

## **BIOGRAPHICAL DETAILS OF STAFF AND ENGINE ERECTORS**

[Source: Chapter XXI in *James Watt: Craftsman & Engineer* H.W. Dickinson (Cambridge University Press 1936)].

"The Boulton and Watt correspondence, particularly in the early period, contains many references to the workmen employed; some of these references are in connection with the erection of particular engines, but many relate to difficulties in the Soho workshop arising from the drunkenness and irregularities of the men. As time went on there is less evidence of this; no doubt the organization was improved, a steadier lot of men were got together, and it became possible to weed out the worst of them; indeed, later on, Soho men came to have a high reputation and the establishment may truly be said to have been a nursery for millwrights and mechanical engineers."

Set out below are some brief biographical details on a number of individuals, arranged in alphabetical sequence:

### **William Brunton**

In 1796 Gilbert Hamilton was engaging men in the Glasgow district for Boulton and Watt. Among others he took on Brunton, who had been working under his (Brunton's) father, "making iron and brass machinery" for the New Lanark Mills. He came with a testimonial that he "is an ingenious lad in his business, that he has received a virtuous education, & is accordingly both temperate and attentive". Brunton very soon made his mark with Boulton and Watt. A little more than twelve months after he was engaged, we find John Southern reporting: "William Brunton is a very valuable hand, and has more "gumption" than most of his contemporary engine erectors." Less than five years after this he was made superintendent of the engine yard at Soho, a position that he retained until 1808, at a salary rising from £80 to £100 a year. He left Soho to go as engineer to Butterley Ironworks, where he made his celebrated steam horse. After seven years or so at Butterley, he returned to Birmingham to become a partner in and manager of the Eagle Foundry, and while there invented one of the first (if not the first) moving fire grates for furnaces. Later on he was engaged in South Wales.

### **Richard Dayus**

Richard Dayus was employed by Boulton and Watt from 1786 until 1804. In 1791 he was sent to Nantes in France to erect an engine for a corn mill and seems to have witnessed some of the more exciting scenes of the French Revolution. In 1800 he was Boulton and Watt's principal erector in London. Rennie thought very highly of him and reports that Dayus was earning over half a guinea a day by this time.

### **Peter Ewart**

The name Peter Ewart occurs in the Boulton and Watt correspondence at a comparatively early date. Thus in 1781 we find Boulton writing to Watt: "I have had a letter from Lady Hopton recommending a young man of ye name of Ewart, 15 years of age, but I presume he wishes to be a practical engineer and millwright. Enclosed you have a letter upon the same subject. I think he is a very likely subject from her Ladyship's description of him, and may be of use to us in time, and therefore if it is agreeable to you it will be so to me to take him. We shall find it conv<sup>t</sup> to breed up a few

young men as our business will, I am persuaded, increase." Just before, Boulton had been alluding to the necessity of getting Watt some assistance in the drawing office.

The letter enclosed by Boulton was probably the letter from Professor Robison to Watt, given in Muirhead, in which Robison solicits-

"employment for a young lad, a near relation of mine, Peter Ewart by name, who wishes to be educated as a millwright or in any good branch of the business of a civil engineer. I could not find him so proper a master as yourself, and I flatter myself that you would find him a very deserving pupil. His father is a clergyman near Dumfries, and has given the boy a very good education, but with no other views. But the boy's inclinations are so much turned to mechanics, and his mind so much caught by anything of this kind, that we all agree that it is the line of business in which he is most likely to succeed. His constitution is healthy and strong, so that he is perfectly fitted for the hard labour by which he is to get his living. If therefore you can find employment for him I shall look on him as setting out in the most favourable manner."

Ewart, however, seems first to have been apprenticed to John Rennie at Musselburgh. When the latter came south to put up the Albion Mills in London Ewart accompanied him; and it was not until about 1790 that he became connected with Boulton and Watt in a more permanent fashion.

In 1788, Ewart was sent to Soho by Rennie to erect a water-wheel and other machinery for Boulton's rolling-construction of the millwork and machinery for his mint. From 1790 to 1792 Ewart was engaged in erecting Boulton and Watt engines in the Manchester district. In 1791 he informs Watt that he had taken a shop in Manchester, and was engaging some hands to begin upon the millwrighting and other work he had undertaken. This business was not of long continuance, for in September 1792 he entered into partnership in a bleaching and calico-printing firm; but this lasted only for a year. In 1795 and 1796 we find him again at Soho laying out shops and plant and devising machinery for Soho Foundry, and for the Engine Shop at Soho Manufactory, including the designs for the boring mill. In reference to the latter, he wrote early in 1797 from Manchester to James Watt junior, "I am exceedingly mortified by your account of the boring mill. I cannot think that the jarring is owing to the weakness of the wheel, for every part of it is much stronger than the rod in proportion to the distance from the centre."

From 1798 to 1835 Ewart was concerned in cotton-spinning in Manchester; he was then appointed chief engineer and inspector of machinery in the Royal Dockyards. He died at his official residence at Woolwich in September 1842, in the 76<sup>th</sup> year of his age, in consequence of injuries caused by the breaking of a chain while he was superintending the removal of a large boiler. Ewart took out three patents: the first in 1813 for working looms; the second in 1822 for coffer dams (this invention was used at the Liverpool docks); and the last in 1833 for spinning machines.

### **Joseph Harrison**

The "father" of the Soho workmen was undoubtedly Joseph Harrison. Nothing is known of his antecedents, but it is reasonable to suppose that Boulton picked out a man who had some experience in the erection of the Newcomen engine. At any rate it was Harrison who re-erected the Kinneil engine at Soho, and in 1775, when the Bill for the

extension of Watt's patent was before Parliament, he was one of the witnesses examined by the Committee of the House of Commons; he then described himself as "a smith at the Soho Manufactory at Birmingham". With the increase in the engine business and the consequent enlargement of the staff, Harrison became the leading man in the Soho engine-yard, but he was frequently sent out erecting, and many of the earlier engines – Bow, Chelsea, Richmond – were put up or completed by him. One gathers that he was a genial, modest sort of man, not given to making difficulties about his work.

In 1779 Hallamannin, one of the first Boulton and Watt engines put up in Cornwall, was doing badly, the result mainly of faulty erection, and the firm decided upon sending Harrison to put it right.

Harrison's failing was the common one. From time to time he gave way to drinking bouts, moreover he was not a man of any education, so in 1778 when the firm decided to appoint a foreman at Soho, a man called Hall was bought in. Hall's tenure of the position was but a short one, and soon after he left Harrison seems to have been put in charge, and we find him referred to as foreman; possibly his duties were of a more restricted nature than the firm had had in view when engaging Hall. Harrison continued to be sent out erecting for a few years after this; he was erecting Shadwell and repairing Bloomfield in 1781; then, the work at Soho increasing and a number of other men having been trained for erecting, he seems to have remained at head-quarters for the rest of his life. His son, William Harrison, was in due course taken on at the works, was an erector for some years, and then was made foreman of the small engine manufactory in the 6-horse shop at Soho Foundry, 1<sup>st</sup> January 1800, and continued in that station until his death, 24<sup>th</sup> August 1815.

### **Logan Henderson**

The first technical assistant engaged by Boulton and Watt was Henderson. Lieutenant Logan Henderson, according to Smiles, had been an officer of marines, and afterwards a sugar planter in the West Indies; he had lost all he possessed in Jamaica, but had gained a knowledge of levelling, draining, and machinery. In the Boulton and Watt correspondence, Henderson is met with for the first time early in the year 1776. He had submitted to Boulton, from Liverpool, a scheme for a rotary engine, and Boulton in reply had sent him an account of the performance of the rotary engines that had been tried at Soho and invited Henderson to call. Henderson paid a visit to Boulton, and being satisfied that his own scheme was inferior to that of Watt, laid it aside. The visit, however, resulted in his being engaged as an assistant, and early in 1777 we find him in London with Boulton, but living at Deptford and travelling to and fro every day. While in Birmingham he lived in Boulton's house. He had charge of the erection of the Torryburn and Byker engines in 1778, and in 1781 he was in Cornwall with Watt. Boulton had thought that Henderson would have lived with Watt and been an intelligent companion with whom he could have discussed engineering matters. Henderson, however, set up an establishment of his own where he lived with a lady referred to as "Miss Peggy"

Perhaps it was as well that Watt and Henderson did not live together; as it was Watt was far from pleased with him, and his letters of this period to Boulton contain frequent references to Henderson's bad temper and sullenness, and show that there was a good deal of friction between him and Wilson, the firm's agent in Cornwall. With Murdock, Henderson got on very well; indeed it is said that he had a great influence over him, and

that he, Henderson, had asserted that Murdock would leave Boulton and Watt if he did so. In 1782 Henderson returned to Birmingham, and about the beginning of the following year he terminated his connection with the firm very abruptly. In 1784 it seems that he was concerned in a foundry in London, and then in 1790 we find him applying, without success, for the post of Engineer to the Dublin Waterworks.

### **Jabez Hornblower**

The son of Jonathan Hornblower the elder, he came from Cornwall to Soho in the same year that Murdock went from Soho to Cornwall; the firm had offered him work at a guinea a week, the same pay as Murdock was receiving, and he was for a few years one of their erectors. He worked on the Ketley, Donnington Wood, and Penryn-dee engines. However, after a few years he left the services of Boulton and Watt as he did not get on well with the other workmen or with his employers. He went on to become a rival engine-maker leading to further conflict with Boulton and Watt.

### **James Lawson**

James Lawson started work at Soho in 1779 and for many years was connected with Boulton and Watt, Boulton's mint, and Boulton, Watt & Co. He was the son of the Reverend Archibald Lawson of Kirkmahoe, near Dumfries. When he first came to Birmingham he seems to have been in the office, for in 1781 we find him among others, signing letters on behalf of the firm. In the following year, however, he was one of the staff of engine erectors in Cornwall, and Boulton says of him that he can "manage the working of an engine better than any of their engine men."

When men like Lawson were not erecting engines, they were paid, not by Boulton and Watt, but by the person or firm for whom the engine was being erected. There were intervals when, due to the non-arrival of materials or for other reasons, no work was going forward, or there was not enough work for all the Soho men. In one such interlude in 1783 Lawson had taken up mine-surveying and for a long time he was at the Poldice mine in Cornwall.

In 1784 Boulton wrote: "Lawson is making plans and sections at the Cornish mines, certain of the mines propose employing him to record the progress of the workings. He can survey land or dial mines, & is expert under-ground, & I think it would answer to the mines to pay him to keep their drawings in course with their mine. The plans & sections which is Lawson's only employment at present will prove of great importance as they serve to detect great mistakes and to enable the adventurers to see clearly with their own eyes."

It is not clear how long Lawson was engaged on the mine-survey work. By 1791 he was engaged under Boulton himself at the Soho mint. He was in charge of the multiplication of the dies and of one press; he had also the office of Inspector of the 2 fire engines. Although there were many problems with the dies and Lawson was even talking of leaving, Boulton wished to retain him in some capacity or other, for although he found ground for complaint he fully recognized Lawson's skill and intelligence. Later on, in November 1793, when he had gone back to engine erecting, Boulton having entered into a contract to supply fifty tons of cooper coin, asks him if he can leave his business at Leeds and "come to Soho for about a week, in order to see that the 6 presses are in the best order. I should be much obliged to you for I fear Busch is not so much master of

that subject, besides, he has his hands too full, & Perhaps Bill Harrison would like to spend his Xmas with his mother & at the same time could render us a little assistance which with all expenses I will pay with pleasure."

A few months before this he had been in London assisting in preparing models and in getting a case for Counsel for one of the lawsuits relating to Watt's patent.

By this time Lawson was taking a leading position as an outdoor man under Boulton and Watt, and he was representing the firm in Leeds and Manchester. He had formed a friendship with James Watt, junior, and in the autumn of 1800 the two made tour in North Wales; terminating in "a fortnight amongst our Lancashire friends & engines". At the conclusion of this tour Lawson entered into an agreement to act for the Soho firm in Scotland for five years, at a salary rising from £250 to £300 per annum with a commission of 1 per cent on all goods sent to Scotland and ½ per cent upon all orders procured by him elsewhere, the firm guaranteeing that in all he should receive not less than £350 per annum during the first half of the term and £400 during the latter half.

James Watt, junior, was not altogether satisfied that the terms were fair to Lawson, whose services he says he would be sorry to underrate. Some years later, about 1811, Lawson was appointed superintendent of machinery to the Royal Mint at a salary of £800 per annum with a residence, but he continued to transact business, in London, for the Soho firm, and received an allowance from them until his death. Lawson was elected a Fellow of the Royal Society in 1812; he died in London on April 9, 1818.

### **Malcolm Logan**

Malcolm Logan was employed to erect engines both in Italy and in Spain. In 1782 Boulton refers to him as "a handy, active and industrious fellow"; he seems soon after this to have given way to drink, but to have pulled himself up in time, for in 1788 when it was a question of selecting a man to go to Naples, "I think", writes Boulton, "he is the properest man we have to send to Naples, as he is a handy fellow either in wood or iron, or engine, or mill, or pumps." He must in addition have been a man of quick intelligence. Later on, 1795-6, he was at work in Spain.

### **William Murdock**

Murdock's entire life was spent in the service of the firm and his story is closely connected with that of James Watt.

Murdock entered the service of Boulton and Watt in the year 1777, when he was 23 years of age; his name first appears in the books of the firm as "Wm. Mordach"; he was paid at the rate of 15s. a week, and some of his first work seems to have been at pattern-making. He very soon made his mark as a man of ability and intelligence, and as early as January 1779 we find Boulton writing: "I think W<sup>m</sup>. Murdock a valuable man & deserves every civility & encouragement." Murdock was at this time engaged in repairs and alterations to the Bedworth engine. A few months later was sent to take charge of the erection of the Wanlockhead engine, and Boulton writes of him to one of the proprietors: "He hath a good deal of experience in our engines and is capable of putting your people to rights in any matter they may not understand, & we doubt not but he will acquit himself to you & to our satisfaction, as he is a man we have a good opinion of. Pray don't keep him longer than necessary as we want him in Cornwall."

About the same time Watt informed the same customer that he is "a very sober, ingenious young man, who has a good deal of experience under us in putting engines together and knows all the little niceties, the omission of which might cause a bad performance in your engine."

Upon his return from Scotland, Murdock was sent to replace Jabez Homblower in the erection of the Ketley and Donnington Wood engines; in September he and another erector, James Law, were sent to Cornwall. As a precaution, in case of their being taken by the press-gang on the way, they were furnished with letters addressed to prominent men in Bristol and Exeter requesting protection. For the first twenty years Cornwall was Murdock's home; there he married, and there his sons were born. From the first he assimilated with the Cornish men far better than Watt ever did, and with occasional interludes of disfavour he was well liked by the great majority of the people concerned in the mines during the whole of his stay in Cornwall. Temperance in the matter of strong drink was a characteristic that distinguished him from most of his fellow erectors. He was particularly dexterous and resourceful in erecting new engines and repairing the old ones, and he was very hard-working – "indefatigable" is the term applied to him in some of the letters. Thus Boulton, writing on September 30, 1782 from Cosgarne, says:

"Murdock hath been indefatigable, ever since they began he has scarcely been in bed or taken necessary food, for everyone seems helpless in comparison of him....After Murdock had been slaved day & night on Thursday & Fryday last, he rec<sup>d</sup>. a letter from W<sup>1</sup>. Virgin in the West insisting upon his coming over directly as they could not se their engine to work, & if he did not come instantly they would let out ye fire. He accordingly went on Saturday morn<sup>g</sup>, set ye engine to work, wch. went on very well during 5 or 6 hours, & then left it & returned back to ye Cons<sup>d</sup>. Mines about 11 at night and was employed about the engines till 4 this morn<sup>g</sup> & then went to bed. I found him at 10 this morn<sup>g</sup> in Poldice cistern, searching for pins & cotters that had jumped out, and I insisted upon his going home to bed for he had a bad cold."

Two years later Boulton, again writing from Cornwall, expresses his satisfaction in even warmer terms in a letter to Watt, November 8, 1784:

"We want more Murdocks, for of all others he is the most active man & best engine erector I every saw, of w<sup>ch</sup> I had a strong proof this day. They stoped Poldice lower engine last Wednesday & took her all to pieces, took out the condenser, took up out of the shaft the greater part of the pumps, took the Nossells to pieces, cut out the iron seatings and put in brass ones w<sup>th</sup> new valves, mended ye education pipe & did a great number of repairs about the beam & engine, put the pumps down into the new engine shaft, did much work at the new engine, & this day about noon both the engines, new and old were set to work again compleat. When I look at the work done it astonishes me & is entirely owing to the spirit & activity of Murdock who had not gone to bed 3 of the nights, & I expect the mine will be in fork again by Wednesday night. I have got him into good humour again without any coaxing, but have spoke plainly to him in presence of Wilson, have prevail'd upon him not to give W<sup>1</sup> Virgin engines up, which he has resolved to do from the ungenerous treatment he rec<sup>d</sup>. from ye Capt<sup>n</sup>."

Although he was such a valuable man, his pay, for the first few years at any rate, was on a very low scale. When he started in Cornwall in 1779 he received 21s. a week; Law, his travelling companion, had 20s. Twelve months later he wanted an increase of pay,

and thought he was entitled to two guineas a week. Boulton seems to have sympathized with his wishes, but Watt objected and thought it would be very wrong to give this sum, "an example of that kind would ruin us by stimulating every other man we had to similar demands". It is not very clear why Boulton and Watt should have kept the pay so low; it affected them only in so far as it increased the total cost of the engine; the erectors were not paid by them, but by the adventurers for whom the engine was being erected. Boulton managed to stave off the difficulty by persuading one of the mine companies to make Murdock a present of ten guineas, to which he added another ten on behalf of Boulton and Watt. At about this time John Budge, one of the most highly respected of the Cornish engineers, was pressing Murdock to enter into partnership with him. It was the practice in Cornwall for the mine-owners to entrust the management and supervision of their engines to an engineer, such as Jonathan Hornblower or John Budge, who made periodical visits, and might have a number of engines in his care. In this instance Budge has offered Murdock the half of all his engines. However, towards the end of 1782 Murdock obtained an appointment of this nature on his own account – the seven new Boulton and Watt engines at Wheal Virgin and Poldice were placed in his charge at a fee of £6 per month. Boulton seems to have been in high glee at this event.

"Murdock will be well off but it fixes him firm to us and our interest." This fee was in addition to his pay for erecting engines, and no doubt, as time went on, Murdock had more work of this and other kinds, and possibly he was getting into such a position that he could make his own terms with the mine companies for erecting new engines. We find Boulton writing from Cornwall in 1784 that "people in general are much prejudiced in fav<sup>r</sup> of W. Murdock and he is thereby intoxicated to a great degree." And in the same letter we have an indication that he was undertaking work on his own account. "He hath erected a new balance bob at W. Maid wch. hangs in a joint & rolls upon a vertical plane, but it is not so good as your old one and I don't believe he now prides himself upon it."

Moreover, he was now taking upon himself, in erecting new engines, to depart in important features from the drawings supplied from Soho. Thus:

"The small rotative engine at W1. Maid will be set to work in a day or two, but he hath in that varied from your drawings, for he hath hung the spear upon the top of the beam, i.e. ye centre of motion of the top end of the spear or connecting rod is upon the beam whilst the centre of motion of the beam itself is under the beam. This he hath done on order that the revolving wheel shall always stand right to begin its stroke."

Murdock's connection with the invention of the sun-and-planet gear and his iron cement were notable contributions. A more important invention with which his name is identified is the introduction of coal-gas as a lighting agent. His first experiments in this direction were made in Cornwall in 1792, but it was not until his return to Birmingham that anything was done on a commercial scale. The Soho Manufactory was fully equipped for lighting by gas in 1803, and the manufacture of gas-making plant became a distinct branch of the business at the Foundry, which became the training-ground of the early gas engineers.

Another project that Murdock engaged upon during his stay in Cornwall, much to the distaste of Watt and his partner, was that of steam carriages. Murdock had in view an air-cooled surface condenser, and a variable-speed gear; apparently he intended to use the sun-and planet gear with a set of plant-wheels of different diameters.

Watt at this time was engaged in draughting the specification for his patent of 1784, covering the parallel motion and other inventions, and he at once proceeded to incorporate in it such a description of a steam carriage as he could do in the time and space at his disposal. This procedure effectually forestalled other steam-carriage projectors for the time being and allayed Murdock's fears on this point.

Boulton and Watt were, however, keen for Murdock to devote most of his time to sorting out various engines (such as North Downs, as mentioned in a letter from Boulton to Watt, November 8, 1784) rather than to experiments with steam carriages. Boulton made this known to Murdock and the latter modified his activities in line with Boulton's wishes. Yet Murdock did not stop his activities with steam carriages altogether. On the contrary, two years later, there is a distinct evidence that a model had been made, for in August 1786 Wilson writes from Chacewater to Watt: "W<sup>m</sup>. Murdock desires me to inform you that he has made a small engine  $\frac{3}{4}$  dia. & 1 $\frac{1}{2}$  inch stroke that he has applied to a small carriage which answers amazingly." From the terms of the letter that can be little doubt that this was, as far as Wilson knew, Murdock's first model, and that it had been made quite recently.

The next invention of Murdock's that we learn of is for raising water "without pumps or great beam." This is news that Boulton hears in London and transmits to Watt. Wilson a little later sends a more circumstantial account which suggests something in the nature of air-lift pumping; he says that Murdock "let me see his new method of raising water; it is by compressing air at the surface which is forced down small pipes to the bottom of the shaft & there communicates with the main pump & forces up the water, what machinery he has at the bottom I cannot tell, only there is no bucket, but there is a clack to prevent the water falling back; his present machinery is a copper tube of 1 inch dia<sup>f</sup>. & 9 inches long, in this he works a wooden plug, from the side is a very small tube, which goes from the top of his house to his well 40 feet & another larger tube by the side up which the water ascends & runs off continually in an equal stream...He proposes writing to you on the business. He says pipes of 3 inches diameter will do for forcing down the air to work 17 inch pumps; if so there must be a great saving in erecting for deep mines. He has a very small string which goes down to the bottom, which he pulls when he sets to work, I suppose to open a valve."

We learn nothing more about this scheme, so presumably it did not answer Murdock's expectations. Ten years later, just before he left Cornwall for Soho, he was constructing a water-pressure engine at Wheal Fanny, and about the same time he was sending mica to Soho for use in the packing of pistons.

Murdock's sojourn in Cornwall was now drawing to an end. Watt's original patent and the Boulton-Watt partnership would terminate in 1800. Watt himself had ceased to take an active share in the direction of affairs; his son James, and Boulton's son, Matthew Robinson, had now taken over the reins, and the Soho Foundry had been commenced. Business in Cornwall was likely to fall off, and the young men felt, no doubt, that it would be wise to have a man of Murdock's experience, capacity, and energy at their disposal. So Murdock was given a post at head-quarters. He did not finally leave Cornwall until the end of 1798, but he had, before this, visited Birmingham to assist in the deliberations upon the new establishment. At the beginning of 1796 we find a letter from James Watt, junior: "P. Ewart leaves us this evening. The last three days have been spent in scheming between him, Murdock, Mr. Southern and A. Story, they have concluded upon the different lathes, boring and drilling apparatus and drawings of all are made." Peter



Ewart, as we have explained, had been bought to Soho for the purpose of designing the machinery for the new works which were being planned; Storey was the manager of the foundry.

From the early part of 1797 James Watt, junior, was calling for the presence of Murdock at Soho, but there were still many jobs to finish. It had by this time become known in the county that he was leaving Cornwall, and the Cornishmen had begun to realize what his departure would mean to them. An engine was to be put up at Wheal Jewel, and at first the adventurers declined to sign the agreement unless a clause was inserted that Murdock was to erect the engine; on this occasion one of the adventurers said that "two years ago M. might have gone to the devil for anything the county cared, but that by the blessing of God their eyes were now opened", and even after he had left Cornwall he was pressed to come back to their assistance at North Downs and other mines.

Upon his arrival at Soho, Murdock set himself with great vigour to getting the boring-mill completed. When this had been done, it seems that it did not answer very well, and there was some delay in settling the plan of a new mill.

Murdock then felt himself at a loose end: "he will begin to think he is losing his time here", writes the younger Boulton; "I have endeavoured to occupy his attention with several other schemes which are going forward, but the construction of the boring-mill being his principal hobby-horse, his thoughts are continually recurring to this favourite subject."

Possibly as one means of occupying his attention about this time, Murdock, with Storey the foundry manager for his companion, was sent on a voyage of discovery to Leeds. Matthew Murray was turning out iron castings and smithwork far superior to the Soho productions, and it was desired to find out how he managed this.

Another project in which Murdock's aid was enlisted was the production of a smaller and cheaper engine than had been made hitherto at Soho. The young partners were convinced that there was a wide field for such engines, and Murdock appears to have been responsible, in the main, for the design of a self-contained engine, known as the "bell-crank" engine. It did not prove a success, but it embodied one of Murdock's most important inventions – the long D-slide valve. This is one of the inventions covered by his patent of 1799. Another is the use of a worm and wheel for driving the bar of a boring-mill; this was applied at Soho both for boring and for large turning-lathes. In his specification he says that the screw "I have commonly used has three threads, is 16 inches diameter, and the advance by one revolution is 6 inches." Probably this was the size used for the boring-mill referred to above.

No doubt from time to time Murdock paid business and other visits to Cornwall. One such visit was in the early part of 1800, and he writes to James Watt, junior, that some of the Cornish mining people say they "are going to make an offer that will be greatly for my benefit if I will remain in Cornwall", and he asks for directions as to the answer he is to make. It appears, too, that Murdock had been asked to recruit smiths for Soho, and in the same letter he states: "I hoped to have sent three before this, but there is a report circulates here that you have starved Simon [Vivian] and his family and at this time I cannot prevail on any of them to go."

Murdock's position at Soho was put on a definite basis in the year 1800 when he entered into an agreement to serve for five years at a salary of £300 per annum, with an

allowance of 1 per cent on all orders for Soho Foundry. This arrangement prevailed up to the year 1810; but he was then getting, in addition, a commission of 1.5 per cent, on all the gas-lighting apparatus made, and his total income amounted to £684.

He was in 1810 put on the footing of a partner at Soho Foundry, but in lieu of a share in the profits, he elected to take a salary of £1000 a year, and this he received for the next twenty years, up to 1830, nine years before his death.

### **Isaac Perrins**

One of the first engines put up by Boulton and Watt was that at Bloomfield Colliery. The proprietors had arranged to put up a Newcomen engine and an engineer named Perrins had undertaken the erection. When they were induced to put up a Boulton and Watt engine instead, Perrins retained his position and erected it; afterwards he was concerned in the erection of Bedworth, Bog Mine, and Minsterley engines. Perrins seems to have been advanced in years; he died in 1780 and is then referred to as "old Perrins", although the adjective may have been used merely to distinguish him from his sons. One of the sons, Issac, was offered a job under the firm in Cornwall in 1780, and this he declined, but early in 1782 he applied for work and was taken on at twelve shillings a week. He was connected with Boulton and Watt for some years, and of all the men under the firm, Issac Perrins was the best known to contemporaries and his name must have been an even more familiar one to the public than that of James Watt himself, for he was a prize-fighter. One morning in 1788 Watt, in Boulton's absence, dealing with the correspondence of the firm, opened a letter from a gentleman in London enclosing a newspaper cutting, and saying "In the enclosed paper of mine is an offer from a person living with you, to fight any man in London; would you please to inform me by a letter of what age Perrins is, what weight he has been known to carry, and something of his mode of life, that I may see whether a match cannot be made for him."

One can picture the consternation with which the staid Watt must have perused this letter, Watt who for a few years before had made it a condition in engaging Southern that he was to enter into a bond to give up music! It is clear that Watt was not aware of Perrin's proclivities, for he minuted the letter "Mr. Roberts, please inform me of the truth of this matter, that I may write to Mr. Boulton." Boulton, however, was not in such ignorance; five or six years before Perrins had fought "the famous Jimmy Sargent" and had beaten him thoroughly, and Boulton was dully informed of that event by Scales. The fight that followed Perrin's challenge on the present occasion terminated quite differently, for he was badly beaten by his opponent, Thomas Johnson, a smaller and lighter man. Perrins was a big fellow, over six feet high and judging from the picture, which is extant, of the fight, he must have been a fine-looking man.

His defeat does not seem to have checked his ardour for fighting; eighteen months after we find James Watt, junior, writing to Southern:

"I advise you to get I. Perrins sent off into the country as soon as you can, for he has received a letter from Mendoza pressing him to fight Big Ben, and offering to back him with £100. If the Birmingham gamblers hear of this, as he seems well inclined to inform them, I am certain they will find it no difficult matter to work up his passions, so as to induce him to challenge his rival, in which case you may bid adieu to him for ever."

Soon after this Perrins was sent to erect engines in Manchester and towards the end of 1793 he moved his household there and took a public-house, still keeping on his work as engine erector, but about a year later, having quarrelled with and threatened Lawson, Boulton and Watt discharged him from their service. Among the points made against him on this occasion was the slovenly condition in which the Boulton and Watt engines in Manchester were kept; but, as Perrins points out in a very outspoken manner, the firm had never paid him anything to look after the engines: "If you had allowed me a competency to have kept them clean, I should not be afraid of dirtying my hands with doing it as some of your servants are that you send here with ruffles at hands and powdered heads, more like some Lord than an engineer. It cannot be thought that I can lose my time and neglect my own business without some consideration for it."

In spite of this shortcomings, no doubt Perrins was a capable man as an engine erector; the terms of James Watt junior's letter, referred to above, make it clear that the firm did not wish to lose him, and for years after he had ceased to be an accredited erector for Boulton and Watt he continued to be employed to put up their engines in the Manchester district. Some of the mill-owners preferred to employ him rather than rely upon the men sent from Soho, and he was able to keep a staff of men employed.

### **William Playfair**

Early in 1778 the increase in work and some troubles with the men led to the appointment of a foreman at Soho. Hall was selected for the post, but he did not prove suitable. Watt wanted to turn him out straight away, especially as Hall had been found making things for himself at Soho with the firm's materials. In the event, he was sent out as an erector and worked on the Ketley, Wren's Nest and Snedhill engines; after which he was dropped from the firm's list of erectors.

To make up in some respect for the loss of Hall at Soho, Watt suggested to Boulton (June 27, 1778) "I would recall Playfair who can do part of the business, and I think now that you are at home you can contrive to give him proper assistance. I must warn you that Playfair is a blunderer." Playfair was brother to John Playfair, a professor at Edinburgh University, and son of the Reverend James Playfair of Bervie near Dundee; like Rennie he served an apprenticeship to Andrew Meikle. He had been employed as draughtsman and clerk to Watt for a brief period before this. Evidently Watt had not a high opinion of him; however, he bought back, but again he was with the firm for but a limited time, and his connection ceased in 1781, when we find Boulton writing (October 23<sup>rd</sup>) that he was sorry Playfair is going, only on account of Watt not having any proper assistant in drawing. Playfair went into business on his own account in London; he took out several patents, but finally dropped into literary work. He wrote a memoir of Watt for the *New Monthly Magazine* which James Watt, junior, found very displeasing; there is a bundle of correspondence on this matter among the papers at Doldowlod.

### **John Southern**

With increasing business, Watt's work had become very heavy, and we find Boulton constantly urging him to get an assistant. After the departure of Playfair in 1781, Boulton suggested a number of young men, and among them John Southern. "I think young Southern would be a very likely person, he seem good-humoured and very obliging. He is now with his brother as a surgeon, but says that though he is keen in the study of surgery, yet he had rather have been employed under you as a draughtsman and

assistant, and if you wish to have him I know he will gladly come. He draws tolerably neat."

John Southern was one of the sons of Thomas Southern, residing at that time at Wensley, near Wirksworth, Derbyshire, and interested in mining affairs in various parts of the country.

Boulton followed up the letter by another again recommending the employment of Southern. To this Watt, then in Cornwall, replies: "If you have a notion that young Southern would be sufficiently sedate, would come to us for a reasonable sum annually, and would engage for a sufficient time, I should be very glad to engage him for a drawer, provided he gives bond to give up music, otherwise I am sure he will do no good, it being the source of idleness."

Other letters follow, and in June 1782 Southern, then at the age of 24, starts with Boulton and Watt on a three years' agreement, and with them he remained until the end of his life. He seems to have dropped into his place without hesitation or friction of any kind, even Watt makes no complaints of him, and he soon proved a valuable assistant and relieved his chief of a good deal of work.

In 1793 Southern married the daughter of Thomas Dobbs of Kings Norton. Dobbs had a Boulton and Watt engine put up in his rolling-mill in 1787, and it may be that Southern's visits on this business led to his acquaintance with the lady.

At one time Southern seems to have interested himself with political affairs, and in 1794 we find Boulton writing that he had called on the Marquis of Stafford, and had learnt that from papers lately seized it appeared "that the country was upon the brink of a ruinous attempt to overthrow its Constitution...I hope to God our Southern is out of the mess, & that none of his letters will be found amongst these papers, & I wish you would speak to him about it, for I have reasons for my fears & wish to guard him."

With this exception Southern seems to have passed a quiet, uneventful life, devoting himself to his business and to scientific research. Whether he gave up music in deference to Watt's desire is not known. There is good reason for thinking that he was the inventor of the steam-engine indicator, that is, as we now understand the term, an instrument with a pencil for tracing the diagram of the varying pressure in the cylinder of an engine.

When in 1791 the Birmingham rioters attacked Edgbaston Hall, then in the occupation of Dr. Withering, we learn that "Mr. Sutherne, a clerk to Boulton and Watt" was one of the party who engaged in the defence of the house.

In 1800 Southern was given in addition to his salary a percentage upon all goods produced at the Soho Engine works, or in lieu thereof £600 per annum, and later in 1810 he was admitted a partner in the firm of Boulton, Watt & Co., to receive one-sixth of the profits. After his death the firm settled £2,000 on Mrs. Southern and the children.

One imagines that Southern was not a man of robust health. In 1812 he was ill in London and in the hands of a doctor; two years later he spent some time at Aberystwyth; he seems to have had a fall and to have gone there to recuperate his health.

He returned to his duties but died at the age of 57 years, in July of the following year, 1815, at his house at Handsworth. Southern was buried in the King's Norton church in the family vault of his wife's father Thomas Dobbs.

### **Thomas Wilson**

In connection with the affairs of Boulton and Watt in Cornwall, the name of Thomas Wilson regularly occurs. He was at Chacewater in 1777 when the Wheal Busy engine (the first Watt engine set up in Cornwall) was ordered, acting as agent for the proprietors, Fentons and the Yorkshire Copper Company. Watt stayed in his house on his first visit to Cornwall, and possibly it was on this occasion that arrangements were made with him to act as the commercial or financial agent for the firm in Cornwall, a position that he continued to hold until the expiry of Watt's patent in 1800. He was an active and intelligent man, but it would seem that he engaged in too many different undertakings to make a great success in any of them. A lively account of his activities in the year 1785 is given by Boulton, who, after discussing the conditions at Chacewater and the difficulty of making the mine pay, goes on:

"I know Mr. Wilson says he had a very good opinion of her, but I will form mine only upon facts, & not opinions. Mr W. hath now several partnerships in shares of ships, he hath always had the tickiting to attend, the assay office, the accts of the Welsh works, the several mine accounts, in wch, he, we & Wilkinson are concerned; he hath a partnership with Ned Rogers in 2 or 3 farms; he hath another with Lantie Atkinson in other farms; his candle trade is a very large concern; he hath several partnerships with diff't. persons in pairs of mules. He hath B & W. business to manage, with gunpowder, candle accounts, stamps, & c., and he hath a large family. I heartily wish him success in these & all other undertakings, but it must be evident to you that he cannot bestow any attention to the mine."

For his services to Boulton and Watt, Wilson was paid a commission of 2.5 per cent on the premiums derived from Cornwall. For the twenty years 1781-1800 he received the sum of £3,485 or a little over £174 per annum on average. He died in 1820, at the age of 72 years, and was buried at Falmouth.