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The industrialization of money: crises, responses, successes and disappointments

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I am most pleased and honoured to be with you, for a second time, at this second all-Australian Numismatic Conference. I wish to talk to you about a body of research that has occupied me, to a greater or lesser degree, for nearly thirty years. It embraces a fairly circumscribed period, roughly the years between 1760 and 1825, and two countries, Great Britain and the United States of America. Specifically, it centres on what happens to money in each country when a new set of technological, demographic and economic practices come into play.

The new set of practices is more commonly known as the Industrial Revolution and it inspired a new set of demands, more or less the same in each country. These requirements had at their heart the provision of more, and safer, money, so that the promise of the new age could be fully achieved. And in a curious display of interrelatedness and synchronicity, the monetary crises engendered by the Industrial Revolution were found to be *solvable by the new products and methods of production made possible by the new era*. In other words, the same movement created both an emergency and the way to solve it, all in a single go.

While historians debate the precise time of the beginning of the British

Industrial Revolution, most would place it between 1760 and 1790, characterized by gradual, then accelerating, trends in three branches of human endeavour. These trends began in relative isolation, but they soon came to interact with each other to a progressive degree. The first phenomenon was a growing utilization of previously unpopular or largely overlooked substances such as iron and coal. The second was the organization of labour in a more rational, hence more productive, fashion. And the third was the creation, or at least the relative perfection, of a new motive force for the production and transportation of goods, namely the power of steam.

The study of the connections between people, technology and objects is also a relatively new phenomenon. In the case of the Industrial Revolution, one could likely say that the 'long view' could not be achieved until a decent interval had transpired between the events under consideration and the time-frame of the modern historian. Eyewitnesses could not be expected to take a detached view of what was going on. They tended to see only the problems arising from the Industrial Revolution rather than the possibilities inherent in the movement; the dark satanic mills, the exploitation of female and child labour, the back-breaking hours in the factory or mine, the miserable wages; all of

these have provided the ingredients for a sort of industrial folklore.

But there was another problem created by the Industrial Revolution that was largely overlooked by eyewitnesses, leaving only a fleeting impression on their minds, and none at all on the minds of many of the historians who followed. This was the difficulty inherent in paying wages of *any* kind, however low, to the new industrial proletariat. The Industrial Revolution meant the uprooting of labour, taking it from a traditional place where payment in kind had been always prevalent, and translating it to a distinctly *non-traditional* place, where no one knew anyone else, where time-honoured methods of exchange would no longer function. We have tended to see the new age primarily in terms of steam power. But the second of the three trends, noted above, the organization of labour in a rational way, was at least as important to the success of the Industrial Revolution. Indeed, it predated the application of steam power and was more important. There could be a factory without steam, but steam existed only in order to power factories.

With or without the steam engine, the repetitive, tightly organized activity inherent in the factory system was a distinctly unnatural mode of human behaviour. The first mill owners and mill workers soon learned that what everyone had always regarded as the 'natural' methods of payment and exchange simply would not work in the new environment. If owners wanted to attract and retain mill workers, they would have to pay them regular wages, in cash. And since current

salaries were modest indeed, what would be required would be large quantities of low-denomination coinage.

In Great Britain this posed a major problem. At the risk of some oversimplification, it can essentially be said that the public coiner, the Royal Mint, was charged with providing a stipulated *amount of coinage* rather than a stipulated *number of coins*. It did not take the eighteenth-century equivalent of rocket science to figure out that it was far easier to strike, say, a thousand golden guineas rather than the equivalent value of 504,000 copper halfpence. The less-than-overworked denizens of Tower Hill cheered the discovery; during most of the sixty-year reign of George III they struck very few copper or silver coins, the very objects most required by the new industrial workers. But, even if the Royal Mint had been more co-operative, and more inclined to rise to the challenge presented by these new wage earners, it would have been hard-put to assist. It still relied on antiquated machinery inherited from an earlier epoch. An observant, if personally interested industrialist named Matthew Boulton (Fig. 1), estimated that a human-powered press of the *balancier* type could strike twenty-seven medium-size coins per minute. Even if he was correct (and in this instance I don't think he was), the Royal Mint had no interest in proving him right or wrong, not when it came to copper coinage. Inevitably, a monetary shortage in the opening days of the Industrial Revolution would turn into a full-blown crisis as the movement progressed.

The private sector responded, even if the public sector would not. Beginning in

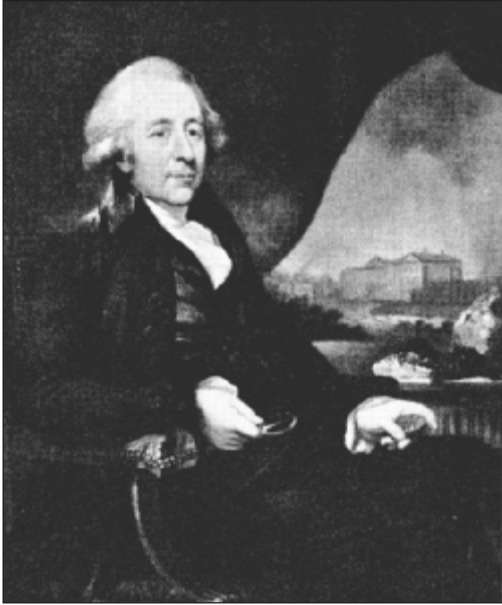


Figure 1. Birmingham industrialist, Matthew Boulton.

1787, firms on the fringes of the new industrialization began striking and circulating copper tokens, the great majority valued at a penny or a halfpenny. They were quickly joined by private copper tokens from closer to the centre of activity—the Midlands, the North and, of course, London. The more popular of the private tokens (or commercial coins, as they were often known) were targeted by forgers mostly operating in the back alleys of Birmingham, then, as now, the centre of the British metal trade.

But the forgers were more likely to create fakes of circulating coins than tokens. Counterfeit copper had long been a problem for the British working class. Writing in the mid-1860s, Samuel Smiles¹ tells us that by 1753, ‘not less than half the copper coin in circulation was counterfeit’—and this was more than three

decades prior to the beginning of increased wage payments and the real monetary crisis. By the beginning of the 1790s, a correspondent of the *Gentleman's Magazine* could bluntly state that ‘not the fiftieth part of our copper currency is legitimate’.² Fake coppers were joined by fake silver pieces: according to John Craig³, plain white-metal discs were commonly substituted for legitimate shillings and sixpences (most of which had been struck a half-century earlier and hence were likely to be nearly as smooth as the counterfeits). To this motley group were added Spanish-American dollars and their subdivisions, sometimes counter-marked and sometimes not, sometimes genuine and sometimes not. To an educated observer on the scene in the year 1790, it would have been clear that the coming to fruition of a new, industrial, wage-based economy was very much in danger and that a solution to the monetary stranglehold had to be found, and found quickly. If not, the promise of a new and better age would remain unmet.

Several thousand miles to the west and a couple of decades later, a second area was going through the birth pains of a second Industrial Revolution. This was the nascent United States of America, where the trouble centred not on coinage but on currency.

The Americans had experienced problems with their money ever since the English first set foot on their shores. The seventeenth-century European definition of money was coinage—specifically, coinage made from gold and silver. English North America offered many products, but precious metals were not among them. While it was true that

Massachusetts managed to create a fairly extensive silver series during the second third of the seventeenth century, it was also true that the only way the colony was able to do so was by melting down other people's coinage that had been acquired through illicit trade. The Crown soon put a stop to such practices, leaving Massachusetts and the other colonies desperately short of *normal* money. They experimented with distinctly *abnormal* monetary expedients, ranging from wampum to tobacco to beaver pelts, but by the turn of the eighteenth century, they had blundered towards the solution that would power their economies for the remainder of the colonial period and the first century or so of independence. The solution was paper money, replacing the more familiar metal coinage.

Massachusetts led the way by issuing paper currency in 1690, and the other colonies quickly followed suit. The original issues were meant to pay for troops and military supplies, but local authorities soon saw the potential of paper currency for fuelling colonial development, in particular, enhancing colonial infrastructures. In time, notes would be issued to build a lighthouse in Georgia, a poorhouse in Pennsylvania, and for debtor relief everywhere. When the War of Independence broke out, rebel authorities adhered to eighty-five years' worth of fiscal tradition; they based their military activities on paper money. Their people were accustomed to the medium, and in fact there was no viable alternative.

The Revolutionary War exposed the weaknesses of such money. The insurgent authorities issued promissory notes payable (theoretically) in Spanish-

American pieces of eight. The bills might have performed adequately had the war been brief and the rebels victorious. But events proved otherwise, and faith in the Americans' paper began spiralling downward with no end in sight. For it to retain *any* of its stated value, its audience had to be convinced that at least it was *genuine* and could not be created by anyone outside the official print shop.

As things stood, this was a tall order indeed. The eighteenth century knew of only two ways of producing paper money; it could be printed from engraved plates or it could be created from moveable type. However, neither method was perfect. Engraved plates meant copper plates, as no one had learned how to engrave on steel. Copper plates wore down fairly rapidly and then had to be retouched or re-engraved, compromising the original design whose deliberate intricacy was to deter counterfeiting. The typeset method made possible far greater numbers of identical notes, but those notes would be perilously easy to counterfeit due to their (unavoidable) crudity of line and design. American currency was vulnerable to forgery, regardless of which of these two methods were used. Counterfeiting and alteration had been problems throughout colonial days, and they worsened during the Revolution as both local criminals and His Majesty's Government took advantage of the emergency.

By the end of the 1780s, a new, stronger, conservative national government had been erected on the ruins of the wartime Continental Congress. With an eye to what had just taken place, the new regime decided that it would eschew the currency medium as much as possible (and

force the States to do the same), replacing it by good coinage. This was unrealistic. You can't preach a hard-money doctrine where no hard money exists, or can be made to exist. Whether the new federalist authorities wished it or not, their countrymen would still depend on paper money, for there simply weren't enough coins to go around. A new national mint set up in 1792 did little to solve the shortage. It has been estimated that by 1830 the mint had still not managed to make one American coin of each denomination available to each citizen, and this after forty-seven years of effort!

Two additional factors now came into play, creating even greater pressures on the nation's monetary system. First, the population grew rapidly, almost doubling between 1790 and 1810. Inevitably, the American economy, or at least that portion of it dependent on coinage or currency, also grew. Second, by around 1800, the first stirrings of the Industrial Revolution were being felt on the American side of the Atlantic Ocean. By British standards, what was happening was modest indeed, a few mills established here and there and a few thousand workers newly employed in those mills. But the new factories and factory hands were being injected into a monetary system that was already very weak.

Two closely related problems came into being, which together would have a profound effect on the story of American and, indeed, world, numismatics. The first we have seen before, the need to pay wages in order to attract workers to the factories. The second problem, while certainly not unique to the United States, was probably more crucial there than

elsewhere. That is, were the new industrialization to flourish, were it to achieve and transcend the 'take-off' stage of development, then enormous new sources of money for investment and purchase would have to be created *regardless* of how new workers were paid.

There was only one object widely available for such purposes, the paper note. *But*, it would have to be privately produced and issued, for under the new Federal Constitution, the national government had denied such activities to itself and to the States. It would have to be produced in large quantities and, finally, it would have to be rendered impossible to forge.

The latter almost certainly meant that it would have to be created from engraved metal plates. But the productive life of those plates somehow had to be extended. And just as in Great Britain, a gifted band of curious souls would find ways out of the current difficulties, *using the new products, processes, and possibilities brought forth by the Industrial Revolution*.

Let us examine the succession of solutions, first in Great Britain and then in the United States. At the centre of the British response was the Birmingham industrialist Matthew Boulton, in his role as the guiding spirit behind the Soho Manufactory. This manufactory had originally been devoted to the production of what in the 18th century were called 'toys', intricate small objects, ranging from buckles to watch chains to buttons, all made from metal, both base and precious. In the late 1760s, Boulton entered into partnership with a morose Scottish inventor named James Watt. Watt had invented an improved steam engine with a separate condenser, increasing motive

force while cutting the consumption of coal. Boulton would find ways to sell it to a waiting world, through either new and improved products or purveyance of the power itself, the sale of steam engines.

It was inevitable that Matthew Boulton would think of harnessing one of his partner's engines to a coining press⁴. He had been making buttons since the 1760s, and the manufacturing processes connected with these objects were not vastly different from the minting of coinage. Steam power would be a natural addition to this manufacturing process and there is some evidence that Boulton saw it as such by the mid-1770s. Moreover, Boulton had a fierce pride in the town of his birth, Birmingham, which had a fully-deserved reputation as the centre of the British counterfeiting industry, a reputation that deeply hurt this man whose fortunes were so tightly bound up with the town. What if he could turn things around and make Birmingham the centre of monetary excellence rather than monetary fraud? And what if he could create safe money, especially safe copper money, for the new legions of industrial workers?

Here Boulton had two objectives. He certainly wanted to increase the output of legitimate money, but he appears to have been more interested in finding ways of making coinage *impossible to replicate outside that establishment legally responsible for its creation*. The employment of steam power was central to the achievement of both dreams.

In a striking display of the connections between events within and beyond numismatics, and of the possibilities of borrowing from one field for the benefit of another, Matthew Boulton succeeded in

conceiving, moving towards, and finally reaching the two goals of increasing production and of making the new coinage impossible to forge, all by means of the new technology and products spawned by the Industrial Revolution. In essence, he turned that movement upon itself, forcing it to solve the monetary crisis it had helped to create.

Boulton seems to have been either endlessly optimistic or hopelessly naïve. He was agitating for a royal contract to strike Great Britain's copper money as early as 1787, at which time he did not have a mint, and he was unclear as to what qualities an unforgeable coin struck by steam could, or should, embrace. It would take ten long years before he was finally awarded his contract. In the meantime, he learned by doing. He secured a patent for a new moneying press in mid-1790, which featured an overhead wheel connected to a steam engine. The wheel had eight cams or pawls on its lower surface and they, in turn, engaged and disengaged the arms of screw presses which, in turn, struck the coins. The mechanism was cumbersome, made an infernal racket and broke down frequently, but it worked. Its first production run occurred in the summer of 1789, and each press was capable of striking forty or more coins per minute.

While Boulton's name may have appeared on the patent, the invention was, as so much else in the industrialization of money, a truly collaborative effort, here in England as also in America. He does indeed deserve credit for the initial concept of applying steam power to a coining press, but James Lawson, Peter Ewart, William Murdock and even James Watt contributed to the success of the enterprise. John

Southern was especially important and he would eventually deserve almost as much credit for the new moneying as did Boulton himself.⁵ But when Boulton and his associates harnessed the power of steam to a coining press, strange things happened that inevitably changed the form of the coin itself.

The changes arose from the greater downward force made possible by steam's application. If you wanted to strike a large number of coins quickly, and you had a large amount of force available for the purpose, your coining dies would have to be cut in shallow relief. You would also be obliged to add a third die to the other two, a collar to restrain the outward flow of metal. Since you would have to eject your coins from that collar rapidly and easily, the edges of the coins needed to be plain, vertically reeded, or incusely ornamented or lettered, but any other possibilities could not be countenanced. All of this inevitably flowed from the application of steam power to the coining process.

But these were precisely the characteristics Matthew Boulton had always considered desirable and attractive in coinage. Shallow relief would be very difficult to convincingly replicate by potential forgers. It would be gentler on dies that must now strike more coins, with greater force, than ever before. The precise, vertical edges on the new coins would discourage clipping. Steam power would make his new money cheaper to produce, which meant that he could put more metal into each piece, another discouragement to forgers. Steam power would also allow for thicker coins, again more metal and hence more protection

against forgery. Finally, Boulton believed that each coin must be identical to every other coin, and so from the mass-production of coins his thoughts went to the mass-production of coin *dies*. Steam power would play no part here, but the shallow relief he found so appealing would play a crucial role; it would be far easier to mass produce shallow, identical dies rather than the deeply-cut versions of the pre-industrial age.

At this point other people and commodities entered the equation. Just as Boulton was finding ways to mass-produce coinage and requiring massive amounts of high-quality steel for the purpose, others in Great Britain were making dramatic strides forward in the production of that very commodity. Foremost among them was Benjamin Huntsman, whose 'crucible steel' was far superior to anything previously available, soft and malleable in an annealed state, and extremely hard when heated and quickly cooled. This was the very thing required for the mass-production of identical coin dies.

But the mass-production of coin dies presupposed that there was a customer, and a large one at that, for the wares. As already mentioned, Boulton had his mint up and running by the summer of 1789 only to find that his customer, the British Government, had other things to contend with. But his Soho Manufactory would eventually gain a contract to coin regal copper (Fig. 2), and then another contract, and another still. In the meantime, Boulton had to coin as he could, so he joined others in producing copper penny and halfpenny tokens (his products are almost always distinguished by their artistry and full



Figure 2. Obverse and reverse of Matthew Boulton's 'cartwheel' twopence with the incuse rim inscription.

copper content), coinage for India, Bermuda, the Gold Coast, and Sierra Leone—anything to keep the mint busy and his workmen employed. He finally had his big break in 1797, but by then he was thinking beyond coinage, mulling over the idea of a logical extension to his labours. He had struck coins and tokens of a new type and he had sent them across the world. Why not create and ship entire mints?

This was done, with Boulton negotiating with the Russian government, just as his first British coining contract was being signed. In the end, Boulton and his son, together with their Soho enterprise, would provide mints and the engines to power them to Russia, Denmark, India, Portugal, Brazil, Mexico and, most satisfying of all, Tower Hill.

The scene now shifts to the other side of the Atlantic, where a gifted band of American inventors and experimenters would do for currency what their counterparts in Great Britain had done for coinage: they would turn the Industrial Revolution upon itself, employing its new products and discoveries to solve a problem it had helped to create.

The leader here was an inventor, engraver, silversmith and self-promoter named Jacob Perkins, resident of Newburyport, Massachusetts (Fig. 3). Perkins was first noticed in the mid-to late 1780s when he made elegant silver plate, created some of the dies for a State copper coinage, and eventually produced a series of funerary medals for George Washington. But Perkins is important to us because he himself acquired an interest in improving the state of America's economic lifeblood, its paper money.⁶

He had done so by the early 1790s. By the end of that decade, he had patented something he called a 'check plate protector', the first of his two contributions to the industrialization of paper money. More commonly known as a *stereotype plate*, the Perkins device consisted of a metal frame into which were tightly incorporated no fewer than sixty-four individual plates, engraved with tiny letters or numbers. Spaces were reserved for the names of banks, towns and denominations, engraved on plates of the same type. Tightly clamped together, this multi-piece tool could be used to print money, injecting such a wealth of detail into its fabrication



Figure 3. Massachusetts inventor, engraver and silversmith, Jacob Perkins.

that it was hoped that aspiring forgers would be scared away.

Perkins' first stereotype plates were made from copper and soft iron, the only materials then available. But the inventor soon found that such plates were ill-suited to massive runs of currency as their intricate details were soon lost in the constant abrasion of the inking, wiping down and re-inking processes involved in printing from engraved plates. Accordingly Perkins began searching for some material that would be soft enough to engrave, but that could be made hard enough for sustained use with no loss of detail. Inevitably he turned to steel; but it would have to be a special kind of steel, and it would lead to a very special technology.

What Perkins first needed was soft steel that was flawless and homogeneous

enough for the type of micro-engraving he had in mind. He found a metal adequate to his purpose and the fact that he could do so was directly related to other workings of the Industrial Revolution, both in America and in Great Britain.

With the special steel in hand, Perkins would be able to achieve the extreme delicacy of line that he desired. However, the soft steel would have to be hardened after it had been engraved; if not, it would serve his purposes no better than had the copper and soft iron of his previous attempts. He found a way of hardening his steel after it had been engraved, a process involving surface cementation. He also found a way of softening the metal by annealing it in a special way. By 1804 he was able to harden and soften steel plates at will and this led him to his (and America's) most crucial contribution to the industrialization of money. This was the technique of *siderography*, the hardening and softening steel at will to enable the mass-production of complete designs for printing. Jacob Perkins discovered that a complex design could be engraved on a soft piece of steel, which could then be hardened with his new technology, and finally employed to *transfer the original design on to other soft pieces of steel*.

It is unclear how he managed the transfer in the beginning, but he soon came to rely on a steel roller to do the work, a method still in use until very recently. He had perfected the technique of siderography by 1804 and, by 1805, was producing notes in his factory in Newburyport for more than a dozen Massachusetts banks. He continued to perfect his craft, adding elaborate reverse printing to some of his notes. In March

1809, Massachusetts passed a law mandating Perkins' processes for all currency printed in the State. His future was assured (Fig. 4).

It has been estimated that a good run with an early copper plate was five thousand prints, after which the plate had to be retouched or scrapped. But Perkins' steel plates were capable of at least thirty thousand prints, *and their designs could be replicated on to other steel plates as often as desired*⁷. America's shortage of safe money had been solved, or so it might have appeared to an observer in the year 1810.

Similarities between the earlier activities of Matthew Boulton and the Perkins story come easily to mind. In both cases several benign effects of the Industrial Revolution had to come together before a malign one could be eradicated. Matthew Boulton needed special steel for his work and so did Jacob Perkins. Here, both men took advantage of others' earlier inventions and efforts. Steam, experimented with by others but perfected by his partner, Watt, stood at the heart of Boulton's reforms. The innovations of Perkins were not dependent on steam, but they did rely heavily on improved lathes, rolling machinery and a host of other contrivances by other inventors. The work of each man formed the apex of a triangle, dependent on the labours of others to fill in the sides, and to provide the springboard to move everything forward.

Both Matthew Boulton and Jacob Perkins had fairly precise blueprints for what ought to happen next. Boulton would strike safe British copper money with the power of steam and a grateful monarchy would give him and his heirs the right to

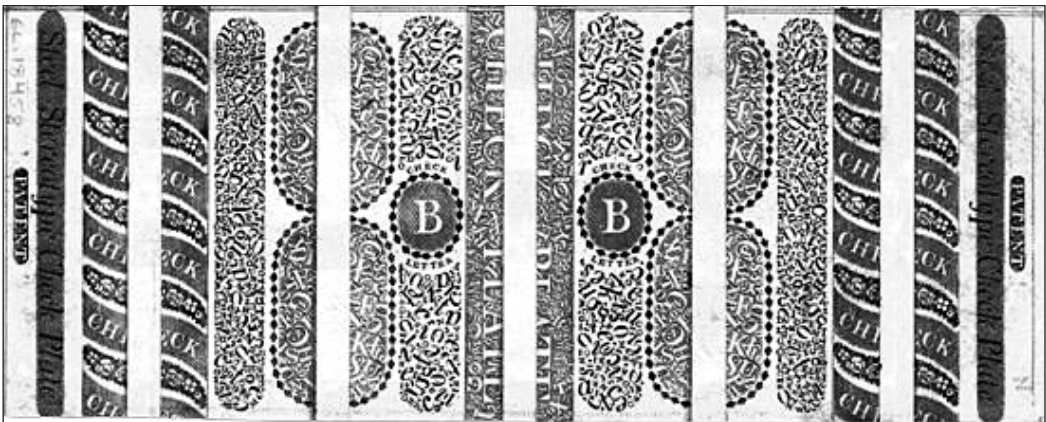
do so in perpetuity. Meanwhile, the exportation of steam-powered coining factories would benefit people the world over, burnishing the reputation of Birmingham, Soho, and Matthew Boulton and his heirs. Jacob Perkins would provide banks across the American Republic with distinctive, identical and safe paper money, the very sinews of commerce for generations to come. However, things didn't quite work out as planned.

Matthew Boulton died in the late summer of 1809, and his son, Matthew Robinson Boulton succeeded him. His duties included overseeing the final stages in the construction of a mint in St. Petersburg, chivvying along a second facility for Denmark, starting a third for Brazil and working with the officials at the Royal Mint, whose premises on Tower Hill were being rebuilt and re-equipped to Soho's specifications. The last facility was ready for limited coining activity by 1810 and the first objects the Royal Mint struck were copper coins! Even though they weren't intended for British consumption, the younger Boulton was still furious. The government for which he and his father had toiled so hard for so long had broken its portion of a sacred trust. What would happen next?

What happened next was a series of crises and farces. The Russians took a Soho workman hostage (who happened to be Zacchaeus Walker Jr, Matthew Boulton's nephew) and wouldn't let him come home for more than a year after his work had been completed. The mint for Brazil was shipwrecked off the coast of Pará, was recovered, and then hidden for two decades, the local authorities having successfully applied to Lloyds of London



Obverse.



Reverse.

Figure 4. Obverse and reverse of an 1814 Gloucester, Massachusetts five-dollar note printed using Perkins' siderography technique.

for the insurance money (which would have to be returned were the mint resurrected). A mint for Mexico turned into a fiasco when it was belatedly discovered that the site chosen for its erection lacked reliable fuel and water (which are matters of some importance for operating a steam engine). Even the most successful projects, involving mints for Calcutta and Bombay, took a tremendous toll on the Soho technocrats sent out to do

the work. Nearly a dozen lost their lives, taking with them their irreplaceable skills.

And across the lands where Matthew Boulton's dreams had reached, there were interesting developments. A minter in Mexico found that he could mass-produce dies in a new way. Someone in India found a better method for creating and disseminating the portrait of the new Queen on the new money. Indeed those to whom the secrets of the new coining had

been entrusted were adding new touches, claiming them as their own. So the industrialization of money acquired a new local authenticity, one that might have surprised its original creator, but one that he would likely have embraced.

Jacob Perkins' story had unexpected twists as well. He ran his own security firm in Newburyport for a number of years and, as business was good, he expanded his plant. Then, in 1815, he was lured to Murray, Draper, Fairman & Company, prestigious printers located in Philadelphia. Perkins was attracted to Philadelphia, in part by the promise that all currency to be emitted by the new Philadelphia-based Bank of the United States would be created from his plates, employing his design concepts and his technology. This promise was broken, as it slowly became evident that he and his new associates held differing views about how to make paper money both plentiful and safe. Jacob Perkins continued to stress a single, unvarying design, one which might be less than beautiful and even downright homely, but whose sheer consistency would always keep forgers at bay. In contrast, Murray, Draper, Fairman & Company wanted to create beautiful intricate designs, relying more on their artistry than their consistency to foil the forger. In fact, they would create an entire library of artistic master dies, each easily and quickly transferable on to working plates by Perkins' technology. In other words, they wanted a part of what Perkins could offer, but not what he saw as the most important part. In 1819, Perkins parted ways with Murray, Draper, Fairman & Company; the parting was amicable but final. Perkins sailed for England, where he arrived mid-1819, afire with plans to reform

British currency in an American way. He was rebuffed, not least because of outraged national sentiment; who did this Yank think he was, anyway? The fire dampened but did not die. Perkins settled with his family in London and lived there comfortably for the next thirty years, kept afloat by royalties from his various inventions and enterprises on both sides of the Atlantic. He died in the summer of 1849, perhaps the most fortunate of the early pioneers in the industrialization of money.

But was Perkins a success? Did his inventions solve the problems they were intended to solve? This question defies a simple answer. It could be argued that his innovations solved matters in one direction, while complicating them in another. That is, the new, beautiful steel engravings made possible by Jacob Perkins' techniques did indeed make plausible forgeries somewhat more difficult to create. And more money than ever before could be created, bearing the beautiful images, to the obvious benefit of business and employment alike.

But along with solutions came complications. Some of the artwork on the counterfeit plates was created by the same people who engraved the images on legitimate ones; they were paid by the piece rather than receiving a regular salary. Moreover, large numbers of nineteenth-century Americans were functionally illiterate, with very limited exposure to printed materials of any kind, including banknotes (one explanation for the fact that some truly awful counterfeits circulated widely is that, to the inexperienced eye, they would have looked as good as anything else in circulation). We would also do well to bear in mind the existence

of hundreds of note-issuing banks in the United States between 1820 and 1865. These banks circulated an average of six denominations each and they changed their designs every few years. Each note, from each bank, bore three or four portraits or pictures. With all of these images on all of these banknotes vying for attention, who could say which ones were genuine and which were false? In sum, it must be admitted that, whether or not it was Jacob Perkins' fault, the Newburyport visionary and inventor may well have made matters more complicated for the average American.

Matthew Boulton had created a new world coin on a single design and his model had basically found permanent acceptance, even if there were lively discussions about the details. Jacob Perkins created the *potential* for a new world currency and it is a matter of record that the inventions and improvements that he devised would one day underpin how all the world made its paper money.

Without Matthew Boulton and Jacob Perkins, the challenges they faced and the dreams they pursued, our world would be very different.

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