Regal coinage design

A determining factor in the design of the regal issues was the military rivalry between Britain and France. Commercial and colonial interests had to be protected, and images on coins were used by the government to bolster its claim to defend the stability of the realm.⁹²² Britannia, holding a trident, was used to indicate Britain's role as a maritime power, and was first seen on Boulton's coinage.⁹²³ The regal coinage issue with the portrait of George III on the obverse, and Britannia on the reverse received favourable comment:

*It is certainly by far the most elegant coinage that ever was actually brought ton circulation by Government at any period of British History. The proportions of thickness to breadth, and idea of forming so accurately weight and measures, The broad and strong protecting circles & sunk letters, also the whole figure and design with the strong execution of the Britannia on the Reverse are all admirable and perhaps scarcely admit of any improvement.*⁹²⁴

⁹²⁰ The Arnold works, a woollen spinning mill, used tokens of four values produced at Soho Mint; crown (five shillings), half a crown, one shilling, and sixpence. F.E. Burton (1923-24) *Arnold Village Tokens* British Numismatics Journal Volume 17 pp 177-178.

⁹²¹ D. Bindman (1989) *The Shadow of the Guillotine* p 66.

⁹²² D. Bindman (1989) *The Shadow of the Guillotine* p 65.

⁹²³ K. Eustace (2006) *Britannia: Some High points in the history of the iconography on British coinage* British Numismatic Journal Volume 76 2006.

⁹²⁴ MS 3782- 12-42 Item 215 James Wright Jr. (Dundee) to MB (Soho) 1 Sep 1797.

This appreciation was not only for the artistic aspects of Boulton's coin, but also for the technological improvements made at Soho Mint. The accuracy of the coins was a feature that had not been seen before in regal coinage, and was an important achievement, as discussed in chapter three.

Collectors' books

The importance of Matthew Boulton's work as objects of art with excellent designs can be seen in several contemporary catalogues. The first books on collecting coins had been written in the early sixteenth century.⁹²⁵ In the eighteenth century there were several more, including by Snelling, as discussed. Thomas Spence, who sold tokens as well as books for a short while, published a catalogue '*The Coin Collectors Companion*' in 1795.⁹²⁶ His book described a '*universal rage of collecting coins*'.⁹²⁷ Several other publications were important including Charles Pye's '*Provincial Coins and Tokens*' and James Conder's '*Arrangement of Provincial Coins, Tokens and Medalets*', both of which were featured in the Barber exhibition associated with this thesis.⁹²⁸ Conder became an ardent collector of the tokens being issued all around him and his book remained the standard work on the subject for nearly a century. To this day, many American collectors refer to 'Conder' tokens.⁹²⁹ The preface was written by James Wright who contacted

⁹²⁵ The first important books on coin collecting were by Guillaume Bude and Andrea Fulvio in 1514 and 1517. K. Sloan (ed.) (2003) *Enlightenment: Discovering the World in the Eighteenth Century* British Museum Press p 126.

⁹²⁶ Spence set up a radical bookshop in London by 1792, selling publications such as Paine's *Rights of Man*. He also produced and sold a variety of tokens, deliberately creating mules for collectors from at least forty dies. Some of his tokens were also intended to circulate propaganda among the working classes. The Barber Institute exhibition displayed a regal coin counter-stamped with 'Spence's Plan', promoting his proposals for the reform of land ownership. R.H. Thompson (1969) *The Dies of Thomas Spence 1750-1814* British Numismatic Journal Volume 38 1969.

⁹²⁷ T. Spence (1795) *The Coin Collector's Companion: Being a descriptive alphabetical list of the modern and provincial, political and other copper coins*, London.

⁹²⁸ R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* p 41; pp 50-53. Books included Thomas Prattent's *The Virtuoso's Companion and Coin Collector's Guide* of 1795-7. D.W. Dykes (2003) *The Eighteenth and early Nineteenth century Token* British Numismatic Journal Volume 73 (2003) pp 169-174.

⁹²⁹ R. Doty (1986) *English Merchant Tokens* <http://www.chicagocoinclub.org/projects/PiN/emt.html>.

Boulton in 1797. His introduction included a list of eminent coin collectors and emphasised the importance of coins as:

*the most faithful of all recorders, the cheapest, most minute, and portable of all pictures; if well designed and well executed during the present age in Britain, they will form a true mirror of the existing features of the times, and hand down to posterity the well earned reputation of our islanders for industry, commerce and arts.*⁹³⁰

He also described Kuchler's designs as being comparable to the best antique coins and the 'cartwheel' as being '*by far the most elegant coinage that was ever actually brought into circulation by government at any period of British History*'.⁹³¹ The artistic importance of the products of the Soho Mint has been discussed by Clay.⁹³²

The interest in tokens by numismatists was not generally sustained in the nineteenth century.⁹³³ However recently there has been increased interest in the contemporary social and industrial development portrayed on coins and in particular in Soho Mint.⁹³⁴

⁹³⁰ J. Conder (1799) *An Arrangement of Provincial Coins, Tokens and Medalets*, Jermyn, London.

⁹³¹ James Wright introduced himself to Boulton as: '*I am the writer who treats of Coins under the signature 'Civis' in the new & excellent London Monthly Magazine Dec 1796 p 867 Feb 1797 p 120 and March 1797 The object of my taking the liberty of troubling you at present is to mention that being employed in writing a preface to a "List of Provincial Coins Tokens and Medalets from the size of One Farthing to the Size of the Penny struck in Britain within the last 20 Years" soon to be published by Mr James Conder of Ipswich, I wish very much with a view to impressing the Reader with some idea of the importance of the Topick treated of.*' MS 3782- 12-42 Item 215 James Wright Jr. (Dundee) to MB (Soho) 1 Sep 1797.

⁹³² R. Clay (2009) in: R. Clay and S. Tugate (eds.) (2009) *Matthew Boulton and the Art of Making Money*.

⁹³³ There was a private publication of Thomas Sharp's *Catalogue of the Chetwynd Collection* in 1834, but no serious overview of eighteenth and early nineteenth century coins and tokens until the 1880s, when descriptive notes by Richard Thomas Samuel (1831-1906) started to appear irregularly in *Bazaar, Exchange and Mart*. There was also a publication by James Atkins (1837-1910) in 1892 on *Tradesmen's Tokens of the Eighteenth Century*. D.W. Dykes (2003) *The Eighteenth and early Nineteenth century Token* British Numismatic Journal Volume 73 (2003) pp 169-174.

⁹³⁴ For example there is the Soho Mint website [<http://www.sohomint.info>] set up in 2009. There are also the series of 2009 publications: see bibliography. Prices for Soho Mint products can be seen in coin sales such as those of Morton and Eden.

Engravers

Not only did Boulton produce some beautifully designed pieces, but he also had a widespread influence on other engravers at the end of the eighteenth century. Many of the well known die engravers in Birmingham and elsewhere were first employed or trained at Soho Mint. These included John Gregory Hancock, who was apprenticed to Boulton in 1765⁹³⁵ and members of the Wyon family, including George and at least two of his sons, Peter and Thomas.⁹³⁶ In turn, John Stubbs Jordan was apprenticed to Hancock. Another former pupil at Soho, Thomas Halliday, manufactured tokens at his own works in Newhall Street from 1810 on, and engraved dies for the trade, for firms such as Edward Thomason, and Young and Deakin of Sheffield. Halliday in turn had William Joseph Taylor as an apprentice in 1818.⁹³⁷ Taylor was important in making restrikes of Soho Mint material.⁹³⁸ Boulton's influence spread further. Sir Edward Thomason, well known for his coin and medal production in the nineteenth century, was apprenticed at Soho in 1786. In his memoirs he recollected: *'I was initiated in this scientific school at Soho which induced in me a versatility of taste for mechanics and to cultivate the arts and sciences'*. In explaining its influence on his future work he wrote: *'Having been accustomed at Soho to witness continuous new inventions in mechanisms and metallurgy, the mind becomes restless to produce some novelty of invention worthy of*

⁹³⁵ A later document details: *'two agreements of 24 June 1763 whereby William Hancock and John Hancock were bound apprentices to Matthew Boulton and John Fothergill of Birmingham, toymakers, for seven years each.'* MS 3782-12/95 Item 3 25 Aug 1794.

⁹³⁶ George Wyon (? -1796) was apprenticed to Hemmings, goldsmith to George II, and came to work at Soho in about 1775. He was still working for Boulton and Fothergill in 1782. George had four sons, Thomas (1767-1830), his twin Peter (1767-1822), George and James. Thomas was active as an engraver in Birmingham from 1790-1800. He was in partnership from around 1796 with his brother Peter in Lionel St as general die sinker. They made tradesmen's tokens often signed W or Wyon, and also worked for Boulton. K. Quickenden (2009) *Boulton Silver and Sheffield Plate* Silver Society, London p356; N. Carlisle (1837) *A Memoir of the Life and Works of William Wyon* Nicol, London.

⁹³⁷ R.C. Bell (1968) *Specious Tokens and those struck for General circulation 1784-1804* p 220; L. Forrer *Biographical Dictionary of Medallists* in 6 volumes p 388.

⁹³⁸ Taylor was apprenticed in 1818 to Halliday who was a former pupil at Soho. D. Vice (1995) *A Fresh Insight into Soho Mint restrikes and those responsible for their manufacture* Format 52 1995.

being patented'.⁹³⁹ Thomason produced a series of medals which were greatly admired, and the Wyon family supplied several engravers to the Royal Mint in the nineteenth century. Thus the Soho Mint spread its influence into future generations of engravers.⁹⁴⁰

Summary to chapter four

In addition to making many products at the Soho Mint, Boulton was able to solve the problems of finding sufficient customers and of transporting coins, tokens and medals all over the world. For certain orders, such as for tokens, the amounts produced were negligible compared to the huge coinage issues produced for the East India Company, and for the British Government, as can be seen in Figure 4:15. The figure shows the wide range of products from the Soho Mint.⁹⁴¹ Boulton's influence on coin design, from both the technological and artistic point of view, was world wide, and many engravers gained their first experience at the Soho Mint. The design process included considerable personal input by Boulton, who followed fashionable trends, but also insisted on simplicity and clarity in the final image. His search for perfection in details, such as inscriptions, and the accuracy of the images made the Soho pieces popular with influential individuals.

A variety of customers kept the Soho Mint operational until the regal coinage contract was gained in 1797. These commissions were gained by Boulton's ability as a publicist, personal contact, and the reputation of Soho Mint as a reliable supplier. Boulton's initial tokens contracts enabled the steam-powered technology to be tested and equipment

⁹³⁹ He was also impressed by the extent and variety of the machinery used there, saying that it excelled '*all others of the like in Europe*'. E. Thomason (1845) *Memoirs* Longman Brown, Green and Longman's, London p 3.

⁹⁴⁰ Boulton's relationship with his engravers, apprentices and other workers is further discussed in an article by the author. S. Tungate (forthcoming) 'Workers at the Soho Mint' in: S. Baggott and K. Quickenden (eds.) *Matthew Boulton- Enterprising Industrialist of the Enlightenment*.

⁹⁴¹ The graph has been drawn from figures collated in Table 1, Appendix 3. It includes the production of the 1787-1791 Anglesey tokens, which were not made at Soho Mint, for comparison.

adjusted. Early orders from the East India Company were pivotal in proving the mint's ability to produce large amounts of coin. Also vital were the issues of heavy tokens made for the Monneron brothers, in testing Boulton's ability to source and transport sufficient copper, and deliver coin. Sales to collectors were important in keeping the Soho Mint in the public eye, and in retaining key workers. These led to further commissions both at home and overseas. Appreciation of the improvements in coin design made by Boulton eventually led to orders for minting equipment as well.

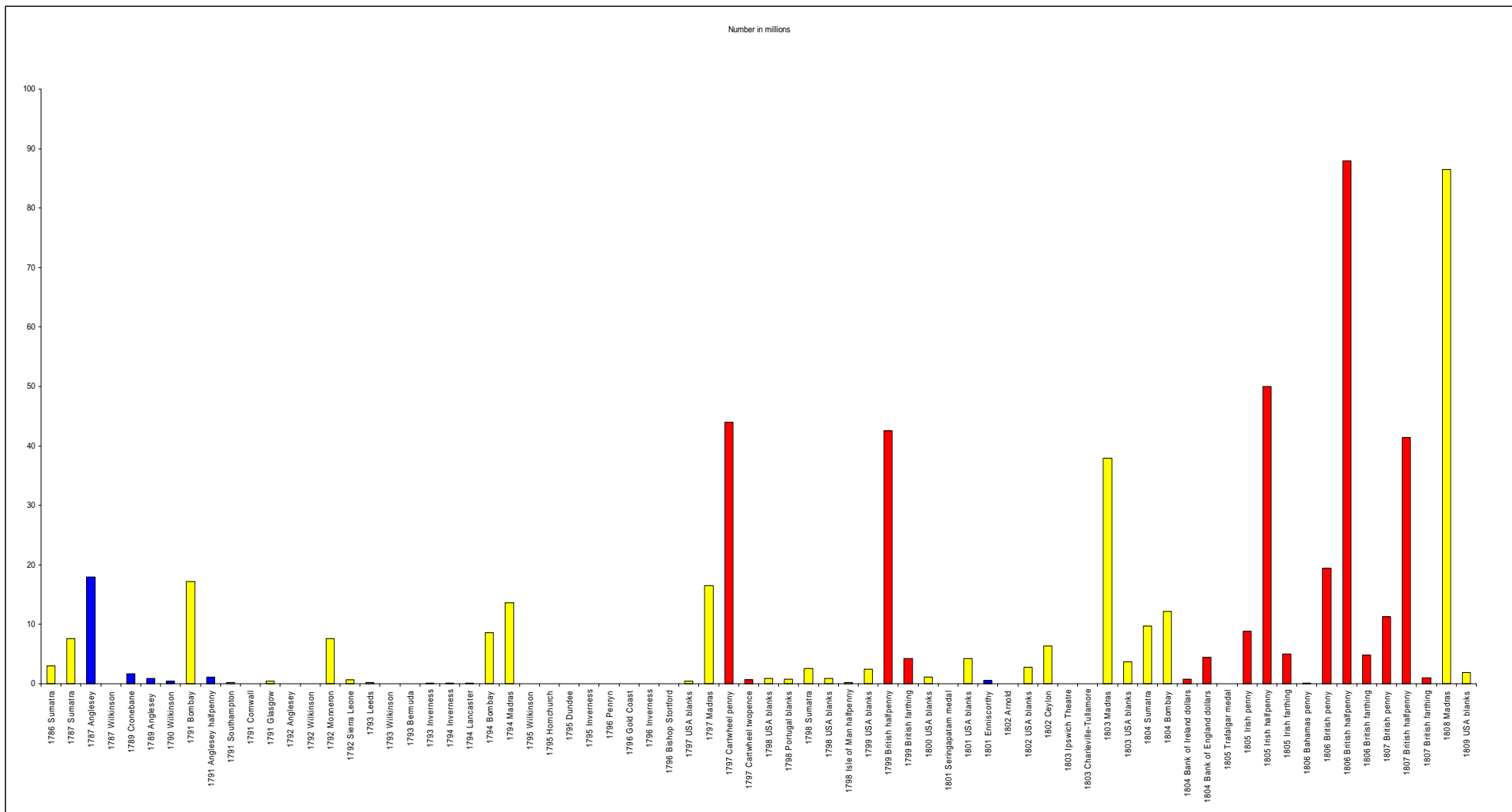


Figure 4.15: Production at the Soho Mint (yellow indicates foreign coins, blue indicates tokens, red indicates regal coinage)

The British government was Soho Mint's most important customer, as discussed further in the catalogue. The use of regular haulage contractors in early contracts for tokens and for foreign coins established the routines which would prove important when shipping these much larger regal coinage orders. Boulton was able to organise the transport of the copper required, and the distribution of a huge amount of coin throughout the country. In addition, this issue received very favourable comments from many admirers.⁹⁴² Their designs were seen as representative of Britain, and of excellent quality.⁹⁴³ Lord Liverpool, President of the Board of Trade commented: *It is with great pleasure I inform you that your copper pence in London & its neighbourhood are received with great satisfaction.*⁹⁴⁴ This would have been very satisfying to Boulton who had achieved the reforms of regal coinage issue, and its distribution, which had defeated others for generations. His organisational skills in coordinating the logistics involved in transporting both resources and finished goods around the world were amazing. Soho Mint also produced a huge range of designs for customers from many walks of life all over the world.

⁹⁴² Colquhoun thanked Boulton for specimens sent and added he '*hopes to see the day when the whole of the coinage of the nation will be under the management of Mr Boulton as then it will be rescued from the disgrace which attends to the present ill executed money, besides being the means of protecting against counterfeiting.*' MS 3782-12-42 Item 142 Patrick Colquhoun (London) to MB (Soho) 15 Jun 1797.

⁹⁴³ Barton said '*They so far exceed anything of the kind I have before ever seen, both in beauty and excellence of workmanship, that I cannot sufficiently admire them.*' MS 3782-12-42 Item 197 John Barton (Office for Trade, Whitehall, London) to [MB] (—) 5 Aug 1797 Another appreciative recipient of coin wrote: '*The specimens of the intended copper pence are, like all your productions, strong marks of the superior excellence of the English artists over those of any other country.*' MS 3782-12-42 Item 139 Brook Watson (London) to MB (Soho) 14 Jun 1797.

⁹⁴⁴ MS 3782- 12-42 Item 223 Earl of Liverpool (Addiscombe Place) to MB [Soho] 9 Sep 1797.

CONCLUSION

Research for this thesis has focused on a range of primary and secondary sources concerning ‘Matthew Boulton and the Soho Mint: Copper to Customer’. During the course of this enquiry the author has had the opportunity to study original archival material about Matthew Boulton, in the Archives of Soho at Birmingham Archives and Heritage, and in a variety of archives available on-line, and elsewhere. Also a vast body of Soho Mint artefacts; coins, medals, tokens, trial strikes, dies and drawings has been examined. Fieldwork in various locations connected with Boulton’s activities has been carried out, including visits to copper mining areas in Anglesey, Cornwall and North Wales, and copper works in Flintshire. Iron-manufacturing works at Bersham, Coalbrookdale and in Stirlingshire have been visited, and the author had the opportunity to look round the Royal Mint. This has enabled a unique understanding of the whole process of coining at the Soho Mint. The reasons why Matthew Boulton became involved in coining has been described, including how coins, medals and tokens were produced, both before and after the establishment of the Soho Mint.

Lack of small change had threatened to derail industrial progress at the end of the eighteenth century. This thesis has shown how Boulton was able to solve this problem. He made major improvements not only in the technological aspects of minting practices, but also in the transport of the raw materials needed, and in the distribution of the completed products. Research has led to an examination of how copper was produced for coining, and the author has outlined Matthew Boulton’s contributions to the steel industry and his influence on die making. How customers were found for the mint, and the design of the wide range of products of the Soho Mint have also been discussed. Boulton’s

coining activities were inextricably linked to the cultural, economic and political shifts of the age in which he lived.

A great part of the innovations at the Soho Mint were due to Matthew Boulton's personal attributes. He had both scientific interests and technical abilities, and sought to find out by experimentation the best methods of preparing copper, annealing metal and forming steel dies. This enabled him to use the best sources and types of copper for his coining activities. Boulton had a hands-on approach, collecting technical knowledge and improving methods of mining and smelting from his experiences in the Cornish copper industry. He also had excellent knowledge of the iron industry, and his connections with Huntsman were important in refining steel for use in coining dies. Boulton's role in making standardized dies for his large-scale coin issues is an aspect of his activities that has been underestimated in previous studies.

In introducing new technology with the steam-powered coining presses at Soho Mint Bolton was applying lessons learnt from previous experiences from his steam-engine business. He was able to select workers who were capable of new practices, including engineers, mechanics, smiths and engravers. They pioneered new procedures, making standardised machine-made products, and introduced a prototype of the now ubiquitous production line of modern industry. I have demonstrated how Boulton was able to break the monopoly of the Royal Mint and eventually make the issue of sufficient copper coins part of the government's remit. By the time he finally obtained his regal coinage contract in 1797, Boulton was sixty-nine years old, with failing health. But despite this, he went on to produce 321 million coins for the British government. His innovations went beyond

that of mere production, in so far as he took it upon himself to distribute the coins across the whole nation rather than having them collected by local merchants and bankers confined to the capital. Boulton had great awareness of the transport infrastructure in existence at the time, having been involved in projects connected with the introduction of canals, and improvements in turnpike roads. He had campaigned for a more widespread distribution of coin. The importance of transport issues has not been fully studied in connection with coining.

Boulton met the challenges of making a regal coinage that was to be significantly better than any previous money, at a time of great uncertainty. In this thesis I have described how global events such as the French Revolution and the wars that followed, plus unforeseen events such as the madness of George III, delayed the hoped-for regal coinage contract. This meant that Boulton had to diversify his customer base, which is illustrated by the many contracts he obtained for tokens and foreign coins, and the medals he produced. In meeting these challenges Boulton proved himself to be a great entrepreneur and salesman, and his former business ventures afforded him a wealth of experience, a first-class business reputation and a vast network of contacts. His coins, medals and tokens were sold and distributed all over the world.

Due to Boulton's technological improvements, the efficiency of Soho's automated steam-driven presses enabled huge quantities of coins, medals, and tokens to be made cheaply. But the improved die-making and metal rolling technologies developed at Soho, along with the use of highly skilled engravers, meant that quality was not compromised in favour of quantity. In fact Boulton's coins were far superior to any others previously

produced. Diversification into medal production meant that his experienced workers and engravers were kept employed when no coin issues were ordered. The thesis has explained that his prior expertise in designing, producing and selling consumer goods proved valuable in setting up the Soho Mint. Examples are given of where Boulton took a personal interest in design, and demonstrate that many of the Soho Mint coins, medals and tokens show artistic merit as well as superior manufacture. The high standards that Boulton insisted upon were incorporated into the aesthetic aspects as well as in technical expertise. His products encouraged contemporary interest in collecting coins, medals, and tokens. Copper tokens were accessible to collectors who were not especially wealthy, but the more expensive medals produced at the Soho Mint were also popular with the elite of society. An appreciative recipient of a Matthew Boulton memorial medal wrote that it was: *'a superior medallic representation of a gentleman by whose taste and spirit the coins and medals of the nation have been so essentially improved'*. He compared them favourably to products from the Royal Mint.⁹⁴⁵ Boulton continued to have influence on future generations of coin and medal producers, as many of them had been trained at Soho Mint.

The overall picture that has emerged during research of this wide range of material shows that the Soho Mint, more than any other of Boulton's business affairs, utilized his talents as an engineer, industrialist, artist, businessman and one of the eighteenth century's foremost net-workers. One of Boulton's unique characteristics was his organisational ability and attention to detail. He was able to organise collaborative effort and to communicate his ideas to a team of individuals, who were motivated by his enthusiasm

⁹⁴⁵ MS 3782-13/22 Item 25 Edward Hawkins (Nutfield) to MRB (Soho) 30 Jun 1821.

for the Soho Mint project. His capacity to motivate his workers, to persuade governments, to keep royalty happy and to obtain foreign orders proved to be essential for the survival of the mint. It was due to his perseverance and drive that the Soho Mint finally succeeded in the face of multiple difficulties, which would have discouraged any one else. His great knowledge of the mechanical and metallurgical arts, his leadership, and his determination were recognized at the time by his co-workers:

*That the management & methodizing of the whole was exclusively his [Boulton's] own; & that to his indefatigable energy & perseverance in pursuit of this the favourite & nearly the sole object of the last twenty years of the active part of his life is to be attributed the perfection it has ultimately attained.*⁹⁴⁶

Boulton spent the last twenty years of his life modifying and perfecting his mint equipment. It was one of his proudest achievements. However after his death in 1809, the Soho Mint declined, and only three coinage issues were struck on the original 1798 presses.⁹⁴⁷ Virtually nothing now remains of Soho Mint, except for the artifacts, the coins, medals and tokens produced there.⁹⁴⁸ Matthew Boulton's son sold minting equipment rather than coins, and future regal issues were struck on new steam-powered coining equipment produced at Soho and installed at the Royal Mint.⁹⁴⁹ Matthew Boulton's legacy was the coining technology and die-making techniques that was sent over the world. Due to his improvements in technology and design, modern money, with

⁹⁴⁶ MS-3782-13-120 Minutes of a meeting held at Soho on 7th January 1810; quoted in R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* p xi.

⁹⁴⁷ These were repeats of earlier orders: over 3 million Bank of England tokens dated 1804, a small issue of Isle of Man coinage of pennies and half pennies in 1813, and Sierra Leone Macauley tokens in 1814.

⁹⁴⁸ The original coining apparatus was sold to Calcutta in 1823, and new equipment installed in 1828, but the Soho Mint business finally closed in 1849. Both the Mint and Manufactory were demolished and no trace of either was left by 1863. Only Soho House remains as a reminder of the estate.

⁹⁴⁹ The Royal Mint, rebuilt and equipped by Soho, was in operation by 10th April 1810 but, no further regal copper coins were struck until 1821. Matthew Robinson Boulton concentrated mainly on producing mint equipment and stores for Mints in Bombay, Calcutta, and the four Mexican mints. R. Doty (1998) *The Soho Mint*.

uniformly sized coins, straight edges and standardized images, are now used throughout the world. His coining heritage continues on at the Royal Mint, at Llantrisant in South Wales, one of only five mints in the world, still capable of making large and beautiful coinage issues.⁹⁵⁰

Research has also led to detailed catalogues of Soho Mint products for several institutions. Full details of each individual coin, medal, token or die studied at Birmingham Museum and Art Gallery, have been loaded onto their on-line catalogue system.⁹⁵¹ Catalogues have also been produced for the Assay Office Collection, and the Avery Museum Collection. Research carried out during this study was also used to inform the exhibitions held during Boulton's bicentenary year, and to contribute to publications associated with them.⁹⁵² In particular a catalogue was produced for the Barber Institute of Fine Arts exhibition *Matthew Boulton and The Art of Making Money* that was held from May 2009 to May 2010 at the University of Birmingham.⁹⁵³ Research findings were also further disseminated by participation in an international conference and a series of public talks.⁹⁵⁴ A forthcoming publication will cover the workers at the Soho Mint.⁹⁵⁵

⁹⁵⁰ These coinage issues are distributed to countries around the world; information on visit to the Royal Mint.

⁹⁵¹ The AHRC collaborative award was to catalogue the BMAG collection and to make archive material and secondary information more accessible, especially to Museum curators, who deal with enquiries about individual coins. The actual catalogue produced for Birmingham Museum and Art Gallery is over 414 pages long and has been entered on their MINISIS computerised catalogue system. The full catalogue of individual items, with images, is available on CD.

⁹⁵² S. Tungate (2009) 'Matthew Boulton's Mints: Copper to Customer' in S. Mason (ed.) (2009) *Matthew Boulton: Selling What All The World Desires* Yale University Press, London and New Haven; S. Tungate (2009) 'Technology, Art and Design in the Works of Matthew Boulton: Coins, Medals and Tokens produced at the Soho Mint' in M. Dick (ed.) (2009) *Matthew Boulton: A Revolutionary Player* Brewin, Studley pp 185-200.

⁹⁵³ R. Clay and S. Tungate (eds.) (2009) *Matthew Boulton and the Art of Making Money* Brewin, Studley. This book was reviewed by M. Gouch (2009) *The Numismatic Circular*, Volume CXVII Number 3 July 2009 pp 121-122.

⁹⁵⁴ International Conference held at the University of Birmingham: *Where Genius and Arts Preside: Matthew Boulton and the Soho Manufactory 1809-2009* 3rd-5th July 2009. British Numismatic Conference 11th July 2009.

⁹⁵⁵ Sue Tungate (forthcoming) 'Workers at the Soho Mint' in Sally Baggott and Ken Quickenden (eds.) *Matthew Boulton- Enterprising Industrialist of the Enlightenment* Ashgate, Farnham.

Without sufficient money in the form of coin to pay workers, industrial expansion in the late eighteenth century would have been difficult, and may have been delayed. Therefore Boulton's contribution to coinage is as important as his development of the steam engines with James Watt. The practices and technologies he initiated spread across the world. He made improvements in all aspects from mining the copper and producing the steel used for dies, to the design, and final delivery of the product. He can truly be said to be the founder of modern coinage.

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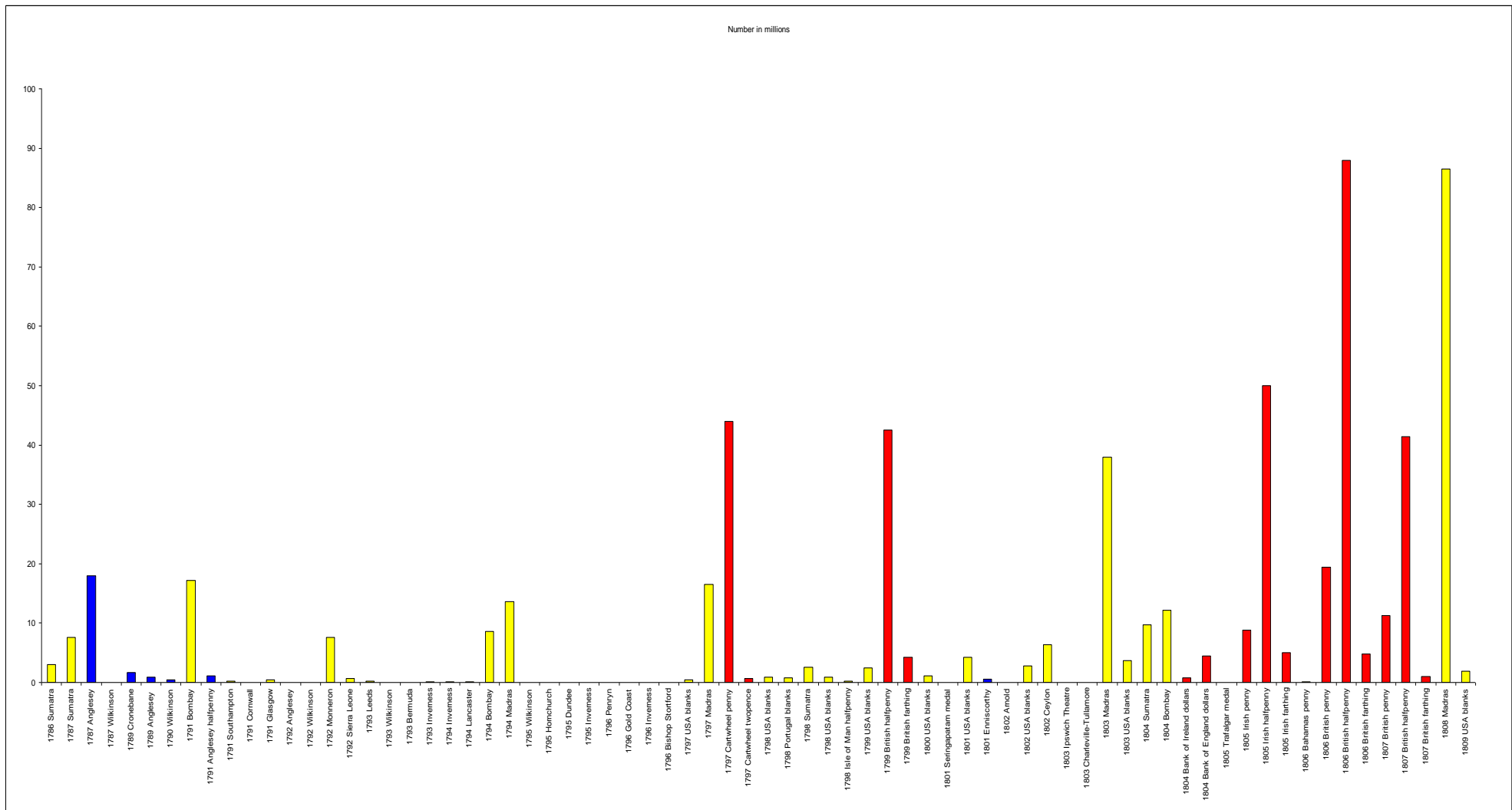


Figure 4.15: Production at the Soho Mint (yellow indicates foreign coins, blue indicates tokens, red indicates regal coinage)

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MS 3782-12-23 General Correspondence 1758-1773 (all)

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MS 3782-12-108 Item 6 1771 List of articles manufactured at Soho

MS 3782-12-108 Item 7 1772 Memorandum book List of scientific apparatus

MS 3782-12-108 Item 8 1772 Notes on dyeing; chemical notes

MS 3782-12-108-9 Notebook 1773

MS 3782-12-108-11 1775-1776

MS 3782-12-108-12 1776-1777

MS 3782-12-108-13 1778

MS 3782-12-108-14 1778 Engines and Mining (Notebooks 15 & 16 are similar)

MS 3782-12-108-16 General Notebook 1780-1790 Copper trade

MS 3782-12-108-17 Holland 1779

MS 3782-12-108-27 1780-1790 General notebook

MS 3782-12-108 Item 40 Notebook 1784

MS 3782-12-108 Item 53 Mint Notebook 1788 'Coining Money 1788'

The notebook contains observations, calculations, and accounts relating to coinage.

MS 3782-12-108 Item 54 Mint Notebook 1789 'Mint Oct 1st 1789'.

The notebook contains observations, calculations, and diagrams relating to coinage and the Mint

MS 3782-12-108 Item 55 1789 -1795 General Notebook labelled 'Copper 1791-1793'

MS 3782-12-108 Item 63 Collection of Facts relative to Coins and to Mint establishments 1792

MS 3782-13-36 Letters between Matthew Boulton and Matthew Robinson Boulton

3rd Sep 1783- 1801 (Items 1-179)

MS 3782-13-37 Matthew Boulton: Biographical Memoirs Items 22-30. These include Boulton's Will; and list of people to whom prints and memorial medals are to be delivered

MS 3782-13-37-117 Medal Distribution list

MS 3782-13-93 History of the Copper Trade
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MS 3782-17-8 License to coin 1807 2nd October 1807

Birmingham Museum and Art Gallery

Phillp album BMAG 2003-0031

British Museum

Items from Sarah Sophia Banks collection of letters and ephemera (uncatalogued). By kind permission of Dr Catherine Eagleton.

Appendix 1: Chronological List of Coins, Medals and Tokens made at Soho Mint

The date of production and name of the item is given, followed by the engraver and the total number of pieces made if known.¹ The items in italics are requests, for orders which were discussed but not started, which were found during research. Individual items are discussed in the catalogue.

1772 ‘Otaheite’ Medal also known as Resolution and Adventure Medal or Captain Cook’s Second Voyage to the Pacific Medal (BHM 165; Eimer 744) **41-44mm John Westwood Senior TOTAL = 2,144**

1774 Regimental Medals 37th Foot (Hampshires) Sir Eyre Coote Medal **45 x 56mm; oval 40 x 52mm; 50mm Westwood TOTAL= 22**

1781 Admiral Rodney Medal (BHM 230) **34mm Thomas Moore/William Wilson**

1786 Sumatra (Bencoolen) three keping, two keping, one keping **William Castleton 28mm; 25mm; 20mm TOTAL= 2,944,620**

1786 *Request from Charles Borel, South Carolina for five tons of copper coin.*²

1787 Sumatra; three keping, two keping, one keping **Castleton 27mm; 25mm; 20mm TOTAL= 7,250,000**

1787 (possibly not struck till after 1815) Siege of Gibraltar (General Eliott/Lord Heathfield) Medal (BHM 247; Eimer 794) **59mm Jean-Pierre Droz**

1787 pattern Shilling **25mm Droz** (ESC 1242)

1787 pattern Sixpence **20.5mm Francis or John Eginton** (ESC 1641)

1787 pattern Halfpenny (drawing only) **Droz**

1787 Anglesey Penny Token (D&H Anglesey 11-85) **33mm John Gregory Hancock** (not struck at Soho Mint)

1787 (struck 1789) Wilkinson **Forge** Halfpenny Token (D&H Warwickshire 340-358; 360-368) **29mm Hancock** (not struck at Soho Mint)

1787/9 *Request from John H Mitchell, South Carolina for terms for coining for the whole of USA.*³

1788 pattern Halfpenny (Peck 935-945; 962-970) **31mm Droz**

1788 pattern Sixpence **20.5mm Eginton/Droz** (ESC 1642)

¹ Numbers of pieces made come from R. Doty (1998) *The Soho Mint*; D. Vice (forthcoming) and from a variety of archive sources found during research.

² MS 3782-12-74 Item 121 Zaccheus Walker (Birmingham) to MB (Chacewater) 28 Sep 1786.

³ MS 3782-12-108 Item 53 Mint Book 1788 p 68.

1788 *Request from Otto Jacob Finck from Altona, Denmark for Schleswig coin.*⁴

1788 *Request from James Jarvis for terms for federal coinage for the USA.*⁵

1788 Anglesey Penny Token (D&H Anglesey 86-140, 169-243) **33mm Hancock** (made later using old blanks)

1788 Anglesey Halfpenny Token (D&H Anglesey 273-279, 281-352) **29mm Hancock** (not all struck at Soho Mint)

1788 (struck 1789) Wilkinson **Forge** Halfpenny Token (D&H Warwickshire 375-384) **29mm Hancock TOTAL= 19,296**

1788 (struck 1789) Wilkinson **Ship** Halfpenny Token (D&H Warwickshire 336) **28mm Hancock TOTAL= 100**

1789 *Counters ordered by Mr Constable for whist.*⁶

1789 Restoration of the Kings Health Medal (BHM 331; Eimer 827) **34mm Droz**

1789 Cronebane Halfpenny Token (D&H Wicklow, Ireland 3-31) **29mm Hancock TOTAL= 1,674,185**

1789 Anglesey Halfpenny Token (D&H Anglesey 355-376) **29mm Hancock TOTAL 915,382**

1790 pattern Halfpenny (Peck 948-961; 971-976) **31mm Droz**

1790 pattern Sixpences **21mm Eginton/Droz** (ESC 1645)

1790 Wilkinson **Forge** Halfpenny Token (D&H Warwickshire 385-388) **29mm Rambert Dumarest/Hancock TOTAL= 404,217**

1790 Anglesey Halfpenny Token (D&H Anglesey 378) **29mm Dumarest after Hancock**

1791 pattern Guinea **24mm Thomas Wyon Senior**

1791 India Bombay Presidency double pice, one and half pice, one pice, half pice **30.5mm; 27mm; 24mm; 21mm Dumarest? TOTAL= 17,232,100**

⁴ *'Weights of 12 copper pieces or sous sent from Mr Fink of Altona.'* MS 3782-12-108 Item 53 Mint Book 1788 p 86.

⁵ James Jarvis wanted to know the cost of making silver money at 136 pieces to the mark. MS 3782-12-108 Item 53 Mint Book 1788 p 68 and 93.

⁶ *'A Half Crown size but thin, to the impression flat & light; on one side a Head of the King with Motto George the Beloved & on the reverse a figure of a drooping Britannia with the figure of Health in the Act of raising her up.'* MS 3782-12-59 Item 17 Richard Chippindall (London) to MB (Soho) 9 May 1789.

1791 Southampton Halfpenny Token (Taylor Moody and Co) (D&H Hampshire 89)
29mm Dumarest TOTAL =194,489

1791 Anglesey Halfpenny Token (D&H Anglesey 386-397) **29mm Dumarest**
TOTAL=1,150,784

1791 Anglesey Penny Token (D&H Anglesey 255) **33mm Hancock/Dumarest**
TOTAL= 34,320

1791 Cornwall Halfpenny Token (Cornish Copper Co, John Vivian) (D&H Cornwall 2)
29mm Dumarest TOTAL = 76,562

1791 Glasgow Halfpenny Token (Gilbert Shearer and Co) (D&H Lanarkshire 2) **29mm**
Dumarest TOTAL =483,903

1791 pattern Barbados Pineapple Penny **32mm T Wyon**

1791 pattern Monneron ‘Liberty Sous La Loi’; ‘Confiance’ two sol (Margolis 1; 2)
32mm Noel-Alexandre Ponthon

1791/2 Monneron ‘Vivre Libre’ Year III 1792; ‘Confiance’ five sol (Margolis 8) **40mm**
Augustin Dupre/Ponthon

1792 Monneron ‘Vivre Libre’ Year IV 1792; ‘Confiance’ five sol (Margolis 9) **40mm**
Dupre/Ponthon TOTAL 7,561,483

1792 Monneron ‘Vivre Libre’ Year IV 1792; ‘Qui Se Vend’ five sol (Margolis 10)
38mm Dupre/Ponthon

1792 Monneron ‘Liberte Sous La Loi’; ‘Qui Se Vend’ two sol (Margolis 11) **32mm**
Ponthon Estimate TOTAL= 3,225,600

1792 Monneron ‘Hercules’ ‘Les Francais’ ‘Qui Se Vend’ five sol (Margolis 12) **40mm**
Dupre/Ponthon TOTAL= 460

1792 Monneron Respublica Gallica ‘Hercules’ ‘La Sagesse Guide’ two sol (Margolis 14)
32mm Dupre/Ponthon TOTAL = 362

1792 (dated 1791) Monneron Serment Du Rois ‘Je Jure’ Medal (Margolis 18) **34/35mm**
Dupre TOTAL= 612

1791 Monneron ‘Acceptation’ Medal (similar to Sermont du Roi) **36mm Dupre** (not
 listed by Margolis)

1792 (undated) Monneron Rousseau Medal (Margolis 19) **34/35mm Dumarest**
(obverse); Ponthon (reverse) TOTAL = 756

1792 (dated 1789/90/91) Monneron Lafayette Medal (Margolis 20) 35mm Dumarest (obverse); Ponthon (reverse) TOTAL= 2,699

1792 '1791' Sierra Leone one dollar, fifty cent; twenty cent; ten cent, one cent, one penny 36mm; 31mm; 24mm; 19mm; 29mm; 32mm Ponthon TOTAL= 736,806

1792 Offer by Ralph Mather on Soho's behalf to supply Mint and coinage to Thomas Jefferson for the USA.⁷

1792 pattern Bengal cowrie coinage 15mm; 10mm Ponthon

1792 (dated 1791) Anglesey Penny Token (D&H Anglesey 386-397) 29mm Hancock TOTAL= 34,320

1792 Wilkinson Forge Halfpenny Token (D&H Warwickshire 389) 29mm Dumarest based on Hancock TOTAL= 27,184

1792 Wilkinson Ship Halfpenny Token (D&H Warwickshire 336) 30mm Hancock TOTAL= 100

1792 Soho Manufactory Medal 32mm Droz

1792 Proposed medal for the Royal Academy.⁸

1792 Request from Col Thomas Johnes for a Prize Medal for Cardiganshire Society of Husbandry.⁹

1793 Louis XVI Farewell/Final Interview Medal (Pollard 1) 48mm Conrad Heinrich Kuchler TOTAL= 423

1793 Execution of Louis XVI (Death) Medal (Pollard 2) 51mm Kuchler/Ponthon TOTAL= 488

1793 Death of Gustav III of Sweden Medal (Pollard 3) 56mm Kuchler TOTAL= 423

1793 Bermuda Halfpenny 30mm Droz/Ponthon TOTAL= 81,942

1793 Leeds Halfpenny Token (Henry Brownbill) (D&H Yorkshire 33-35, 37, 41) 29mm Ponthon TOTAL =179,448

1793 Inverness Halfpenny Token (Mackintosh, Inglis and Wilson) (D&H Inverness 1) 29mm Kuchler TOTAL = 122,577

⁷ However by the time Zaccheus Walker Junior arrived in the United States in November 1792 the idea has come to nothing. MS 3782-12-75 Item 57 Zaccheus Walker (Birmingham) to Matthew Boulton (London) 18 Apr 1793.

⁸ T. Stainton (1983) *The Proposed Academy Medal of 1793* British Numismatic Journal Vol 53 1983 pp 187-197.

⁹ MS 3782-12- 38 Item 73 Colonel Thomas Johnes (Swansea) to MB (Soho) 8 May 1793.

1793 Wilkinson Forge Halfpenny (D&H Warwickshire 409-416) **28mm Dumarest based on Hancock TOTAL= 92,553**

1794 (dated 1793) Execution of Marie Antoinette Medal (Pollard 4) **48mm Küchler TOTAL= 429**

1794 (dated 1792 or 1793) Marquis Cornwallis Medal (Pollard 5; BHM 363; Eimer 845) **48mm Küchler TOTAL= 457**

1794 pattern Canada Halfpenny **29mm Ponthon**

1794 Lancaster/Eccleston Halfpenny Token (D&H Lancashire 57) **29mm Ponthon TOTAL = 104,752**

1794 Inverness Halfpenny Token (Mackintosh, Inglis and Wilson) (D&H Inverness 2) **28.5mm Küchler TOTAL= 96,668**

1794 Essex Agricultural Society Medal (Pollard 7) **45mm Küchler TOTAL= 50 to 1808**

1794 India Bombay Presidency double pice, pice and half pice (pattern one and half pice) **30mm, 28m, 25mm, 20mm Ponthon? TOTAL = 8,653,390**

1794 India Madras Presidency (Northern Circars) 1/48 rupee, 1/96 rupee **30mm, 24mm Ponthon TOTAL = 13,559,018**

1794 *Request for spanish silver pistorinas and half pistorinas from Mr Aniswick, Albion St, Black Friars Bridge* This order could have been for colonies in the West Indies.¹⁰

1794/5 Ibberson London Halfpenny Token (D&H Middlesex 338-343) **29mm Ponthon**

1795 (dated 1794) Lord Howe and the Glorious First of June Medal (Pollard 8; BHM 383; Eimer 855) **48mm Küchler**

1795 *Lord Hood Medal designs sent 22.1.1795 by Küchler*¹¹

1795 pattern Halfpenny (Peck 1036-1046) **30-31mm T. Wyon based on Droz**

1795 Wilkinson Forge Halfpenny Token (D&H Warwickshire 420-423) **29mm Dumarest/ Hancock TOTAL=86,488**

1795 Hornchurch, Romford, Essex Halfpenny Token (George Cotton) (D&H Essex 33-4) **28mm Ponthon TOTAL= 10,563**

¹⁰ The amount wanted was '1 to 5 thousand pounds value per ann to be exactly copied from the cur' coin. They cannot procure a sufficiency of coins from Spain. Want it strictly equal to the value of the coin of that kingdom.' MS 3782-12-59 Item 63 Richard Chippindall (London) to MB (Soho) 29 Mar 1794.

¹¹ J.G. Pollard (1970) *Matthew Boulton and Conrad Heinrich Küchler*.

1795 Inverness Halfpenny Token (Mackintosh, Inglis and Wilson) (D&H Inverness 3)
28.5mm K chler TOTAL= 79,316

1795 (undated) pattern Swainson Vegetable syrup, London Token (D&H Middlesex 907) **28mm Ponthon**

1795/6 (undated) Dundee Halfpenny Token (W. Croom) (D&H Angusshire 12-15)
28mm Ponthon TOTAL = 52,805

1795 (dated 1797) Marriage of Prince of Wales Medal (Pollard 9; BHM 392; Eimer 865)
48mm K chler TOTAL= 50

1795 Queen Charlotte Frogmore Medal (Pollard 10; BHM 389; Eimer 864) **34mm K chler/Ponthon TOTAL= 50**

1795 Queen Charlotte Birthday: George III Frogmore Medal (BHM 390) **35mm Droz/Ponthon TOTAL= 50**

1795 Visit of Prince and Princess of Wales to Frogmore Medal (BHM 401) **47mm K chler/Ponthon TOTAL= 50**

*1795 Hutton Jackson & Magrath of Angle Court in Friday Street, London, for a Silk Manufactory, with Weavers Arms for the obverse and bale of silk with a Shuttle for the reverse.*¹²

*1795 George Bowser, one ton of Halfpennies for Lockwood Morris & Co LM & Co cypher and T & Co on reverse with edge inscription to read 'Payable at 26 Bush Lane, London.'*¹³

1796 (dated 1791) Sierra Leone ten cent, one cent **19mm, 29mm Ponthon**

1796 Medallic dies for Anton Schaeffer **79mm K chler**

1796 Catherine II of Russia Medallet (Pollard 11) **29mm K chler TOTAL= 33**

1796 pattern Myddleton Kentucky Token **29mm Ponthon/K chler TOTAL= 50**

1796 Inverness Halfpenny Token (D&H Invernesshire 4) **28.5mm K chler TOTAL= 85,254**

1796 (dated 1795) Bishop's Stortford Halfpenny Token (D&H Hertfordshire 4) **28.5mm K chler TOTAL =24,814**

1796 '1794' Penryn Volunteers Halfpenny Token (D&H Cornwall 4) **28mm K chler TOTAL = 19,173**

¹² MS 3782-12-75 Item 94 Zaccheus Walker (Birmingham) to MB (London) 29 Jan 1795.

¹³ MS 3782-12- 40 Item 17 George Bowser (London) to MB [Soho] 14 Jan 1795.

1796 Gold Coast one ackey; half ackey ; quarter ackey; tackoe **31mm, 24mm, 19mm**
Küchler TOTAL =11,886

1796 *Request from Sir Joseph Banks for Rumford Medal.*¹⁴

1796 *Proposed Jersey coinage.*¹⁵

1796/7 Major General Claude Martin coins (BHM 424) **43mm; 38mm; 34mm; 26mm**
Küchler/Alexander Mackenzie

1797 *Proposed coin for West Indian islands for Mr Bundack, East Cheaping.*¹⁶

1797 *Possible coinage for the United States.*¹⁷

1797 Blanks for cents United States Mint, Philadelphia **TOTAL= 425,535**

1797 dated 1793 Board of Agriculture Prize (Pollard 6; Eimer 853) **48mm Küchler**

1797 *Request for sample coins from John Ashworth; to take to dominions of the Vizier of Aude.*¹⁸

1797 India Madras (Northern Circars) Presidency 1/48 rupee, 1/96 rupee **32mm, 24mm**
Küchler based on Ponthon? TOTAL = 16,535,202

1797 Cartwheel Two pence (Peck 1064-1077) **42mm Küchler TOTAL = 722,180**

1797 Cartwheel Penny (Peck 1083-1133) **36mm Küchler TOTAL =43,969,204**

1797 pattern Penny (various) **36mm Küchler**

1797 pattern Halfpenny (Peck 1152-1160) **31mm Küchler**

1797 pattern Farthing (Peck 1186-1190) **25-26mm Küchler**

1798 Blanks for cents United States Mint **TOTAL= 926,834**

1798 Blanks for Lucena & Crawford, Portugal 36 to lb (221,929); 72 to lb (295,686); 120 to lb (242,400) **TOTAL= 760,015**

¹⁴ MS 3782-12-56 Item 31 Sir Joseph Banks (London) to Matthew Boulton (Soho) 30 Nov 1796.

¹⁵ MS 3782-12-73 Item 122 Thomas Williams (Anglesey) to MB (Soho) 6 Sep. 1796; Item 123 MB to Thomas Williams 15 Sep 1796.

¹⁶ MS 3782-12-59 Item 91 and 92 Richard Chippindall (London) to MB (Soho) 24 and 25 Apr 1797.

¹⁷ Fox had sent a proof penny 'to My Friend the Secretary of State at Philadelphia, he is quite pleased with it & was going to show it to the President Officers of Government & to the Directors of the Mint. I told him I should be pleased to supply to copper for a coinage of the same kind for the U.S. of A & I believe you would be pleased to manufacture it into money. He wishes me to ascertain by thy assistance the expense of coining any given quantity of pence & half pence etc.' MS 3782-12-42 Item 282 George C. Fox & Sons (Falmouth) to Matthew Boulton (Soho) 11 Dec 1797.

¹⁸ MS 3782- 12-42 Item 15 Captain John Ashworth (—) to MB (Soho) 2 Feb 1797.

1798 Hafod Friendly Society Medal 41mm John Phillp TOTAL= 120

1798 pattern Guinea 24mm Kuchler

1798 pattern Shield Crown/Dollar (ESC 168-180) 42mm Kuchler

1798 pattern Farthing (Peck 1202-1206) 25-26mm Kuchler

1798 Mrs Mary Linwood, Linwood Concert Rooms tickets TOTAL = 100

**1798 Sumatra three keping, two keping, one keping 27mm, 24mm, 20mm Kuchler?
TOTAL = 2,562,345**

1798 Isle of Man Penny 33mm Kuchler TOTAL = 95,045

1798 Isle of Man Halfpenny 27mm Kuchler TOTAL = 193,234

1798 The Second Presidency of George Washington 'Seasons' Medals TOTAL= 720
 'Shepherd' Medal (Pollard 12) **48mm Kuchler**
 'Farmer' Medal (Pollard 13) **48mm Kuchler**
 'Spinner' Medal (Pollard 14) **48mm Kuchler**

**1798 Battle of the Nile (Davidson's Nile Medal) (Pollard 15; BHM 447; Eimer 890)
48/47/45mm Kuchler TOTAL=7,316**

**1798 British Victories (Army and Navy Victories) Medal (BHM 458; Eimer 897) 48mm
Kuchler**

1799 Blanks for cents United States Mint TOTAL= 2,526,501

**1799 pattern and currency Halfpenny (Peck 1218-1253) 30mm Kuchler TOTAL =
42,480,000**

**1799 pattern and currency Farthing (Peck 1268-1280) 23mm Kuchler TOTAL
=4,224,000**

**1799 pattern Christian VII Denmark coins 39mm, 34mm, 27mm, 21mm, 18mm
Kuchler**

1799 Count Alexander Suvarow Medal (Pollard 17) 48mm Kuchler TOTAL= 348

**1799 Ferdinand IV of Naples and Sicily Medal (Pollard 18; BHM 479; Eimer 908)
48mm Kuchler TOTAL= 611**

1799 South Devon Militia Defence of Waterford Medal 31mm Kuchler TOTAL= 596

1800 Earl St Vincent's Medal (Battle 1797) (Pollard 19; BHM 489; Eimer 919) **47mm Kuchler TOTAL= 637**

1800 Preservation of George III from Assassination Medal (Pollard 23; BHM 482, 483, 484 and 485; Eimer 916) **48mm Kuchler TOTAL= 217**

1800 Penydarran Works token (five shillings, two shillings and sixpence, one shilling, sixpence and three-pence) **34mm, 32mm, 30mm, 29mm, 26mm Phillip**

1800 Blanks for half cents United States Mint (188,382); cents (947,710) **TOTAL= 1,136,092**

1801 Blanks for cents United States Mint **TOTAL= 4,207,008**

1801 (dated 1800) Staffordshire Agricultural Society Medal (Pollard 21) **47mm Kuchler TOTAL= 200**

1801 (dated 1800) Enniscorthy Halfpenny Token (D&H Wexford 1-4) **28mm Kuchler TOTAL = 655,304**

1801 dated 1796 Gold Coast one ackey; half ackey ;quarter ackey; tackoe **34mm, 31mm, 24mm, 19mm Kuchler TOTAL =13,200**

1801 Union of Britain and Ireland (Pollard 24; BHM 523, 524 and 525; Eimer 927) **48mm Kuchler TOTAL= 316**

1801 (dated 1799) Seringapatam Medal (Pollard 20; Eimer 903) **48mm Kuchler TOTAL= 51,165**

1801 Preparation for Peace of Amiens Medal (BHM 513; Eimer 941) **48mm Kuchler**

1801 *Request from Mr James Braithwaite of Kendal for 50,000 pieces of base silver Danish money which MB 'advised him to decline it as it is contrary to the Laws of the Kingdom & of Nations.'*¹⁹

1802 *Discussion of possible coinage for France.*²⁰

1802 Peace of Amiens Medal (Pollard 25; BHM 534, 535 and 536; Eimer 941) **48mm Kuchler or Dumarest TOTAL= 204**

1802 Birmingham Loyal Association Medal (Eimer 943) **47mm Hancock**

1802 Nottinghamshire Yeomanry Medal (Pollard 26; Eimer 945) **36mm Kuchler TOTAL= 246**

¹⁹ MS 3782-12-46 Item 352-23a Request for Danish money 5 Nov 1801.

²⁰ MS 3219-4 Item 124 MB (Soho) to James Watt [Frankfurt] 10 Oct 1802

**1802 Manchester and Salford Volunteers Medal (Eimer 944) 36mm Küchler
TOTAL= 106**

1802 Blanks for cents United States Mint TOTAL= 2,812,664

**1802 Ceylon rupee 1/48 rix dollar; 1/96 rix dollar; 1/192 rix dollar 30mm; 23mm, 18mm
Küchler TOTAL = 6,440,121**

**1803 India Madras Presidency twenty cash, ten cash; five cash; one cash 31mm; 25mm,
21mm; 11mm Phillp/Küchler TOTAL = 37,936,629**

**1802 '1791' Arnold Works token (Davison and Hawksley) (crown (five shillings), half a
crown, one shilling, and sixpence) 43mm, 30mm, Peter Wyon TOTAL= 22,489**

1802 Sierra Leone ten cents 24mm Dies based on Ponthon

1803 Sierra Leone ten cents 24mm Dies based on Ponthon

1803 St. Albans Female Friendly Society Medal 42mm Phillp TOTAL= 200

**1803 (dated 1798) pattern Fridericus II Duke of Würtemberg thaler 44mm Küchler
TOTAL= 100**

1803 Ipswich Theatre 41mm Phillp TOTAL=4,000

**1803 (dated 1798) Boulton's Medallie Scale Medal (Pollard 27; BHM 462; Eimer
901a/b) 42/41mm Dumarest/ Küchler**

**1803 Boydell's Shakespeare Medal (Pollard 28; BHM 553 and 554; Eimer 950) 48mm
Küchler/Phillp**

1803 trial strike Duke of Bridgwater Medal 48mm Phillp?

1803 Blanks for United States Mint (1,186,387); cents (1,868,011) TOTAL= 3,054,398

1804 Enquiry from Antigua for silver and copper coin.²¹

**1803/4 (dated 1802) Charleville-Tullamore one shilling and one penny token (D&H
Kings County 1-4) 36mm Hancock. TOTAL = 10,211**

**1804 Ceylon rupee 1/48 rix dollar; 1/96 rix dollar; 1/192 rix dollar 30mm, 23mm, 18mm
Küchler TOTAL=66**

1804 Sumatra four, two and one keping 30mm; 26mm; 20mm Phillp

²¹ 'Antigua wants to coin £500 sterling into small silver & copper for the use of the Island. I have this morning told the agent that you could execute such a work much cheaper than the [Royal] mint will do.' MS 3782-12-56 Item 69 Sir Joseph Banks (London) to MB (Soho) 28 Mar 1804.

TOTAL 9,775,025

**1804 India Bombay Presidency double pice, one pice, half pice 30mm; 26mm; 20mm
Phillp TOTAL 12,240,550**

1804 pattern Alexander I of Russia rouble 41mm Kuchler TOTAL= 59

1804 pattern Alexander I of Russia imperial 27mm Kuchler TOTAL= 77

**1804 pattern Bank of England Regenerated Garter Dollar Token (ESC 181-9)
41mm Kuchler TOTAL= 70**

**1804 Bank of England Regenerated Britannia Five Shilling Dollar Token (ESC 190-3)
40-42mm Kuchler TOTAL= 4,496,192 (up till 1811)**

**1804 Bank of Ireland Regenerated Six Shilling Dollar Token 42mm Kuchler
TOTAL= 791,561**

1805 Dies for Royal Visit to Soho Medal (Pollard 29a)

**1805 Boulton's Trafalgar Medal (Pollard 30; BHM 584; Eimer 960) 48mm Kuchler
TOTAL 14,000**

1805 Irish Penny 33mm Kuchler TOTAL 8,788,416

1805 Irish Halfpenny 27-28mm Kuchler TOTAL = 49,795,200

1806 Irish Farthing 20mm Kuchler TOTAL = 4,996,992

1805 pattern Penny (Peck 1288-1292) 34-35mm Kuchler

1805 pattern Halfpenny (Peck 1301-1306) 30mm Kuchler

1806 (dated 1800) Drayton Agricultural Society Medal 47mm Kuchler TOTAL = 53

1806 Bahamas Halfpenny 28mm Kuchler TOTAL= 120,317

1806 currency Penny (Peck 1320-1343) 34mm Kuchler TOTAL = 19,355,480

1806 currency Halfpenny (Peck 1356-1377) 28mm Kuchler TOTAL = 87,893,526

1806 currency Farthing (Peck 1386-1395) 21mm Kuchler TOTAL = 4,833,768

1807 St. Albans Female Friendly Society Medal 42mm Phillp TOTAL= 50

1807 currency Penny (Peck 1344-1345) 33-34mm Kuchler TOTAL = 11,290,168

1807 currency Halfpenny (Peck 1378) 28mm Kuchler TOTAL = 41,394,384

1807 currency Farthing (Peck 1399) 21mm Kuchler TOTAL = 1,075,200

1807 (made till 1840) Royal Society of Arts Medal

Pallet Prize Medal **63 x 52 mm Kuchler TOTAL=386 silver and 1 gold**
 Minerva Medal: **43mm G.F. Pidgeon TOTAL=278 silver, 94 gold**
 Isis Medal: **39mm Thomas Wyon Junior TOTAL=120 silver and 94 gold**

1808 India Madras Presidency twenty cash; ten cash **31mm, 25mm Phillp**
TOTAL = 86,515,344

1808 Dies for Haiti coinage

1809 *Request for recoinage for Guernsey*²²

1808 on East India Company College Prize for Persian Medal (Pollard 31) **37mm**
Küchler TOTAL = 34

1808 on East India Company College Prize for Sanskrit Medal pattern (Pollard 32)
37mm Küchler TOTAL = 57

1809 pattern India Bengal Presidency one pice; half pice **27mm, 21mm Phillp**

1809 pattern Brazil 960 reis **41mm Küchler**

1809 Death of Matthew Boulton Medal (BHM 659) **45mm P. Wyon**

1809 (made 1817?) Death of Matthew Boulton Medal (Roux/Thomason) (BHM 660;
 Eimer 1000) **102mm P. Wyon**

1809 Matthew Boulton Obsequies Medal (BHM 662; 663; Eimer 1002; 1003) **40/41mm**
Küchler TOTAL 532

1809 Matthew Boulton 'Farewel' (sic) Medal (Pollard 33; BHM 661; Eimer 1001) **48mm**
Küchler

1809 Blanks for cents United States Mint **TOTAL TOTAL= 1,886,637**

1810 pattern coin for Penang **T. Wyon Junior**

1810 Lord Radnor's Jubilee Medal for George III (Pollard 34; BHM 684; Eimer 1008)
48mm Küchler TOTAL= 685

1810 George III Jubilee (Frogmore) Medal (BHM 686; Eimer 1007) **48mm Phillp**
TOTAL= 1710

1811 (dated 1803) Westminster Fire Office token **Phillp TOTAL 218**

²² MS 3782-13-8 Item 58 Bowerbank, Monkhouse, & Co. (London) to MRB (Soho) 17 Jun. 1809

1811 pattern 'Regenerated' Dollar Bank token (five shillings and sixpence Britannia)
George III **Phillp/based on Kuchler**

1811 pattern 'Regenerated' Dollar Bank token (five shillings and sixpence oak wreath)
George III **Phillp/Kuchler**

1811 Blanks for cents United States Mint **TOTAL TOTAL= 1,770,221**

1812 Blanks for Brazil? Ordered by Abraham Rhodes at 32 per lb (1,638,336); at 81.5 per lb (5,215,920); at 120 per lb (1,369,386) **TOTAL= 8,223,642**

1812 Blanks for Portugal ordered by J.C. Harris 36 per lb for 10 reis **TOTAL= 741,744**

1813 (dated 1808) Beilby Christ's College Medal (BHM 632, 633 and 634; Eimer 991)
42/43mm; 50mm Kuchler/Phillp/Pidgeon

1813 Isle of Man Penny **based on Kuchler**

1813 Isle of Man Halfpenny **based on Kuchler**

1814 (dated 1807) Macauley and Babington (Abolition of the Slave Trade) token (Eimer 984) **36mm Pidgeon/Phillp (reverse) TOTAL= 50,000**

1814 (dated 1809) John, Prince Regent of Portugal/'Cayenne seized' Medal **51mm Pidgeon TOTAL= 257**

1815 Blanks for cents United States Mint **TOTAL= 461,659**

1816 (dated 1801) Highland Society Medal (BHM 512) **Pidgeon**

1816 Blanks for cents United States Mint **TOTAL= 1,866,637**

1817 Blanks for cents United States Mint **TOTAL= 2,333,296**

1817 Blanks for Brazil May & Lukin at 32 per lb (1,092,224); at 81.5 per lb (2,084,186); at 120 per lb (2,282,631) **TOTAL= 5,459,041**

1818 Blanks for cents United States Mint **TOTAL= 2,006,635**

1819 Boulton Memorial Medal 'Inventas' (BHM 976) **64mm; 55mm Pidgeon**

1819 Blanks for cents United States Mint **TOTAL= 2,799,955**

1820 Death of George III Medal (BHM 991 and 992; Eimer 1121) **48mm after Kuchler**

1820 pattern Crown George III (from Monneron Hercules token) **Droz after Dupre**

1820 (dated 1801) Hudson Bay Company token (BHM 1062 and 1063; Eimer 1120)
48mm after Küchler

1820 pattern Portugal reis for May and Lukin

1820 Blanks for Brazil at 32 per lb (3,135,000); at 81.5 per lb (6,389,600); at 120 per lb (2,097,200) **TOTAL= 11,621,800**

Post 1820

1821 St Helena 1821 Half pence **Thomas Webb** (TOTAL 702,704)

1812-1827 Blanks for Rio de Janeiro (Brazil)

1822-4 Argentina Buenos Aires un decim (TOTAL 4,000,000)

1823 Sumatra four, two and one keping (TOTAL 13,560,532)

1827 pattern 80 reis Brazil; 960 reis Brazil

1828 Mexico Guanaxuato one cuartilla

1830 pattern Visit of Princess Victoria to Soho Mint medal

1830 pattern Visit of the Duchess of Kent to Soho Mint medal

1830 Guernsey four doubles; one double (TOTAL 2,522,600)

1831 pattern Mexico eight escudo

1831 Sumatra Singapore (TOTAL 51,935,310 to 1847)

1832 India Bombay Presidency

1833 India Bombay Presidency quarter anna

1834 Guernsey eight doubles

1835 Sumatra Tarumon, Singapore Menangkabau, Singapore Dilli, Singapore Selangor, Singapore Celebes, Singapore Siam

1835 Chile un centavo; Chile Medio centavo (TOTAL 3,839,504)

1843 Mexico eight escudo

1837-44 Lower Canada Banks (TOTAL 8,824,284)²³

1849-50 Annand token, Australia (TOTAL 45,503)

²³ D. Vice (1990) *Canada tokens 1837-1845* Format 41 1990.

Appendix 2: List of Coins, Medals, Tokens and Dies examined during research

1772 ‘Otaheite’ also known as Captain Cook’s Second Voyage to the Pacific or Resolution and Adventure Medal (BHM 165)

1772 Captain Cook’s ‘Otaheite’ Medal Assay Office 3	0°; 44mm; 45.95g; silver
1772 Captain Cook’s ‘Otaheite’ Medal BMAG: 1981N17	0°; 43 mm; 45.91g; silver
1772 Captain Cook’s ‘Otaheite’ Medal BMAG: 1997N11	0°; 41 mm; 28.61g; bronzed
1772 Captain Cook’s ‘Otaheite’ Medal Assay Office 1	0°; 42mm; 28.50g; brass
1772 Captain Cook’s ‘Otaheite’ Medal Assay Office 2	0°; 42mm; 33.45g; brass with loop

1786 Sumatra keping

1786 Sumatra three keping Pridmore 6 BMAG: 1968N349.1	180°; 28 mm; 9.83g; copper
1786 Sumatra three keping Pridmore 6A BMAG: 1885N1541.183	180°; 27.5 mm; 9.60g; copper
1786 Sumatra three keping Pridmore 6 BMAG: 1968N349.2	180°; 28 mm; 9.56g; copper

1786 Sumatra two keping Pridmore 11A BMAG: 1885N1541.184	180°; 25 mm; 6.38g; copper
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1786 Sumatra one keping Pridmore 17 BMAG: 1968N350.1	180°; 20 mm; 3.28g; copper
1786 Sumatra one keping Pridmore 17 BMAG: 1968N350.2	180°; 20 mm; 3.26g; copper
1786 Sumatra one keping Pridmore 17A BMAG: 2007.1261	180°; 20 mm; 3.24g; copper

1787 Sumatra keping

1787 Sumatra three keping Pridmore 7 BMAG: 2007.1258	180°; 27 mm; 9.80g; copper
1787 Sumatra three keping Pridmore 7A BMAG: 1885N1541.185	180°; 27 mm; 9.63g; copper

1787 Sumatra two keping Pridmore 13A BMAG: 2007.1259	180°; 24 mm; 6.51g; copper
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1787 Sumatra one keping Pridmore 19A BMAG: 2007.1262	180°; 20 mm; 3.17g; copper
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1787 Anglesey Penny Token D&H Anglesey (not made by Boulton)

1787 Anglesey Penny Token D&H 57 BMAG: 1967N977	0°; 33 mm; 28.69g; copper
1787 Anglesey Penny Token D&H 39 BMAG: 1967N976	0°; 33 mm; 28.69g; copper
1787 Anglesey Penny Token D&H 76 BMAG: 1885N1534.8	0°; 33 mm; 28.63g; copper
1787 Anglesey Penny Token D&H 19 BMAG: 1936N127	0°; 33 mm; 28.61g; copper
1787 Anglesey Penny Token D&H 50 BMAG: 1967N609	0°; 33 mm; 28.50g; copper
1787 Anglesey Penny Token D&H 31 BMAG: 1967N 975	0°; 33 mm; 28.10g; copper
1787 Anglesey Penny Token D&H 81 BMAG: 1955N235	0°; 33 mm; 28.06g; copper
1787 Anglesey Penny Token D&H 66 BMAG: 1967N610	0°; 33 mm; 27.98g; copper
1787 Anglesey Penny Token D&H 75 BMAG: 1936N345.18	0°; 33 mm; 27.96g; copper
1787 Anglesey Penny Token D&H 11 BMAG: 1967N974	180°; 33 mm; 27.88g; copper

1787 Wilkinson Forge Halfpenny D&H Warwickshire (not made by Boulton)

1787 Wilkinson Forge Halfpenny D&H 361 BMAG: 1967N873	0°; 29mm; 14.38g; copper
1787 Wilkinson Forge Halfpenny D&H 359 BMAG: 1967N955	0°; 29mm; 14.20g; copper
1787 Wilkinson Forge Halfpenny D&H 341 BMAG: 1930N447.178	0°; 29mm; 14.18g; copper
1787 Wilkinson Forge Halfpenny D&H 340 BMAG: 1967N953	0°; 29mm; 14.08g; copper
1787 Wilkinson Forge Halfpenny D&H 351 BMAG: 1967N954	0°; 29mm; 13.98g; copper
1787 Wilkinson Forge Halfpenny D&H 355 BMAG: 1967N567	0°; 29mm; 13.76g; copper

1787 pattern shilling

1787 pattern shilling (Droz) British Museum: Thornhill 8381	0°; 25mm; 5.02g; silver
1787 pattern shilling (Droz) British Museum: SSB E 3351	0°; 25mm; 5.00g; silver

1787 pattern sixpence

1787 pattern sixpence star (Eginton) British Museum Thornhill 8381	0°; 20.5mm; 2.59g; silver
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1788 pattern sixpence

1788 pattern sixpence (Eginton) British Museum 8384 0°; 22mm; 3.85g; silver
 1788 pattern sixpence (Eginton) British Museum 8383 0°; 22mm; 3.65g; silver

1788 Halfpenny collar die

1788 Droz collar die Assay Office 2074 16mm thick; total diameter
 165mm; central hole 32mm diameter; steel

1788 pattern halfpenny with rudder

1788 pattern Halfpenny (Early Soho) DH 4 BMAG: 1969N636 Peck 943 0°; 31mm; 14.02g; gilt
 1788 pattern Halfpenny (Early Soho) DH 2 BMAG: 1969N632 Peck 937 180°; 30.5mm; 16.98 g; bronzed
 1788 pattern Halfpenny (Early Soho) DH4 BMAG: 1885N1536.149 0°; 31 mm; 16.29g; bronzed
 1788 pattern Halfpenny (Early Soho) DH 1 BMAG: 1969N630 Peck 935 0°; 31mm; 16.15g; bronzed
 1788 pattern Halfpenny (Early Soho) Assay Office 77 Peck 944 180°; 31mm; 16.15g; bronzed
 1788 pattern Halfpenny (Early Soho) DH 4 BMAG: 1969N635 Peck 940 0°; 31mm; 16.14g; bronzed
 1788 pattern Halfpenny (Early Soho) DH 4 BMAG: 1969N637 Peck 945 180°; 31mm; 16.22g; copper
 1788 pattern Halfpenny (Early Soho) DH 1 BMAG: 1969N631 Peck 936 0°; 31mm; 16.08g; copper
 1788 pattern Halfpenny (Late Soho) DH12 BMAG: 1885N1541.201 Peck 969 180°; 31 mm; 16.29g; gilt
 1788 pattern Halfpenny (Late Soho) DH 12 BMAG: 1969N655 Peck 969 180°; 31mm; 16.04g; gilt
 1788 pattern Halfpenny (Late Soho) DH 13 BMAG: 1969N656 Peck 970 180°; 31mm; 15.88g; gilt
 1788 pattern Halfpenny (Late Soho) DH 11 BMAG: 1969N651 Peck 965 180°; 31mm; 15.78g; gilt
 1788 pattern Halfpenny (Late Soho) DH 11 BMAG: 1969N649 Peck 962 0°; 31mm; 16.15g; brown gilt
 1788 pattern Halfpenny (Late Soho) DH 11 BMAG: 1969N653 Peck 967 180°; 31mm; 15.95g; bronzed
 1788 pattern Halfpenny (Late Soho) DH 11 BMAG: 1969N654 Peck 968 180°; 31mm; 16.10g; copper

1788 pattern halfpenny with date

1788 pattern Halfpenny (Early Soho) DH 3 BMAG: 1969N633 Peck 938 0°; 31mm; 14.21g; gilt
 1788 pattern Halfpenny (Early Soho) DH3 BMAG: 1885N1536.153 0°; 31 mm; 14.06g; bronzed
 1788 pattern Halfpenny (Late Soho) DH 11 BMAG: 1969N650 Peck 964 180°; 31mm; 16.56g; silver plated
 1788 pattern Halfpenny (Late Soho) Assay Office 78 Peck 965 180°; 31mm; 15.90g; gilt
 1788 pattern Halfpenny (Late Soho) Assay Office 79 Peck 966 0°; 31mm; 16.15g; brown gilt
 1788 pattern Halfpenny (Late Soho) DH 11 BMAG: 1969N652 Peck 966 180°; 31mm; 15.20g; brown gilt

1788 Anglesey Penny Token D&H Anglesey (not made by Boulton)

1788 Anglesey Penny Token D&H 174 BMAG: 1968N368 0°; 34mm; 29.71g; copper
 1788 Anglesey Penny Token D&H 242 BMAG: 1885N1526.120 0°; 34mm; 28.27g; copper
 1788 Anglesey Penny Token D&H 233; BMAG: 1967N612 0°; 33mm; 27.53g; copper
 1788 Anglesey Penny Counterfeit D&H 152 BMAG: 1967N611 0°; 33mm; 23.32g; copper
 1788 Anglesey Penny Counterfeit D&H 165 BMAG: 1953N972 0°; 33mm; 23.31g; copper

1788 Anglesey Halfpenny Token D&H Anglesey (not made by Boulton)

1788 Anglesey Halfpenny Token D&H 274 BMAG: 1968N112 0°; 29mm; 14.60g; copper
 1788 Anglesey Halfpenny Token D&H 307 BMAG: 1967N615 0°; 29mm; 14.48g; copper
 1788 Anglesey Halfpenny Token D&H 279 BMAG: 1955N489 0°; 29mm; 14.44g; copper
 1788 Anglesey Halfpenny D&H 318 BMAG: 1885N1526.220 0°; 29mm; 14.35g; copper
 1788 Anglesey Halfpenny Token D&H 285 BMAG: 1885N1526.1 0°; 28mm; 14.34g; copper
 1788 Anglesey Halfpenny Token D&H 315 BMAG: 1967N616 0°; 29mm; 14.15g; copper
 1788 Anglesey Halfpenny Token D&H 303 BMAG: 1968N381 0°; 28mm; 13.95g; copper
 1788 Anglesey Halfpenny Token D&H 332 BMAG: 1967N978 0°; 29mm; 13.65g; copper
 1788 Anglesey Halfpenny Token D&H 338 BMAG: 1955N263 180°; 29mm; 11.83g; copper
 1788 Anglesey Halfpenny Token D&H 350 BMAG: 1967N617 0°; 29mm; 11.83g; copper

1788 Wilkinson Forge Halfpenny Token D&H Warwickshire (not made by Boulton)

1788 Wilkinson Forge Halfpenny D&H 380 BMAG: 1967N956 0°; 28.5 mm; 13.55g; copper

1788 Wilkinson Ship Halfpenny Token D&H Warwickshire (not made by Boulton)

1788 Wilkinson Ship Halfpenny D&H 336 BMAG: 1885N1526.30 0°; 30 mm; 14.15g; copper

1789 Cronebane Halfpenny D&H Wicklow, Ireland

1789 Cronebane Halfpenny D&H 18 BMAG: 1885N1536.94	180°; 29mm; 12.64g; gilt
1789 Cronebane Halfpenny D&H 18 BMAG: 1885N1541.26	180°; 29mm; 13.22g; bronzed
1789 Cronebane Halfpenny D&H 18 Assay Office 129	180°; 29mm; 13.00g; bronzed
1789 Cronebane Halfpenny D&H 23 BMAG: 1967N703	180°; 29mm; 12.88g; copper
1789 Cronebane Halfpenny D&H 15 BMAG: 1967N970	180°; 29mm; 12.56g; bronzed
1789 Cronebane Halfpenny D&H 12 BMAG: 1885N1526.218	180°; 29mm; 12.36g; bronzed
1789 Cronebane Halfpenny D&H 27 BMAG: 1967N704	180°; 29mm; 12.62g; copper
1789 Cronebane Halfpenny D&H 21 BMAG: 1936N345.20	180°; 29mm; 12.59g; copper
1789 Cronebane Halfpenny D&H 19 BMAG: 1967N701	180°; 29mm; 12.33g; copper
1789 Cronebane Halfpenny double strike D&H 21 BMAG: 1967N702	180°; 34 mm; 11.52g; copper

1789 Cronebane Halfpenny tokens Counterfeits/evasive (Arms, no crosier)

1789 Cronebane Halfpenny D&H 43b BMAG: 1967N709	180°; 29mm; 10.25g; bronzed
1789 Cronebane Halfpenny D&H 43c BMAG: 1967N710	180°; 29mm; 9.72g; bronzed
1789 Cronebane Halfpenny D&H 43a BMAG: 1967N971	180°; 29mm; 9.28g; bronzed
1789 Cronebane Halfpenny D&H 43g BMAG: 1929N350	180°; 28 mm; 9.78g; copper

1789 Cronebane Halfpenny tokens Counterfeits/evasive (Arms, crosier)

1789 Cronebane Halfpenny D&H 48b BMAG: 1967N711	180°; 29mm; 10.99g; bronzed
1789 Cronebane Halfpenny D&H 46b BMAG: 1885N1526.4	180°; 29mm; 10.54g; bronzed
1789 Cronebane Halfpenny D&H 49b BMAG: 1967N972	180°; 28 mm; 9.92g; bronzed
1789 Cronebane Halfpenny D&H 51c BMAG: 1885N1526.219	180°; 28 mm; 9.85g; bronzed
1789 Cronebane Halfpenny D&H 44a BMAG: 1953N974	180°; 29mm; 9.22g; bronzed
1789 Cronebane Halfpenny D&H 51a BMAG: 1967N712	180°; 28 mm; 9.16g; bronzed

no date Cronebane Halfpenny Tokens (Miners Arms)

no date Cronebane Halfpenny D&H 39b BMAG: 1967N706	180°; 29mm; 9.34g; copper
no date Cronebane Halfpenny D&H 38 BMAG: 1967N705	180°; 29mm; 9.01g; copper
no date Cronebane Halfpenny D&H 42 BMAG: 1967N708	180°; 29mm; 8.82g; copper

1789 Macclesfield Penny D&H Cheshire (not made by Boulton)

1789 Macclesfield Penny D&H 3 BMAG: 1967N10	180°; 36 mm; 26.54g; copper
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1789 Macclesfield Halfpenny D&H Cheshire (not made by Boulton)

1789 Macclesfield Halfpenny D&H 11 BMAG: 1967N13	180°; 29mm; 12.71g; copper
1789 Macclesfield Halfpenny D&H? BMAG: 1994N122	180°; 28 mm; 12.31g; copper
1789 Macclesfield Halfpenny D&H 7 BMAG: 1967N12	180°; 28.5 mm; 9.44g; copper

1789 Anglesey Halfpenny Token D&H Anglesey (The Anglesey Mines Halfpenny)

1789 Anglesey Halfpenny D&H 370 BMAG: 1885N1526.221	0°; 29mm; 12.65g; copper
1789 Anglesey Halfpenny D&H 375 BMAG: 1936N345.19	0°; 28.5 mm; 12.26g; copper

1789 Restoration of the King's Health George III Medal (BHM 311)

1789 Recovery of George III Medal BMAG: 2003N0035 1.1	0°; 34mm; 2003 19.02g; silver
BMAG: 2003N0035 1.2 paper	

1790 Wilkinson Forge Halfpenny (John Wilkinson) D&H Warwickshire

1790 Wilkinson Forge Halfpenny D&H 385 BMAG: 1885N1526.28	180°; 29mm; 14.50g; copper
1790 Wilkinson Forge Halfpenny D&H 387 Assay Office 120	180°; 28.5mm; 13.15g; copper
1790 Wilkinson Forge Halfpenny D&H 387 BMAG: 1885N1526.277	180°; 29mm; 12.57g; copper

1790 pattern Sixpence

1790 Pattern sixpence British Museum: E 3557	0°; 21mm; 2.70g; silver
1790 Pattern sixpence British Museum: Ruth Weighman 8-17-538	0°; 21mm; 2.65g; silver

1790 pattern Halfpenny

1790 pattern Halfpenny/farthing reverse Punch BMAG: 1971N480	27mm; total 51mm; 120g plus
1790 pattern Halfpenny (Early Soho) DH 7 BMAG: 1969N646 Peck 956	180°; 31mm; 16.82g; silver
1790 pattern Halfpenny (Early Soho) DH 5 BMAG: 1969N640 Peck 950	180°; 31mm; 16.12g; brown gilt
1790 pattern Halfpenny (Early Soho) DH 6 BMAG: 1969N642 Peck 952	180°; 31mm; 16.05g; brown gilt
1790 pattern Halfpenny (Early Soho) DH 6 BMAG: 1969N645 Peck 955	180°; 31mm; 15.96g; brown gilt
1790 pattern Halfpenny (Early Soho) DH 6 BMAG: 1969N643 Peck 953	180°; 31mm; 16.40g; bronzed
1790 pattern Halfpenny (Early Soho) DH 5 BMAG: 1969N638 Peck 948	180°; 31mm; 15.17g; bronzed
1790 pattern Halfpenny (Early Soho) DH 6 BMAG: 1969N644 Peck 954	0°; 31mm; 16.34g; copper
1790 pattern Halfpenny (Early Soho) DH 5 BMAG: 1969N639 Peck 949	0°; 31mm; 15.24g; copper
1790 pattern Halfpenny (Early Soho) DH 7 BMAG: 1969N647 Peck 958	180°; 31mm; 15.20g; copper
1790 pattern Halfpenny (Early Soho) DH 5 BMAG: 1969N641 Peck 951	180°; 31mm; 15.04g; copper
1790 pattern Halfpenny (Early Soho) DH 10 BMAG: 1969N648 Peck 961	180°; 31mm; 12.30g; copper
1790 pattern Halfpenny (Late Soho) DH 17 BMAG: 1969N661 Peck 976	180°; 31mm; 14.68g; gilt
1790 pattern Halfpenny (Late Soho) DH 15 BMAG: 1969N659 Peck 974	180°; 31mm; 17.14g; bronzed
1790 pattern Halfpenny (Late Soho) Assay Office 80 Peck 971	180°; 31mm; 16.55g; bronzed
1790 pattern Halfpenny (Late Soho) DH 14 BMAG: 1969N657 Peck 971	180°; 31mm; 16.47g; bronzed
1790 pattern Halfpenny (Late Soho) DH 14 BMAG: 1969N658 Peck 973	180°; 31mm; 15.79g; copper
1790 pattern Halfpenny (Late Soho) DH 16 BMAG: 1969N660 Peck 975	0°; 31mm; 7.90g; pewter
1790 pattern Halfpenny (trial strike) R27 BMAG: 1969N692 Peck 1021	0°; 30mm; 13.11g; bronzed
1790 pattern Halfpenny (trial strike) R2 BMAG: 1969N663 Peck 980	0°; 31mm; 11.57g; tin

1790 Wilkinson Vulcan Halfpenny Token D&H Warwickshire (not made by Boulton)

1790 Wilkinson Vulcan Halfpenny D&H 433 BMAG: 1885N1526.305	0°; 30 mm; 12.71g; copper
1790 Wilkinson Vulcan Halfpenny D&H 430 BMAG: 1939N220	0°; 29mm; 12.04g; copper
1790 Wilkinson Vulcan Halfpenny D&H 425 BMAG: 1967N571	0°; 29mm; 11.85g; copper

1790 Macclesfield Halfpenny Token D&H Cheshire (not made by Boulton)

1790 Macclesfield Halfpenny D&H 23 BMAG: 1967N901	180°; 29mm; 12.51g; copper
1790 Macclesfield Halfpenny D&H 17 BMAG: 1967N14	180°; 29.5 mm; 12.41g; copper
1790 Macclesfield Halfpenny D&H 21 BMAG: 1968N331	180°; 29mm; 12.39g; copper
1790 Macclesfield Halfpenny D&H 20 BMAG: 1967N858	180°; 29mm; 12.30g; copper

1791 pattern Guinea

no date George III pattern Guinea obverse Punch BMAG: 1971N457	na; 38/29mm; 20.63g; white metal
1791 George III pattern Guinea Assay Office 64	180°; 24mm; 5.65g; gilt
1791 George III pattern Guinea BMAG: 1971N484	180°; 24mm; 5.27g; gilt
1791 George III pattern Guinea BMAG: 1930N191	180°; 24mm; 4.37g; gilt
1791 George III pattern Guinea BMAG: 1930N190	0°; 24mm; 4.33g; gilt
1791 George III pattern Guinea BMAG: 2007.1239	0°; 24mm; 6.83g; bronzed
1791 George III pattern Guinea BMAG: 1885N1536.163	0°; 24mm; 6.81g; bronzed

1791 India Bombay Presidency double pice, one and half pice, one pice and half pice

1791 India Bombay Presidency one and half pice Assay Office 157	180°; 26 mm; 10.20g; bronzed
1791 India Bombay Presidency one and half pice Assay Office 156	180°; 28 mm; 9.65g; bronzed
1791 India Bombay Presidency one and half pice BMAG: 1885N1541.186	180°; 27 mm; 9.63g; bronzed
1791 India Bombay Presidency pice BMAG: 2007.1244	180°; 24 mm; 6.38g; bronzed
1791 India Bombay Presidency half pice BMAG: none	180°; 21mm; 3.26g; bronzed
1791 India Bombay Presidency half pice Assay Office 158	180°; 20mm; 3.25g; bronzed
1791 India Bombay Presidency half pice BMAG: 2007.1245	180°; 20mm; 3.13g; copper

1791 Macclesfield Halfpenny Token D&H Cheshire (not made by Boulton)

1791 Macclesfield Halfpenny D&H 30 BMAG: 1885N1526.11	180°; 29mm; 12.87g; copper
1791 Macclesfield Halfpenny D&H 31 BMAG: 1967N859	180°; 29mm; 12.79g; copper
1791 Macclesfield Halfpenny D&H 29 BMAG: 1885N1526.213	180°; 29mm; 12.54g; copper

1791 Macclesfield Halfpenny D&H 49 BMAG: 1953N954	180°; 30 mm; 12.53g; copper
1791 Macclesfield Halfpenny D&H 52 BMAG: 1967N902	180°; 30 mm; 12.46g; copper
1791 Macclesfield Halfpenny D&H 36 BMAG: 1885N1526.212	180°; 29mm; 12.42g; copper
1791 Macclesfield Halfpenny D&H 50 BMAG: 1937N528	180°; 30 mm; 12.40g; copper

1791 Anglesey Halfpenny Token D&H Anglesey (The Anglesey Mines Halfpenny)

1791 Anglesey Halfpenny Token D&H 387 Assay Office 123	180°; 29mm; 13.25g; bronzed
1791 Anglesey Halfpenny Token D&H 391 BMAG: 1885N1541.155	180°; 29mm; 12.60g; copper

1791 Anglesey Halfpenny Token D&H Anglesey (Anglesey Mines Halfpenny) (not made by Boulton)

1791 Anglesey Halfpenny Token D&H 401a BMAG: 1967N618	180°; 28 mm; 15.07g; copper
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1791 Anglesey Parys Miners Halfpenny Token D&H Anglesey

1791 Anglesey (Paris Miners) Halfpenny D&H 436 BMAG: 1939N19	180°; 27 mm; 9.97g; copper
1791 Anglesey (Paris Miners) Halfpenny D&H 438b BMAG: 1937N408	180°; 28 mm; 9.15g; copper
1791 Anglesey (Paris Miners) Penny Token D&H 440 BMAG: 1936N128	180°; 28 mm; 9.95g; copper

1791 Southampton Halfpenny Token (Taylor Moody and Co.) D&H Hampshire

1791 Southampton Halfpenny Token D&H 87 BMAG: 1967N90	0°; 29mm; 12.04g; copper
1791 Southampton Halfpenny D&H 89 BMAG: 1885N1536.98	180°; 28mm; 10.81g; copper
1791 Southampton Halfpenny D&H 89 BMAG: 1967N906	180°; 27mm; 11.17g; copper
1791 Southampton Halfpenny D&H 89 Assay Office 114	180°; 28mm; 10.55g; bronzed

1791 Cornwall Halfpenny (John Vivian Cornish Metal Company) Token

1791 Cornwall Halfpenny D&H 2 BMAG: 1885N1536.100	180°; 29mm; 13.09g; bronzed
1791 Cornwall Halfpenny Proof D&H 2 BMAG: 1885N1541.161	180°; 29mm; 12.99g; bronzed
1791 Proof Cornwall Halfpenny D&H 2 Assay Office 110	180°; 29mm; 12.80g; bronzed

1791 Glasgow Halfpenny Token (Gilbert Shearer and Co.) D&H Lanarkshire

1791 Glasgow Halfpenny D&H 2 Assay Office 128	180°; 28.5mm; 12.75g; bronzed
1791 Glasgow Halfpenny D&H 3a BMAG: 1937N468.2	180°; 28.5mm; 9.69 g; bronzed
1791 Glasgow Halfpenny D&H 3c; BMAG: 1967N654	0°; 29mm; 9.68g; bronzed
1791 Glasgow Halfpenny D&H 3 BMAG: 1937N468.1	180°; 29mm; 9.19g; bronzed
1791 Glasgow Halfpenny D&H 2 BMAG: 1885N1536.87	180°; 28.5mm; 12.26 g; copper

1791-3 France Monneron Freres of Paris

1791 France Monneron: 2 sol 'Liberty Sous La Loi' Medaille de Confiance (Margolis 2)

1791 Monneron 2 sol 'Liberte' Year III BMAG: 1935N397.1	180°; 32mm; 18.36g; bronzed
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1792 Monneron: 2 sol 'Liberte Sous La Loi' 'Medaille Qui Se Vend' (Margolis 11)

1792 Monneron 2 sol (Margolis 11) BMAG: 1885N1541.8	180°; 32mm; 16.21g; gilt
1792 France Monneron: 2 sol (Margolis 11) Assay Office 144	180°; 32mm; 16.85g; bronzed
1792 Monneron 2 sol (Margolis 11) BMAG: 1885N1536.97	0°; 32mm; 16.70g; bronzed
1792 Monneron 2 sol (Margolis 11) BMAG: 1885N1541.63	0°; 32mm; 17.10g; copper

1792 France Monneron: 5 sol 'Pacte Federatif' Year IV Medaille de Confiance (Margolis 9)

1792 Monneron 5 sol Pacte Federatif Confiance BMAG: 1937N581	180°; 40mm; 28.58 g; copper
1792 Monneron 5 sol Pacte Federatif Confiance BMAG: 1885N1526.344	180°; 39mm; 28.29g; copper
1792 Monneron 5 sol Pacte Federatif Confiance BMAG: 1937N1218	180°; 39mm; 27.56g; copper

1792 France Monneron: 5 sol 'Pacte Federatif Year IV Medaille Qui Se Vend' (similar to Margolis 10)

1792 Monneron 5 sol Pacte Federatif BMAG: 1885N1541.1	180°; 39mm; 31.38 g; gilt
1792 France Monneron: 5 sol Pacte Federatif Assay Office 142	0°; 39mm; 27.05g; gilt
1792 Monneron 5 sol Pacte Federatif BMAG: 1885N1541.4	180°; 40mm; 27.01g; bronzed
1792 Monneron 5 sol Pacte Federatif BMAG: 1885N1536.136	180°; 40mm; 26.80 g; copper
1792 France Monneron: 5 sol Pacte Federatif Assay Office 141	0°; 40mm; 26.35g; copper

1792 Monneron: 5 sol 'Hercules' 'Les Francais' 'Medaille Qui Se Vend' (Margolis 12)

1792 Monneron: 5 sol 'Hercules' 'Les Francais' Assay Office 143	0°; 39mm; 27.70g; copper
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1792 Monneron 5 sol 'Hercules' 'Les Francais' BMAG: 1885N1541.12	180°; 39mm; 27.21g; copper
1792 Monneron: 2 sol Respublica Gallica 'La Sagesse Guide La Force' (Margolis 14)	
1792 France Monneron: 2 sol 'Respublica Gallica' Assay Office 145	0°; 32mm; 16.80g; bronzed
1792 Monneron 2 sol 'Hercules' BMAG: 1885N1541.11	0°; 32mm; 16.68g; bronzed
1792 France Monneron: 2 sol 'Respublica Gallica' Assay Office 146	0°; 32mm; 15.25g; bronzed
1791 France Monneron: Serment du Rois 'Je Jure' Medal (Margolis 18)	
1791 Sermont du Roi 'Je Jure' BMAG: 1885N1541.7	0°; 35mm; 21.74g; gilt
1791 Serment du Rois 'Je Jure' Medal Assay Office 147	0°; 34mm; 24.95g; bronzed
1791 Sermont du Roi 'Je Jure' BMAG: 1885N1536.74	0°; 34mm; 24.09g; bronzed
1791 Serment du Rois 'Je Jure' Medal Assay Office 148	180°; 34mm; 18.50g; bronzed
1791 France Monneron: Serment du Rois 'Acceptate' Medal (not listed by Margolis)	
1791 Monneron 3 figures 'Acceptance' BMAG: 1885N1536.145	0°; 36mm; 26.75g; bronzed
1791 France Monneron: Rousseau Medal (Margolis 19)	
1791 Rousseau Medal Assay Office 152	0°; 34mm; 25.15g; bronzed
1791 Rousseau Medal Assay Office 151	0°; 35mm; 24.85g; bronzed
1791 Rousseau Medal BMAG: 1885N1541.10	0°; 35mm; 24.72g; bronzed
1791 Rousseau Medal BMAG: 1885N1541.9	0°; 35mm; 20.13g; bronzed
1791 Rousseau Medal BMAG: 1885N1536.132	0°; 34mm; 18.22g; bronzed
1791 France Monneron Lafayette Medal (Margolis 20)	
1791 Lafayette Medal BMAG: 1885N1536.141	0°; 35mm; 25.38g; bronzed
1791 Lafayette Medal Assay Office 149	0°; 34mm; 25.45g; copper
1791 Lafayette Medal Assay Office 150	0°; 34mm; 25.45g; copper
1791 Lafayette Medal BMAG: 1967N1190	0°; 35mm; 22.95g; copper
(dated 1791) Sierra Leone one dollar, one penny; fifty cent; twenty cent; ten cent, one cent (made in 1792/1793/1796/1802/1803/1805)	
1791 Sierra Leone one dollar (100) BMAG: 1885N1541.23	180°; 36mm; 25.95g; bronzed
1791 Sierra Leone one dollar (100) Assay Office 177	180°; 36 mm; 26.05g; bronzed
1791 Sierra Leone Penny (1) Assay Office 184	180°; 31mm; 19.35g; bronzed
1791 Sierra Leone Penny (1) Assay Office 185	180°; 30mm; 16.95g; bronzed
1791 Sierra Leone Penny (1) BMAG: 1885N1536.39	180°; 30mm; 16.79g; bronzed
1791 Sierra Leone 50 cent Obverse Die BMAG: 1951S00088.00095	63mm; 31.5mm; 1000g plus; steel
1791 Sierra Leone 50 cent Assay Office 178	180°; 31mm; 13.20g; silver
1791 Sierra Leone 50 cent Assay Office 179	180°; 31mm; 12.75g; bronzed
1791 Sierra Leone 50 cent proof BMAG: 1885N1541.172	0°; 30.5mm; 12.75g; bronzed
1791 Sierra Leone 50 cent proof BMAG: 1885N1541.173	0°; 30.5mm; bronzed
1791 Sierra Leone 20 cent Assay Office 180	180°; 24mm; 5.40g; silver
1791 Sierra Leone 20 cent proof BMAG: 1885N1536.44	180°; 24mm, 5.50g; gilt
1791 Sierra Leone 20 cent BMAG: 1885N1541.174	180°; 24mm; 5.02g; bronzed
1791 Sierra Leone 20 cent Assay Office 181	180°; 24mm; 5.00g; bronzed
1791 Sierra Leone 10 cent Assay Office 182	180°; 19 mm; 2.65g; silver
1791 Sierra Leone 10 cent BMAG: 1885N1541.175	180°; 19mm; 2.59g; bronzed
1791 Sierra Leone 10 cent BMAG: 1885N1536.47	180°; 19 mm; 2.58g; bronzed
1791 Sierra Leone 10 cent Assay Office 183	180°; 19 mm; 2.55g; bronzed
1791 Sierra Leone one cent (1) Assay Office 186	180°; 29mm; 13.40g; bronzed
1791 Sierra Leone one cent (1) proof BMAG: 1885N1526.86	180°; 28.5mm; 12.57g; bronzed
1792 India Bengal Presidency pattern cowrie	
1792 India Bengal pattern cowrie British Museum: SSB 159-65	0°; hexagonal: 15mm; 1.45g; bronzed
1792 India Bengal pattern cowrie British Museum: SSB 159-66	0°; hexagonal: 10mm; 0.35g; bronzed

1792 Wilkinson Forge Halfpenny (John Wilkinson) D&H Warwickshire

1792 Wilkinson Forge Halfpenny D&H 389a BMAG: 1885N1536.86 180°; 28.5 mm; 11.26g; copper
 1792 Wilkinson Forge Halfpenny D&H 389 Assay Office 121 180°; 28.5mm; 11.00g; bronzed

1792 Wilkinson Ship Halfpenny Token D&H Warwickshire (not made by Boulton)

1792 Wilkinson Ship Counterfeit Token D&H 339 BMAG: 1885N1526.232 180°; 28mm; 9.95g; copper

1792 Wilkinson Vulcan Halfpenny Token D&H Warwickshire (not made by Boulton)

1792 Wilkinson Vulcan Halfpenny D&H 448 BMAG: 1967N572 180°; 29mm; 11.13g; copper

1792 Soho Manufactory Medal

1792 Soho Manufactory BMAG: 1978N1 0°; 32mm; 16.36g; bronzed

1793 Louis XVI Farewell Medal (Pollard 1)

1793 Louis XVI Farewell BMAG: 1885N1536.4 0°; 48mm; 59.64g; gilt
 1793 Louis XVI Farewell Avery Museum: 21.1.16. 0°; 48mm; 59.75g; bronzed
 1793 Louis XVI Farewell BMAG: 2000N7.1 0°; 48mm; 56.82g; bronzed
 1793 Louis XVI Farewell BMAG: 1939N609 0°; 48mm; 55.01g; bronzed
 1793 Louis XVI Farewell Assay Office 5 0°; 48 mm; 54.00g; bronzed
 1793 Louis XVI Farewell BMAG: 1930N283 0°; 48mm; 53.84g; bronzed
 1793 Louis XVI Farewell Assay Office 4 0°; 48 mm; 46.50g; bronzed
 1793 Louis XVI Farewell BMAG: 1885N1541.3 0°; 48mm; 46.03g; bronzed

1793 Execution of Louis XVI Death Medal (Pollard 2)

1793 Execution of Louis XVI Death BMAG: 1885N1536.13 0°; 51 mm; 73.21g; bronzed
 1793 Execution of Louis XVI Death Assay Office 7 0°; 51 mm; 72.70g; bronzed
 1793 Execution of Louis XVI Death BMAG: 1885N1541.5 0°; 51mm; 61.23g; bronzed
 1793 Execution of Louis XVI Death Assay Office 6 0°; 51 mm; 60.70g; bronzed

1793 (dated 1792) Gustav III of Sweden Medal (Pollard 3)

1792 Gustav III of Sweden Assay Office 9 0°; 56 mm; 87.15g; bronzed
 1792 Gustav III of Sweden BMAG: 1885N1541.66 0°; 56 mm; 81.80g; bronzed
 1792 Gustav III of Sweden Avery Museum: 21.1.17 0°; 56mm; 80.45g; bronzed
 1792 Gustav III of Sweden BMAG: 1885N1541.67 0°; 56 mm; 79.28g; bronzed
 1792 Gustav III of Sweden BMAG: 1885N1536.78 0°; 56mm; 76.06g; bronzed
 1792 Gustav III of Sweden Assay Office 8 0°; 56 mm; 75.20g; bronzed
 1792 Gustav III of Sweden BMAG: 1930N279 0°; 56mm; 74.57g; bronzed

1792/3 Marquis Cornwallis (Defeat of Sultan Tipoo) Medal (BHM 363; Pollard 5)

1792 Marquis Cornwallis Avery Museum: 21.1.5 0°; 48mm; 60.60g; bronzed
 1792 Marquis Cornwallis Assay Office 13 0°; 48mm; 54.05g; bronzed
 1792 Marquis Cornwallis BMAG: 1885N1536.31 0°; 48mm; 46.09g; bronzed
 1792 Marquis Cornwallis Assay Office 12 0°; 48mm; 45.95g; bronzed
 1792 Marquis Cornwallis BMAG: 1885N1536.61 0°; 48mm; 45.86g; bronzed

1793 Marquis Cornwallis BMAG: 1974N27.1

0°; 48 mm; 59.80g; bronzed

1793 Bermuda Halfpenny

1793 Bermuda Halfpenny proof Pridmore 5a Assay Office 135 180°; 30mm; 14.55g; bronzed
 1793 Bermuda Halfpenny proof BMAG: 1885N1526.85 180°; 30mm; 13.23g; bronzed
 1793 Bermuda Halfpenny proof (Taylor restrike) Pridmore 8 Assay Office 136 0°; 30.5mm; 11.25g; bronzed

1793 Wilkinson Forge Halfpenny D&H Warwickshire

1793 Wilkinson Forge Halfpenny D&H 394a BMAG: 1967N569 180°; 29mm; 13.09g; copper
 1793 Wilkinson Forge Halfpenny D&H 394 BMAG: 1994N131 180°; 28mm; 11.58g; copper
 1793 Wilkinson Forge Halfpenny D&H 416 BMAG: 1939N218 180°; 29mm; 11.25g; copper

1793 Wilkinson Forge Halfpenny D&H 412 BMAG: 1994N129 180°; 29.5mm; 10.19g; copper
 1793 Wilkinson Forge Halfpenny D&H 395 BMAG: 1994N130 180°; 29mm; 9.25g; copper
 1793 Wilkinson Forge Halfpenny D&H 417 BMAG: 1939N219 180°; 28 mm; 8.53g; copper

1793 Wilkinson Forge Halfpenny (Counterfeit) D&H 395c BMAG: 1967N570 180°; 28 mm; 9.19g; copper

1793 Leeds Halfpenny Token (Henry Brownbill) D&H Yorkshire

1793 Leeds Halfpenny D&H 45 BMAG: 1885N1526.5 180°; 29mm; 12.51g; bronzed
 1793 Leeds Halfpenny D&H 38 BMAG: 1885N1541.27 180°; 29mm; 12.30g; bronzed
 1793 Leeds Halfpenny D&H 32 BMAG: 1967N959 180°; 29mm; 12.29g; bronzed
 1793 Leeds Halfpenny D&H 34 Assay Office 122 180°; 29mm; 12.25g; bronzed
 1793 Leeds Halfpenny D&H 37 BMAG: 1969N960 180°; 29mm; 12.16g; bronzed
 1793 Leeds Halfpenny D&H 38 BMAG: 1885N1536.83 0°; 29mm; 12.11g; bronzed
 1793 Leeds Halfpenny D&H 41 BMAG: 1885N1526.17 180°; 29mm; 11.96g; bronzed
 1793 Leeds Halfpenny D&H 33 BMAG: 1968N342 180°; 29mm; 11.54g; bronzed

1793 Inverness Halfpenny (Mackintosh, Inglis & Wilson) D&H Invernesshire

1793 Inverness Halfpenny D&H 1b Assay Office 125 180°; 29mm; 12.30g; copper
 1793 Inverness Halfpenny D&H 1a BMAG: 1885N1526.31 180°; 28mm; 11.37g; copper
 1793 Inverness Halfpenny D&H 1b BMAG: 1885N1536.96 180°; 28.5mm; 10.53g; copper

1794 (dated 1793) Execution of Marie Antoinette Medal (Pollard 4)

1793 Execution of Marie Antoinette Avery Museum: 21.1.7 0°; 48mm; 59.90g; bronzed
 1793 Execution of Marie Antoinette BMAG: 1930N278 0°; 48mm; 58.53g; bronzed
 1793 Execution of Marie Antoinette BMAG: 2000.7.2 0°; 48mm; 57.17g; bronzed
 1793 Execution of Marie Antoinette Assay Office 11 0°; 48mm; 56.30g; bronzed
 1793 Execution of Marie Antoinette Assay Office 10 0°; 48mm; 54.50g; bronzed
 1793 Execution of Marie Antoinette BMAG: 1885N1536.12 0°; 48mm; 54.43g; bronzed
 1793 Execution of Marie Antoinette BMAG: 1885N1541.6 0°; 48mm; 54.29g; bronzed

1794 Inverness Halfpenny (Mackintosh, Inglis & Wilson) D&H Invernesshire

1794 Inverness Halfpenny D&H 2b Assay Office 126 180°; 29mm; 10.80g; copper
 1794 Inverness Halfpenny D&H 2 MAG: 1885N1541.164 180°; 28.5mm; 10.10g; copper

1794 Lancaster Halfpenny (Daniel Eccleston) D&H Lancashire

1794 Lancaster Halfpenny D&H 57 BMAG: 1885N1541.28 180°; 29mm; 12.75g; bronzed
 1794 Lancaster Halfpenny D&H 57 BMAG: 1885N1536.93 0°; 29mm; 11.11g; bronzed
 1794 Lancaster Halfpenny D&H 57 Assay Office 116 180°; 28.5 mm; 12.80g; copper
 1794 Lancaster Halfpenny D&H 58 Assay Office 117 28.5mm 180°; 29mm; 10.05g; copper

1794 (undated) London Ibberson Halfpenny Token D&H Middlesex

1794 Ibberson Halfpenny D&H 339 Proof BMAG: 1885N1536.84 0°; 28.5mm; 11.04g bronzed
 1794 Ibberson Halfpenny D&H 339 Proof BMAG: 1885N1541.165 180°; 29mm; 10.52g; bronzed
 1794 (undated) Ibberson Halfpenny D&H 342 Assay Office 118 180°; 28.5mm; 10.20g; bronzed
 1794 (undated) Ibberson Halfpenny D&H 342 Assay Office 119 180°; 29mm; 10.20g; bronzed
 1794 Ibberson Halfpenny D&H 342 BMAG: 1967N264 180°; 28.5mm; 10.10g; bronzed
 1794 Ibberson Halfpenny D&H 342 Proof BMAG: 1994N46 180°; 28.5mm; 9.37g; bronzed

1794 Essex Agriculture Society Medal (Pollard 7)

1794 Essex Agriculture Society BMAG: 1885N1541.70 0°; 45mm; 34.65g; gilt
 1794 Essex Agriculture Society BMAG: 1885N1536.128 0°; 45mm; 36.57g; bronzed

1794 Lord Howe 'Glorious First of June' Medal (BHM 383; Pollard 8)

1794 Lord Howe, Battle of the First of June Assay Office 15 0°; 48 mm; 67.25g; bronzed
 1794 Lord Howe 'First of June' BMAG: 1885N1536.10 0°; 48mm; 64.49g; bronzed
 1794 Lord Howe, Battle of the First of June Assay Office 14 0°; 48 mm; 55.75g; bronzed
 1794 Lord Howe 'Glorious First of June' BMAG: 1885N1541.54 0°; 48mm; 53.59g; bronzed

1794 Copper Company of Upper Canada pattern Halfpenny (Breton 721)

1794 Canada Copper Company Halfpenny Assay Office 137 0°; 29mm; 12.55g; silver
 1794 Canada Copper Company Halfpenny British Museum: E4235 SSB 208-30 180°; 29mm; 12.45g; bronzed

1793 Canada/Kentucky Mule BMAG: 1885N1541.30 0°; 28 mm; 10.74g; bronzed
 1793 Canada/Kentucky Mule BMAG: 1885 N 1536.66 0°; 28 mm; 10.42g; bronzed

1794 India Bombay Presidency

1794 Bombay Presidency double pice BMAG: 1885N1541.187 180°; 30mm; 12.76g; bronzed

1794 Bombay Presidency half pice BMAG: 1885N1536.68 180°; 20 mm; 3.15g; bronzed

1794 India Madras Presidency (Northern Circars)

1794/1797 Madras Presidency 1/48 rupee **Obverse Die** BMAG: 1951S00088.00100 62mm; face 31mm; 1000g; steel
 1794 Madras Presidency 1/48 rupee BMAG: 1885N1541.188 180°; 31mm; 13.40g; bronzed
 1794 Madras Presidency 1/48 rupee Pridmore 311 Assay Office 163 180°; 30mm; 13.35g; bronzed
 1794 Madras Presidency 1/48 Rupee BMAG: 1885N1541.189 180°; 30mm; 13.28g; bronzed

1794 Madras Presidency 1/96 rupee BMAG: 1885N1536.54 180°; 23.5 mm; 6.67g; bronzed

1794 Madras Presidency 1/96 rupee Pridmore 322 Assay Office 164 180°; 23.5mm; 6.65g; bronzed

1794 Madras Presidency 1/96 rupee BMAG: 2007.1249 180°; 23.5 mm; 6.60g; bronzed

1795 Inverness Halfpenny (Mackintosh, Inglis & Wilson) D&H Invernesshire

1795 Inverness Halfpenny D&H 3 Assay Office 127 180°; 29mm; 9.35g; copper

1795 pattern Halfpenny

1795 Halfpenny (Early Soho) KH 2 BMAG: 1969N707 Peck 1039 180°; 30mm; 14.79g; silver
 1795 Halfpenny (Early Soho) KH 2 BMAG: 1969N708 Peck 1040 180°; 31mm; 16.20g; gilt
 1795 Halfpenny (Early Soho) KH 3 BMAG: 1969N711 Peck 1043 180°; 30mm; 17.21g; bronzed
 1795 Halfpenny (Early Soho) KH 2 BMAG: 1969N709 Peck 1041 180°; 30mm; 13.71g; bronzed
 1795 Halfpenny (Early Soho) KH 2 Assay Office 81 Peck 1041 180°; 30.5mm; 13.00g; bronzed
 1795 Halfpenny (Early Soho) KH 2 BMAG: 1885N1536.150 Peck 1038 0°; 31mm; 11.54g; bronzed
 1795 Halfpenny (Early Soho) KH 1 BMAG: 1969N705 Peck 1037 0°; 30mm; 17.11g; copper
 1795 Halfpenny (Early Soho) KH 2 BMAG: 1969N706 Peck 1038 180°; 31mm; 16.89g; copper
 1795 Halfpenny (Early Soho) KH 1 BMAG: 1969N704 Peck 1036 180°; 31mm; 16.32g; copper
 1795 Halfpenny (Early Soho) KH 2 BMAG: 1969N710 Peck 1042 0°; 30.5mm; 13.64g; copper
 1795 Halfpenny (Late Soho) KH 5 BMAG: 1969N713 Peck 1046 180°; 31mm; 13.44g; copper

1795 Wilkinson Forge Halfpenny Token D&H Warwickshire

1795 Wilkinson Forge Halfpenny D&H 423 BMAG: 1967N957 180°; 29mm; 11.46g; copper

1795 Wilkinson Forge Halfpenny D&H 420 BMAG: 1994N132 180°; 29.5mm; 10.85g; copper

1795 Wilkinson Forge Halfpenny D&H 422 BMAG: 1961N482 0°; 29mm; 10.29g; copper

1795 (undated) Hornchurch (George Cotton) Halfpenny Token D&H Essex

1795 Hornchurch Halfpenny D&H 34 Assay Office 113 180°; 28mm; 9.40g; bronzed

1795 (undated) Hornchurch Halfpenny D&H 34 BMAG: 1885N1536.89 180°; 28 mm; 10.01g; copper

1795 (undated) Hornchurch Halfpenny Proof D&H 34 BMAG: 1885N1541.29 180°; 28 mm; 9.76g; copper

1795 (undated) Hornchurch Halfpenny Proof D&H 34 BMAG: 1967N38 180°; 28 mm; 9.44g; copper

(undated) 1795/6 Dundee Token (William Croom) Halfpenny Token D&H Angusshire

undated Dundee Token D&H 13; BMAG: 1885N1536.102 180°; 28mm; 10.32g; copper

undated Dundee Token D&H 12; BMAG: 1885N1541.162 180°; 28mm; 9.72g; copper

undated Dundee Token D&H 13 Assay Office 124 180°; 29mm; 9.50g; copper

undated Dundee Token D&H 14; BMAG: 1967N639 180°; 28mm; 9.29g; bronzed

1795 (incorrectly dated 1797) Marriage of Prince of Wales Medal (BHM 392; Pollard 9)

1795 Marriage of Prince of Wales Obverse Die BMAG: 2004.0182.1	75mm; 48mm; 1000g plus; steel
1795 Marriage of Prince of Wales British Museum: PI 5144 (Banks collection)	0°; 47mm; 51.30g; gold
1795 Marriage of Prince of Wales BMAG: 1885N1536.81	0°; 48 mm; 50.37g; gilt
1795 Marriage of the Prince of Wales BMAG: 1885N1541.64	0°; 47mm; 55.84g; bronzed
1795 Marriage of Prince of Wales Assay Office 18	0°; 48mm; 51.85g; bronzed
1795 Marriage of Prince of Wales Assay Office 17	0°; 48mm; 50.25g; bronzed
1795 Marriage of Prince of Wales BMAG: 1885N1536.25	0°; 47mm; 47.02g; bronzed
1795 Marriage of Prince of Wales Assay Office 16	0°; 48mm; 46.70g; bronzed
1795 Marriage of Prince of Wales BMAG: 2003.0035.2.1	0°; 48mm; 46.01g; bronzed
with BMAG: 2003.0035.2.2 case	5.84g; 4.94g
1795 Marriage of Prince of Wales BMAG: 1885N1541.65	0°; 48 mm; 45.96g; bronzed

1795 Queen Charlotte' Birthday, Frogmore Medals (BHM 389; Pollard 10)

1795 Queen Charlotte Frogmore British Museum: PI 5054, M 5027	0°; 35mm; 28.15g; silver
1795 Queen Charlotte Frogmore British Museum: PI 5136, Banks collection	0°; 35mm; 17.35g; silver
1795 Queen Charlotte Frogmore BMAG: 1885N1541.98	0°; 34mm; 23.86g; bronzed
1795 Queen Charlotte Frogmore BMAG: 1885N1536.133	0°; 34mm; 17.39g; bronzed
1795 Queen Charlotte Frogmore trial strike obverse British Museum: M 5028	n/a; 32mm; 12.30g; bronzed

1795 George III Frogmore (BHM 390) British Museum: PI 5138 M 5026 0°; 35mm; 23.75g; silver

1795 Prince Of Wales Frogmore (BHM 401) British Museum: M5029 0°; 47mm; ?g; silver

1796 Anton Schaeffer Medal Die

1796 Anton Schaeffer Die BMAG: 1976N2	88mm; face 79mm; 120g plus; steel
1796 Anton Schaeffer Die BMAG: 1976N3	88mm; face 79mm; 120g plus; steel

1796 Catherine of Russia medal (Pollard 11)

1796 Catherine II of Russia Assay Office 20	0°; 29mm; 8.75g; gilt
1796 Catherine II of Russia BMAG: 1885N1541.180	0°; 29mm; 12.51g; bronzed
1796 Catherine II of Russia BMAG: 1885N1536.116	0°; 28.5mm; 9.96g; bronzed
1796 Catherine II of Russia Assay Office 19	0°; 29mm; 9.35g; bronzed

1796 Myddleton Kentucky pattern Token

1796 Myddleton Kentucky Token (pattern) British Museum: SSB 294 38	180°; 29mm; 11.70g; copper
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1796 (undated) London, Swainson's Vegetable Syrup pattern Halfpenny D&H Middlesex 907

1796 (undated) Swainson's Halfpenny BMAG: 1885N1541.180°; 28mm; 10.79g; copper
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1796 (dated 1795) Bishop's Stortford (George Jackson) Halfpenny Token D&H Hertfordshire

1795 Bishop's Stortford Halfpenny D&H 4a BMAG: 1885N1536.90	0°; 29mm; 10.46; gilt
1795 Bishop's Stortford Halfpenny D&H 4. Assay Office 115	180°; 28.5mm; 10.55g; bronzed
1795 Bishop's Stortford Halfpenny D&H 4 BMAG: 1885N1541.160	0°; 28.5 mm; 9.92g; copper

1796 (dated 1794) Penryn Volunteers Halfpenny Token (George Chapman George) D&H Cornwall

1796 (dated 1794) Penryn Halfpenny D&H 4 Assay Office 111	180°; 28.5mm; 11.05g; bronzed
1796 (dated 1794) Penryn Halfpenny D&H 4 BMAG: 1885N1536.95	0°; 28.5 mm; 10.61g; copper
1796 (dated 1794) Penryn Halfpenny D&H 4 Assay Office 112	180°; 28.5mm; 10.50g; copper
1796 (dated 1794) Penryn Halfpenny D&H 4 BMAG: 1885N1536.99	0°; 28.5 mm; 10.42g; copper

1796 'Gold Coast' (Royal African Company of Merchants) one ackey; half ackey; quarter ackey; tackoe

1796 Gold coast one ackey Assay Office 153	0°; 34mm; 25.15g; bronzed
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1797 (dated 1793) Board of Agriculture Prize Medal (Pollard 6)

1793 Board of Agriculture Prize BMAG: 1885N1541.71	0°; 48mm; 53.84g; bronzed
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1797 Major General Claude Martin (BHM 424)

1797 Claude Martin 4 knob British Museum: M 5105	180°; 43mm; 31.45g; silver
1797 Claude Martin 4 knob British Museum: M 5106	180°; 42mm; 20.75g; silver
1797 Claude Martin 3 knob British Museum: M 5107	180°; 38mm; 23.50g; silver
1797 Claude Martin 3 knob British Museum: M 5109	180°; 38mm; 14.55g; silver
1797 Claude Martin 3 knob British Museum: M 5108	180°; 38mm; 20.00g; bronzed
1797 Claude Martin 2 knob British Museum: M 5110	180°; 34mm; 16.05g; silver
1797 Claude Martin 2 knob British Museum: M 5112	180°; 34mm; 10.75g; silver
1797 Claude Martin 2 knob British Museum: M 5111	180°; 34.5mm; 13.55g; bronzed

1797 India Madras Presidency (Northern Circars)

1797 India Madras Presidency 1/48 Rupee BMAG: 1885.N 1536.52	180°; 32mm; 13.76g; gilt
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1797 Counter-stamped Spanish 'pieces of eight' (oval stamp)

1797 Oval counter-stamped Spanish pieces of Eight British Museum	0°; 40mm; 27.10g; silver
1797 Oval counter-stamped Spanish pieces of Eight British Museum	0°; 40mm; 27.00g; silver
1797 Oval counter-stamped Spanish pieces of Eight British Museum	0°; 40mm; 26.95g; silver

1797-8 British Currency**1797 proof Two pence**

1797 proof Two pence (Early Soho) KT1 Assay Office 67 Peck 1064	180°; 41mm; 57.20g; gilt
1797 proof Two pence (Early Soho) KT 1a BMAG: 1969N726 Peck 1064	180°; 42mm; 56.37g; gilt
1797 proof Two pence (Early Soho) KT 1a BMAG: 1969N727	0°; 41mm; 56.38g; copper
1797 proof Two pence (Early Soho) KT 1b BMAG: 1969N728 Peck 1066	180°; 41mm; 57.57g; copper
1797 proof Two pence (Late Soho) KT 3 BMAG: 1969N733 Peck 1072	180°; 40mm; 42.42g; silver; 3mm flan
1797 proof Two pence (Late Soho) KT 2 BMAG: 1969N729 Peck 1067	180°; 42mm; 58.88 g; gilt
1797 proof Two pence (Late Soho) KT 3 BMAG: 1969N734 Peck 1074	180°; 41mm; 57.76g; gilt; 3mm flan
1797 proof Two pence (Late Soho) KT2 BMAG: 1969N731 Peck 1068	180°; 41mm; 57.97g; bronzed
1797 proof Two pence (Late Soho) KT 2 BMAG: 1969N730 Peck 1068	180°; 40mm; 56.93g; bronzed
1797 proof Two pence (Late Soho) KT3 Assay Office 68 Peck 1068	180°; 41mm; 56.70g; bronzed; 3mm flan
1797 proof Two pence (Late Soho) KT 3 BMAG: 1969N735 Peck 1075	180°; 41mm; 53.76g; bronzed
1797 proof Two pence (Late Soho) KT 3 BMAG: 1885N1536.160 Peck 1075	180°; 41mm; 53.69g; bronzed
1797 proof Two pence (Late Soho) KT 2 BMAG: 1969N732 Peck 1069	180°; 41mm; 55.09g; copper
1797 proof Two pence (Late Soho) KT 2 BMAG: 1885N1541.202 Peck 1068	180°; 41mm; 45.99g; copper; 3mm flan

1797 currency Two pence (5mm flan)

1797 currency Two pence KT 4 BMAG: 1971N478 Peck 1077	180°; 41mm; 57.22g; coin gilded
1797 currency Two pence KT 4 BMAG: 1971N476 Peck 1077	180°; 41mm; 56.65g; coin gilded
1797 currency Two pence KT4 BMAG: 1937N270.9	180°; 41mm; 58.13g; copper
1797 currency Two pence KT 4 BMAG: 1969N738 Peck 1077	180°; 40mm; 58.11g; copper
1797 currency Two pence KT 4 BMAG: 1937N270.10	180°; 41mm; 57.84g; copper
1797 currency Two pence KT 4 BMAG: 1969N736 Peck 1077	180°; 40mm; 57.60g; copper
1797 currency Two pence KT4 Avery Museum	0°; 41mm; 56.85g; copper
1797 currency Two pence KT4 BMAG: 1931N180	180°; 41mm; 56.68g; copper
1797 currency Two pence KT 4 BMAG: 1885N1526.372 Peck 1077	180°; 41mm; 56.49g; copper
1797 currency Two pence KT 4 BMAG: 1931N108 Peck 1077	180°; 41mm; 56.34g; copper
1797 currency Two pence KT4 Avery Museum	0°; 40mm; 56.25g; copper
1797 currency Two pence BMAG: 1885N1526.387	180°; 41mm; 55.82g; copper
1797 currency Two pence BMAG: 1989N1639. 1	180°; 41mm; 55.79g; copper
1797 currency Two pence BMAG: 1936N91	0°; 40mm; 55.42g; copper
1797 currency Two pence BMAG: 1989N1639. 4	180°; 41mm; 55.34g; copper
1797 currency Two pence BMAG: 1989N1639. 2	180°; 41mm; 55.00g; copper
1797 currency Two pence BMAG: 1953N58	180°; 41mm; 54.61g; copper

1797 counterfeit Two pence Think tank 180°; 41mm; 14.59g; copper

1797 pattern Penny (Britannia with a helmet)

1797 pattern Penny (Early Soho) KP 1 BMAG: 1969N743 Peck 1083 180°; 36mm; 28.01g; copper
 1797 pattern Penny (Early Soho) KP 2 BMAG: 1969N744 Peck 1084 0°; 36mm; 27.62g; pewter
 1797 pattern Penny (Late Soho) KP 7 BMAG: 1885N1536.154 Peck 1095 180°; 36mm; 28.58g; bronzed
 1797 pattern Penny (Late Soho) KP 7 BMAG: 1969N751 Peck 1095 180°; 36mm; 28.49g; bronzed
 1797 pattern Penny (Late Soho) KP 7 Assay 73 Peck 1114a 0°; 36mm; 22.00g; bronzed
 1797 pattern Penny (Late Soho) KP 7 BMAG: 1969N752 Peck 1096 180°; 35mm; 19.87g; bronzed
 1797 pattern Penny (Late Soho) KP 7 BMAG: 1885N1541.210 Peck 1096 0°; 36mm; 19.29g; bronzed
 1797 pattern Penny (Late Soho) KP 7 BMAG: 1969N753 Peck 1097 180°; 36mm; 28.39g; copper

1797 pattern Penny

1797 pattern Penny (Late Soho) KP 4 BMAG: 1969N745 Peck 1086 180°; 36mm; 27.26g; silver
 1797 pattern Penny (Late Soho) KP 12 BMAG: 1969N756 Peck 1105 180°; 36mm; 26.93g; silver
 1797 pattern Penny (Late Soho) KP 5 BMAG: 1969N747 Peck 1089 180°; 36mm; 29.34g; gilt
 1797 pattern Penny (Late Soho) KP 4 BMAG: 1969N746 Peck 1088 180°; 36mm; 28.47g; gilt
 1797 pattern Penny (Late Soho) KP 5 BMAG: 1969N748 Peck 1090 180°; 36mm; 29.24g; bronzed
 1797 pattern Penny (Late Soho) Assay Office 69 Peck 1107 180°; 36mm; 28.50g; bronzed
 1797 pattern Penny (Late Soho) KP 8 BMAG: 1969N754 Peck 1098 0°; 36mm; 25.53g; bronzed
 1797 pattern Penny (Late Soho) Assay Office 70 Peck 1109 180°; 36mm; 25.45g; bronzed
 1797 pattern Penny (Late Soho) KP12 BMAG: 1969N749 Peck 1091 180°; 36mm; 29.01g; copper
 1797 pattern Penny (Late Soho) KP 12 BMAG: 1969N755 Peck 1104 180°; 36mm; 28.84g; copper
 1797 pattern Penny (Late Soho) KP 12 BMAG: 1885N1541.204 180°; 35mm; 28.73g; copper
 1797 pattern Penny (Late Soho) KP 12 BMAG: 1969N757 Peck 1106 180°; 36mm; 28.60 g; copper
 1797 pattern Penny (Late Soho) KP 6 BMAG: 1969N750 Peck 1094a 180°; 36mm; 27.39g; copper

1797 proof Penny

1797 proof Penny (Late Soho) KP15 BMAG: 1969N761 Peck 1114 180°; 35mm; 31.37g; gilt
 1797 proof Penny (Late Soho) KP 15 BMAG: 1885N1536.148 Peck 1114 180°; 35mm; 31.32g; gilt
 1797 proof Penny (Late Soho) KP 20 BMAG: 1885N1541.207 Peck 1130 180°; 35mm; 28.84g; gilt
 1797 proof Penny (Late Soho) KP 17 BMAG: 1971N465 Peck 1123 180°; 36mm; 28.59g; gilt
 1797 proof Penny (Late Soho) KP16 BMAG: 1969N763 Peck 1117 180°; 35mm; 28.53g; gilt
 1797 proof Penny (Late Soho) KP 17 Assay Office 71 Peck 1124 180°; 36mm; 28.45g; gilt
 1797 proof Penny (Late Soho) KP 16 BMAG: 1930N188 Peck 1117 180°; 35mm; 28.19g; gilt
 1797 proof Penny (Late Soho) KP 20 BMAG: 1969N774 Peck 1130 180°; 35mm; 28.02g; gilt
 1797 proof Penny (Late Soho) KP 18 BMAG: 1969N769 Peck 1125 180°; 35mm; 28.94g; bronzed
 1797 proof Penny (Late Soho) KP 14 BMAG: 1885N1536.161 Peck 1109 180°; 36mm; 28.14g; bronzed
 1797 proof Penny (Late Soho) KP 18 BMAG: 1969N770 Peck 1126 180°; 36mm; 28.12g; bronzed
 1797 proof Penny (Late Soho) KP 14 BMAG: 1885N1541.205 Peck 1109 180°; 36mm; 25.28g; bronzed
 1797 proof Penny (Late Soho) KP15 BMAG: 1969N760 Peck 1113 180°; 36mm; 25.18g; bronzed
 1797 proof Penny (Late Soho) KP 14 BMAG: 1969N758 Peck 1109 180°; 36mm; 25.03g; bronzed
 1797 proof Penny (Late Soho) KP 17 BMAG: 1969N767 Peck 1123 180°; 36mm; 29.01g; copper
 1797 proof Penny (Late Soho) KP 17 BMAG: 1969N766 Peck 1122 180°; 35.5mm; 28.92g; copper
 1797 proof Penny (Late Soho) KP 14 BMAG: 1969N759 Peck 1110 0°; 35mm; 28.80g; copper
 1797 proof Penny (Late Soho) KP16 BMAG: 1969N765 Peck 1119 180°; 36mm; 28.61g; copper
 1797 proof Penny (Late Soho) KP16 BMAG: 1969N764 Peck 1118 180°; 35.5mm; 28.59g; copper
 1797 proof Penny (Late Soho) KP15 BMAG: 1969N762 Peck 1116 180°; 36mm; 28.35g; copper
 1797 proof Penny (Late Soho) KP 19 BMAG: 1969N772 Peck 1128 180°; 36mm; 28.33g; copper
 1797 proof Penny (Late Soho) KP 19 BMAG: 1969N773 Peck 1129 180°; 35.5mm; 22.91g; tin

1797 currency Penny

1797 currency Penny KP 21 BMAG: 1969N776 Peck 1132 180°; 35mm; 28.96g; copper
 1797 currency Penny BMAG: 2007.1230 180°; 35mm; 28.70g; copper
 1797 currency Penny BMAG: 1937N270.8 180°; 35mm; 28.68g; copper
 1797 currency Penny KP 21 BMAG: 1936N93 180°; 35mm; 28.63g; copper
 1797 currency Penny BMAG: 1930N447.24 180°; 35mm; 28.59g; copper

1797 currency Penny BMAG: 1885N1541.203	180°; 35mm; 28.49g; copper
1797 currency Penny KP 21 BMAG: 1969N775 Peck 1132	180°; 36mm; 28.43g; copper
1797 currency Penny BMAG: 1989N1639.00003	180°; 36mm; 28.25g; copper
1797 currency Penny Avery Museum	180°; 35mm; 28.25g; copper
1797 currency Penny KP 22 BMAG: 1969N779 Peck 1133	180°; 36mm; 27.93g; copper
1797 currency Penny KP 21 BMAG: 1969N778 Peck 1132	180°; 36mm; 27.86g; copper
1797 currency Penny KP 22 BMAG: 1969N780 Peck 1133	180°; 36mm; 27.83g; copper

Worn 1797 Pennies

1797 currency Penny Think tank	180°; 36mm; 27.39g; copper
1797 currency Penny BMAG: 1885N1534.31	180°; 35mm; 27.09g; copper
1797 currency Penny Think tank	180°; 36mm; 26.71g; copper
1797 currency Penny Think tank	180°; 36mm; 26.22g; copper
1797 currency Penny Think tank	180°; 36mm; 25.49g; copper
1797 currency Penny Think tank	180°; 36mm; 25.37g; copper
1797 currency Penny Think tank	180°; 35mm; 25.00g; copper
1797 currency Penny Think tank	180°; 36mm; 24.94g; copper
1797 currency Penny Think tank	180°; 36mm; 24.72g; copper
1797 currency Penny Think tank	180°; 36mm; 24.48g; copper
1797 currency Penny Think tank	180°; 35mm; 24.46g; copper

1797 Counterfeit Penny

1797 counterfeit Penny BMAG: 1976N25	180°; 35mm; 21.19g; copper
1797 Trial Strike/Counterfeit Penny BMAG: 1976N29	0°; 36mm; 30.51g; white metal
1797 counterfeit Penny Think tank	180°; 33mm; 16.94g; copper

1797 pattern Halfpenny

1797 Halfpenny (Early Soho) KH 6 BMAG: 1930N189 Peck 1152	180°; 31mm; 14.22g; gilt
1797 Halfpenny (Early Soho) KH 7 BMAG: 1969N795 Peck 1156	180°; 31mm; 14.18; gilt
1797 Halfpenny (Early Soho) KH 6 BMAG: 1969N791 Peck 1152	180°; 31mm; 14.01g; gilt
1797 Halfpenny (Early Soho) KH 6 BMAG: 1969N794 Peck 1155	180°; 31mm; 13.75g; gilt
1797 Halfpenny (Early Soho) KH 6 BMAG: 1969N792 Peck 1153	180°; 30mm; 14.30g; bronzed
1797 Halfpenny (Early Soho) Assay Office 83 Peck 1157	180°; 30mm; 14.10g; bronzed
1797 Halfpenny (Early Soho) KH 6 BMAG: 1969N793 Peck 1154	180°; 30mm; 14.24g; copper
1797 Halfpenny (Early Soho) KH 7 BMAG: 1969N796 Peck 1157	180°; 31mm; 13.70g; copper
1797 Halfpenny (Late Soho) KH 8 BMAG: 1969N797 Peck 1158A	180°; 31mm; 14.09g; copper
1797 Halfpenny (Late Soho) KH 9 BMAG: 1969N799 Peck 1160	180°; 31mm; 13.67g; copper

1797 pattern Halfpenny with ornament

1797 Halfpenny (Late Soho) KH 9 BMAG: 1969N798 Peck 1159	0°; 31mm; 16.63g; silver
1797 obverse halfpenny punch BMAG: 1971N479	31 mm; total 40mm; 33.90g
1797 reverse halfpenny punch BMAG: 1971N481	30 mm; total 45mm; 89.57g
1797 reverse farthing punch BMAG: 1971N483	27 mm; total 39mm; 48.89g
1797 Britannia farthing punch BMAG: 1971N482	24 mm; total 35mm; 52.99g

1797 pattern Farthing

1797 Farthing (Early Soho) KF 1 BMAG: 1969N813 Peck 1186	180°; 26mm; 7.42g; gilt
1797 Farthing (Early Soho) Assay Office 91 Peck 1187	180°; 25mm; 7.45g; bronzed
1797 Farthing (Late Soho) KF 2 BMAG: 1969N814 Peck 1188	180°; 26mm; 7.48g; gilt
1797 Farthing (Late Soho) Assay Office 92 Peck 1189	180°; 25mm; 7.45g; bronzed
1797 Farthing (Late Soho) KF 2 BMAG: 1969N815 Peck 1190	180°; 25mm; 7.63g; copper
1797 Farthing (Late Soho) KF 2 BMAG: 1969N816 Peck 1190	180°; 26mm; 7.52g; copper

1798 pattern Farthing

1798 pattern Farthing (Early Soho) Assay Office 93 Peck 1202	180°; 25mm; 7.10g; gilt
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1798 pattern Farthing (Early Soho) KF3 BMAG: 1930N195 Peck 1202	180°; 25mm; 7.04g; gilt
1798 pattern Farthing (Early Soho) KF 3 BMAG: 1969N825 Peck 1202	180°; 26mm; 7.03g; gilt
1798 pattern Farthing (Early Soho) KF 4 BMAG: 1969N828 Peck 1205	180°; 25mm; 7.21g; bronzed
1798 pattern Farthing (Early Soho) KF 3 BMAG: 1969N826 Peck 1203	180°; 26mm; 7.11 g; bronzed
1798 pattern Farthing (Early Soho) KF 3 BMAG: 1969N827 Peck 1204	180°; 26mm; 7.12g; copper
1798 pattern Pattern Farthing (Late Soho) KF 5 BMAG: 1969N829 Peck 1206	180°; 25mm; 6.44g; gilt

1798 pattern Dollar

1798 pattern Dollar George III (Seaby 175) BMAG: 1885N1536.146	0°; 42mm; 24.08g; bronzed
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1798 pattern Guinea

1798 pattern Guinea BMAG: 1885N1541.217	180°; 23.5mm; 4.32g; gilt
1798 pattern Guinea BMAG: 1885N1541.158	180°; 23.5 mm; 4.22g; gilt
1798 pattern Guinea BMAG: 1930N204	180°; 23.5 mm; 4.18g; gilt
1798 pattern Guinea Assay Office 65	

1798 Isle of Man

1798 Isle of Man Penny BMAG: 1885N1541.211	0°; 33mm; 22.14g; gilt
1798 Isle of Man Halfpenny BMAG: 1885N1541.215	0°; 27mm; 10.91g; gilt
1798 Isle of Man Halfpenny BMAG: 1885N1541.214	0°; 27mm; 10.14g; bronzed
1798 Isle of Man Halfpenny BMAG: 1885N1536.172	0°; 27mm; 10.13g; bronzed

1798 Sumatra

1798 Sumatra three keping Pridmore 8A BMAG: 1885N1541.190	180°; 27 mm; 9.58g; copper
1798 Sumatra one keping Pridmore 20A BMAG: 2007.1263	180°; 20 mm; 2.97g; copper

1798 The Second Presidency of George Washington ‘Seasons’ Medal (Pollard 12, 13, 14)

1798 George Washington (‘Shepherd’ 12) BMAG: 1885N1536.20	0°; 48mm; 47.98g; bronzed
1798 George Washington (‘Shepherd’ 12) BMAG: 1885N1541.73	0°; 48mm; 47.70g; bronzed
1798 George Washington (‘Shepherd’ 12) British Museum: SSB Collection	0°; 48mm; 47.15g; bronzed
1798 George Washington (‘Farmer’ 13) British Museum: PS 265986 SSB	0°; 48mm; 47.00g; bronzed
1798 George Washington (‘Spinning’ 14) British Museum: 44839 SSB	0°; 48mm; 46.30g; bronzed

1798 Davison’s Battle of the Nile Medal (BHM 447; Pollard 15)

1798 Davidson’s Nile Medal Reverse Punch Assay Office 2049	68mm; face 46m; 1000g; steel
1798 Davison’s Victory of the Nile 1885N1536.30	0°; 48mm; 40.64g; bronzed
1798 Davidson’s Nile Medal British Museum PI 5275 Miss Banks	0°; 48mm; 40.05g; bronzed
1798 Davidson’s Nile Medal Assay Office 22	0°; 48mm; 40.00g; bronzed
1798 Davidson’s Nile Medal Avery Museum: 21.1.18	0°; 48mm; 39.95g; bronzed
1798 Davidson’s Nile Medal British Museum PI 5276	0°; 48mm; 39.90g; bronzed
1798 Davidson’s Nile Medal British Museum PI 5274	0°; 48mm; 39.75g; bronzed
1798 Davidson’s Nile Medal Assay Office 21	0°; 48mm; 38.65g; bronzed
1798 Battle of the Nile Trial strike reverse BMAG: 1988N8	0°; 47mm; 18.92g; tin

1798 British Victories (Army and Navy Victorious) Medal (BHM 458; Pollard 16)

1798 British Victories Medal BMAG: 1930N272	0°; 48mm; 54.65g; bronzed
1798 British Victories Medal BMAG: 1885N1536.36	0°; 48mm; 54.54g; bronzed
1798 British Victories Medal Assay Office 23	0°; 48mm; 54.50g; bronzed
1798 British Victories Assay Office 24	0°; 48mm; 54.50g; bronzed

1798 Hafod Friendly Society Medal

1798 Hafod Friendly Society BMAG: 1885N1541.105	0°; 41mm; 37.97g; bronzed
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1798 Birmingham Loyal Association Medal (BHM 459) (not made by Boulton)

1798 Birmingham Loyal Association Assay Office 219	0°; 41mm; 29.85g silver
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1798 Birmingham Loyal Association BMAG: 1885N1541.126	0°; 41mm; 34.98g; gilt
1798 Birmingham Loyal Association Assay Office 220	0°; 41mm; 34.95g; bronzed
1798 Birmingham Loyal Association Assay Office 221	0°; 41mm; 21.90g; white metal
1798 Birmingham Loyal Association BMAG: 1968N870	not seen

1799 British Currency

1799 pattern Halfpenny (George III with crown)

1799 Halfpenny (Early Soho) KH 12 BMAG: 1969N842 Peck 1223	180°; 30mm; 13.00g; gilt
1799 Halfpenny (Early Soho) KH 10 BMAG: 1969N838 Peck 1218	180°; 30mm; 12.75g; gilt
1799 Halfpenny (Early Soho KH 11) BMAG: 1885N1541.216	180°; 31mm; 12.72g; gilt
1799 Halfpenny (Early Soho) KH 10 BMAG: 1969N839 Peck 1220	180°; 30mm; 13.00g; copper
1799 Halfpenny (Early Soho) KH 11 BMAG: 1969N841 Peck 1222	180°; 31mm; 13.18g; pewter/tin
1799 Halfpenny (Late Soho) KH 18 BMAG: 1969N851 Peck 1237	180°; 30mm; 14.52g; bronzed
1799 Halfpenny (Late Soho) KH 18 BMAG: 1885N1536.164 Peck 1237	180°; 30mm; 14.48g; bronzed
1799 Halfpenny (Late Soho) KH 18 BMAG: 1885N1541.221 Peck 1238	180°; 30mm; 13.95g; bronzed

1799 pattern Halfpenny (laureate George III)

1799 Halfpenny (Early Soho) KH 16 Assay Office 84 Peck 1233	180°; 30mm; 13.25g; gilt
1799 Halfpenny (Early Soho) KH 13 BMAG: 1969N843 Peck 1224	180°; 31mm; 13.06g; gilt
1799 Halfpenny (Early Soho) KH 13 BMAG: 1969N845 Peck 1226	180°; 30mm; 12.90g; gilt
1799 Halfpenny (Early Soho) KH 16 BMAG: 1969N847 Peck 1233	180°; 30mm; 12.76g; gilt
1799 Halfpenny (Early Soho) KH 16 BMAG: 1969N848 Peck 1234	180°; 30mm; 12.38g; bronzed
1799 Halfpenny (Early Soho) KH 13 BMAG: 1969N844 Peck 1225	180°; 30mm; 12.95g; copper
1799 Halfpenny (Early Soho) KH 15 BMAG: 1969N846 Peck 1232	180°; 30mm; 12.81g; copper
1799 Halfpenny (Early Soho) KH 16 BMAG: 1969N849 Peck 1235	180°; 30mm; 12.32g; copper
1799 Halfpenny (Early Soho) KH 17 BMAG: 1969N850 Peck 1236	180°; 30mm; 11.99g; copper
1799 Halfpenny (Late Soho) KH 22 BMAG: 1885N1536.151 Peck 1243	180°; 30mm; 12.75g; gilt
1799 Halfpenny (Late Soho) KH 22 BMAG: 1969N856 Peck 1243	180°; 30.5mm; 12.61g; gilt
1799 Halfpenny (Late Soho) KH 24 BMAG: 1885N1541.218 Peck 1246	180°; 30mm; 12.89g; bronzed
1799 Halfpenny (Late Soho) KH 23 BMAG: 1969N858 Peck 1245	180°; 30mm; 12.79g; bronzed
1799 Halfpenny (Late Soho) KH 24 BMAG: 1969N859 Peck 1246	180°; 30mm; 12.79g; bronzed
1799 Halfpenny (Late Soho) KH 22 BMAG: 1969N857 Peck 1244	180°; 30mm; 12.50g; bronzed
1799 Halfpenny (Late Soho) KH24 Assay Office 85 Peck 1246	180°; 30mm; 11.95g; bronzed
1799 Halfpenny (Late Soho) KH 25 BMAG: 1969N860 Peck 1247	180°; 30mm; 9.68g; bronzed
1799 Halfpenny (Late Soho) KH 21 BMAG: 1969N855 Peck 1242	180°; 30mm; 10.16g; copper

1799 pattern Halfpenny (with BRITANN. REX inscription)

1799 Halfpenny (Late Soho) KH 19 BMAG: 1969N852 Peck 1239	180°; 30mm; 14.06g; bronzed
1799 Halfpenny (Late Soho) KH 19 BMAG: 1969N853 Peck 1240	180°; 30mm; 11.24g; copper
1799 Halfpenny (Late Soho) KH 20 BMAG: 1969N854 Peck 1241	180°; 30mm; 9.45g; copper
1799 Halfpenny (obverse only) KH 15 BMAG: 1930N200 Peck 1230	180°; 30.5mm; 12.66g; gilt
1799 Halfpenny (obverse only) KH 26 BMAG: 1969N867 Peck 1253	180°; 30mm; 11.91g; copper

1799 currency Halfpenny

1799 currency Halfpenny KH 26 BMAG: 1971N467 Peck none	180°; 30 mm; 12.26g; gilded later
1799 currency Halfpenny KH 26 BMAG: 1971N468 Peck none	180°; 30 mm; 12.56g; bronzed
1799 currency Halfpenny KH 26 BMAG: 1885N1526.388 Peck none	180°; 30mm; 13.22g; copper
1799 currency Halfpenny KH 26 BMAG: 1969N862 Peck 1248	180°; 30mm; 13.12g; copper
1799 currency Halfpenny KH 26 BMAG: 1969N865 Peck 1251	180°; 30mm; 13.05g; copper
1799 currency Halfpenny KH 26 BMAG: 1969N864 Peck 1250	180°; 30mm; 12.84g; copper
1799 currency Halfpenny KH 26 Assay Office 86 Peck 1248	180°; 30mm; 12.75g; copper
1799 currency Halfpenny KH 26 BMAG: 1969N863 Peck 1249	180°; 30mm; 12.67g; copper
1799 currency Halfpenny BMAG: 1936N94	180°; 30mm; 12.54g; copper
1799 currency Halfpenny KH 26 BMAG: 1969N866 Peck 1252	180°; 30mm; 12.39g; copper
1799 currency Halfpenny KH 26 BMAG: 1969N861 Peck 1248	180°; 30mm; 12.36g; copper

1799 pattern Farthing

1799 Farthing (Early Soho) KF6 BMAG: 1969N875 Peck 1268	180°; 23 mm; 4.88g; copper
1799 Farthing (Late Soho) KF7 BMAG: 1930N196 Peck 1269	180°; 23mm; 6.50g; gilt
1799 Farthing (Late Soho) KF9 BMAG: 1969N881 Peck 1275	180°; 23.5mm; 6.29g; gilt
1799 Farthing (Late Soho) KF8 BMAG: 1969N878 Peck 1272	180°; 23 mm; 6.28g; gilt
1799 Farthing (Late Soho) KF7 BMAG: 1969N876 Peck 1269	not measured gilt
1799 Farthing (Late Soho) KF8 BMAG: 1969N879 Peck 1273	180°; 23mm; 6.42g; bronzed
1799 Farthing (Late Soho) KF7 BMAG: 1969N877 Peck 1270	180°; 23 mm; 6.41g; bronzed
1799 Farthing (Late Soho) Assay Office 95 Peck 1269	180°; 23mm; 6.40g; bronzed
1799 Farthing (Late Soho) Assay Office 96 Peck 1277	180°; 23mm; 6.25g; bronzed
1799 Farthing (Late Soho) KF9 BMAG: 1969N882 Peck 1276	180°; 23 mm; 6.20g; bronzed
1799 Farthing (Late Soho) KF10 BMAG: 1885N1536.152 Peck 1277	180°; 23mm; 7.29g; copper
1799 Farthing (Late Soho) KF10 BMAG: NONE Peck 1277	180°; 23.5mm; 7.19g; copper
1799 Farthing (Late Soho) KF8 BMAG: 1969N880 Peck 1274	180°; 23mm; 6.26g; copper
1799 Farthing (Late Soho) KF10 BMAG: 1969N883 Peck 1278	180°; 23mm; 6.25g; copper

1799 currency Farthing

1799 currency Farthing KF11 BMAG: 1969N884 Peck 1279	180°; 23 mm; 6.47g; copper
1799 currency Farthing KF11 BMAG: 1936N95	180°; 23mm; 6.09g; copper
1799 currency Farthing KF11 BMAG: 1969N885 Peck 1280	180°; 23 mm; 5.98g; copper

1799 Count Alexander Suvarow Medal (Pollard 17)

1799 Count Alexander Suvarow British Museum:	0°; 48mm; 53.85g; gilt
1799 Count Alexander Suvarow Avery Museum: 21.1.22	0°; 48mm; 53.60g; gilt
1799 Count Alexander Suvarow Assay Office 26	0°; 48mm; 53.45g; gilt
1799 Count Alexander Suvarow BMAG: 1885N1536.29	0°; 48mm; 53.31g; gilt
1799 Count Alexander Suvarow BMAG: 1885N1541.59	0°; 48mm; 58.07g; bronzed
1799 Count Alexander Suvarow Assay Office 25	0°; 48mm; 57.80g; bronzed
1799 Count Alexander Suvarow British Museum:	0°; 48mm; 56.10g; bronzed
1799 Count Alexander Suvarow BMAG: 1885N1541.60	0°; 48mm; 55.72g; bronzed
1799 Count Alexander Suvarow British Museum:	0°; 48mm; 54.40g; bronzed
1799 Count Alexander Suvarow British Museum:	0°; 48mm; 54.35g; bronzed
1799 Count Alexander Suvarow British Museum:	0°; 48mm; 54.15g; bronzed
1799 Count Alexander Suvarow BMAG: 1930N276	0°; 48mm; 51.94g; bronzed

1799 Christian VII Denmark pattern coins

no date Christian VII Denmark BMAG: 1885N1536.125	180°; 39 mm; 24.36g; bronzed
no date Christian VII Denmark BMAG: 1885N1536.72.1	180°; 39 mm; 24.29g; bronzed
no date Christian VII Denmark BMAG: 1885N1541.177	180°; 34 mm; 15.94g; copper
no date Christian VII Denmark BMAG: 1885N1536.70	180°; 34 mm; 16.36g; copper
no date Christian VII Denmark BMAG: 2007.1268	180°; 33.5 mm; 16.32g; copper
no date Christian VII Denmark BMAG: 1885N1536.73	180°; 27 mm; 8.15g; copper
no date Christian VII Denmark BMAG: 1885N1541.178	180°; 27mm; 8.15g; copper
no date Christian VII Denmark BMAG: 1885N1536.59	180°; 21 mm; 4.07g; copper
no date Christian VII Denmark BMAG: 1885N1541.38	180°; 21mm; 4.13g; copper
no date Christian VII Denmark BMAG: 1885N1536.65	180°; 18mm; 1.85g; copper
no date Christian VII Denmark BMAG: 1885N1541.39.1	180°; 18mm; 1.82g; copper
no date Christian VII Denmark BMAG: 1885N1541.39.2	180°; 18mm; 1.85g; copper

1799 Ferdinand IV of Naples and Sicily Medal (BHM 479; Pollard 18)

1799 Ferdinand IV of Naples and Sicily BMAG: 1885N1541.58	0°; 48mm; 59.92g; gilt
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1799 Ferdinand IV of Naples and Sicily Assay Office 28	0°; 48mm; 64.75g; bronzed
1799 Ferdinand IV of Naples and Sicily BMAG: 1885N1541.57	0°; 48mm; 64.71g; bronzed
1799 Ferdinand IV of Naples and Sicily Assay Office 27	0°; 48mm; 58.45g; bronzed
1799 Ferdinand IV of Naples and Sicily BMAG: 1930N275	0°; 48mm; 58.12g; bronzed
1799 Ferdinand IV of Naples and Sicily BMAG: 1885N1536.34	0°; 48 mm; 53.46g; bronzed

1800 Earl St. Vincent Medal (BHM 489; Pollard 19)

1800 Earl St. Vincent's Medal BMAG: 1937N701	0°; 47mm; 23.76g; silver
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1800 Preservation from Assassination of George III Medal (BHM 482-485; Pollard 23)

1800 Preservation of George III (BHM 482) BMAG: 2006.0978	0°; 48 mm; 50.37g; bronzed
1800 Preservation of George III Medal (BHM 483) Assay Office 29	0°; 48mm; 65.10g; bronzed
1800 Preservation of George III (BHM 483) BMAG: 1885N1536.24	0°; 48mm; 65.02g; bronzed
1800 Preservation of George III Medal (BHM 483) Assay Office 30	0°; 48mm; 54.70g; bronzed
1800 Preservation of George III (BHM 483) BMAG: 1885N1541.72	0°; 48mm; 53.08g; bronzed

1800 Penydarran Token

1800 Penydarran Five Shilling Token BMAG: 1968N170	180°; 34mm; 13.77g; gilt
1800 Penydarran Two Shilling and Sixpence Token BMAG: 1968N171	180°; 32mm; 12.59g; gilt
1800 Penydarran Two Shilling Token and Sixpence BMAG: 1968N172	180°; 32mm; 12.63g; bronzed
1800 Penydarran Sixpence Token BMAG: 1968N173	180°; 28mm; 10.23g; bronzed

1801 (dated 1799) Seringapatam Medal (Pollard 20)

1801 (dated 1799) Seringapatam BMAG: 1885N1541.62	0°; 48mm; 55.88g; bronzed
1801 (dated 1799) Seringapatam BMAG: 1885N1536.82	0°; 48mm; 55.46g; bronzed
1801 (dated 1799) Seringapatam BMAG: 1885N1536.26	0°; 48mm; 39.93g; bronzed

1800 Staffordshire Agricultural Society Medal (Pollard 21)

1800 Staffordshire Agricultural Society BMAG: 1885N1536.123	0°; 47mm; 60.44g; bronzed
1800 Staffordshire Agricultural Society (trial) BMAG: 1885N1541.69	0°; 47mm; 54.47g; bronzed
1800 Staffordshire Agricultural Society (trial) Assay Office 63	0°; 48mm; 54.85g; bronzed
1800 Staffordshire Agricultural Society (trial) BMAG: 1972N140	0°; 47mm; 53.96g; bronzed
1800 Staffordshire Agricultural Society (trial) BMAG: 1885N1541.68.1	0°; 47mm; 46.06g; bronzed

1800 Drayton Agricultural Society Medal (Pollard 22)

1800 Drayton Agricultural Society BMAG: 1885N1536.124	0°; 47mm; 61.38g; bronzed
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1801 (dated 1800) Enniscorthy Halfpenny Token D&H Wexford, Ireland

1801 (dated 1800) Enniscorthy Halfpenny D&H 2 Assay Office 130	180°; 28mm; 7.65g; bronzed
1801 (dated 1800) Enniscorthy Halfpenny BMAG: 1885N1536.91	180°; 28mm; 7.63g; bronzed
1801 (dated 1800) Enniscorthy Token D&H 2 BMAG: 1885N1541.167	180°; 28mm; 7.63g; bronzed

Different version:

1801 (dated 1800) Enniscorthy Halfpenny D&H 4 BMAG: 1967N969	180°; 28 mm; 8.22g; copper
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1801 dated 1796 'Gold Coast' (Royal African Company of Merchants) one ackey; half ackey; quarter ackey; tackoe

1796 Gold coast one ackey proof BMAG: 1885N1536.53	180°; 31 mm; 15.68g; bronzed
1796 Gold coast one ackey proof BMAG: 1885N1536.60	180°; 31 mm; 15.68g; bronzed
1796 Gold coast one ackey proof BMAG: 1885N1541.171	180°; 31 mm; 15.66g; bronzed

1796 Gold coast quarter ackey proof BMAG: 1885N1536.58	180°; 19 mm; 3.93g; gilt
1796 Gold coast quarter ackey proof BMAG: 2007.1266	180°; 19 mm; 3.89g; bronzed
1796 Gold coast quarter ackey proof BMAG: 1885N1541.22	180°; 19 mm; 3.88g; bronzed
1796 Gold coast quarter ackey Assay Office 154	180°; 19 mm; 3.85g; bronzed

1796 Gold coast trade tackoe Assay Office 155	180°; 16.5mm; 2.00g; bronzed
1796 Gold coast 1 tackoe proof BMAG: 2007.1267	180°; 17mm; 1.88g; bronzed
11796 Gold coast 1 tackoe proof BMAG: 1885N1541.21	180°; 16.5mm; 1.85g; bronzed

1801 Union of Britain and Ireland Medal (BHM 523 - 525; Pollard 24)

1801 Union of Britain and Ireland (BHM 523) BMAG: 1885N1541.50 0°; 48mm; 54.05g; gilt
 1801 Union of Britain and Ireland (BHM 523) Assay Office 32 0°; 48mm; 53.90g; gilt

1801 Union of Britain and Ireland (BHM 524) BMAG: 1885N1541.49 0°; 48mm; 54.90g; bronzed
 1801 Union of Britain and Ireland (BHM 524) Assay Office 31 0°; 48mm; 53.75g; bronzed
 1801 Union of Britain and Ireland (BHM 524) BMAG: 1885N1536.19 0°; 48mm; 53.32g; bronzed

1801/1802

1801/1802 Mule (reverses) Union /Peace of Amiens BMAG: 1935N541.6 0°; 48mm; 56.06g; bronzed

1802 Peace of Amiens Medal (BHM 534-536; Pollard 25)

1802 Peace of Amiens Assay Office 33 (BHM 535) 0°; 48mm; 54.70g; bronzed
 1802 Peace of Amiens Assay Office 35 (BHM 535) 0°; 48mm; 54.35g; bronzed
 1802 Peace of Amiens BMAG: 1885N1536.33 (BHM 535) 0°; 48mm; 53.98g; bronzed
 1802 Peace of Amiens Assay Office 34 (BHM 535) 0°; 48mm; 53.50g; bronzed

1802 Birmingham Loyal Association Medal (Eimer 943)

1802 Birmingham Loyal Association BMAG: 1984N27 0°; 47mm; 49.20g; silver, pierced
 1802 Birmingham Loyal Association BMAG: 1954N612 0°; 47mm; 47.75g; silver; pierced
 1802 Birmingham Loyal Association Assay Office 235 0°; 48mm; 47.30g; silver; pierced
 1802 Birmingham Loyal Association Assay Office 234 0°; 48mm; 50.85g; silver, unpierced
 1802 Birmingham Loyal Association British Museum: M 4396 0°; 47mm; 50.00g; silver, unpierced
 1802 Birmingham Loyal Association BMAG: 1923N37 0°; 47mm; 49.87g; silver, unpierced
 1802 Birmingham Loyal Association BMAG: 1885N1526.166 0°; 47mm; 49.75g; silver, unpierced
 1802 Birmingham Loyal Association BMAG: 1932N171 0°; 47mm; 49.40g; silver, unpierced
 1802 Birmingham Loyal Association BMAG: 1947N9 0°; 47mm; 49.32g; silver, unpierced
 1802 Birmingham Loyal Association Assay Office 233 0°; 48mm; 49.20g; silver, unpierced
 1802 Birmingham Loyal Association BMAG: 1929N333 0°; 47mm; 47.60g; silver, unpierced

1802 Manchester and Salford Volunteers Medal (Eimer 944)

1802 Manchester and Salford Volunteers Assay Office 36 0°; 36mm; 22.50g; gold
 1802 Manchester and Salford Volunteers British Museum: Hastings & Irwin p 363 No 2 0°; 36mm; 22.85g; gold
 1802 Manchester and Salford Volunteers BMAG: 1885N1541.81 0°; 36mm; 17.55g; gilt
 1802 Manchester and Salford Volunteers BMAG: 1885N1541.82 0°; 36mm; 18.87g; bronzed
 1802 Manchester and Salford Volunteers BMAG: 1885N1536.143 0°; 36mm; 19.23g; bronzed
 1802 Manchester and Salford Volunteers Assay Office 37 0°; 36mm; 19.00g; bronzed

Different version:

1802 Manchester and Salford Volunteers British Museum: Hastings & Irwin p 363 No 3 0°; 36mm; 19.45g; bronzed

1802 Nottinghamshire Yeomanry Medal (Pollard 26)

1802 Nottinghamshire Yeomanry BMAG: 1972N332 0°; 36mm; 28.48g; gold
 1802 Nottinghamshire Yeomanry Medal British Museum: PI 5408 0°; 36mm; 27.50g gold
 1802 Nottinghamshire Yeomanry Medal British Museum: M 5161 0°; 36mm; 17.05g bronzed

1802 dated '1791' Arnold 'Davison and Hawksley' Halfpenny Token D&H Nottinghamshire

1802 '1791' Arnold Works one shilling D&H 3 BMAG: 1885N1541.20 180°; 30mm; 11.33g; bronzed
 1802 '1791' Arnold Works crown trial strike BMAG: 1976N19 0°; 43mm; 14.13g; white metal bronzed

1802 Ceylon (Sri Lanka) rupee/rix dollar/stiver

1802 Ceylon 1/48 rix dollar **Reverse Die** BMAG: 1951S00088.00107 63mm; face 31mm; 1000g; steel
 1802 Ceylon 1/48 rix dollar Pridmore 83B BMAG: 1885N1536.42 180°; 30 mm; 9.83g; gilt
 1802 Ceylon 1/48 rix dollar BMAG: 2003.0035. 7.1 180° 30mm; 9.86g; bronzed
 1/48 rix dollar cases BMAG: 2003N0035. 7.4 2.46g; 2.60g
 11802 Ceylon 1/48 rix dollar Pridmore 83a Assay Office 138 180°; 30 mm; 9.90g; copper

1802 Ceylon 1/48 rix dollar Pridmore 83A BMAG: 1885N1536.46.2	180°; 30 mm; 9.75g; copper
1802 Ceylon 1/48 rix dollar Pridmore 83A BMAG: 1885N1536.46.1	180°; 30 mm; 9.74g; copper
1802 Ceylon 1/96 rix dollar Pridmore 86B BMAG: 1885N1541.15	0°; 23 mm; 4.66g; gilt
1802 Ceylon 1/96 rix dollar BMAG: 2003N0035. 7.2	0°; 23mm; 4.93g; bronzed
1/96 rix dollar cases BMAG: 2003N0035. 7.5	1.68g; 1.69g
1802 Ceylon 1/96 rix dollar Pridmore 86A BMAG: 1885N1541.16	0°; 23 mm; 4.92g; bronzed
1802 Ceylon 1/96 rix dollar BMAG: 1938N435	180°; 23 mm; 4.54g; bronzed
1802 Ceylon 1/96 rix dollar Pridmore 86a Assay Office 139	180°; 23mm; 4.90g; copper
1802 Ceylon 1/192 rix dollar BMAG: 2007.1254	180°; 18 mm; 2.45g; bronzed
1802 Ceylon 1/192 rix dollar BMAG: 2003N0035. 7.3	180° 18mm; 2.41g; bronzed
1/192 rix cases BMAG: 2003N0035. 7.6	1.00g; 1.03g
1802 Ceylon 1/192 rix dollar BMAG: 2007.1253	180°; 18 mm; 2.35g; bronzed
1802 Ceylon 1/192 rix dollar Pridmore 87a Assay Office 140	180°; 18.5mm; 2.40g; copper
1802 Ceylon 1/192 rix dollar BMAG: 1885N1536.48	180° 18mm; 2.35g; copper
1803 India Madras Presidency	
1803 India Madras Presidency ten cash Pridmore 201 Assay Office 166	?°; 25mm; 6.55g; gilt
1803 India Madras Presidency ten cash BMAG: 1885N1536.51	0°; 25 mm; 4.90g; bronzed
1803 India Madras Presidency ten cash Pridmore 200 Assay Office 167	?°; 25mm; 4.80g; bronzed
1803 India Madras Presidency five cash Obverse Die BMAG: 1951S00088.00114	62mm; face 21mm; 900g; steel
1803 India Madras Presidency five cash BMAG: 1938N348	0°; 20 mm; 3.29g; bronzed
1803 India Madras Presidency five cash Pridmore 209 Assay Office 168	?°; 21mm; 3.15g; bronzed
1803 India Madras Presidency five cash BMAG: 2007.1251	180°; 20 mm; 2.98g; bronzed
1803 India Madras Presidency one cash BMAG: 1885 N1536.56	180°; 11mm; 0.71g; bronzed
1803 India Madras Presidency one cash BMAG: 1885 N1536.73	180°; 11mm; 0.65g; bronzed
1803 India Madras Presidency one cash Pridmore 213 Assay Office 169	?°; 11mm; 0.65g; bronzed
1803 (undated) St. Albans Female Friendly Society Medal	
undated St. Albans Female Friendly Society BMAG: 1885N1541.104	0°; 42 mm; 38.61g; bronzed
1803 dated '1798' Fridericus II Duke of Württemberg trial strike	
1798 Fridericus II Duke of Württemberg (trial strike ob) BMAG: 1976N9	n/a; 44mm; 9.07g; white metal
1798 Fridericus II Duke of Württemberg (trial strike rev) BMAG: 1976N12	n/a; 43mm; 8.35g; white metal
1798 Mule Duke of Württemberg/Pattern Dollar BMAG: 1885N1536.131	0°; 42mm; 27.07g; gilt
1803 Ipswich Theatre Token	
1803 Ipswich Theatre BMAG: 1885N1541.106	0°; 37mm; 26.68g; bronzed
1803 (dated 1798) Boulton's Medalllic Scale Medal (BHM 462; Pollard 27)	
1803 (dated 1798) Boulton's Medalllic Scale BMAG: 1930N205	0°; 41mm; 31.88g; gilt
1803 (dated 1798) Boulton's Medalllic Scale BMAG: 1996N3	0°; 41mm; 24.57g; bronzed
1803 (dated 1798) Boulton's Medalllic Scale BMAG: 1885N1541.238	U0°; 42mm; 48.26g; bronzed
1803 (dated 1798) Boulton's Medalllic Scale Assay Office 38	0°; 43mm; 38.15g; bronzed
1803 (dated 1798) Boulton's Medalllic Scale Assay Office 39	0°; 43mm; 39.95g; bronzed
1803 (dated 1798) Boulton's Medalllic Scale Assay Office 40	0°; 43mm; 30.40g; white metal
1803/4 Droz medal	
1803/4 Droz medal claim bronzed BMAG: 1967N1296	180°; 40 mm; 25.88g; bronzed
1803 Boydell's Shakespeare Medal (Great National Edition) (BHM 553; Pollard 28)	
1803 Boydell's Shakespeare Medal British Museum: PI 5469	0°; 48mm; 56.50g; gold
1803 Boydell's Shakespeare Medal British Museum: M 5205	0°; 48mm; 39.05g; silver
1803 Boydell's Shakespeare Medal Assay Office 41	0°; 48mm; 38.80g; silver
1803 Boydell's Shakespeare Medal BMAG: 1885N1541.55	0°; 48mm; 38.17g; silver

1803 Boydell's Shakespeare Medal BMAG: 1885N1536.22	0°; 48mm; 60.81g; bronzed
1803 Boydell's Shakespeare Medal BMAG: 1885N1541.56	0°; 48mm; 53.27g; bronzed
1803 Boydell's Shakespeare Medal trial strike BMAG: 1950N190.21	n/a; 45mm; 13.45g; lead
1803 Duke of Bridgewater medal (trial strikes only)	
1803 Duke of Bridgewater trial strike obverse BMAG: 1972N349	0°; 51mm; 23.54g; bronzed tin
1803 Duke of Bridgewater trial strike obverse BMAG: 1976N22	0°; 48mm; 20.27g; white metal/bronzed
1803 Duke of Bridgewater trial strike reverse BMAG: 1972N350	0°; 50mm; 20.51g; bronzed tin
1803/4 (dated 1802) Tullamore-Charleville One Shilling and One Penny Token D&H Kings County Offaly, Ireland	
1802 Tullamore 1s 1d Token D&H 1 BMAG: 1885N1536.75	0°; 36 mm; 27.90g; bronzed
1802 Tullamore 1s 1d Token D&H 1 BMAG: 1885N541.31	0°; 36 mm; 26.59g; bronzed
1802 Tullamore 1s 1d Token D&H 1 Assay Office 131	0°; 36 mm; 24.70g; copper
1802 Tullamore 1s 1d Token D&H 1 Assay Office 132	0°; 36 mm; 22.65g; copper
1802 Tullamore 1s 1d trial strike obverse BMAG: 1976N24.1	n/a; 38mm; 8.08g; white metal/bronzed
1802 Tullamore 1s 1d trial strike reverse BMAG: 1976N24.2	n/a; 38mm; 6.56g; white metal/bronzed
1804 Sumatra keping	
180? EIC unfinished Obverse Die BMAG: 1951S00088.00099	60mm; face 31mm; 1000g; steel
1804 Sumatra four keping proof Pridmore 4B BMAG: 1885N1536.62	180°; 30 mm; 12.81g; gilt
Cases	2.53g; 2.65g
1804 Sumatra four keping Pridmore 4A BMAG: 1885N1541.191	180°; 30mm; 13.11g; bronzed
1804 Sumatra 4 keping proof BMAG: 2003.0035 3.1	180°; 31mm; 13.02g; bronzed
1804 Sumatra four keping Pridmore 4A BMAG: 1936N345.159	180°; 30mm; 12.89g; bronzed
1804 Sumatra four keping Pridmore 4A BMAG: 1885N1541.192	180°; 30 mm; 13.01g; copper
1804 Sumatra four keping Pridmore 15a Assay Office 188	180°; 30 mm; 12.95g; copper
1804 Sumatra four keping Pridmore 5 BMAG: 1932N107.39	180°; 30 mm; 8.84g; copper
1804 Sumatra four keping Pridmore 5 BMAG: 1966N724	180°; 30 mm; 8.26g; copper
1804 Sumatra two keping proof BMAG: 2003.0035 3.2	180°; 25 mm; 6.56g; bronzed
Cases	1.89g; 1.79g
1804 Sumatra two keping Pridmore 15A BMAG: 2007.1260	180°; 25 mm; 6.55g; bronzed
1804 Sumatra two keping Pridmore 15a Assay Office 189	180°; 25 mm; 6.50g; bronzed
1804 Sumatra two keping Pridmore 15A BMAG: 1885N1536.71	180°; 25 mm; 6.36g; bronzed
1804 Sumatra one keping BMAG: 2003.0035 3.3	180°; 21 mm 3.30g; bronzed
Cases	0.94g; 0.85g
1804 Sumatra one keping Pridmore 21A BMAG: 2007.1264	180°; 21mm; 3.31g; copper
1804 Sumatra one keping Pridmore 21A BMAG: 1885N1541.194	180°; 21mm; 3.30g; copper
1804 Sumatra one keping Pridmore 21 BMAG: 2007.1265	180°; 21mm; 3.29g; copper
1804 Sumatra one keping Pridmore 21a Assay Office 190	180°; 21mm; 3.25g; copper
1804 India Bombay Presidency	
1804 India Bombay Presidency double pice Pridmore 195 Assay Office 159	180°; 30 mm; 13.10g; bronzed
1804 India Bombay Presidency double pice BMAG: 1885N1541.193	180°; 30 mm; 13.06g; bronzed
1804 India Bombay Presidency double pice BMAG: 2007.1252	180°; 30 mm; 12.95g; bronzed
1804 India Bombay double pice (trial strike) BMAG: 1976N15	0°; 33mm; 5.28g; white metal
1804 India Bombay Presidency pice BMAG: 2007.1247	180°; 25 mm; 6.67g; gilt
1804 India Bombay Presidency pice Pridmore 200 Assay Office 161	180°; 25 mm; 6.25g; gilt
1804 India Bombay Presidency pice BMAG: 1885N1536.63	180°; 26 mm; 6.53g; bronzed
1804 India Bombay Presidency pice BMAG: 2007.1246	180°; 25 mm; 6.50g; bronzed
1804 India Bombay Presidency pice Pridmore 199 Assay Office 160	180°; 25 mm; 6.50g; bronzed

1804 India Bombay Presidency pice (trial strike) BMAG: 1976N14	0°; 28mm; 3.63g; white metal
1804 India Bombay Presidency Pridmore 202 half Pice Assay Office 162	180°; 20 mm; 3.35g; bronzed
1804 India Bombay Presidency half Pice BMAG: 2007.1248	180°; 20 mm; 3.34g; bronzed
1804 India Bombay Presidency half Pice BMAG: 1885N 1541.195	180°; 20 mm; 3.25g; bronzed
1804 Ceylon (Sri Lanka) rupee/rix dollar/stiver	
1804 Ceylon 1/192 rix dollar Obverse Die BMAG: 1951S00088.0003	58mm; face 19mm; 1000g; steel
1804 Ceylon 1/192 rix dollar Obverse Die BMAG: 1951S00088.00096	58mm; face 18mm; 900g; steel
1802/4 Ceylon 1/192 rix dollar Reverse Die BMAG: 1951S00088.00098	61mm; face 19mm; 900g; steel
1804 Alexander I Russia Pattern Rouble (Pollard 29)	
1804 Alexander I Russia Pattern Rouble BMAG: 1885N1536.43	0°; 40 mm; 40.5g; bronzed
1804 Alexander I Russia Pattern Rouble BMAG: 2007.2035	180° ; 40mm; 26.43g; bronzed
1804 Alexander I Russia Pattern Rouble BMAG: 1885N1536.8	0°; 40 mm; 25.58g; bronzed
1804 Alexander I Russia Pattern Rouble Assay Office 172	0°; 41mm; 26.70g; copper
1804 Alexander I Russia Pattern Rouble Assay Office 171	180°; 41mm; 26.30g; copper
1804 Alexander I Russia Pattern Imperial	
1804 Alexander I Russia Pattern Imperial Assay Office 175	0°; 27mm; 9.55g; gilt
1804 Alexander I Russia Pattern Imperial BMAG: 1885N1536.181.1	0°; 27mm; thick flan; 9.54g; copper
1804 Alexander I Russia Pattern Imperial Assay Office 174	0°; 27mm; 7.80g; copper
1804 Alexander I Russia Pattern Imperial BMAG: 1885N1541.182	0°; 27mm; 7.15g; copper
1804 Alexander I Russia Pattern Imperial Assay Office 173	0°; 27mm; 7.10g; copper
1804 Alexander I Russia Pattern Imperial BMAG: 1885N1541.181.2	0°; 27mm; 7.08g; copper
1804 Counterstamped Spanish pieces of Eight (octagonal stamp)	
1804 Counterstamped Spanish pieces of Eight British Museum	0°; 40mm; 26.95g; silver
1804 Bank of England pattern Garter Dollar Bank Token	
1804 pattern Garter Dollar BMAG: 1885N1536.135	0°; 41mm; 24.26g; bronzed
1804 pattern Garter Dollar BMAG: 1885N1536.140	180°; 41mm; 23.66g; bronzed
1804 Bank of England Britannia Dollar five shilling Bank Token	
1804 Britannia Dollar George III BMAG: 1932N285.434	0°; 42mm; 27.11g; silver
1804 Britannia Dollar George III BMAG: 1937N938.1	0°; 41mm; 27.07g; silver
1804 Britannia Dollar George III Assay Office 66 ESC 144	180°; 40mm; 26.90g; silver
1804 Britannia Dollar British Museum: PS 303344 T.H. B. Graham 501	0°; 41mm; 26.85g; silver
1804 Britannia Dollar George III BMAG: 1932N43	5°; 40mm; 26.56g; silver
1804 Britannia Dollar British Museum: PS 303344 T.H. B. Graham 501	0°; 41mm; 26.08g; silver
1804 Britannia Dollar George III BMAG: 1885N1541.17	0°; 41mm; 24.35g; bronzed
1804 Britannia Dollar George III BMAG: 1885N1536.130	0°; 40mm; 22.17g; bronzed
1804 Fake Dollar George III BMAG: 1932N285.435	5°; 40mm; 22.89g; silver/base metal
1804 Fake Dollar George III BMAG: 2007.1271	5°; 40mm; 22.20g; silver/base metal
1804 Fake Dollar George III BMAG: 1964N5122	0°; 40mm; 24.67g; copper
1804 Bank of Ireland Six shillings token	
1804 Bank of Ireland Six shillings Assay Office 100	0°; 42mm; 27.10g; silver
1804 Bank of Ireland Six shillings British Museum: Thornhill 8993	0°; 41mm; 27.05g; silver
1804 Bank of Ireland Six shillings British Museum: SSB p 14 No.30	0°; 42mm; 26.95g; silver
1804 Bank of Ireland Six shillings British Museum: Fairburn	0°; 41mm; 26.80g; silver
1804 Bank of Ireland Six shillings BMAG: 1885N1541.40	0°; 42mm; 24.29g; gilt
1804 Bank of Ireland Six shillings BMAG: 1885N1536.137	0°; 41 mm; 27.09g; bronzed
1804 Bank of Ireland Six shillings BMAG: 1885N1541.41	0°; 41.5 mm; 24.34g; bronzed

1805 Boulton's Trafalgar Medal (BHM 584; Pollard 30)

1805 Boulton's Trafalgar Medal Obverse Die Assay Office 2050A	72mm; face 48mm; 1000g; steel
1805 Boulton's Trafalgar Medal Avery Museum: 21.1.19A	0°; 48mm; 46.35g; silver
1805 Boulton's Trafalgar Medal BMAG: 1885N1536.28	0°; 48mm; 41.29g; silver
1805 Boulton's Trafalgar Medal Assay Office 44	0°; 48mm; 55.70g; bronzed
1805 Boulton's Trafalgar Medal Assay Office 43	0°; 48mm; 55.35g; bronzed
1805 Boulton's Trafalgar Medal BMAG: 1885N1537.3	0°; 48mm; 54.92g; bronzed
1805 Boulton's Trafalgar Medal BMAG: 1885N1541.52	0°; 48mm; 54.55g; bronzed
1805 Boulton's Trafalgar Medal Avery Museum: 21.1.19	0°; 48mm; 41.10g; copper
1805 Boulton's Trafalgar Medal Assay Office 42 pierced	0°; 48mm; 41.40g; pewter
Different version	
1805 Boulton's Trafalgar Medal Assay Office 45	0°; 48mm; 55.80g; silver
1805 Trial Strike Lord Nelson Phillp BMAG: 1976N21	0°; 45mm; 14.87g; white metal/bronzed
1805 Trial Strike Lord Nelson Phillp BMAG: 1976N10	0°; 48mm; 14.97g; white metal
Unknown bust B BMAG: 1972N353	na; 48mm; 9.72g; bronzed tin

1805 Trafalgar Medal (Restrike) silver BMAG: 1972N55.1

0°; 48mm; 60.60g; silver

1805 pattern Penny (Britanniarum)

1805 Penny (Early Soho) KP 23 BMAG: 1930N197 Peck 1289	180°; 35mm; 18.97g; gilt
1805 Penny (Early Soho) KP23 BMAG: 1969N890 Peck 1288	180°; 35mm; 19.00g; bronzed
1805 Penny (Early Soho) KP 23 BMAG: 1885N1536.166 Peck 1288	180°; 35mm; 19.49g; copper
1805 Penny (Early Soho) KP 23 BMAG: 1885N1541.223 Peck 1288	180°; 34mm; 17.58g; copper
1805 Penny KP24 (Late Soho) BMAG: 1969N891 Peck 1291	180°; 35mm; 18.82g; copper
1805 Penny KP24 (Late Soho) BMAG: 1969N892 Peck 1291	30-40°; 35.5mm; 21.18g; pewter

1805 pattern Halfpenny (Britanniarum)

1805 Halfpenny (Early Soho) KH29 BMAG: 1969N898 Peck 1302	180°; 30mm; 9.33g; silver
1805 Halfpenny (Early Soho) KH 28 BMAG: 1969N897 Peck 1301	180°; 30mm; 9.45g; copper
1805 Halfpenny (Late Soho) KH31 BMAG: 2007.1236 Peck 1305	180°; 30mm; 14.33g; bronzed
1805 Halfpenny (Late Soho) KH 31 BMAG: 1971N475 Peck 1306	0°; 30mm; 13.78g; bronzed
1805 Halfpenny (Late Soho) KH 30 BMAG: 1969N899 Peck 1303	180°; 30mm; 11.37g; bronzed
11805 Halfpenny (Late Soho) KH 30 BMAG: 1885N1536.165 Peck 1304	180°; 30mm; 11.41g; copper
1805 Halfpenny (Late Soho) KH 30 BMAG: 1969N900 Peck 1304	180°; 30mm; 11.34g; copper

1805 Irish Penny

1805 Irish Penny BMAG: 1940N655	180°; 33.5mm; 17.51g; gilt
Case 2.97g and 3.35g	
1805 Irish Penny (Dowle and Finn 593) Assay Office 102	180°; 33.5mm; 17.45g; gilt
1805 Irish Penny BMAG: 1885N1541.225	180°; 33.5mm; 17.85g; bronzed
1805 Irish Penny BMAG: 1885N1541.224	180°; 33.5mm; 17.79g; bronzed
1805 Irish Penny BMAG: 1939N488	180°; 33mm; 17.72g; bronzed
1805 Irish George III Penny BMAG: 1885N1541.226	180°; 33.5mm; 17.60g; bronzed
1805 Irish Penny (Dowle and Finn 592) Assay Office 101	180°; 33mm; 17.50g; bronzed
1805 Irish Penny BMAG: 2007.1240	180°; 33.5 mm; 17.42g; bronzed
1805/1806 mule penny KP32 Irish penny BMAG: 1885N1536.168	180°; 33.5mm; 16.49g; bronzed

1805 Irish Halfpenny

1805 Irish Halfpenny (Dowle and Finn 598) Assay Office 103	180°; 28mm; 8.80g; bronzed
1805 Ireland Halfpenny BMAG: 2007.1241	180°; 27mm; 8.70g; bronzed
1805 Ireland Halfpenny BMAG: 1885N1536.169	180°; 27.5mm; 8.61g; bronzed
1805 Ireland Halfpenny BMAG: 1885N1541.227	180°; 27mm; 8.58g; bronzed

1806 Irish Farthing

1805 Irish Farthing (Dowle and Finn 605) Assay Office 105	180°; 20.5mm; 4.40g; gilt
1806 Irish Farthing BMAG: 1930N203	180°; 20.5 mm; 4.38g; gilt

1806 Irish Farthing BMAG: 2007.1243	180°; 20mm; 4.38g; bronzed
1806 Irish Farthing BMAG: 2007.1242	180°; 20.5mm; 4.36g; bronzed
1805 Irish Farthing (Dowle and Finn 603) Assay Office 104	0°; 20.5mm; 4.35g; bronzed
1806 Irish Farthing BMAG: 1939N489	180°; 20mm; 4.33g; bronzed
1806 Irish Farthing BMAG: 1936N124	180°; 20mm; 4.32g; bronzed

1806 proof Penny

1806 proof Penny (Early Soho) KP 29 BMAG: 1969N910 Peck 1321	0°; 34mm; 19.01g; gilt
1806 proof Penny (Early Soho) Assay Office 74 Peck 1321	0°; 34mm; 18.85g; gilt
1806 proof Penny (Early Soho) KP 28 BMAG: 1969N909 Peck 1320	180°; 35mm; 18.67g; copper
1806 proof Penny (Late Soho) KP 33 BMAG: 1969N919 Peck 1330	180°; 34mm; 20.06g; silver
1806 proof Penny (Late Soho) KP 31 BMAG: 1969N914 Peck 1325	0°; 34mm; 18.99g; gilt
1806 proof Penny (Late Soho) KP 30 BMAG: 1969N911 Peck 1322	0°; 34mm; 18.70g; gilt
1806 proof Penny (Late Soho) KP 33 BMAG: 1969N920 Peck 1331	180°; 34mm; 16.63g; gilt
1806 proof Penny (Late Soho) KP 32 BMAG: 1885N1541.229 Peck 1806 proof Penny (Late Soho) Assay Office 76 Peck 1328	180°; 33.5mm; 20.33g; bronzed
1806 proof Penny (Late Soho) KP 32 BMAG: 1969N918 Peck 1329	0°; 34mm; 18.75g; bronzed
1806 proof Penny (Late Soho) Assay Office 75 Peck 1328	0°; 34mm; 18.69g; bronzed
1806 proof Penny (Late Soho) KP 33 BMAG: 1969N922 Peck 1335	0°; 34mm; 18.65g; bronzed
1806 proof Penny (Late Soho) KP 32 BMAG: 1969N917 Peck 1328	180°; 34mm; 16.81g; bronzed
1806 proof Penny (Late Soho) KP 33 BMAG: 1969N921 Peck 1334	180°; 33.5mm; 20.35g; copper
1806 proof Penny (Late Soho) KP 31 BMAG: 1969N915 Peck 1326	0°; 33.5mm; 19.11g; copper
1806 proof Penny (Late Soho) KP 30 BMAG: 1969N912 Peck 1323	0°; 33.5mm; 19.11g; copper
1806 proof Penny (Late Soho) KP 31 BMAG: 1969N916 Peck 1327	0°; 33.5mm; 18.93 g; copper
1806 proof Penny (Late Soho) KP 30 BMAG: 1969N913 Peck 1324	0°; 33.5mm; 18.93g; copper
1805/6 Pattern Mule Penny (Late Soho) KP 34 BMAG: 1969N923 Peck 1337	180°; 33.5mm; 18.79g; copper
1805/6 Pattern Mule Penny (Late Soho) KP 35 BMAG: 1969N924 Peck 1338	0°; 33.5mm; 18.86g; copper
1805/6 Pattern Mule Penny (Late Soho) KP 35 BMAG: 1969N925 Peck 1339	180°; 33.5mm; 16.43g; copper
	180°; 33.5mm; 18.11g; bronzed

1806 currency Penny

1806 currency Penny KP 37 BMAG: 1969N928 Peck 1342	180°; 33.5mm; 19.35g; copper
1806 currency Penny KP 38 BMAG: 1969N931 Peck 1343	180°; 33.5mm; 19.06g; copper
1806 currency Penny KP 37 BMAG: 1969N930 Peck 1342	180°; 33.5mm; 18.99g; copper
1806 currency Penny KP 37 BMAG: 1969N929 Peck 1342	180°; 33.5mm; 18.97g; copper
1806 currency Penny KP 37 BMAG: 1969N927 Peck 1342	180°; 33.5mm; 18.92g; copper
1806 currency Penny KP 37 BMAG: 1969N926 Peck 1342	180°; 34mm; 18.81g; copper
1806 currency Penny KP 37 BMAG: 1933N564 Peck 1342	180°; 33.5mm; 18.75g; copper

1806 proof Halfpenny

1806 proof Halfpenny (Early Soho) KH 33 BMAG: 1969N941 Peck 1357	0°; 28mm; 9.56g; gilt
1806 proof Halfpenny (Early Soho) KH 32 BMAG: 1969N940 Peck 1356	180°; 28mm; 9.50g; copper
1806 proof Halfpenny (Late Soho) KH 43 BMAG: 1969N956 Peck 1372	180°; 29mm; 11.75g; silver
1806 proof Halfpenny (Late Soho) KH 38 BMAG: 1969N950 Peck 1366	0°; 28mm; 9.53g; gilt
1806 proof Halfpenny (Late Soho) KH 36 BMAG: 1969N946 Peck 1362	0°; 28mm; 9.51g; gilt
1806 proof Halfpenny (Late Soho) Assay Office 88 Peck 1362	0°; 28.5mm; 9.45g; gilt
1806 proof Halfpenny (Late Soho) KH 34 BMAG: 1969N942 Peck 1358	0°; 28.5mm; 9.44g; gilt
1806 proof Halfpenny (Late Soho) KH 34 BMAG: 1930N194 Peck 1358	0°; 28mm; 9.42g; gilt
1806 proof Halfpenny (Late Soho) KF 43 BMAG: 1969N957 Peck 1373	180°; 28mm; 8.97g; gilt
1806 proof Halfpenny (Late Soho) KH 36 BMAG: 1969N947 Peck 1363	0°; 28.5mm; 9.58g; bronzed
1806 proof Halfpenny (Late Soho) KH 34 BMAG: 1969N943 Peck 1359	0°; 28mm; 9.54g; bronzed
1806 proof Halfpenny (Late Soho) KH 40 BMAG: 1969N952 Peck 1368	180°; 29mm; 9.49g; bronzed
1806 proof Halfpenny (Late Soho) KH 41 BMAG: 1969N953 Peck 1369	180°; 28.5mm; 9.46g; bronzed
1806 proof Halfpenny (Late Soho) KH 35 BMAG: 1969N945 Peck 1361	0°; 28mm; 9.43g; bronzed
1806 proof Halfpenny (Late Soho) KH 43 BMAG: 1885N1536.162 Peck 1374	180°; 28mm; 9.40g; bronzed
1806 proof Halfpenny (Late Soho) Assay Office 89 Peck 1369	0°; 28.5mm; 9.25g; bronzed
1806 proof Halfpenny (Late Soho) KH 42 BMAG: 1969N954 Peck 1370	0°; 28mm; 9.21g; bronzed
1806 proof Halfpenny (Late Soho) KF 43 BMAG: 1969N958 Peck 1374	180°; 28mm; 8.98g; bronzed
1806 proof Halfpenny (Late Soho) KH 39 BMAG: 1969N951 Peck 1367	0°; 28mm; 9.63g; copper

1806 proof Halfpenny (Late Soho) KH 36 BMAG: 1969N948 Peck 1364 0°; 28mm; 9.49g; copper
 1806 proof Halfpenny (Late Soho) KH 34 BMAG: 1969N944 Peck 1360 0°; 29mm; 9.46g; copper
 1806 proof Halfpenny (Late Soho) KH 43 BMAG: 1969N959 Peck 1375 180°; 28.5mm; 9.30g; copper
 1806 proof Halfpenny (Late Soho) KH 42 BMAG: 1969N955 Peck 1371 0°; 29mm; 9.21g; copper

1806 currency Halfpenny

1806 currency Halfpenny KH 45 BMAG: 1969N963 Peck 1377 180°; 28mm; 9.82g; copper
 1806 currency Halfpenny KF 44 BMAG: 1969N962 Peck 1376 180°; 28mm; 9.50g; copper
 1806 currency Halfpenny KH 44 BMAG: 1969N961 Peck 1376 180°; 28mm; 9.46g; copper
 1806 currency Halfpenny KH 45 BMAG: 1969N965 Peck 1377 180°; 28mm; 9.44g; copper
 1806 currency Halfpenny Think tank BMAG: 1931N1969.22 180°; 28mm; 9.40g; copper
 1806 currency Halfpenny BMAG: 1939N458 180°; 28mm; 9.37g; copper
 1806 currency Halfpenny KH 44 BMAG: 1969N960 Peck 1376 180°; 29mm; 9.36g; copper
 1806 currency Halfpenny KH 45 BMAG: 1969N964 Peck 1377 180°; 28.5mm; 9.32g; copper
 1806 currency Halfpenny BMAG: 1885N1536.107 180°; 28mm; 9.24g; copper
 1806 currency Halfpenny BMAG: 1936N96 180°; 28mm; 9.13g; copper

1806 proof Farthing

1806 proof Farthing (Early Soho) KF 13 BMAG: 1930N199 Peck 1387 180°; 21mm; 4.79g; gilt
 1806 proof Farthing (Early Soho) Assay Office 97 Peck 1387 180°; 21mm; 4.75g; gilt
 1806 proof Farthing (Early Soho) KF 13 BMAG: 1969N969 Peck 1388 180°; 21mm; 4.75g; bronzed
 1806 proof Farthing (Early Soho) KF 13 BMAG: 1969N970 Peck 1389 180°; 21mm; 4.74g; copper
 1806 proof Farthing (Early Soho) KF 12 BMAG: 1969N967 Peck 1386 180°; 21mm; 4.59g; copper
 1806 proof Farthing (Late Soho) KF 15 BMAG: 1969N973 Peck 1394 180°; 21mm; 4.32g; gilt
 1806 proof Farthing (Late Soho) Assay Office 98 Peck 1390 180°; 21mm; 4.85g; bronzed
 1806 proof Farthing (Late Soho) KF 14 BMAG: 1953N570 Peck 1390 180°; 21mm; 4.66g; bronzed
 1806 proof Farthing (Late Soho) KF 14 BMAG: 1969N971 Peck 1390 180°; 21mm; 4.66g; bronzed
 1806 proof Farthing (Late Soho) Assay Office 99 Peck 1390 180°; 21mm; 4.65g; bronzed
 1806 proof Farthing (Late Soho) KF 15 BMAG: 1969N974 Peck 1395 180°; 21mm; 4.65g; bronzed
 1806 proof Farthing (Late Soho) KF 14 BMAG: 1885N1536.167 Peck 1391 180°; 21mm; 4.71g; copper
 1806 proof Farthing (Late Soho) KF 14 BMAG: 1969N972 Peck 1391 180°; 21mm; 4.64g; copper

1806 currency Farthing

1806 currency Farthing KF 16 BMAG: 1969N976 Peck 1396 180°; 21mm; 4.76g; copper
 1806 currency Farthing KF 17 BMAG: 1969N977 Peck 1397 180°; 21mm; 4.76g; copper
 1806 currency Farthing KF 16 BMAG: 1969N975 Peck 1396 180°; 21mm; 4.70g; copper
 1806 currency Farthing KF 17 BMAG: 1969N979 Peck 1397 180°; 21mm; 4.69g; copper
 1806 currency Farthing KF 16 BMAG: 1969N980 Peck 1395 180°; 21mm; 4.68g; copper
 1806 currency Farthing KF 17 BMAG: 1969N978 Peck 1397 180°; 21mm; 4.65g; copper
 1806 currency Farthing KF 16 BMAG: 1939N460 Peck 1396 180°; 21mm; 4.63g; copper

1806 Bahamas Penny

1806 Bahamas Penny British Museum: SSB 169-20 0°; 29mm; 9.75g; bronzed
 1806 Bahamas Penny British Museum: SSB 169-20 180°; 28mm; 9.55g; bronzed
 1806 Bahamas Penny British Museum: T.B. Clarke-Thornhill 9121 180°; 29mm; 9.45g; bronzed
 1806 Bahamas Penny proof BMAG: 1885N1536.69 180°; 28mm; 9.17g; bronzed
 1806 Bahamas Penny proof Pridmore 1a Assay Office 134 180°; 28mm; 9.15g; bronzed

1807 currency Penny

1807 currency Penny KP 39 BMAG: 1971N471 Peck 1344 180°; 33.5mm; 18.65g; bronzed
 1807 currency Penny KP 39 BMAG: 1969N932 Peck 1344 180°; 33.5mm; 19.17g; copper
 1807 currency Penny KP 39 BMAG: 1939N453 180°; 33mm; 18.92g; copper
 1807 currency Penny KP 39 BMAG: 1953N565 180°; 34mm; 18.02g; copper
 1807 currency Penny KP 39 BMAG: 1969N933 Peck 1345 180°; 33.5mm; 17.44g; copper

1807 currency Halfpenny

1807 currency Halfpenny KH 46 BMAG: 1936N97 Peck 1378 180°; 28 mm; 9.20g; gilded

1807 currency Halfpenny KH 46 BMAG: 2007.1231 Peck No. 1378	180°; 28.5mm; 9.05g; gilded
1807 currency Halfpenny KH 46 BMAG: 1971N472 Peck 1378	180°; 28 mm; 9.30g; bronzed
1807 currency Halfpenny KH 46 BMAG: 1969N966 Peck 1378	180°; 28.5mm; 9.48g; copper
1807 currency Halfpenny KH 46 BMAG: 1966N451 Peck 1378	180°; 28mm; 9.16g; copper
1807 currency Farthing	
1807 currency Farthing KF18 BMAG: 1971N473 Peck 1399	180°; 21mm; 4.83g; bronzed
1807 currency Farthing KF 18 BMAG: 1969N981a Peck 1399	180°; 21mm; 4.76g; copper
1807 currency Farthing KF 18 BMAG: 1969N981b Peck 1399	180°; 21mm; 4.63g; copper
1807/1810 London Society of Arts Pallet Medal	
Undated (1807) London Society of Arts-Pallet Assay Office 61	0°; 63 x 52 mm; 73.45g; silver
Undated (1810) London Society of Arts-Pallet Assay Office 62	0°; 63 x 52 mm; 78.05g; silver
1808 India Madras Presidency	
1808 India Madras Presidency twenty cash BMAG: 2007.1250	180°; 31mm; 10.07g; bronzed
1808 India Madras Presidency twenty cash BMAG: 1885N1541.196	0°; 31mm; 9.53g; bronzed
1808 India Madras Presidency twenty cash BMAG: 1885N1536.50	180°; 31mm; 9.51g; bronzed
1808 India Madras Presidency twenty cash Pridmore 198 Assay Office 165	180°; 31mm; 9.35g; bronzed
1808 India Madras Presidency ten cash BMAG: 1885N1541.197	0°; 25 mm; 4.86g; bronzed
1809 India Bengal Presidency pattern	
1809 India Bengal Presidency pice BMAG: 1885N1541.198	0°; 27mm; 8.40g; copper
1809 India Bengal Presidency pice BMAG: 1997N38	0°; 27mm; 8.40g; copper
1809 India Bengal Presidency half pice BMAG: none	0°; 21mm; 4.01g; bronzed
1809 John of Portugal/Prince Regent of Portugal/Cayenne Medal	
1809 John of Portugal/Cayenne BMAG: 1885N1541.93	0°; 51mm; 91.73g; bronzed
1809 John of Portugal/Cayenne BMAG: 1885N1536.79	0°; 51mm; 74.14g; bronzed
1809 John of Portugal/Cayenne BMAG: 1885N1536.27	0°; 51mm; 71.08g; bronzed
1809 John of Portugal/Cayenne Assay Office 51	0°; 51mm; 71.05g; bronzed
1809 John of Portugal/Cayenne British Museum: PI 5692; M5328	0°; 51mm; 64.20g; bronzed
1809 John of Portugal/Cayenne Avery Museum: 21.1.14	0°; 51mm; 60.10g; copper
1809 John of Portugal (trial strike reverse) BMAG: 1976N13	0°; 52mm; 29.18g; white metal
1809 Brazil 960 reis	
1809 Brazil 960 reis BMAG: 1885N1536.147	40°; 41mm; 25.56g; bronzed
1809 Brazil 960 reis BMAG: 1885N1541.34	0°; 41mm; 25.51g; bronzed
1809 East India Company College Medal (Pollard 31 and 32)	
1809 East India Company College Medal Arabic BMAG: 1885N1536.61	0°; 37mm; 27.36g; bronzed
1809 East India Company College Medal Sanskrit BMAG: 1885N1541.74	0°; 37mm; 27.48g; bronzed
1809 East India Company College Medal Sanskrit BMAG: 1885N1541.75	0°; 37mm; 26.68g; bronzed
1809 Boulton Memorial Medal (P. Wyon after Rouw) (BHM 659)	
1809 Matthew Boulton Memorial (Rouw) BMAG: 1966N693	0°; 45mm; 36.55g; bronzed
1809 Matthew Boulton Memorial (Rouw) BMAG: 1966N694	0°; 45mm; 35.73g; silvered bronze
1809 Matthew Boulton Memorial medal (Rouw) Assay Office 246	0°; 45mm; 36.10g; bronzed
1809 Matthew Boulton Memorial medal (electrolytic copy) Assay Office 247	n/a; 45mm; 11.80g; copper
1809 (made 1817) Boulton Memorial Medal (Thomason) (BHM 660)	
1809 Matthew Boulton medal (Thomason) in gilt cast frame Assay Office 250	0°; 102 mm; more than 200g; gilt
1809 Matthew Boulton medal obverse (Thomason) Assay Office 248	0°; 102 mm; more than 200g; bronzed
1809 Matthew Boulton medal obverse (Thomason) in wooden frame Assay Office 249	0°; 102 mm; more than 200g; bronzed

1809 Matthew Boulton medal (Thomason) BMAG: 1885N1536.14	0°; 102 mm; more than 200g; bronzed
1809 Matthew Boulton medal (Thomason) Avery Museum: 21.1.3	0°; 102mm; 100g plus; copper; blacked
1809 Matthew Boulton medal (Thomason) trial obverse BMAG: 1905N207	n/a; 102 mm; more than 120g; bronzed
1809 Matthew Boulton medal obverse (Thomason) plaster cast Assay Office 251	0°; 102 mm; ?g; plaster

1809 Boulton Memorial Medal ('Farewel') (BHM 661; Pollard 33)

1809 Matthew Boulton Death 'Farewel' BMAG: 1885N1536.11	0°; 48mm; 59.94g; bronzed
1809 Matthew Boulton Death 'Farewel' BMAG: 1885N1536.1	0°; 48mm; 55.56g; bronzed
1809 Matthew Boulton Death 'Farewel' BMAG: 1885N1541.90	0°; 48mm; 52.19g; bronzed
1809 Matthew Boulton Death 'Farewel' Assay Office 50	0°; 48mm; 51.05g; bronzed

1809 Boulton Memorial Medal (Obsequies) (BHM 662 and BHM 663)

1809 Matthew Boulton Obsequies BMAG: none	0°; 40mm; 34.04g; bronzed
1809 Matthew Boulton Obsequies Assay Office 46	0°; 41mm; 35.80g; bronzed
1809 Matthew Boulton Obsequies BMAG: none	0°; 40mm; 35.69g; bronzed
1809 Matthew Boulton Obsequies BMAG: 1885N1541.91	0°; 40mm; 35.67g; bronzed
1809 Matthew Boulton Obsequies BMAG: 1966N695	0°; 40mm; 35.56g; bronzed
1809 Matthew Boulton Obsequies BMAG: 1885N1537.4	0°; 40mm; 35.20g; bronzed
1809 Matthew Boulton Obsequies Assay Office 47	0°; 41mm; 35.15g; bronzed
1809 Matthew Boulton Obsequies Assay Office 49	0°; 41mm; 35.10g; bronzed
1809 Matthew Boulton Obsequies Assay Office 48	0°; 41mm; 35.00g; bronzed

1809 Matthew Boulton Obsequies (restrike) BMAG: 1885N1541.92	0°; 40mm; 39.27g; bronzed
1809 Matthew Boulton Obsequies (trial strike ob.) BMAG: 1972N348	n/a; 43mm; 15.43g; tin

1819 Pidgeon's Matthew Boulton Memorial Medal (BHM 976)

1819 Pidgeon's Memorial Medal Avery Museum 21.1.1	0°; 64mm; 100g plus; gilt
1819 Pidgeon's Memorial Medal Assay Office 55	0°; 64mm; 100g plus; bronzed
1819 Pidgeon's Memorial Medal BMAG: 1885N1536.14	0°; 64mm; 101.90 g; bronzed
1819 Pidgeon's Memorial Medal BMAG: 1966N692	0°; 64mm; 100.90 g; bronzed
1819 Pidgeon's Memorial Medal BMAG: 2003.0035.5.1	0°; 63mm; 96.97g; bronzed
Case BMAG: 2003.0035.5.2	18.70g; 17.72g;
1819 Pidgeon's Memorial Medal Assay Office 54	0°; 64mm; 96.90g; bronzed
1819 Pidgeon's Memorial Medal Assay Office 56	0°; 62mm; 82.20g; white metal
Case	22.40g
1819 Pidgeon's Memorial Medal (trial strike obverse) BMAG: 1973N404	n/a; 48mm; 41.03g; bronzed

Different version

1819 Pidgeon's Memorial Medal Assay Office 57	0°; 55mm; 55.30g; bronzed
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1810 Lord Radnor's George III Jubilee Medal (BHM 684; Pollard 34)

1810 Lord Radnor's George III Jubilee Medal British Museum: PI 5701; M 5344	0°; 48mm; 94.85g; gold
1810 Lord Radnor's George III Jubilee Medal British Museum: PI 5702; SSB 6 p14	0°; 48mm; 52.80g; bronzed

1810 George III Golden Jubilee (Frogmore) Medal (BHM 686)

1810 George III Golden Jubilee Avery Museum: 21.1.12	0°; 48mm; 43.65g; silver?
1810 George III Golden Jubilee BMAG: 1885N1541.99	0°; 48mm; 40.37g; silver?
1810 George III Golden Jubilee Assay Office 52	0°; 48mm; 61.50g; bronzed
1810 George III Golden Jubilee BMAG: 1930N267	0°; 48mm; 53.68g; bronzed
1810 George III Golden Jubilee Assay Office 53	0°; 48mm; 53.40g; bronzed
1810 George III Golden Jubilee BMAG: 1885N1536.35	0°; 48mm; 53.28g; bronzed
1810 George III Golden Jubilee trial strike obverse BMAG: 1976N7	0°; 45mm; 13.32g; white metal
1810 George III Golden Jubilee trial strike reverse BMAG: 1976N23	0°; 45mm; 16.43g; bronzed tin

1811 (dated 1803) Westminster Fire Office

1803 Westminster Fire Office BMAG: 1885N1541.80	0°; 40mm; 35.28g; bronzed
1803 Westminster Fire Office (trial strike obverse) BMAG: 1972N346	0°; 39mm; 12.74g; white metal
1803 Westminster Fire Office (trial strike obverse) BMAG: 1972N345	0°; 55mm; 9.99g; white metal

1803 Westminster Fire Office (trial strike obverse) BMAG: 1976N11 0°; 40mm; 9.15g; white metal
 1803 Westminster Fire Office (trial strike reverse) BMAG: 1972N347 0°; 41mm; 10.47g; bronzed tin

1811 pattern Bank of England Britannia Five Shilling and Sixpence Token

1811 Bank of England token die and plaster 1976N5
 1811 Bank of England 5s 6d token **Rev. Die** BMAG: 1972N358 0°; 42mm; 38.92g; steel
 1811 Bank of England 5s 6d token BMAG: 1885N1541.43 0°; 41mm; 23.64g; bronzed
 1811 Bank Token (trial strike reverse) Britannia BMAG: 1976N16 0°; 43mm; 13.44g; white metal
 1811 Bank Token (trial strike reverse) Britannia BMAG: 1976N20 0°; 43mm; 12.88g; white metal

 Counterfeit blank three shillings BMAG: 1976N26 0°; 35mm; 13.45g; white metal
 Trial Strike: Counterfeit Three Shillings BMAG: 1976N27 0°; 36mm; 13.93g; white metal

1811 Bank of England 5s 6d dollar (George III facing left; inscription 'BANK TOKEN' on reverse)

1811 Bank of England 5s 6d token **Ob. Die** BMAG: 1976N4 0°; 42mm; 39.15g; steel
 1811 Bank of England 5s 6d token **Ob. Die** Avery Museum Die 8 65mm; 41mm face; 1000g; steel
 1811 Bank of England 5s 6d token **Rev. Die** BMAG: 1951 S 00088.00092 63mm; 42mm; 1000g; steel
 1811 Bank of England 5s 6d token BMAG: 1885N1541.104 0°; 41mm; 26.93g; bronzed
 1811 Bank of England 5s 6d token BMAG: 1885N1536.138 0°; 41.5mm; 29.76g; brass
 1811 Bank of England 5s 6d token (trial strike obverse) BMAG: 1969N292 0°; 40mm; 22.22g; tin bronzed
 1811 Bank of England 5s 6d token (trial strike obverse) BMAG: 1972N355 n/a; 44mm; 11.61g; tin bronzed
 1811 Bank of England 5s 6d token (trial strike reverse) BMAG: 1972N356 n/a; 43mm; 12.75g; tin bronzed
 1811 Bank of England 5s 6d token (trial strike reverse) BMAG: 1972N357 n/a; 42mm; 10.89g; tin bronzed

1813 (dated 1808) Beilby Medal (Christ's College, Cambridge) (BHM 632) (Phillp)

Complete medal large gate

1808 Beilby Medal Christ's College, BMAG: 1885N1541.79 0°; 42mm; 25.92g; silver?
 1808 Beilby Medal Christ's College (trial strike obverse) BMAG: 1950N190.1 n/a 43mm; 20.82g; bronzed tin
 1808 Beilby Medal Christ's College (trial strike obverse) BMAG: 1972N339 n/a; 48mm; 19.89g; bronzed tin
 1808 Beilby Medal Christ's College (trial strike obverse) BMAG: 1972N336 n/a; 42mm; 18.67g; bronzed tin
 1808 Beilby Medal Christ's College (trial strike obverse) BMAG: 1972N335 n/a; 42mm; 12.50g; bronzed tin
 1808 Beilby Medal Christ's College (trial strike obverse) BMAG: 1976N8 n/a; 44mm; 15.75g; white metal
 1808 Beilby Medal Christ's College (trial strike reverse) BMAG: 1972N338 n/a; 55mm; 18.67g; bronzed tin
 1808 Beilby Medal Christ's College (trial strike reverse) BMAG: 1972N337 n/a; 55mm; 13.18g; bronzed tin

1813 (dated 1808) Beilby Medal (BHM 633)

Complete medal small gate

1808 Beilby Medal Christ's College BMAG: 1885N1541.78 0°; 49mm; 40.80g; silver
 1808 Beilby Medal Christ's College, BMAG: 1885N1536.15 0°; 49 mm; 51.95g; bronzed

Small gate large building

1808 Beilby Medal Christ's College (trial strike reverse) BMAG: 1972N341 n/a; 49mm; 22.14g; bronzed tin
 1808 Beilby Medal Christ's College (trial strike reverse) BMAG: 1972N342 n/a; 49mm; 17.02g; bronzed tin
 1808 Beilby Medal Christ's College (trial strike reverse) BMAG: 1972N340 n/a; 46mm; 16.27g; bronzed tin
 1808 Beilby Medal Christ College (trial strike reverse) BMAG: 1976N17 n/a; 48mm; 15.77g; bronzed tin
 1808 Beilby Medal Christ College (trial strike reverse) BMAG: 1976N18 n/a; 44mm 12.87g; bronzed tin

1813 (dated 1808) Beilby Medal (BHM 634)

Complete medal small gate with trees

1808 Beilby Medal Christ's College, BMAG: 1885N1536.17 0°; 49mm; 52.00g; bronzed

Small gate with trees

1808 Beilby Medal Christ's College (trial strike reverse) BMAG: 1972N344 n/a; 55mm; 20.87g; white metal

1813 Isle of Man

1813 Isle of Man Penny **punch obverse** BMAG: 1972N359 34mm; 26.25g; steel bronzed
 1813 Isle of Man Penny BMAG: 1885N1536.171 180°; 33mm; 20.67g; bronzed
 1813 Isle of Man Penny Assay Office 106 180°; 33mm; 20.60g; bronzed
 1813 Isle of Man Penny BMAG: 1885N1541.213 180°; 33mm; 20.52g; bronzed

1813 Isle of Man Penny BMAG: 1885N1541.212	180°; 33mm; 20.38g; bronzed
1813 Isle of Man Halfpenny Assay Office 107	180°; 27mm; 10.30g; bronzed
1814 (dated 1807) Sierra Leone Macauley and Babbington Penny ('Slavery Medal')	
1807 Sierra Leone Macauley Penny Obverse Die Avery Museum 9	64mm; face 36mm; 1000g; steel
1807 Sierra Leone Macauley Penny Reverse Die BMAG: 1951S00088-00101	62mm; face 36mm; 1000g; steel
1807 Sierra Leone Macauley Penny Avery Museum: 21.1.9	0°; 35mm; 22.95g; bronzed
1807 Sierra Leone Macauley Penny BMAG: 2003.35.4.1	0°; 35mm; 17.70g; bronzed copper
Case 3.85g; 4.06g	
1807 Sierra Leone Macauley Penny BMAG: 1885N1541.88	0°; 36mm; 17.50g; bronzed
1807 Sierra Leone Macauley Penny BMAG: 2003.0035.4.2	0°; 35mm; 17.43g; bronzed
1807 Sierra Leone Macauley and Babbington Penny BMAG: none	0°; 35mm; 17.13g; bronzed
1807 Sierra Leone Macauley Penny Assay Office 187	90°; 35.5mm; 16.80g; bronzed
1807 Sierra Leone Macauley Penny BMAG: 2001.37	0°; 36mm; ?g; white metal
1807 Sierra Leone Macauley (trial strike reverse) BMAG: 1972N351	n/a; 48mm; 18.20g; tin
1816 (dated 1801) Tribute to the 42nd Regiment from the London Highland Society Medal (BHM 512)	
1816 (dated 1801) London Highland Society British Museum: N5161	0°; 49mm; 69.70g; gold with loop
1816 (dated 1801) London Highland Society British Museum: PI 5408	0°; 49mm; 67.70g; bronzed
1819 Pidgeon's Matthew Boulton Memorial Medal (BHM 976)	
1819 Pidgeon's Memorial Medal Avery Museum 21.1.1	0°; 64mm; 100g plus; gilt
1819 Pidgeon's Memorial Medal Assay Office 55	0°; 64mm; 100g plus; bronzed
1819 Pidgeon's Memorial Medal BMAG: 1966N692	0°; 64mm; 100.90 g; bronzed
1819 Pidgeon's Memorial Medal BMAG: 2003.0035.5.1	0°; 63mm; 96.97g; bronzed
2003.0035.5.1 with case	18.70g; 17.72g;
1819 Pidgeon's Memorial Medal Assay Office 54	0°; 64mm; 96.90g; bronzed
1819 Pidgeon's Memorial Medal Assay Office 56	0°; 62mm; 82.20g; white metal
1819 Pidgeon's Memorial Medal (trial strike obverse) BMAG: 1973N404.1	n/a; 48mm; 41.03g; bronzed
Different version	
1819 Pidgeon's Memorial Medal Assay Office 57	0°; 55mm; 55.30g; bronzed
1820 Death of George III Medal (BHM 991 and BHM 992)	
1820 Death of George III BHM 991 BMAG: 1930N268	0°; 48mm; 56.39g; bronzed
1820 Death of George III BHM 991 BMAG: 1885N1541.46	0°; 48mm; 53.52g; bronzed
1820 Death of George III BHM 991 BMAG: 1885N1541.47	0°; 48mm; 55.76g; bronzed
1820 Death of George III Assay Office 58	0°; 48mm; 58.60g; bronzed
1820 Death of George III Assay Office 59	0°; 48mm; 55.80g; bronzed
1820 Death of George III BHM 992 BMAG: 1974N2	0°; 48mm; 51.67g; bronzed
1820 Pattern Crown George III	
1820 Pattern Crown George III (Hercules) BMAG: 1885N36.129	0°; 39mm; 28.07g; bronzed
1820 Pattern Crown George III (Hercules) BMAG: 1885N1541.83	0°; 38mm; 26.77g; bronzed
1820 Pattern Crown George III (Hercules) BMAG: 1885N1541.84	0°; 39mm; 23.58g; bronzed
1802/1820 Hudson's Bay Company token	
1802/1820 Hudson Bay Company BMAG: 1885N1541.44	0°; 48 mm; 56.79g; bronzed
1802/1820 Hudson Bay Company BMAG: 1885N1541.45	0°; 48 mm; 53.90g; bronzed
1802/1820 Hudson Bay Company Assay Office 60	0°; 48mm; 55.85g; bronzed
1820 Portugal	
1820 Portugal pattern reis BMAG: 1885N1541.35	180°; 34 mm; 14.47g; copper
1821 St. Helena	
1821 St Helena Halfpenny Obverse Die BMAG: 1951S00088-00105	62mm; 28mm; 1000g; steel
1821 St Helena Halfpenny proof BMAG: 1885N1541.200	0°; 28 mm; 9.39g; bronzed

1821 St Helena Halfpenny proof BMAG: 1885N1536.64	0°; 28 mm; 9.28g; bronzed
1821 St Helena Halfpenny proof Assay Office 176	0°; 28 mm; 9.20g; bronzed
1822 Argentina	
1822 Argentina one decimo BMAG: none	0°; 23.5mm; 6.72g; bronzed
1822 Argentina one Decimo Assay Office 133	0°; 23.5mm; 6.70g; bronzed
1822 Argentina one decimo BMAG: 1885N1536.57	0°; 23.5mm; 6.39g; bronzed
1827 Brazil	
1827 80 reis Brazil BMAG: 1885N1536.122	180°; 39mm; 28.54g; bronzed
1828 Mexico	
1828 Mexico Guanajuato One cuartilla BMAG:1885N1541.37	180°; 27mm; 6.05g; copper
1828 Columbia	
1828 Columbia Quartillo (Farthing) BMAG: 1988N56	160°; 22 mm; 2.94g; bronzed
1830 Trial strikes for the Visit of Princess Victoria to Soho Mint	
1830 Princess Victoria 5 th Aug (trial strike obverse) BMAG: 2003N0035. 6.11	0°; 45mm; 29.23g; tin/whitemetal
1830 Princess Victoria 6 th Aug (trial strike reverse) BMAG: 2003N0035.6.2	0°; 43mm; 29.06g; brass?
1830 Guernsey	
1830 Guernsey four doubles Proof BMAG: 1885N1541.176	180°; 28mm; 10.71g; copper
1830 Guernsey four doubles Proof BMAG: 1885N1541.175	180°; 29 mm; 10.22g; bronzed
1830 Guernsey four doubles Proof BMAG: 1937N990	180°; 28mm; 10.13g; bronzed
1830 Guernsey four doubles Proof BMAG: 1885N1536.109	180°; 28.5mm; 9.86g; bronzed
1830 Guernsey four doubles (Pridmore 35a) Assay Office 108	180°; 28mm; 9.70g; bronzed
1830 Guernsey one double Proof BMAG: 1935N389	180°; 18 mm; 2.48g; bronzed
1830 Guernsey one double Proof BMAG: 1885N1536.45	180°; 19mm; 2.47g; bronzed
1830 Guernsey one double (Pridmore 72a) Assay Office 109	180°; 18mm; 2.45g; bronzed
1830 Guernsey one double Proof BMAG: 1930N447.42	180°; 18 mm; 2.44g; bronzed
1831 Mexico	
1831 Eight escudo Mexico BMAG: 1885N1541.32	180°; 36.5mm; 17.87g; bronzed
183- Mexico eight reales Assay Office 170	180°; 37mm; 27.15g; silver
1831 Sumatra	
1831 Sumatra Singapore BMAG: 2007.1255	180°; 22 mm; 4.31g; bronzed
1832 Bombay	
1832 India Bombay Presidency BMAG: 1965N1442	180°; 24.5 mm; 6.23g; bronzed
1833 Bombay	
1833 India Bombay Presidency quarter anna BMAG: 1937N270.38	180°; 24.5 mm; 6.39g; bronzed
1833 India Bombay Presidency quarter anna BMAG: 1965N1443	180°; 24mm; 6.50g; bronzed
1834 Guernsey	
1834 Guernsey eight Doubles Proof BMAG: 1885N1536.134	180°; 39 mm; 20.43g; bronzed
1834 Sumatra	
1834 Sumatra one keping BMAG: 2007.1256	180°; 20 mm; 2.35g; bronzed
1834 Sumatra one keping BMAG: 2007.1257	180°; 20 mm; 2.22g; bronzed
1835 Sumatra	
1835 Sumatra Tarumon two keping Prid 43A BMAG: 1966N548	180°; 22 mm; 4.16g; bronzed
1835 Singapore Tarumen two keping Prid 43A BMAG: 1966N547	180°; 22 mm; 4.11g; copper

1835 Singapore Siam No value Prid 54A BMAG: 1966N557	180°; 22 mm; 4.34g; bronzed
1835 Singapore Siam No value Prid 55A BMAG: 1966N558	180°; 22 mm; 4.32g; bronzed
1835 Singapore one keping Prid 33 BMAG: 1966N757	180°; 20 mm; 1.94g; copper
1835 Singapore Menangkabau one keping Prid 46A BMAG: 1966N550	180°; 20 mm; 2.15g; bronzed
1835 Singapore Dilli one keping Prid 47A BMAG: 1966N551	180°; 20 mm; 2.10g; bronzed
1835 Singapore Dilli one keping Prid 48A BMAG: 1966N552	180°; 20 mm; 2.08g; bronzed
1835 Singapore Selangor one keping Prid 51A BMAG: 1966N553	180°; 20 mm; 2.06g; bronzed
1835 Singapore Selangor one keping Prid 51A BMAG: 1966N554	180°; 20 mm; 1.97g; bronzed
1835 Singapore Celebes one Doit Prid 53A BMAG: 1966N555	180°; 20 mm; 2.17g; bronzed
1835 Singapore Celebes one Doit Prid 53A BMAG: 1966N556	180°; 20 mm; 2.05g; bronzed

1835 Chile

1835 Chile un centavo copper BMAG: 1536 85 49	0°; 29mm; 18.12g; copper
1835 Chile un centavo BMAG: 1885N1541.179	180°; 29mm; 17.92g; bronzed
1835 Chile un centavo BMAG: 1885N1541.36	180°; 29.5mm; 17.65g; bronzed
1835 Chile Medio centavo BMAG: 1885N1536.55	180°; 22mm; 8.91g; bronzed
1835 Chile Medio centavo copper BMAG: 2007.1270	0°; 22mm; 9.10g; copper
1835 Chile Medio centavo BMAG: 2007.1269	0°; 22mm; 8.94g; copper

1843 Mexico

1843 Mexico real BMAG: 1885N1541.33	180°; 37mm; 17.85g g; bronzed
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1837-1845 Canada

1837 Canada one penny Reverse Die BMAG: 1951S00088.00112	63mm; face 34mm; 900g; steel
1842-44 Canada one penny Obverse BMAG: 1951S00088.00103	64mm; face 34mm; 900g; steel
1842-44 Canada one penny Reverse Die Avery Die 1	64mm; face 34mm; 1130g; steel

Appendix 3: Production at the Soho Mint²⁴

Table 1: Numbers of coins produced with weight of metal used and engravers

Items made in copper at Soho Mint	Number of coins	Weight in tons	Engraver
1786 EIC Sumatra keping (3, 2 and 1 keping)	2,944,620	18.31	W. Castleton
1787 EIC Sumatra keping (3, 2, 1 keping)	7,750,000	30.47	W. Castleton
1789 Cronebane halfpenny token	1,674,541	20.76	J.G. Hancock
1789/90 Anglesey halfpenny token (2 issues)	915,382	12.39	J.G. Hancock
1789 (dated 1788) Wilkinson Forge halfpenny token	19,296	0.27	J.G. Hancock
1790 Wilkinson Forge halfpenny token	404,217	5.01	Dumarest/Hancock
1791 EIC Bombay pice (2, 1½, 1, ½ pice)	17,232,100	100.71	R. Dumarest?
1791 Anglesey halfpenny token	1,151,134	16.01	R Dumarest
1791 Cornwall (John Vivian, CM Co) halfpenny token	76,562	1.07	R Dumarest
1791 Glasgow (Gilbert Shearer & Co) halfpenny token	484,128	6.01	R Dumarest
1791/1792 Southampton (Taylor, Moody & Co) halfpenny token	192,203	2.41	R Dumarest
1792 (dated 1791) Anglesey penny token	34,320	0.96	J.G Hancock
1792 Wilkinson Forge halfpenny token	94,183	1.16	J.G Hancock
1792 Monneron 'Vivre Libres' Con fiance 2 sol	3,780,741	30.01?	N-A Ponthon
1792 Monneron 'Vivre Libres' Con fiance 2 sol (lighter)	2,700,450	45.01	N-A Ponthon
1792 Monneron L'AN IV Federation 5 sol	2,800,000	70.01	Ponthon/Dupre
1792 Monneron L'AN IV Revolution 5 sol	880,000	22.01	Ponthon/Dupre
1791/1792 Monneron (other production) 5 sol	3,780,741	30.01?	N-A Ponthon
1792/3 (dated 1791) Sierra Leone Co (penny and cent)	716,028	3.99	N-A Ponthon
1793 Bermuda halfpenny	83,871	1.13	Droz/Ponthon
1793 Wilkinson Forge halfpenny token	93,083	1.15	Dumarest/Hancock
1793 Leeds (Birchall/Brownbills) halfpenny token	179,448	2.22	N-A Ponthon
1793 Inverness (Tayler & Mander) halfpenny token	120,766	1.28	C.H. Kuchler
1794 Inverness (Tayler & Mander) halfpenny token	94,942	1.01	C.H. Kuchler
1794 Lancaster/Eccleston halfpenny token	104,752	1.06	N-A Ponthon
1794 EIC Bombay pice (2, 1, ½ pice)	8,653,390	50.96	N-A Ponthon?
1794 EIC /Madras rupee (1/48; 1/96 rupee)	13,559,219	148.36	N-A Ponthon
1795 Wilkinson Forge halfpenny token	86,448	1.07	J.G Hancock
1795 Hornchurch (Cotton) halfpenny token	10,662	0.11	N-A Ponthon
1795 Inverness (Walker, Mackintosh) halfpenny token	79,316	0.77	C.H. Kuchler
1795/6 (undated) Dundee (Croom) halfpenny	53,203	0.52	C.H. Kuchler
1796 Inverness (Tayler & Mander) halfpenny token	82,530	0.83	C.H. Kuchler
1796 (dated 1795) Bishop's Stortford halfpenny token	25,515	0.26	C.H. Kuchler
1796 (dated 1794) Penryn halfpenny token	19,406	0.22	C.H. Kuchler
1796 (various dates) Sierra Leone Company (10 cent)	550,129	0.13	N-A Ponthon
1796/7 Claude Martin token (4 sizes)	11,769	0.16	C.H. Kuchler/A. McKenzie
1797 EIC Madras rupee (1/48; 1/96 rupee)	16,535,192	147.91	C.H. Kuchler
1797 Cartwheel two-pence	722,972	40.29	C.H. Kuchler
1797 Cartwheel penny	43,969,204	1227.84	C.H. Kuchler

²⁴ Numbers for this table were taken from a variety of sources, including measurements made by the author, details from archive sources and from Vice and Doty.

Table 1 continued

Items made in copper at Soho Mint	Number of coins	Weight in tons	Engraver
1798 Davison's Nile medal (copper)	6,525	0.31	C.H. Kuchler
1798 EIC Sumatra (3, 2 and 1 keping)	2,563,545	15.01	C.H. Kuchler
1799 (dated 1798) Isle of Man penny	92,045	1.96	C.H. Kuchler
1799 (dated 1798) Isle of Man halfpenny	193,234	2.05	C.H. Kuchler
1799 British farthing	4,225,428	26.17	C.H. Kuchler
1800 Penydarran works token (5s; 2s6d; 1s; 6d; 3d)	?	?	?
1801 (dated 1800) Enniscorthy halfpenny token	655,388	4.51	C.H. Kuchler
1801/2 (dated 1799) Seringapatam medal	51,165	?	C.H. Kuchler
1802 EIC Ceylon rix dollar (1/48, 1/96, 1/192 rupee)	6,440,444	44.69	J.Phillp?
1802 (dated 1791) Arnold token (5s; 2s 6d; 1s; 6d)	22,489	0.26	Peter Wyon
1802/3 Ipswich Theatre ticket W. Wilkins (14 silver)	4,172	0.11	?
1803/4 (dated 1802) Charleville/Tullamore 1s 1d token	10,211	0.22	J.G Hancock
1803 EIC Madras cash (20, 10, 5, 1 cash)	37,936,609	104.8	J. Phillp
1804 EIC Sumatra keping (4, 2 and 1 keping)	9,775,415	54.31	J. Phillp
1804 EIC Bombay pice (two, one and half pice)	12,240,550	67.42	J. Phillp
1805 Irish penny	8,788,416	150.93	C.H. Kuchler
1805 Irish halfpenny	49,795,200	427.54	C.H. Kuchler
1806 Irish farthing	4,996,992	21.45	C.H. Kuchler
1806/7 Bahamas penny	120,317	1.14	C.H. Kuchler
1806 British penny	19,355,480	360.03	C.H. Kuchler
1806 British halfpenny	87,803,526	817.46	C.H. Kuchler
1806 British farthing	4,833,768	22.48	C.H. Kuchler
1807 British penny	11,290,168	210.01	C.H. Kuchler
1807 British halfpenny	41,394,384	384.99	C.H. Kuchler
1807 British farthing	1,075,200	5.01	C.H. Kuchler
1808 EIC Madras (20 and 10 cash)	86,515,342	558.53	J. Phillp
1797-1809 US blanks cents	18,866,099	207.53	none
1797-1809 US blanks half cents	1,121,700	6.16	none
1796 Portuguese blanks (2 sizes)	108,000	1.12	none
1798 Portugal blanks (3 sizes)	760,015	5.48	none
Total	586,184,836	6,005.7	
Items made by Soho Mint in silver			
1792/3 (dated 1791) Sierra Leone Company (5 values)	21,837	0.31	N-A Ponthon
1796 Sierra Leone (10 cent)	4,000	0.01	N-A Ponthon
1802 (dated 1796) Sierra Leone 10 cent	2,765	0.007	N-A Ponthon
1803 (dated 1796) Sierra Leone 10 cent	2,265	0.05	N-A Ponthon
1805 EIC Sierra Leone 10 cent	6,100	0.015	J. Phillp?
1796 Gold Coast (4 values)	11,925	0.05	C.H. Kuchler
1801 (dated 1796) Gold Coast (4 values)	13,231	0.06	C.H. Kuchler
1804 Bank of Ireland dollars	791,561	21.37	C.H. Kuchler
1804 Bank of England dollars	1,006,943	27.09	C.H. Kuchler
1809 (dated 1804) British dollars	397,780	10.7	C.H. Kuchler
Total	2,258,459	59.6	

Table 2: Size of coins

Items made in copper	Number per lb weight	Weight of coin in grams	Diameter in mm	Weight in grains
1787 Anglesey penny	16	28.45	33	440
1788 Anglesey halfpenny	32	14.25	29	220
1787 Wilkinson Forge halfpenny	32	14.25	29	220
Items made by Soho Mint in copper				
1786 EIC Sumatra keping (3, 2, 1 keping)	50; 72; 144	9.75, 6.50, 3.25	28; 25; 20	150; 100; 50
1787 EIC Sumatra keping (3, 2, 1 keping)	50; 72; 144	9.75, 6.50, 3.25	28; 25; 20	150; 100; 50
1789 Cronebane halfpenny token	36	12.65	29	195
1789/90 Anglesey halfpenny token	32 then 36	14.25; 12.65	29	220, 195
1789 Wilkinson Forge halfpenny token	32	14.25	29	220
1790 Wilkinson Forge halfpenny token	32 then 36	14.5 then 12.95	29	200
1791 EIC Bombay pice (2, 1½, 1, ½ pice)	36; 50; 72; 144	13.00; 9.75; 6.50; 3.25	30; 27; 25; 20	200; 150; 100; 50
1791 Anglesey halfpenny token	36	12.65	29	196
1791 Cornwall halfpenny token	32	14.25	29	220
1791 Glasgow halfpenny token	36, then 46	12.65, 9.85	29	196 152
1791/1792 Southampton halfpenny token	44	11	28	
1792 (dated 1791) Anglesey penny token	16	28.45	33	440
1792 Wilkinson Forge halfpenny token	42	10.25-11.25	29	
1792 Monneron Liberte Confiance 2 sol	24	18.36	32	285
1792 Monneron Liberte Confiance 2 sol	26	17.10	32	264
1792 Monneron L'AN IV Federation 5 sol	15	31.38	39	484
1792 Monneron L'AN IV Revolution 5 sol	16	27.50	39	440
1791/1792 Monneron 5 sol	16	27-28.5	40	440
1792/3 Sierra Leone Co (penny and cent)	26; 160	18.9; 2.59	30; 19	
1793 Bermuda halfpenny	36	13.23	30	
1793 Wilkinson Forge halfpenny token	42	11.25	29	
1793 Leeds halfpenny token	36	12.65	29	196
1793 Inverness halfpenny token	42	10.8	28.5	
1794 Inverness halfpenny token	42	10.8	28.5	
1794 Lancaster/Eccleston halfpenny token	44	10.3	28.5	
1794 EIC Bombay pice (2, 1, ½ pice)	36; 72; 144	13.00; 6.50; 3.25	30; 25; 20	200; 100; 50
1794 EIC Madras rupee (1/48; 1/96 rupee)	34; 68	13.39; 6.67	31; 24.5	206; 103
1795 Wilkinson Forge halfpenny token	42	10.8	29	
1795 Hornchurch (Cotton) halfpenny token	43	9.5-10	28	
1795 Inverness halfpenny token	46	9.85	28	152
1795/6 (undated) Dundee halfpenny	46	9.5-10	28	
1796 Inverness halfpenny token	46	9.5-11	28	
1796 (Bishop's Stortford) halfpenny token	44	10.3	28.5	
1796 (dated 1794) Penryn halfpenny token	40	10.6	28	
1796 (Sierra Leone Company (10 cent)	26	18.9	30	
1796/7 Claude Martin (token (4 sizes)	17; 23; 35; 47	10-16; 14-23; 20-31	26; 34.5; 38; 42	
1797 EIC Madras rupee (1/48; 1/96 rupee)	34; 68	13.39; 6.67	30-31; 24.5	206; 103
1797 Cartwheel penny	16	28.35	30.5	440
1797 Cartwheel two-penny	8	56.70	41	880

**Table 2 continued:
Items made in copper**

	Number per lb weight	Weight in grams	Diameter in mm	Weight in grains
1798 Davison's Nile medal (copper)	12	40	48	
1798 EIC Sumatra (3, 2 and 1 keping)	36; 72; 144	13.00; 6.50; 3.25	28; 25; 20	200, 100, 50
1799 (dated 1798) Isle of Man penny	21	24.14	33	
1799 (dated 1798) Isle of Man halfpenny	42	10.14	27	
1799 British halfpenny	36	12.95	30	
1799 British farthing	72	6.2	23.5	
1800 Penydarran token (5s; 2s 6d; 1s; 6d; 3d)	?	13.8; 12.6; ?; 10; ?	34-26	
1801 Enniscorthy halfpenny token	60	8.2	28	
1801/2 (dated 1799) Seringapatam medal	?	55	48	
1802 EIC Ceylon rix dollar (3 values)	46, 92, 184	10.8; 4.9; 2.46	30; 23; 17	166, 75, 35
1802 (dated 1791) Arnold token (5s; 2s 6d; 1s; 6d)	?	11.5; ?; ?; ?	30; ?; ?; ?	
1802/3 Ipswich Theatre ticket W. Wilkins	18	26.68	41	
1803/4 Charleville/Tullamore 1s 1d token	18	26.6-27.5	36	337 s
	36, 72, 144,		31; 25; 21;	
1803 EIC Madras cash (20, 10, 5, 1 cash)	720	13.00; 6.50; 3.25; 0.65	11	200, 100, 50, 10
1804 EIC Sumatra keping (4, 2 and 1 keping)	36; 72; 144	13.00; 6.50; 3.25	30; 25; 21	200, 100, 50
1804 EIC Bombay pice (2, 1, ½ pice)	36; 72; 144	13.00; 6.50; 3.26	30; 26; 20	200, 100, 50
1805 Irish penny	26	17.42	33	
1805 Irish halfpenny	52	8.65	27	
1806 Irish farthing	104	4.32	20	
1806/7 Bahamas penny	48	9.5	29	
1806 British penny	24	18.7	34	
1806 British halfpenny	48	9.45	28	
1806 British farthing	96	4.75	21	
1807 British penny	24	18.7	34	
1807 British halfpenny	48	9.45	28	
1807 British farthing	96	4.75	21	
1808 EIC Madras (20 and 10 cash)	48; 96	9.35; 4.66	31; 25	144; 72
1797-1809 US cents	45	11.01	?	
1797-1809 US half cents	90	5.5	?	
1796 Portuguese blanks (2 sizes)	36, 72 and 120	12.95; 6.47; 3.92	?	
1798 Portugal blanks (3 sizes)	36, 72 and 121	12.95; 6.47; 3.93	?	
Items made by Soho Mint in silver				
1792/3 Sierra Leone Company (5 values)		28; 25; 12.75; 5; 2.6	36., 31, 24, 20	440; 400; 200; 80; 40
1796 Sierra Leone (10 cent)		2.58	20	40
1802 (dated 1796) Sierra Leone 10 cent		2.65	20	40
1803 (dated 1796) Sierra Leone 10 cent		2.35	20	36.4
1805 EIC Sierra Leone 10 cent		2.46	20	38
1796 Gold Coast (4 values)	32; 64; 128; 256	15.68, 7.84, 3.88, 1.85	31; 19; 17; 24;	
1801 Gold Coast (4 values)	32; 64; 128; 257	15.68, 7.84, 3.88, 1.86	31; 24; 19; 17	
1804 Bank of Ireland dollars (silver)	18	26.95	42	
1804 Bank of England dollars (silver)	18	26.95	42	
1809 (dated 1804) British dollars (silver)	18	26.9	40	

Table 3: Size of pattern coins and Medals

Pattern coins made by Soho Mint	Number produced	Weight in grams	Diameter in mm
1791 Barbados pattern pineapple penny	?	13.25-17.65	32
1791 Monneron pattern Liberte (with MB) 2 sol	?	18.36	32
1791 Monneron pattern Liberte 2 sol	337	18.36	32
1792 Monneron pattern L'AN III 5 sol (several types)	60	17.1	32
1792 Monneron pattern 'Revolution' cinq sol 5 sol	484	27.5	39
1792 Monneron pattern Hercules 5 sol	460	27	29
1792 EIC Bengal pattern cowrie (2 values)	100	1.45; 0.35	15; 10
1792 Wilkinson Ship (silver) token	100	14.15	30
1794 Canada pattern halfpenny token	?	13.34	29
1795 Ibberson halfpenny token	372	9.44	29
1795 Swainson pattern halfpenny token	8	10.95	28
1796 Myddelton-Kentucky pattern token	64	11.7	29
1803 (dated 1798) Wurttemberg pattern thaler	100	10.8	43-44
1799 Christian of Denmark pattern coins (5 sizes)	?	?, 16.3; 8.15; 4.1; 1.8	39; 34; 27; 21; 18
1804 Alexander I Russia pattern rouble (cross)	77	25.40.5	40
1804 Alexander I Russia pattern imperial (eagle)	59	7.15-9.84	27
1803/4 EIC Ceylon (dies only)	?	n/a	?
1808 Haiti pattern coins (3 sizes)	36	n/a	?
1809 Bengal pattern coinage (2 values)	?	8.4; 4.00	27.5; 21
1809 Brazil pattern 960 reis	?	25.5	41
Pattern regal coins that did not go into production			
1787 pattern shilling (portrait & ciper) (Garbett)	?	5.01	25
1787 pattern sixpence (star & garter) (Garbett)	?	3.95	20.5
1788 pattern sixpence (cipher & Britannia) (Garbett)	?	?	?
1788 pattern halfpenny	?	15.9	31
1790 pattern halfpenny	?	3	31
1790 pattern sixpence (Garbett) (silver)	?	2.6	21
1791 pattern guinea (Garbett) (gold)	?	6.8	24
1791 pattern sixpence (Garbett)	?	?	?
1795 pattern halfpenny	?	11 to 18	30-31
1798 pattern shield crown/guinea (gold)	?	24.08	42
1798 pattern penny	?	18-29	36
1797 pattern halfpenny	?	14	31
1797 pattern farthing	?	7.5	26
1798 pattern farthing	?	7.5	25
1804 pattern garter dollar (imperial)	140	24.26	41
1805 pattern penny	?	18-22	35
1806 pattern halfpenny	?	11.5	29

Table 3 continued:

Medals made by Soho Mint	Number produced	Weight in grams	Diameter in mm
1772 Otaheite/Captain Cook medal	2144	45	41-44
1774 37th Foot Regimental medal (3 versions)	22	?	45x56,40x52,50
1781 Admiral Rodney/St. Eustatius medal	?	?	34
1787 Elliott/Gibraltar medal	?	?	59?
1789 Restoration of the King's Health medal	?	19	34
1791 Monneron Acceptatance medal	?	26.75	36
1791 Monneron Sermont du Roi medal	907	24	34-35
1791/2 Monneron Rousseau medal	1115	18-20	34-36
1792 (various dates) Monneron Lafayette medal	3058	22	36
1792 Monneron Hercules/Respublica medal	362	15-16	32
1792 Soho Manufactory (trial?) medal	?	16	32
1793 Execution Louis XVI (Final Interview) medal	488	45-60	48
1793 Execution Louis XVI (Death) medal	450	61-73	51
1793 Gustav III Assassination medal	423	75-82	56
1794 (dated 1792) Lord Cornwallis medal	527	55-59	48
1794 (dated 1793) Marie Antoinette medal	429	45-60	48
1794 Essex Agricultural Society medal (to 1815)	105	35-37	45
1794 Handsworth Friendly Society medal	?	?	?
1795 (dated 1794) Lord Howe medal	316	54	48
1795 (dated 1797) Marriage of Prince of Wales medal	50	45-56	47-48
1795 Queen Charlotte Frogmore medal	50	18-24	34
1795 George III Frogmore medal	50	24	35
1795 Prince and Princess of Wales Frogmore medal	50	?	47
1796 Anton Schaeffer die x2	?	?	79?
1796 Catherine of Russia (pattern/medallion)	33	12.51	29
1797 (dated 1793) Board of Agriculture medal	74	54	48
1798 (dated 1796) Washington 'Sowing' medal	240	48	48
1798 (dated 1796) Washington 'Spinning' medal	237	48	48
1798 (dated 1796) Washington 'Shepherd' medal	240	46	48
1798 (made 1800/ 1810?) British Victories medal	?	55	48
1798 Davison's Nile medal	6700	40	48
1798 Hafod Friendly Society medal	120	38	41
1799 Ferdinand of Naples and Sicily medal	1165	53-64	48
1799 Alexander Suvarow medal	348	55	48
1801/2 (dated 1799) Seringapatam medal	51,165	40-55	48
1799 Defence of Waterford/South Devon medal	596	?	32
1800 Preservation from Assassination medal	217	53-65	48
1801 Earl St. Vincent medal	637	23	47
1801 (dated 1800) Staffordshire Agricultural medal	200	46-60	47
1801 Union of Britain and Ireland medal	316	54	48
1802 Peace of Amiens medal (4 versions)	204	53.98	48
1802 Birmingham Loyal Association medal	?	47-50	48
1802 Nottinghamshire Yeomanry medal	246	17-27	36
1802/3 Duke of Bridgewater trial strike for medal	?	?	?
1803 (dated 1802) Manchester and Salford medal	106	17-19	36
1803 Boulton's Medalllic Scale medal (2 versions)	?	24-48	41-42

Table 3 continued:

Medals made by Soho Mint	Number produced	Weight in grams	Diameter in mm
1803 St Albans Female Friendly Society medal	200	38	42
1804/5 (dated 1803) Boydell's Shakespeare medal	654	38-61	48
1805 Boulton's Trafalgar medal	14,577	55	48
1806 (dated 1804) Priestley medal	14,577	?	55
1806 Drayton Agricultural Society medal	53	61	47
1807 St Albans Female Friendly Society medal	50	38	42
1807 (dated 1803) Boydell's Shakespeare medal	100	38-61	48
1808 Royal Society of Art Minerva and Isis medal	40	?	43, 39
1808 Royal Society of Art Pallet medal (till 1840)	387	73-78	63x52
1809 Matthew Boulton Farewell medal	?	52-59	48
1809 Matthew Boulton Obsequies medal	532	34-39	40
1809 Matthew Boulton medal (BHM 660)	?	?	35
1808 EIC Sanskrit prize medal (struck till 1849)	?	27	37
1808 EIC Persian prize medal (struck till 1849)	?	27	37
1809 Farming Society of Ireland medal (silver)	200	?	?