

## **BIBLIOGRAPHY CONCERNING JAMES WATT**

BIBLIOGRAPHY reprinted from *James Watt and the Steam Engine*. H.W. Dickinson and R. Jenkins (2<sup>nd</sup> edition 1981. Moorland Publishers).

See Appendix I, pp.359-372.

First published in 1927.

### **GENERAL NOTES**

It is a matter for regret that James Watt, although so ready with his pen, as evidenced by his voluminous letter-writing, wrote practically nothing for publication; what he did write might be said to have been almost exclusively for professional or business purposes. He had some thoughts in 1773 of writing a book on "the elements of the theory of steam engines", in order to advertise the engine (see letter from Watt to Small, August 17, 1773). Again, in 1778 it was stated: "The result of these experiments (i.e. on the volume of steam) he intends to lay before the publick, in a treatise upon that subject." (see Pryce: *Mineralogra Cornubiensis*, p.309) Nothing came of these, however.

After his retirement from business, at the solicitations of his friends, his thoughts reverted to the subject of writing a history of his improvements in the steam engine, and there is evidence that about 1808 he collected and annotated a good deal of matter for the purpose. His disinclination to court publicity, and his advancing age led to the project being shelved. The occasion of the publication of the collected works of his old friend Robison, however, stirred Watt to action in 1814, but the result was rather annotations on the former's work than an original monograph such as we, at the present day, should have prized.

A very valuable source of information about Watt personally is to be found in the documentary matter preserved by the present representative of the family. This matter covers the whole of his life and comprises letters, letter-books, note-books, journals, accounts, reports, memoranda, patent specifications, law cases, drawings, and books on the steam engine. Of the letters alone, there are several thousands. (Referred to by Dickinson and Jenkins as the Doldowlod Papers.) Speaking broadly, this is the material used by Muirhead in his biographical works on Watt mentioned below.

An equally valuable source of information, more particularly from the technical point of view, for the period 1775-1800 and, indeed, later still, is the Boulton and Watt Collection. This material constitutes the records of the firm, and comprises upwards of 10,000 drawings with a very large number of documents such as correspondence and letter-books, together with printed books, models, and plant.

When the effects of the firm were dispersed in 1895 these objects were purchased by the late Mr. George Tangye, who presented them in 1911 to the City of Birmingham; they are now housed in the Free Reference Library (now known as the Central Library, Birmingham and referred to by Dickinson and Jenkins as the B. & W. Colln.) This matter has not been utilized hitherto to any extent and has consequently been drawn on extensively for the present volume (Dickinson and Jenkins point out).

Another collection comprising journals, deeds, ledgers, letters, printed matter, and other documents, in the main complementary to the two collections named above, was in the possession of Lionel B.C.L. Muirhead, Esq., a relative of the biographer of Watt, till September 1921 when it was handed over to the care of the Free Reference Library, Birmingham (now known as the Central Library, Birmingham and referred to by Dickinson and Jenkins as the Muirhead Papers).

About a thousand letters from Watt to Matthew Boulton, together with a few to Dr. William Small, covering the period 1768 till his death, along with a large amount of documentary matter

concerning Boulton's business undertakings, were preserved by the Boulton family at the family seat, Tew Park, Oxon., till last year when they were removed to the Assay Office, Birmingham. (Referred to by Dickinson and Jenkins as the Boulton Papers and now also at the Central Library, Birmingham.) This material was used both by Muirhead and Smiles.

The Central Library, Birmingham also possesses the following papers:

*Letters from James WATT to John SOUTHERN*, 1789 to 1815. In 1 vol.4to. (Referred to in this volume as the Southern Papers.)

*Collection of original letters, &c.*, relating to WATT and BOULTON and SOHO (1761 et seq.) formed by Samuel TIMMINS. 1 vol.fol.

*Letters from R. CARRUTHERS*, five in number, to W.C. Aitken, relating to Burns and James WATT, 1851-69.

*Letters from Samuel SMILES* to W.C. Aitken relating to James WATT and James KEIR, 1861-70. (In a collection of papers of W.C. Aitken.) 8vo.

*Extracts relating to BOULTON, WATT AND EGINTON*, 1808-95 (c.1895), by G.N. Osborne. 1 vol. 4to.

Other bibliographical matter is arranged below chronologically, explanatory notes being appended to any item where this course seems to be needed. Some sifting has been effected, and mere compilations of matter already published have been excluded.

## **DETAILED NOTES**

MACKELL, Robert, and WATT, James.

An account of the navigable Canal, proposed to be cut from the Tiver Clyde to the River Carron, as surveyed by Robert Mackell and James Watt.  
London, 1767. 18pp., 4to. 1 engraved map.

This was a scheme for joining the rivers Forth and Clyde by a canal via the Loch Lomond passage. As eventually carried out by Brindley and Smeaton, the direct route for the Canal was adopted.

WATT, James.

A scheme for making a navigable Canal from the City of Glasgow to the Monkland Coalierys.  
Glasgow, [1769]. 12 pp., 4to.

This was the Monkland Canal, the first part of which was carried out entirely by Watt.

WATT, James.

Report concerning the Harbour of Port-Glasgow, made to the Magistrates of Glasgow, by James Watt, Engineer, and submitted to the consideration of the Merchants.  
Glasgow, Aug. 9, 1771. 8 pp., 4to.

WATT, James.

A Report to the Honorable His Majesty's Commissioners for managing the Annexed States in Scotland concerning the Isthmusses of Tarbert and Crinan.  
Glasgow, Dec. 21, 1772. 107 pp., 4to.

Only known to the Editors in the manuscript state. One copy, no part of which is in Watt's handwriting, is preserved in the British Museum. (Add. MS. 9059.)

WATT, James.

An account of the scheme for rendering navigable the Rivers Forth and Devon with estimates of the Expense by James Watt.  
Edinburgh, MDCCLXXIV. 4to.

WATT, James.

*An account of JAMES WATT'S Improvements upon the Steam or Fire Engine.*  
(London 1774.) 8 pp., fcp. 4to.

This was the statement that Watt distributed to Members of Parliament when the Bill for extending his patent was before the House, as evidenced by his note on one copy in the Boulton and Watt Collection: "Delivered to the members of the House of Commons, 1774-5."

PARLIAMENT, Houses of.

An Act for vesting in James Watt, Engineer, his executors, administrators and assigns the sole use and property of certain steam engines commonly called fire engines, of his invention, for a limited time.

15 Geo. III, clxi, pp. 1587-94.

London (1775), fol.

Prior to its passage into law, it was printed as a Bill. It was reprinted subsequently in several forms.

PRYCE, William.

*Mineralogia Cornubiensis.*

London, 1778, fol.

In the Appendix, p. 308, a full description of and historical notes on Watt's engine are given, but no drawing. The information was supplied by Watt (Boulton to Henderson, 1777 Aug. 13) and is the first public notice of the engine in print. Both Boulton and Watt were subscribers to the book.

BOULTON and WATT.

*Proposals to the adventurers in...by Boulton and Watt.*

(Birmingham, 1778) 8 pp., 4to.

A form to be filled up for any one wishing to erect their engines. The experiments at Poldice on the coal consumption of the existing fire-engine are described. One paragraph reads: (3) "The profit which we require for such licence drawings and instructions is to be such sums...as shall be equal in value to a third part of the savings in fuel."

WATT, James.

*Directions for erecting and working the newly-invented steam engines by Boulton and Watt.*

(Birmingham, 1779) iv+24+16 pp., 6 plates, 12 mo.

Reproduced in full in Appendix II. Comprises "General Directions for building the engine house"; "Directions for putting the engine together"; "Directions for working the engine"; "Additional directions" and "Explanation of plates". These directions are detailed and precise, clearly revealing Watt's hand. The booklet was meant for private circulation among the firm's engine erectors and clients.

It is obviously a compilation. E.g. the "additional directions" are separately paged and the plates are numbered X to XII. This is known to be the case, as separate portions exist in manuscript in the Boulton and Watt Collection. Five of the copper plates are still preserved there. The date is fixed by entries in Watt's journals, see Chap. XX, showing when he was at work upon it.

PRIESTLEY, Joseph, LL.D.

*Experiments and observations relating to various branches of Natural Philosophy.*

Birmingham, 1781. 8 vo.

The second volume has on p. 388 an appendix Number III, entitled "Observations on this volume with which I was favoured by Mr. Watt". This is one page of notes which reveal Watt's acquaintance with the chemistry of the day.

[BOULTON and WATT.]  
Directions relating to the Engine.  
[Birmingham, 1784.] 1 sh., post.

Reproduced in full in Appendix III. The sheet was obviously meant to be hung up on the wall of the engine house.

[WATT, James.]  
Remarks on a Government Paper entitled Iron Trade, England and Ireland.  
(London, 1784), 3 pp., fcp.

Several copies of this paper exist in the Boulton and Watt Collection, but there is no definite evidence that Watt wrote it; the subject matter would point rather to Boulton or Wilkinson as the author. The occasion was a proposal by Mr. Pitt to impose additional duties on manufactures exported to Ireland from Gt. Britain.

There is another paper in existence, entitled "An Answer to the Treasury paper on the Iron Trade of England and Ireland", whose composition much more savours of the hand of Watt.

WATT, James.  
Thoughts on the Constituent Parts of Water and Dephlogistigated Air; with an account of some Experiments on that Subject. In a letter from Mr. James Watt, Engineer, to Mr. De Luc, F.R.S. Read Apl. 29, 1784 (before the Royal Society). Printed in *Phil. Trans.*, LXXIV, pp. 329-53.  
Sequel to the Thoughts on the Constituent Parts of Water and Dephlogistigated Air: in a subsequent letter from Mr. James Watt, Engineer, to Mr. De Luc, F.R.S. Read May 6, 1784. Printed in same vol. of *Transactions* : pp. 354-7.

The original letters are still in the possession of the Royal Society (Guard Book No. 74). These letters gave rise to a bitter controversy between the supporters of Watt and Cavendish as to which of them had the prior claim to the discovery of the composition of water. The letters, with much additional matter, were subsequently reprinted in volume form.

DALRYMPLE, Sir John.  
Address and proposals from Sir John Dalrymple on the subject of the Coal, Tar and Iron Branches of the trade.  
London and Edinburgh, 1784. 15 pp., 8 vo.

Sir John was one of the Barons of Exchequer in Scotland. Writing to Matthew Boulton on Aug. 6, 1784, he encloses a copy of what he calls "a little pamphlet" in one part of which he says: "I have done justice to your and Mr Watt's great improvements upon the Fire Engine."

WATT, James.  
Heads of a Bill to explain and amend the laws relative to Letters Patent and grants of privilege for new Inventions.  
B. & W. Colln. MS. 15 pages, 4 to.

Probably drafted in 1785 or 1786 when there was some talk by opulent manufacturers of combining to attack patents just as Arkwright's had been treated. Watt says:  
"A pursuance of such decisions as have been given lately in several cases must at length drive men of invention to take shelter in countries where their ingenuity will be protected."

Boulton writing to De Luc was still stronger.  
"Some late decisions against the validity of certain patents have raised the spirits of the illiberal, sordid, unjust, ungenerous and inventionless misers who prey upon the vitals of the ingenious, and make haste to seize upon what their laborious and often costly application has produced." (see Boulton Papers: Watt to Boulton, March, 1786).

[BOULTON and WATT.]  
Short Statement on the part of Messrs. Boulton and Watt, in Opposition to Mr. Jonathan Hornblower's Application to Parliament for an Act to prolong the Terms of his Patent.  
Birmingham, 1792. 1 sheet fcp., folded.

Hornblower was only trying to do for his compound engine patent what Watt and Boulton had done for the separate condenser patent. It appears from the Boulton MS. that Watt got thoroughly alarmed at the competition threatened by

Hornblower, and it is said that they lobbied actively against the prolongation of the patent with the result that it was not granted.

[BOULTON and WATT.]

Observations on the part of Messrs, Boulton and Watt re: Hornblower's steam engine bill. [Birmingham], Apl. 17, 1792. 1 p., fcp.

WILSON, Thomas.

A comparative statement of the effects of Messrs. Boulton and Watt's Steam Engines with Newcomen's and Mr. Hornblower's. Addresses to the lords of, and adventurers in mines in Cornwall.

Truro, 1792. 25 pp., 8 vo.

WILSON, Thomas.

An address to the Mining Interest of Cornwall on the subject of Messrs. Boulton and Watt's and Mr. Hornblower's engines.

Truro, 1793. 22 pp., 8 vo.

Addressed similarly to the last.

Wilson was the agent in Cornwall of Boulton and Watt, and there can be little doubt that the above two pamphlets were prepared by him at the firm's instigation, or possibly by Watt himself, to counteract the Hornblower competition.

COURT OF COMMON PLEAS.

The Special Case in the cause of Boulton and Watt against Bull, in the Court of Common Pleas, with the arguments of the Judges thereon; and an Appendix of matters referred to.

London, 1795. 3 pp., fcp.

Quite probably edited by Watt.

The Special Case in the cause of Boulton and Watt against Bull, in the Court of Common Pleas, with the arguments of the Judges thereon; and an Appendix of matters referred to.

London, 1795. 8 pp., 8 vo.

This is merely a reprint of the preceding in handier format. Contains the shorthand report of the case. The Appendix is a list of patents in which *methods* of doing something were specified.

BEDDOES, Thomas, M.D., and WATT, James.

Considerations on the medicinal use of factitious airs, and the manner of obtaining them in large quantities. In two parts. Part I by Thomas Beddoes, M.D. Part II by James Watt, Esq.

Bristol, 1794. 8 vo. Separately paged, Part I, 48 pp., and Part II, 33 pp.

The sub-title of Part II is: Description of an Air Apparatus; with hints respecting the use and properties of different elastic fluids. By James Watt, Esq.

Consists of a series of letters of various dates from June 17 to Oct. 2, 1794, giving descriptions and drawings of the apparatus. Under date July 14<sup>th</sup>, Watt mentions that at Dr. Beddoe's desire: "Boulton and Watt have agreed to manufacture these machines for the Public."

BEDDOES, Thomas, M.D. and WATT, James.

Considerations on the medicinal use, and on the production of factitious airs Part I by Thomas Beddoes, M.D. Part II by James Watt, Engineer. Edition the second, to which are added communications from Doctors Carmichael, Darwin, Ewart...and others.

Bristol, 1795. 8 vo. Separately paged, part I has 172 pp., Part II has 40 pp., 5 copper-plates, and two tables.

In Part I there is a note that "at Mr. Chippendale's, *Salisbury Court, Fleet Street, London*, Mr Watt's Air apparatus may be seen".

Part II has the sub-title, "Description of a pneumatic apparatus with directions for procuring the factitious airs, by James Watt, engineer." The preface dated January 1795 says: "The Author has also availed himself of this opportunity to methodize and elucidate his description in a manner which the former hasty publication would not admit of."

Both second and third editions were printed also at Birmingham. "Edition the third, corrected and enlarged", appeared in 1796. Paged continuously 222 pp., 5 pl.

BEDDOES, Thomas, M.D. and WATT, James.

Considerations on the medicinal use and production of factitious airs. By Thomas Beddoes, M.D., and James Watt, Engineer. Part III. Bristol, 1795. x + 121 pp., 3 pl., 8 vo.

Contains letters from physicians and others as to the treatment, among them being three from Watt (pp. 34, 36, and 105).

A 'Second Edition, corrected and enlarged' appeared the following year.

Bristol, 1796. xx+178 pp., 3p., 8 vo.

BEDDOES, Thomas, M.D., and WATT, James.

Medical cases and speculations; including Parts IV and V, of consideration on the medicinal powers, and the production of factitious airs by Thomas Beddoes, M.D., and James Watt, Engineer.

Bristol, 1796. 8 vo. Part IV, XV + 168 pp. Part V separately paged, 96 + (25 to 42 bis), 2 plates Nos. 4 and 5, is entitled: "Supplement to the description of a pneumatic apparatus, for preparing factitious airs; containing a description of a simplified apparatus and of a portable apparatus. By James Watt, Engineer." 42 pp. of this is devoted to a description of the apparatus. A price list is given. The descriptive portion of Part V was reprinted with the same title as a separate pamphlet, evidently to push the sale of the apparatus.

Birmingham, 1796. 48 pp., 8 vo.

The reason why Watt was led to the study of this branch of medicinal treatment, viz. inhalation of oxygen, &c., was that his youngest son Gregory, by his second wife, a lad of great promise, suffered from consumption. In fact, consumption was in the family, for a daughter, Jessy, had died of the complaint in 1794. In spite of all the care expended on Gregory he, too, died of the disease in 1804, while staying in Devon on account of his health; he was buried in Exeter.

Thomas Beddoes was the well-known and enterprising physician who founded the Pneumatic Institution.

WATT, James, junior.

Directions for using the patent portable Copying Machines. Invented & made by James Watt and Company of Soho, near Birmingham. [Birmingham, 1795.] 18 pp., 12 mo.

Some copies have as a frontispiece a copperplate engraving of the desk. The pamphlet states that machines are to be had from Richardson and Harrison, Leadenhall St.

Directions for using the patent portable Copying Machines invented and made by James Watt & Company of Soho, near Birmingham.

Birmingham, 1813. 16 pp., 12 mo.

With the exception that some of the introductory matter is deleted, and a few mistakes corrected, this is only a reprint of the preceding. Reprints of this were bought out in 1818 and 1830.

Manière de se servir de la Machine Portative à Copier. Inventée & Patentée par Jacques Watt & Co., de Soho, près de Birmingham.

Birmingham, 1805. 16 pp., 12 mo.

A French translation of the pamphlet became necessary owing to the fact that a sale for the copying machine had been created abroad. This is possibly not the earliest edition.

Manière de se servir de la machine à copier. Inventée & patentée par Jacques Watt & Co., a Soho, près de Birmingham.

Birmingham, 1807. 24 pp., 12 mo, 1 plate.

Practically a reprint of the preceding. A further reprint was bought out in 1818, 16 pp., 12 mo.

Anweisung zum Gebrauch der tragbaren Kopir-Maschinen erfunden und verfertigt von James Watt und Comp. zu Soho bei Birmingham.

Birmingham (? 1805). 24 pp., 12 mo.

Probably prepared at the same time as the French translation. The agent for the machines was G. H. Busch, Hamburg.

Watt patented the press copying system, and the machine therefore in 1781. A separate firm, James Watt & Co., was formed to exploit the invention, and their letter book, the first in which the system now so wide-spread was used, is preserved in the Boulton and Watt Collection. The sale of the machine was hindered by the prejudice of bankers and business people generally, and it was not till the patent had well nigh run its course that this opposition gave way before the merits of the system. It was at this time that James Watt, the younger, saw that the firm would not reap where they had sown unless the manufacture of the machines was taken up more vigorously, as another firm was already making machines. He bought out a portable form of the machine, combined with a writing-case and, as we learn from the Boulton correspondence [Boulton Papers] which fixes the date, compiled the above "Directions" in order to push the invention. It is not unlikely that Watt may have revised the manuscript.

PRONY, Gaspard Clair François Marie Riche de. Nouvelle Architecture Hydraulique.  
Paris, 1796. 2 vols. 4 to, plates.

The double-acting engine described is stated (vol. I, p. 571) to be that constructed by MM. Périer Frères in 1790, based on a model to the scale of 1 in. to a foot made by M. le Chevalier de Bettancourt as a result of a visit to England in 1788. It is stated to have been "entièrement de l'invention" of that gentleman, but this claim was afterwards withdrawn and it was admitted that the information was taken from Watt's engines. The drawings are therefore the earliest published representing the Watt engine.

BRAMAH, Joseph.

A Letter to the Rt. Hon. Sir James Eyre, Lord Chief Justice of the Common Pleas: on the subject of the case, Boulton and Watt v. Hornblower and Maberley, for infringement of Mr. Watt's patent for an improvement on the Steam Engine, by Joseph Bramah, Engineer.

London 1797. 90 pp., 8 vo.

Substance of matter prepared by him as witness for the defence in the above trial.

ROBISON, John, M.A., LL.D., F.R.S.E.

Articles "Steam" and "Steam Engine" in the *Encyclopaedia Britannica*, 3<sup>rd</sup> edition, vol. XVI.

Edinburgh, 1797. 4 to, 3 plates.

WATT, James.

Specification of an invention of certain improvements upon Steam or Fire Engines for raising water and other mechanical purposes, and certain new pieces of mechanism applicable to the same by James Watt, Engineer.

[London, 1798.] 4 to, 19 pp. + 7 pp. references, 2 pl.

Simply a transcript of the patent specification of Mar. 12, 1782 (No. 1321). It is not obvious why it was printed, as the patent had then expired – probably it was intended for private circulation.

COURT OF COMMON PLEAS.

The arguments of the Judges in two Cases relating to the Letters Patent granted to James Watt, Engineer, for his method of lessening the consumption of steam and fuel in Fire Engines. Taken in shorthand by Mr. Gurney. In two parts: with an Appendix.

London, 1799. 104 pp., 8 vo.

The first part is a transcript of Watt's first patent specification, Jan. 5, 1769 (no. 913), and of the Act for extending the patent for twenty-five years from May 22, 1775.

The second part contains the reports of the cases Boulton and Watt v. Bull, and the same plaintiffs v. Hornblower and Maberley. As to the first of these two, the pamphlet merely reprints the matter given earlier, dated 1795.

ROBISON, John, LL.D., F.R.S.E.

Two articles, "Steam" and "Steam Engines", written for the *Encyclopaedia Britannica*...with notes and additions, by James Watt...And a letter on "Some Properties of Steam" by the late John Southern, Esq.

Edinburgh, 1818. 184 pp., 8 vo., 8 plates.

This is a reprint of the article above, with much additional matter comprising corrections in the text, footnotes, and an appendix from Watt's own pen, together with a covering letter to Sir David Brewster from Watt, dated Heathfield, May 1814.

The reason which had moved Watt to take all this trouble was his great regard for the memory of his old friend, Robison, an edition of whose works (see below) was then being prepared under the editorship of Sir David Brewster. This is explained in a pencil note on the copy now in the British Museum, which Watt sent inscribed "To the Right Hon. Sir Jos. Banks, Bart., G.C.B., etc., etc., from his obliged servant James Watt." The note reads: "The book of which this forms a part will not be published till winter, and until that time Sir Joseph is respectfully requested to keep this in his own possession, June, 1818."

In the covering letter to Brewster, which, by the way, was also printed in *Edin. Phil. Journ.*, 1820, II, by permission of James Watt, junior, Watt says: "I have not attempted to render Dr. Robison's memoir a complete history of the Steam-engine; nor have I even given a *detailed* account of my own improvements upon it. The former would have been an undertaking beyond my present powers, and the latter must have exceeded the limits of a commentary upon my friend's work. I have therefore confined myself to correcting such part as appeared necessary, and to adding such matter as he had not an opportunity of knowing."

Watt takes the opportunity of correcting the statement that he had been the pupil of Dr. Black at Glasgow, and that he had owed the improvements on the steam engine to Black's instruction.

The importance of the memoranda, for we can call them nothing more, is that they are really all we have at first hand from Watt himself upon his inventions. The letter from Southern is addressed to Watt under date March 1814, and gives the result of his and William Creighton's experiments and calculations on the temperance and pressure of steam, figures which remained the authority till superseded by the more precise figures established by Rankine. One or two letters passed between Watt and Southern about this time. For example, Watt writes: "I am at work on the Proffrs acct of my invention in the Dictionary, which I find will be a difficult thing to correct leaving any of the Proffrs words." (See Southern papers: Watt to Southern, December 20, 1813).

FAREY, John

Article "Steam Engine" in Rees's *Cyclopaedia*, vol. XXXIV.

London, 1819. 4 to, plates.

The fullest practical account of the steam engine that had appeared up to that date. Written subsequently to 1816 with information obtained from Watt. The plates alluded to are dated 1812 to 1818. The author subsequently expanded the matter into book form (see below).

HACHETTE, Jean Nicolas Pierre.

Notice sur la vie et les travaux de James Watt.

*Bulletin de la Société d'Encouragement*, CLXXXII, August 1819.

Very brief-Hachette had just been in England and had received from James Watt, junior, a bust by Chantrey for the Société d'Encouragement.

JEFFREY, Hon. Francis, Lord.

Character of Mr. Watt. Obituary eulogy in *Scotsman* newspaper. Edinburgh, Sept. 4, 1819. This was reprinted in *Edinburgh Magazine*, September 1819, no: 203.

PLAYFAIR, William.

Original memoirs of Eminent Persons. The late James Watt, Esq., F.R.S., & c., & c., communicated by Mr. Wm. Playfair.

*Monthly Magazine or British Register*, XLVIII, 1819, pp. 230-9.

Playfair was in the employ of the firm from 1777 to 1782 and therefore had inside knowledge of this period.



PLAYFAIR, William.  
Memoir of James Watt, F.R.S.  
*New Monthly Magazine and Universal Register*, 1819, vol.xii, p.576.

In a prefatory note the Editor states that it was written by Mr. Playfair and remarks that he had disposed of a copy of the rival magazine (i.e. the above); the memoirs are, however, quite different in matter.

WATT, James.  
Thirteen letters from the late James Watt, Esq., to James Lind.  
*Monthly magazine or British Register*, L, 1820, p. 239.

These cover the period 1764-99 and deal with Watt's scientific pursuits.

ROBISON, John, LL.D.  
A system of mechanical philosophy. With notes by (Sir) David Brewster.  
Edinburgh, 1822. 5 vols., 8 vo.

The first part of Vol. II consists of the matter given above under date 1818, in fact the pagination, even to the title-page, is identical; obviously the type had been kept standing.

[WATT, James, jun., and JEFFREY, Francis, Lord].  
Article "James Watt" in the supplement to the fourth, fifth, and sixth editions of the *Encyclopaedia Britannica*, vol.VI, pp. 778-85.  
Edinburgh, 1824. 4 to.

The first satisfactory biographical memoir of Watt. Three-fourths is from the pen of James Watt, jun.; the rest of it is taken up by an eulogy on Watt from the pen of Lord Jeffery, being, in fact, a reprint of his *Scotsman* article (*see ante*).

[WATT, James, jun., and JEFFREY, Francis, Lord].  
Memoir of James Watt, F.R.S., L & E., from the supplement to the *Encyclopaedia Britannica*, vol.VI.  
[Edinburgh, 1824.] 32 pp., 8 vo, privately printed.

Consists of above matter paged up in book form.

[TURNER, Charles Hampden, *Chairman*.]  
Proceedings of the public meeting held at Freemasons' Hall [London] on the 18<sup>th</sup> June, 1824, for erecting a monument to the late James Watt.  
London, 1824. 96 pp., 8 vo. A large paper copy was also issued.

As a result of this meeting, a public subscription was started, and the outcome was the Chantry statue in Henry VII's Chapel, Westminster Abbey.

FAREY, John.  
A treatise on the Steam Engine, historical, practical, and descriptive.  
London, 1827. 4.to.

An expansion in volume form of the article in the *Encyclopaedia Britannica* mentioned above. Contains a large amount of first-hand detailed information about the Watt engines.

STUART, Robert. (Pseudonym of Robert Meikleham.)  
Historical and descriptive Anecdotes of Steam Engines, and of their Inventors and Improvers.  
London, 1829. 2 vols, 16 mo, portraits and plates.

ARAGO, Dominique François Jean.  
Éloge historique de James Watt.  
*Mémoires de l'Académie Royale des Sciences de l'Institut de France*, vol. XVII, pp. 1xix1xxxviii.  
Paris, 1840. 127 pp., 4 to.

Watt occupied the distinguished position of being one of the eight foreign Associates of the Academy, an honour which was bestowed upon him in 1814; he had been a corresponding Member of the Institute since 1808. In 1833, by direction of the Academy, M. Arago, the Perpetual secretary, was charged with the task of writing a memoir of Watt. For this purpose he came to this country, and gleaned much information at first hand, notably from James Watt, junior, and Lord Brougham. The result was this eulogy, which was read at a public meeting of the Institute on Dec. 8, 1834. The Éloge is a valuable contribution to the biography of Watt.

To the Éloge is appended a translation of an historical account of the discovery of water by Lord Brougham who, before transmitting the manuscript to Arago, submitted it to James Watt, junior. The latter added a number of notes, which Lord Brougham considered so valuable that he asked Arago to retain them in printing. This he did, and there is a note to that effect on p. clxxxviii.

It may be remarked that the above matter was printed off by itself with new pagination, pp. 128, but without a title-page. Copies were presented to his friends by James Watt, jun.

ARAGO, D.F.J.

Biographical Memoir of James Watt, one of the Eight Foreign Associates of the Academy of Sciences, by M. Arago, Perpetual Secretary.  
*Edinburgh New Philosophical Journal*, XXVII. October 1839, pp. 221-324. 12 mo.

A translation made by Hyde Clarke of the Éloge mentioned above. To it is appended Arago's essay "On Machinery considered in Relation to the Prosperity of the Working Classes", which did not appear in the Mémoires. This essay is intended to show that inventions such as those of Watt are not detrimental to the interests of workers, as was then maintained by some.

ARAGO, D.F.J.

Life of James Watt, to which are subjoined, "Memoir on Machinery considered in relation to the prosperity of the working classes", by M. Arago; and "Historical Account of Discovery of the Composition of Water", by Lord Brougham.  
Edinburgh, October 1839. 142 pp., 12 mo.

This is the matter from the *Edin. New Phil. Journ.* Above, in book form. Its early appearance was apparently due to the enterprise of the Editor and proprietors of that Journal.

Although not mentioned in the title-page, the volume contains on p. 125 the *Eulogium of James Watt* by Lord Jeffrey (from the *Encyclopaedia Britannica* already cited).

This Life of Watt ran into a second and third edition the same year (1839); the latter was illustrated with engravings and ran to 222 pp.

ARAGO, D.F.J.

Historical Éloge of James Watt. Translated from the French, with additional notes and an appendix, by James Patrick Muirhead, Esq., M.A.  
London and Edinburgh, November 1839. ix + 261 pp., 8 vo, portrait. A large paper copy was also issued.

Although this contains the same matter as the preceding book, the translation is different and in some respects of greater merit. The Appendix includes: The Article on the Composition of Water by Lord Brougham; the Eulogy by Jeffrey; the Memoir on Machinery by Arago, and a reprint of the proceedings of the Meeting for Erecting a Monument to Watt, already cite *ante*.

WILLIAMSON, George.

Letters respecting the Watt Family.  
Greenock, 1840. 69 pp., 8 vo. Privately printed.

Practically all the matter is incorporated in the author's "Memorials" (see *infra*).

BROUGHAM, Henry, Lord, F.R.S.

Lives of Men of Letters and Science who flourished in the time of George III.  
London, 1845, 8 vo., steel engraved portrait.

The biography of Watt occupies pp. 353-401 and includes an appendix on the discovery of the theory of the composition of water.

MUIRHEAD, James Patrick, M.A., F.R.S.E.

Correspondence of the late James Watt on his Discovery of the theory of the Composition of Water with a letter from his son. Edited with introductory remarks and an appendix by James Patrick Muirhead, Esq., F.R.S.E.

London, 1846. 264 pp., 8 vo, portrait. A large paper copy was also issued.

As we have said above, acrimonious discussion arose between the partisans of Watt and Cavendish as to their respective claim to priority in the discovery of the composition of water. The writer, being a relative of Watt, is naturally biased. It is now conceded that while Watt was the first to adduce reasoned arguments to show that water was not an element, Cavendish independently supplied the experimental data on which accurate knowledge alone could be founded.

ENGLISH, Henry.

Mining Almanack.

London, 1849. 8 vo.

English was the Editor of the *Mining Journal*. On p. 301 there is a "Life of James Watt" by the Editor and on p. 302 we read: "An éloge has been published by M. Arago, translations of which had been written by Mr. Muirhead and Mr. Hyde Clark."

ANON. (Religious Tract Society.)

James Watt, and the Steam Engine.

London, 1852. 192 pp., 16 mo.

[MURRAY, Thomas, LL.D., Secretary.]

Inauguration of the Statue of James Watt in connection with the Watt Institution and Edinburgh School of Arts.

Edinburgh, 1854. 23 pp., 8 vo.

In 1824 a public meeting was held in Edinburgh for the purpose of erecting a memorial in honour of Watt. The original idea was to erect a building "for the accommodation of the Edinburgh School of Arts, whereby the memory of Watt may be for ever connected with the promotion, among a class to which he himself originally belonged, of those mechanical arts from which his own usefulness and glory arose".

Eventually the fund was devoted to the purchase in 1852 of the premises that had been long used for the purposes of the School of Art, when the name was changed to the "Watt Institution and Edinburgh School of Arts". It was felt that, in addition, something distinctive should be done to mark the concatenation: accordingly a statue was erected in front of the School. The School is now merged in the Heriot-Watt College.

MUIRHEAD, James Patrick, M.A., F.R.S.E.

The Origin and Progress of the Mechanical Inventions of James Watt illustrated by his correspondence with his friends and the specifications of his patents.

London, 1854. 3 vols., 8 vo., portrait. A large paper copy was also issued.

Based almost entirely on letters in the Doldowlod Papers, it is undoubtedly the richest mine of information about Watt.

The first volume is mainly taken up with an account, not sufficiently discriminating perhaps, of Watt's life. The second is devoted to transcripts of his letters commencing in 1765, and continuing till the year before his death. Possibly the letters have been chosen too much for their social and literary rather than for their scientific interest, but on the other hand such a choice appeals to the widest circle. The third volume gives the patent specifications and reprints of the Patent Cases already referred to.

WILLIAMSON, George.

Memorials of the lineage, early life, education, and development of the genius of James Watt.

Printed for the Watt Club.

(Greenock), 1856. 4 to.

Authoritative on Watt's ancestry and early life. There are two portraits: one, frontpiece, an engraving of the Henning portrait, 1803; the other facing p. 120, a lithograph of the oil painting by Partridge.

COMMISSIONERS OF PATENTS.

A.D. 1769, No. 913. Specification of James Watt. Steam Engines, &c.

New invented method of lessening the Consumption of Steam and Fuel in Fire Engines. Dated Jan. 5, 1769. It is important to note that the patent only covered England, Wales, and the Colonies.  
London, 1855. 3 pp., 4 to.

A.D. 1769, No. 913\*. Extension of Patent of James Watt. Steam Engines, &c.  
London, 1857. 6 pp., 4 to.

An Act for vesting in James Watt, Engineer, his executors administrators and assigns, the sole use and property of certain Steam Engines commonly called Fire Engines, of his Invention, described in the said Act, throughout his Majesty's Dominions, for a limited time (22<sup>nd</sup> May, 1775).

A point to be noted is that this Act extended the Patent to Scotland.

A.D. 1780. No. 1244. Specification of James Watt. Copying Letters, &c.

A new method of copying letters and other writings expeditiously. Dated Feb 14, 1780.  
London, 1856. 4 pp., 4 to.

A.D. 1781. No. 1306. Specification of James Watt. Steam Engines.

Certain new methods of applying the vibrating or reciprocating motion of steam or fire engines to produce a continued rotative or circular motion round an axis or centre, and thereby to give motion to the wheels of mills and other machines. Dated Oct. 25, 1781.  
London, 1855. 9 pp., 4 to, plates.

A.D. 1782. No. 1321. Specification of James Watt. Steam Engines

Certain new improvements upon steam or fire engines for raising water, and other mechanical purposes, and certain new pieces of mechanism applicable to the same. Dated Mar. 12, 1782.  
London, 1855. 16 pp., 4to, plates.

A.D. 1784. No. 1432. Specification of James Watt. Fire and Steam Engines, &c.

Certain new improvement on fire and steam engines, and upon machines worked or moved by the same. Dated Ap. 28, 1784.  
London, 1855. 14pp., 4to, plates.

A.D. 1785. No. 1485. Specification of James Watt. Furnaces and Fireplaces.

Certain newly improved methods of constructing furnaces or fireplaces for heating, boiling, or evaporating of water and other liquids, which are applicable to steam engines and other purposes; and also for heating, melting, and smelting of metals and their ores, whereby greater effects are produced from the fuel, and the smoke is in a great measure prevented or consumed. Dated June 14, 1785.  
London, 1854. 4pp., 4to, plates.

SCHIMMEL PENNING, Mary Anne.

Life of, edited by Christiana C. Hankin.

London, 1858. 8 vo.

Reminiscent character sketches written in 1856 of Matthew Boulton, James Watt, and the family of the latter as they were in 1788-90.

MUIRHEAD, James Patrick, M.A., F.R.S.E.

Life of James Watt, with selections from his correspondence.

London, 1859. 8 vo.

This is in substance the memoir from the author's *Mechanical Inventions* referred to above. It ran into a second revised edition, 1859.

HART, Robert.  
Reminiscences of James Watt. *Trans. Glasgow Archaeological Society*, Pt. I, i.  
Glasgow, 1859. 8 vo.

Valuable recollections of Watt in his old age, i.e. in 1813 or 1814.

SMILES, Samuel, LL.D.  
Lives of Boulton and Watt, principally from the original Soho MSS. comprising also a History of the Invention and Introduction of the Steam Engine.  
London, 1865. xvi+521 pp., 8 vo in 1 or 2 vols.

Attractively written, avoids the introduction of technical detail, but is not always accurate. This ran into a second edition the following year.

COMMISSIONERS OF PATENTS.  
Contributions to the History of the Steam Engine being two deeds relating to the Erection by Messrs. Boulton and Watt of Steam Engines on the United Mines at Gwennap, Cornwall, and at Werneth Colliery, near Oldham, Lancashire, from the originals in the Patent Office Library.  
London, 1872. 16 pp., 8 vo.

The date of these deeds is 1779 and 1799 respectively. The title should read: "...Werneth Colliery in the parish of Prestwich, Lancashire..."

TIMMINS, Samuel.  
James Watt, from *Trans. Archaeol. Section of the Birmingham and Midland Inst.*, 1872.  
Birmingham, 1873. 4 to.

SMILES, Samuel, LL.D.  
Lives of the Engineers. The Steam Engine-Boulton and Watt, New and revised edition.  
London, 1878. Plates, 12 mo.

Vo.IV of the "Lives" slightly abridged from the author's larger work, *ante*.

COWPER, Edward A., M.I.Mech.E.  
On the Inventions of James Watt and his models preserved at Handsworth and South Kensington. Excerpt *Proc. Inst. Mech Eng.*, 1883. Pp. 599-631, and plates 55-87.  
London, 1883. 8 vo.

Written by a capable engineer who had made a study of the subject; perhaps the best description extant of Watt's inventions.

TANGYE, [Sir] R[ichard] and G[eorge].  
James Watt and William Murdock.  
Birmingham (1888). II pp., 2 prints, 12 mo.

Comprises: "The Earliest Locomotive in England" and "James Watt's Garret".

BARR, Archibald, LL.D., D.Sc.  
James Watt and the Application of Science to the Mechanical Arts: An Address.  
Glasgow, 1889. 27 pp., 8 vo.

PREECE, Sir William H., C.B., F.R.S., M.Inst.C.E.  
Watt and the Measurement of Power. Watt Anniversary Lecture delivered before the Greenock Philosophical Society, 1897.  
Greenock, 1897. 13 pp., 8 vo., 2 figs.

THORPE, Sir Thomas E., D.Sc.,LL.D.,F.R.S.

James Watt and the Discovery of the Composition of Water. Watt Anniversary Lecture delivered before the Greenock Philosophical Society, 1898.  
Greenock, 1898. 19 pp., 8 vo.

A full, impartial, and judicious summing up, by a chemist of world-wide fame, of the long drawn-out controversy among the partisans of Watt, Cavenish, and Lavoisier, as to what were their respective shares in this great discovery.

BRAMWELL, Sir Fredrick, Bart., LL.D., F.R.S., M.Inst.C.E.

Article , "James Watt" in *Dictionary of National Biography*, vol. 1x, pp. 51-62. Also paged up separately as a booklet of 24 pp.  
London, 1899. 8 vo.

The best short biography extant, by an engineer of ripe experience.

BECK, Theodor.

Beiträge zur Geschichte des Maschinenbaues.  
Berlin, 1900. 582 pp., 8 vo.

THOMSON, William, Baron Kelvin, P.R.S.

James Watt, an Oration delivered in the University of Glasgow on the commemoration of its ninth Jubilee.  
Glasgow, 1901. 2 pp., 8 vo.

Deals in the main with Watt's connection with the College of Glasgow.

THORPE, Sir Thomas E.,F.R.S.,&c.,

Essays in Historical Chemistry.  
London, 1902. 8 vo.

Essay V, pp. 98-122, is devoted to "James Watt and the Discovery of the Composition of Water". This is a reprint of the Watt Anniversary Lecture noted above. This Essay was not, of course, in the author's earlier volume under the same title published in 1894. A third edition appeared in 1911.

JACKS, William, LL.D., D.L.

James Watt.  
Glasgow, 1901. 215 pp., portrait, 12 mo.

Repeats some misstatements of former writers, and is not sufficiently critical.

HELE-SHAW, H.A., F.R.S., M.Inst.C.E.,M.I.Mech.E.

James Watt, Inventor. Watt Anniversary Lecture delivered before the Greenock Philosophical Society, 1902.  
Greenock, 1902. 28 pp., 4 plates, 8 vo.

PEMBERTON, T. Edgar.

James Watt of Soho and Heathfield. *Annals of Industry and Genius*.  
Birmingham 1905. 233 pp., portrait, 3 plates, 12 mo.

The Pemberton family occupied Heathfield from 1857 to 1876. Gives matter relative to Watt's connection with the house and estate, his associates at Soho, and with the Lunar Society. From 1876 to 1920 Heathfield was occupied by the late Mr. George Tangye.

CARNEGIE, Andrew.

James Watt.  
London, 1905. 240 pp., 8 vo.

Painstaking and eulogistic, but brings out no new facts.

CARNEGIE, Andrew.  
James Watt. (Famous Scots Series.)  
Edinburgh and London [1905]. 164 pp., 12 mo.

Condensed from the preceding.

MATSCHOSS, Conrad, Ph.D., Dipl. Eng.  
Die Entwicklung der Dampfmaschine.  
Berlin, 1908. 2 vols., 4 to.

Appraises Watt's experiments and discoveries, pp. 339-72. Comments upon his influence on the progress of machine design.

BURSTALL, Henry Frederic William, M.A.M.Inst.C.E.  
Nine Famous Birmingham Men. Lectures delivered in the University, edited by J.H. Muirhead, LL.D.  
Birmingham, 1909. Portraits, 8 vo.

The Fourth Lecture, pp. 109-30 is devoted to James Watt, by Prof. Burstall.

FOX, Howard, F.G.S.  
Boulton and Watt.  
Reprinted from the Report of the Royal Cornwall Polytechnic Society for 1909.  
Penryn, 1910. 20 pp., 8 vo.

Letters, or extracts there from, received by Thomas Wilson, agent of Boulton and Watt in Cornwall, during the period 1794-1802.

CAIRD, Robert, LL.D., F.R.S.E., M.Inst.C.E.  
James Watt's Contribution to the Advancement of Engineering. Watt Anniversary Lecture delivered before the Greenock Philosophical Society, 1910.  
Greenock, 1910. 23 pp., 8 vo.

CORMACK, J.D., C.M.G., D.Sc., M.Inst.C.E.  
In the Days of Watt... Watt Anniversary Lecture delivered before the Greenock Philosophical Society, 1915.  
[Greenock, 1915.] 17 pp., 8 vo.

DICKINSON, Henry Winram, M.I.Mech.E.  
Some unpublished letters of James Watt. Excerpt *Proc.Inst.Mech.Eng.*, pp.487-534.  
London, 1913. 8 vo.

Annotated transcripts of letters from the Boulton and Watt Collection and from the Boulton Papers, bringing out points of technical interest.

GRANT, John W  
James Watt and the Steam Age.  
London, 1917. pp.223, portrait, 8 vo.

A gossiping sketch.

BOARD OF EDUCATION.  
Catalogue of Mechanical Engineering Collection in the Science Museum, South Kensington. Pt.I, 6<sup>th</sup> edition, with a supplement containing illustrations.  
London, 1919. 8 vo.

Includes technical description of original Watt models preserved at South Kensington.

HENDERSON, H., *Librarian*.

James Watt Centenary Exhibition [at the Watt Monument, Greenock], Sept. 4, 1919.  
Greenock, 1919. 19 pp., portrait, 8 vo.

WATT CENTENARY COMMITTEE.

James Watt Centenary Commemoration, Sept. 16-20, 1919. Souvenir Guide Book of Special Exhibit in the Art Gallery, Birmingham.  
Birmingham, 1919. 60 pp., 8 vo.

BOARD OF EDUCATION, Science Museum.

Catalogue of Watt Centenary Exhibition.  
London, 1919. 45 pp., portrait, 8 vo.

A Collection of portraits, drawings, holograph letters, original models, books, &c.

GALLOWAY, T. Lindsay, M.A., F.G.S.

James Watt.

*Proc. Roy. Phil. Soc. Glasgow*, vol. L, 154.  
Glasgow, 1921. 16 pp., 8 vo.

FLEMING, James Arnold, O.B.E., F.R.S.E., F.S.A., Scot., F.C.S.

Scottish Pottery.

Glasgow, 1923. 8 vo.

Gives *inter alia* an account of Watt's connection with pottery manufacture—a hitherto little-known activity of his.

LORD, John, B.A.

Capital and Steam-Power, 1750-1800.

London, 1923. 8 vo.

Deals with the economics of the introduction of the steam engine into industry. Uses the history of the firm of Boulton and Watt as the basis of his thesis. Employs the same material very largely, although from a different angle, as do the authors of the present volume, in conjunction with which it should be read.

MARSHALL, Thomas Humphrey, M.A.

James Watt (1736-1819). Roadmaker Series.

London and Boston, 1925. 8 vo.

Racily written - effectively uses the known material, including the preceding volume, well set in relationship to contemporary events.

JENKIN, A.K. Hamilton, M.A. B.Litt.

Boulton and Watt in Cornwall. Excerpt Rept. Roy.

Cornwall Polytechnic Soc., N.S., vol. V. 1926.

Camborne, 1926. 8 vo.

Extracts are given from a collection of about 1,000 letters from the firm to Thomas Wilson, their agent. The letters are now the property of the Society and are preserved in their Library.