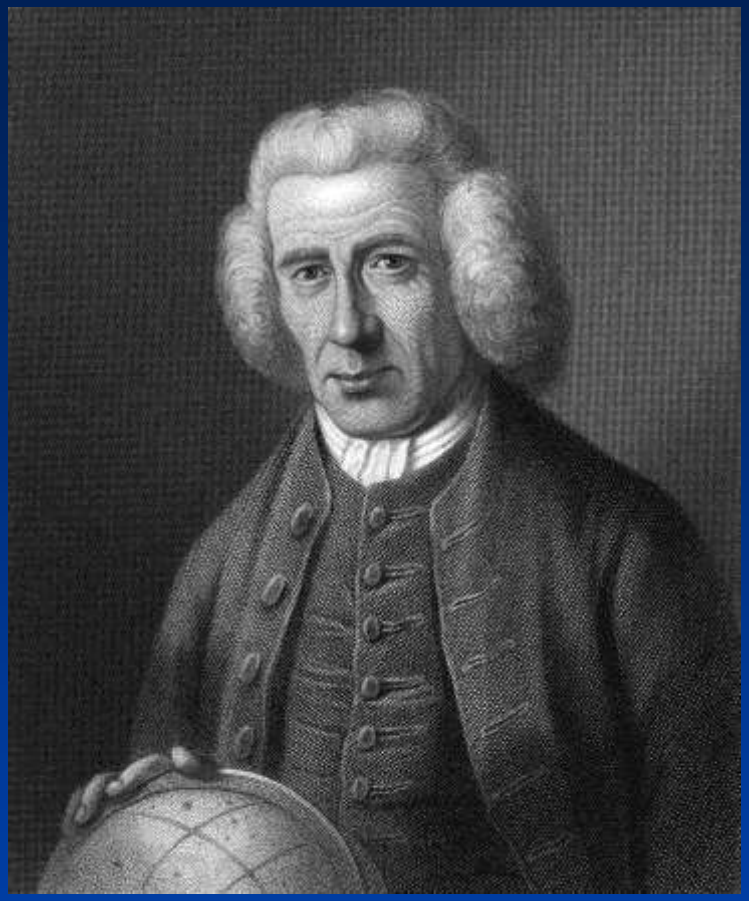
Lecture to the Edinburgh Bibliographical Society - 22 April 2010



‘Wheelwright of the Heavens’ and natural philosopher

JAMES FERGUSON FRS (1710-76)

By Professor Roland Paxton MBE FICE FRSE
School of the Built Environment, Heriot-Watt University

1710 1720 1730 1740 1750 1760 1770 1780 1790 1800 1810 1820 1830 1840 1850

EAST SCOTLAND I LONDON I d. 16 November 1776
b. 25 April 1710

I MARRIED IFRS I
I LIMNER LECTURER I
IPENSIONI

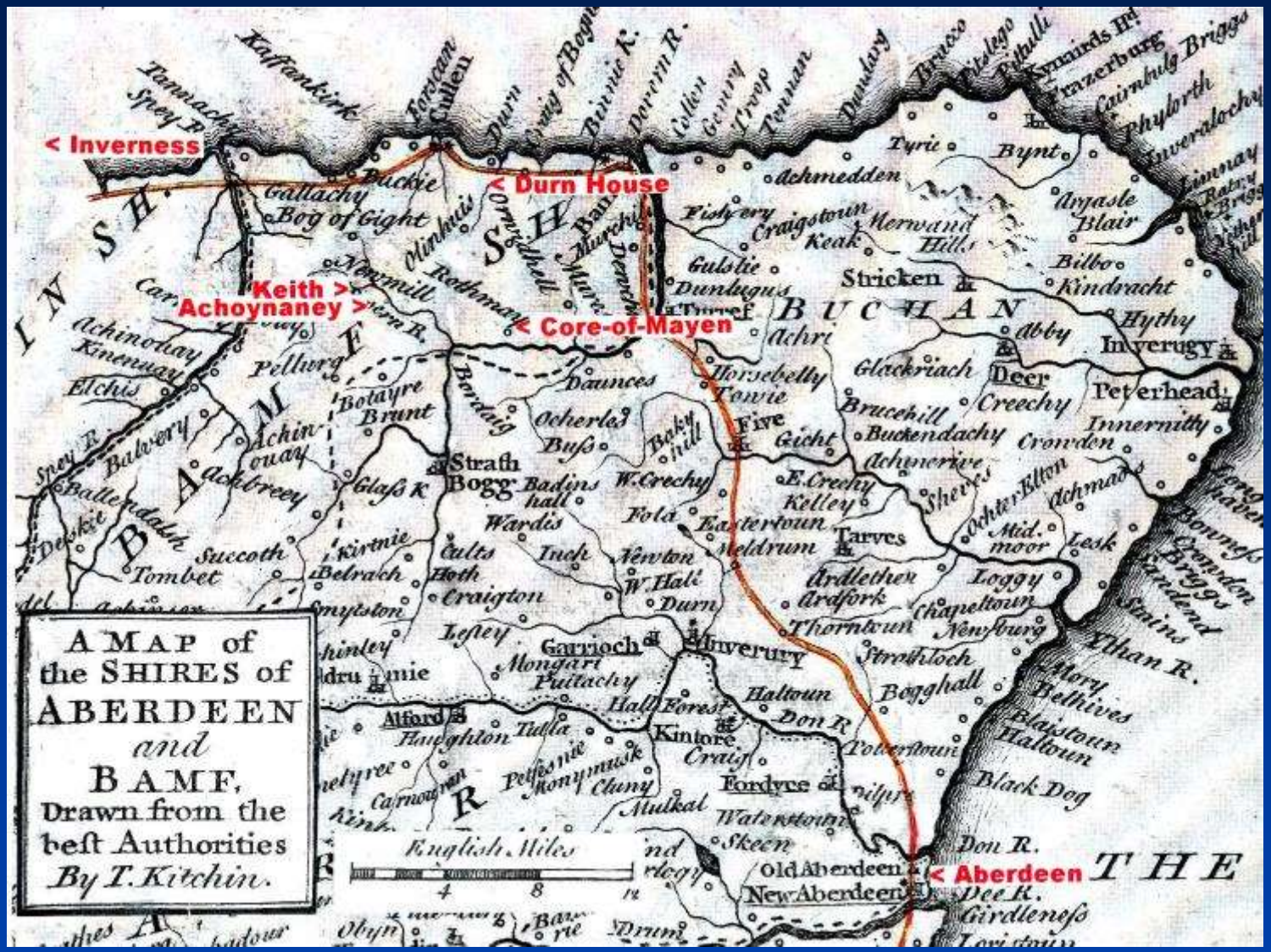
ASTRONOMICAL ROTULA	1742-1817	9
ASTRONOMY EXPLAIND NEWTON's PRINCIP	1756-1843	22
LECTURES SELECT SUBJECTS MECHAN	1760-1843	22
ANALYSIS OF LECTURES	1761-76	9
TABLES & TRACTS	1767-71	2
YOUNG GENT & LADY'S ASTRON	1768-1835	23
INTRODUCTION TO ELECTRICITY	1770-1825	7
GUTHRIE'S GRAM ASTRON CHAPT	1771-1825	22
SELECT MECH EXERCISES	1773-1823	3
ART OF PERSPECTIVE	1775-1823	10
[Minor publications, encyclopaedia and periodical articles]		50+
Total editions/reprints		169+

[Main Publications]

[Lecture and/or model display venues, some on multiple occasions, included - London, Liverpool, Birmingham, Manchester, Bristol, Bath, Derby, Northampton, Lancaster, Plymouth, Tunbridge Wells, Edinburgh, Kelso, Morpeth, Newcastle-upon-Tyne, Norwich, Kidderminster, Worcester, Newcastle-under-Lyme, Cheadle (Staffs), Windsor]

Anne I Geo I I George II I George III I G IV IWIVI Victoria
1710 1720 1730 1740 1750 1760 1770 1780 1790 1800 1810 1820 1830 1840 1850

Chronological outline of Ferguson's life and work



[T. Kitchin 1756]

Places where Ferguson stayed from 1710-1743

[Henderson 1867]

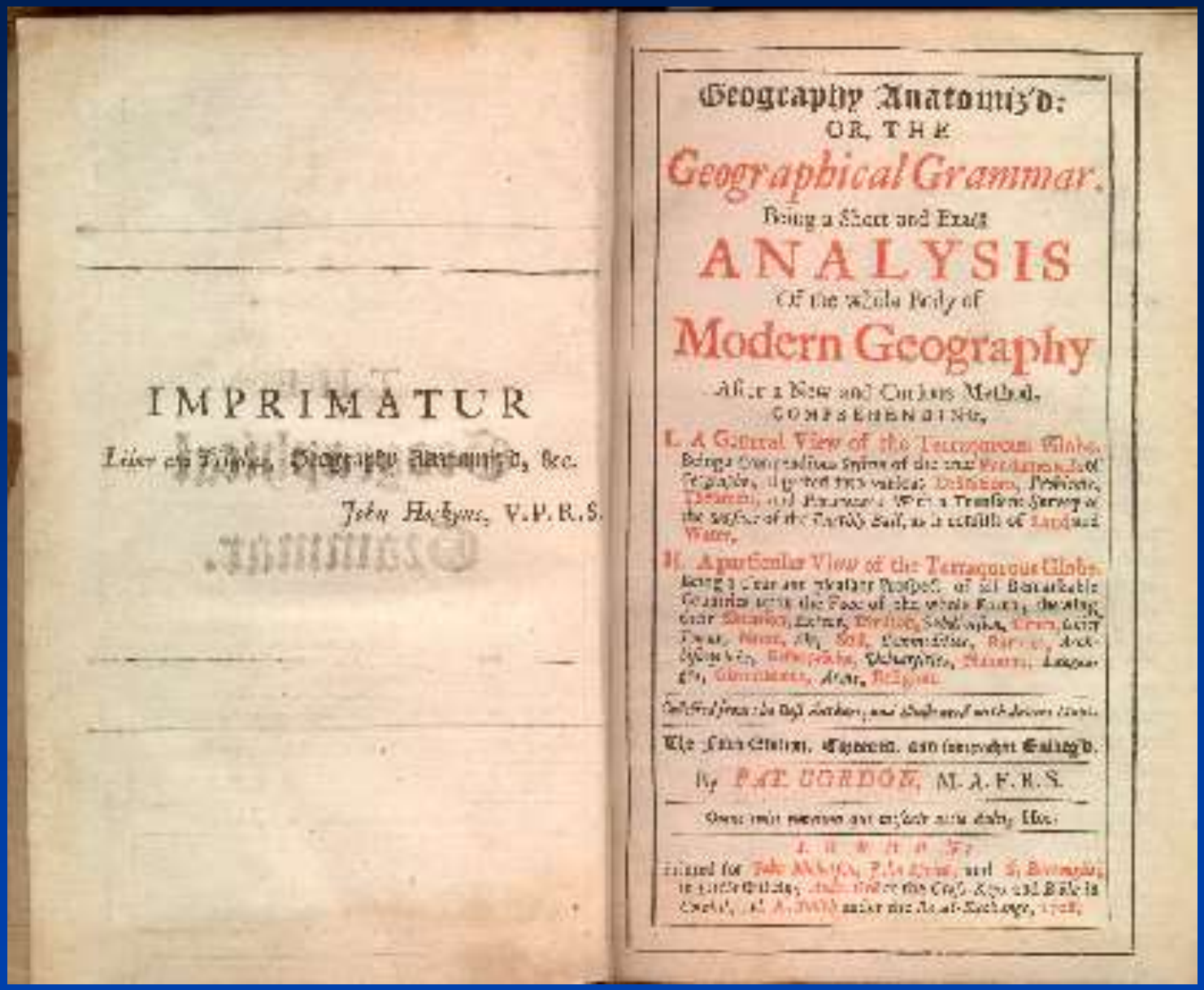
Ferguson seeing his father levering up fallen cottage roof c.1720

[Henderson 1867]

Ferguson after work mapping stars using threads and beads 1724-26

From 1728-30 Thomas Grant of Achoynaney House took Ferguson in and had him taught by his mathematically competent butler Alexander Cantley who gave him a copy of *Gordon's Geographical Grammar* . Ferguson wrote of this gift as "a great treasure. There is no figure of a globe in it although it contains a tolerable description . . . From this . . . I made a globe in three weeks at my father's, having turned the ball thereof out of a piece of wood; which ball I covered with paper, and delineated a map of the world upon it; made the meridian ring and horizon of wood; covered them with paper, and graduated them; and was happy to find that by my globe (which was the first I ever saw) I could solve the problems."

From 1730-1, after Cantley had moved on, Ferguson worked for a tipsy miller and a doctor.



IMPRIMATUR

Liber cui Titulus, Geography Anatomiz'd, &c.

John Hayes, V.P.R.S.

Geography Anatomiz'd:

OR, THE

Geographical Grammar.

Being a Short and Exact

ANALYSIS

Of the whole Body of

Modern Geography

After a New and Curious Method,

CONTAINING

I. A General View of the Terraqueous Globe, Being a Comprehensive Survey of the most Remarkable of Terrestrial, digested into various Definitions, Propositions, Theorems, and Problems: With a Transient Survey of the surface of the Earth's Soil, as it consists of Land and Water.

II. A particular View of the Terraqueous Globe, Being a Clear and Shorter Prospect of all Remarkable Countries upon the Face of the whole Earth, dividing their Situation, Extent, Division, Subdivisions, Cities, Chief Towns, Rivers, Air, Soil, Commodities, Rarities, Antiquities, Curiosities, Inhabitants, Manners, Language, Government, Arms, Religion.

Collected from the best Authors, and illustrated with Curious Cuts.

The Fifth Edition, Corrected, and Improved Enlarged.

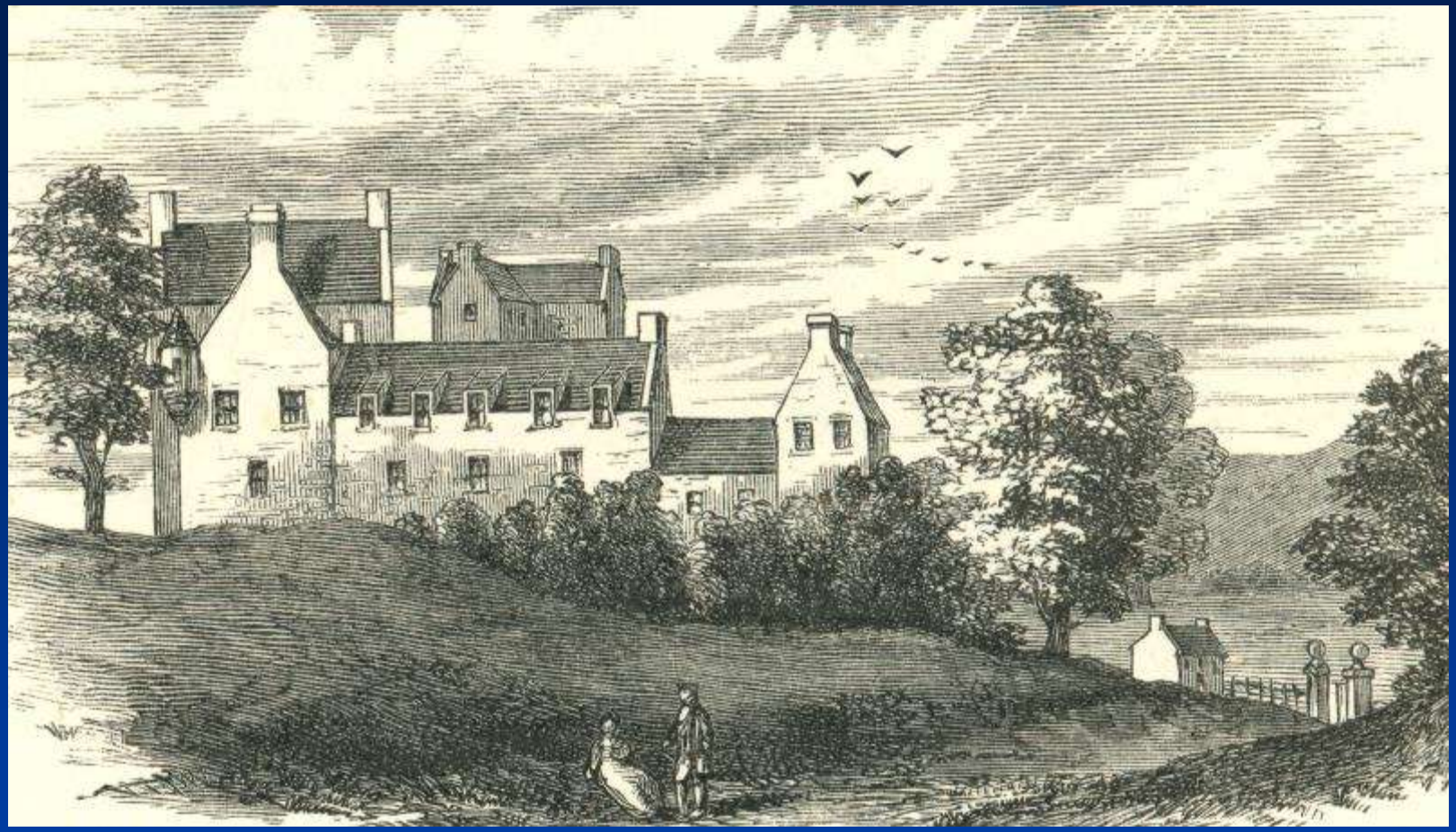
By PAT. GORDON, M.A. F.R.S.

Omne tulit punctum qui miscuit utile dulci. Hor.

L O N D O N:

Printed for John Nicholson, Palmer Kent, and S. Birmingham, in Little Britain, and Sold at the Crown, Kings Head Bible in Cornhill, and at Jonathan's under the Royal Exchange, 1708.

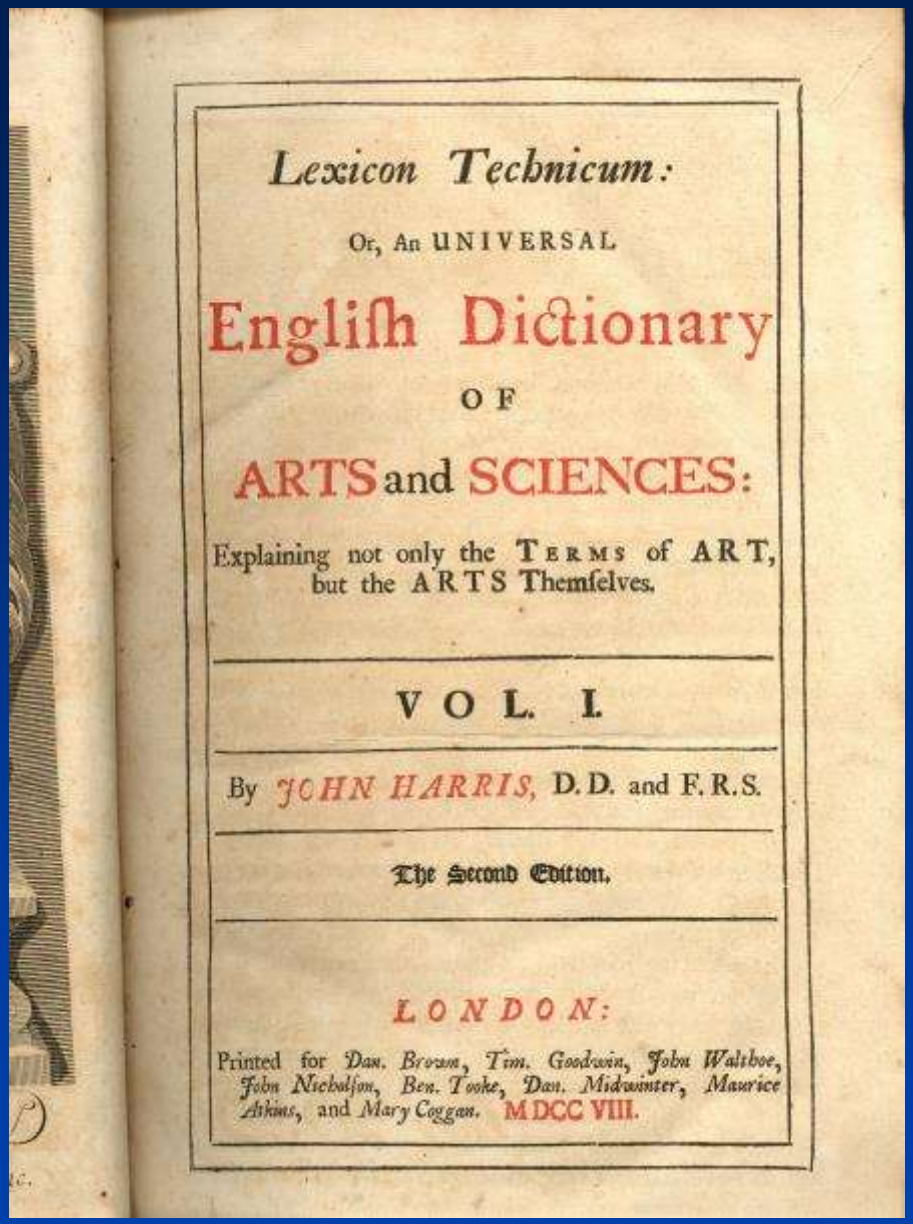
Cantley's gift to Ferguson c.1730 (edition unknown) which led to him making his first globe



[Henderson]

Durn House nr Portsoy where
Ferguson stayed c. 1732

From 1732-34 Lady Dipple, sister of Sir James Dunbar of Durn House, became Ferguson’s patron. Locally, he cleaned clocks, repaired machinery, and painted globes on Durn House gateposts. He furthered his knowledge by reading Harris’s *Lexicon Technicum* when visiting William Baird at Auchmedden. Lady Dipple then took Ferguson to Edinburgh to train as a general artist for which he seems to found little aptitude, but he did become a limner making pen and ink portraits for a living for much of the next 26 years. Baird was Ferguson’s first miniature sitter.



Lexicon Technicum:

Or, An UNIVERSAL

English Dictionary

OF

ARTS and SCIENCES:

Explaining not only the TERMS of ART, but the ARTS Themselves.

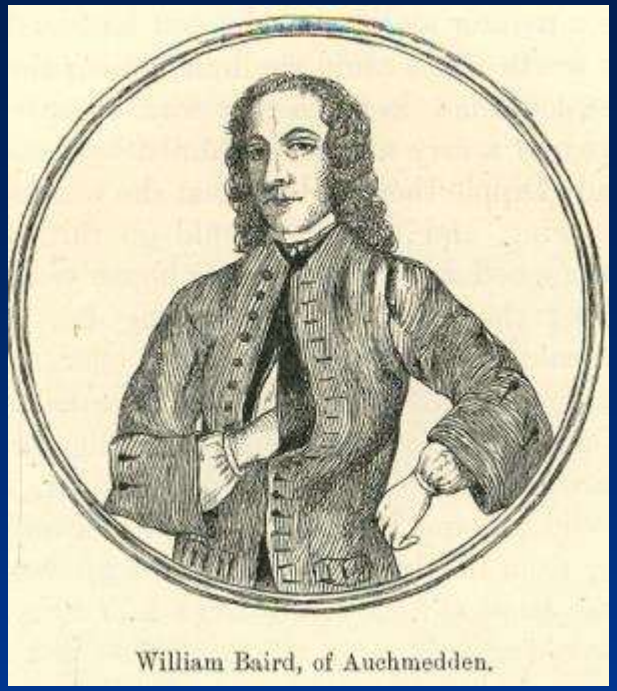
VOL. I.

By *JOHN HARRIS*, D.D. and F.R.S.

The Second Edition.

LONDON:

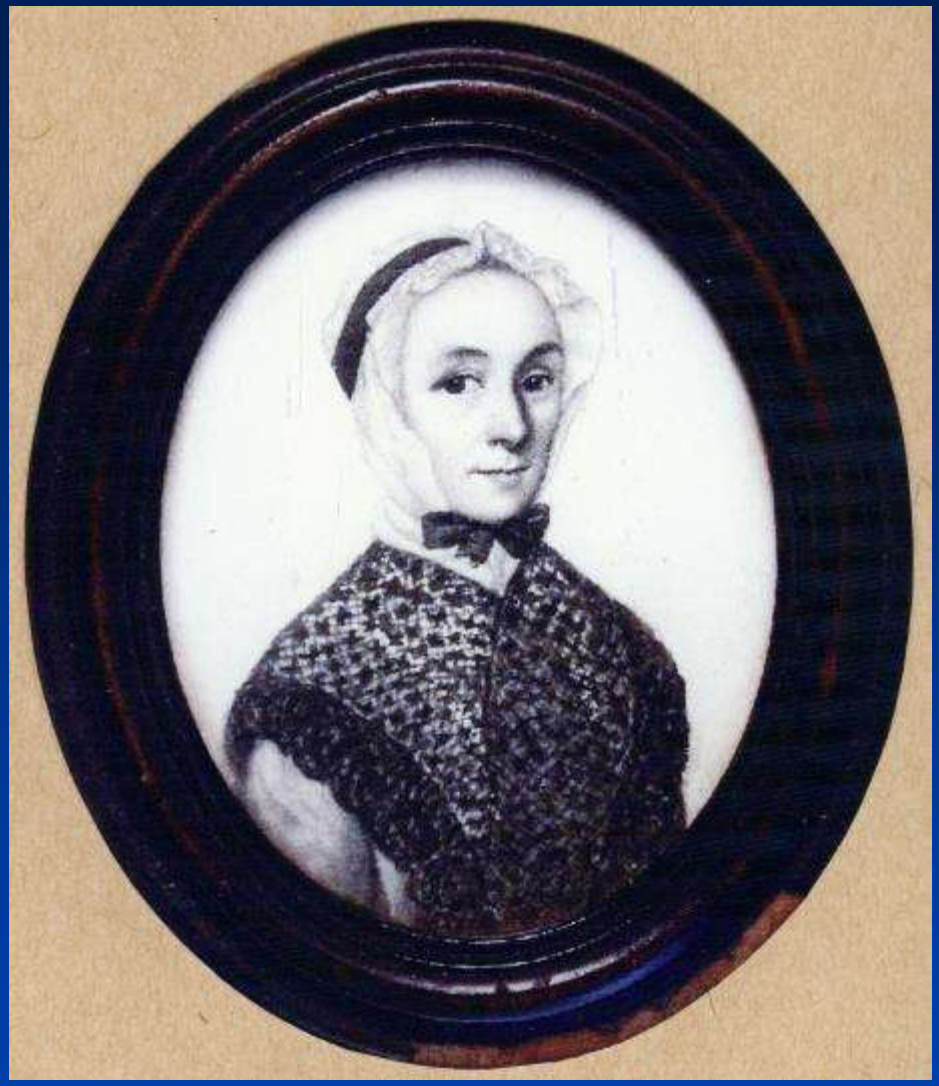
Printed for *Dan. Brown*, *Tim. Goodwin*, *John Walthoe*, *John Nicholson*, *Ben. Tooke*, *Dan. Midwinter*, *Maurice Atkins*, and *Mary Coggan*. MDCCVIII.



William Baird, of Auchmedden.

Baird's copy of Harris's *Lexicon Technicum* and an engraving of Ferguson's miniature of him

From 1734-36, when staying with Lady Dipple in Edinburgh, the Rev. Robert Keith introduced Ferguson to Lady Jane Douglas of Merchiston Castle, where he stayed in the room in which Lord Napier invented logarithms. Ferguson decides to earn his living as a physician.



[Granite Pail Catalogue – courtesy Neil Taverner]

Ferguson miniature c.1740

[Millburn 1998]

In 1736 Ferguson left Edinburgh to become a physician in Keith/Rothiemay area but was unsuccessful. In 1739-40 he resumed his limning and astronomical interests at Inverness. In May 1739 he married Isabella Cautley. He devised the Astronomical Rotula and had it engraved by Richard Cooper of Edinburgh (published 1742). He was befriended in Edinburgh by an influential patron in Professor Colin Maclaurin [d.1746].

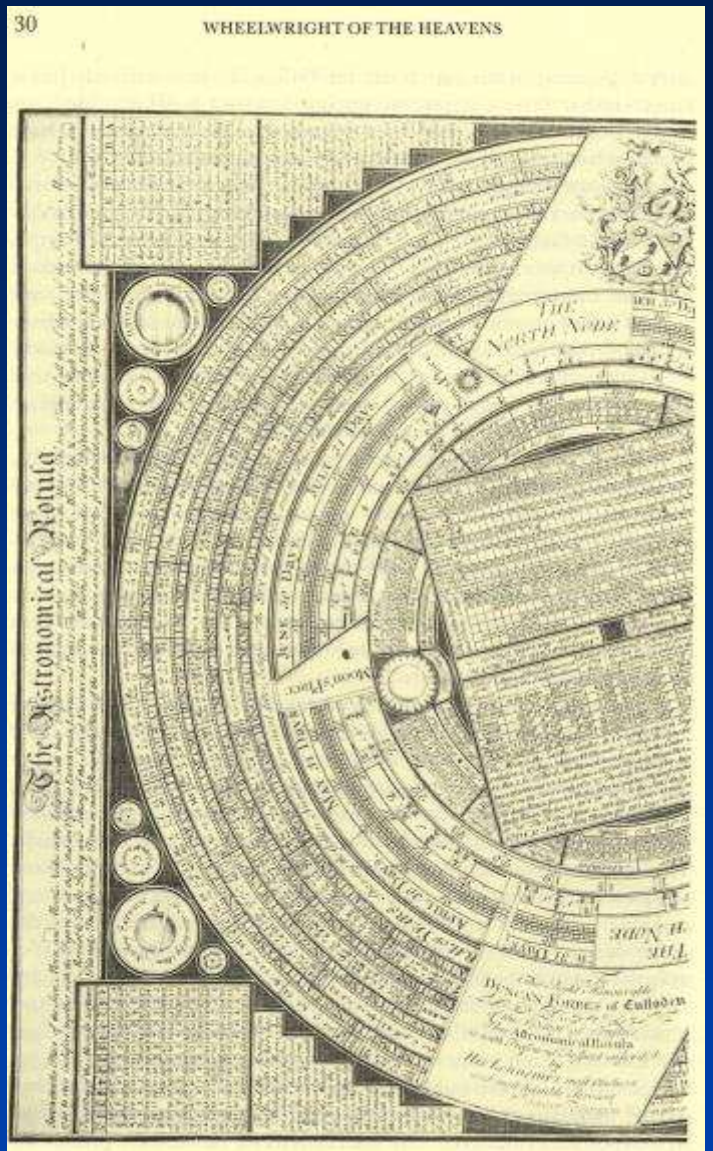
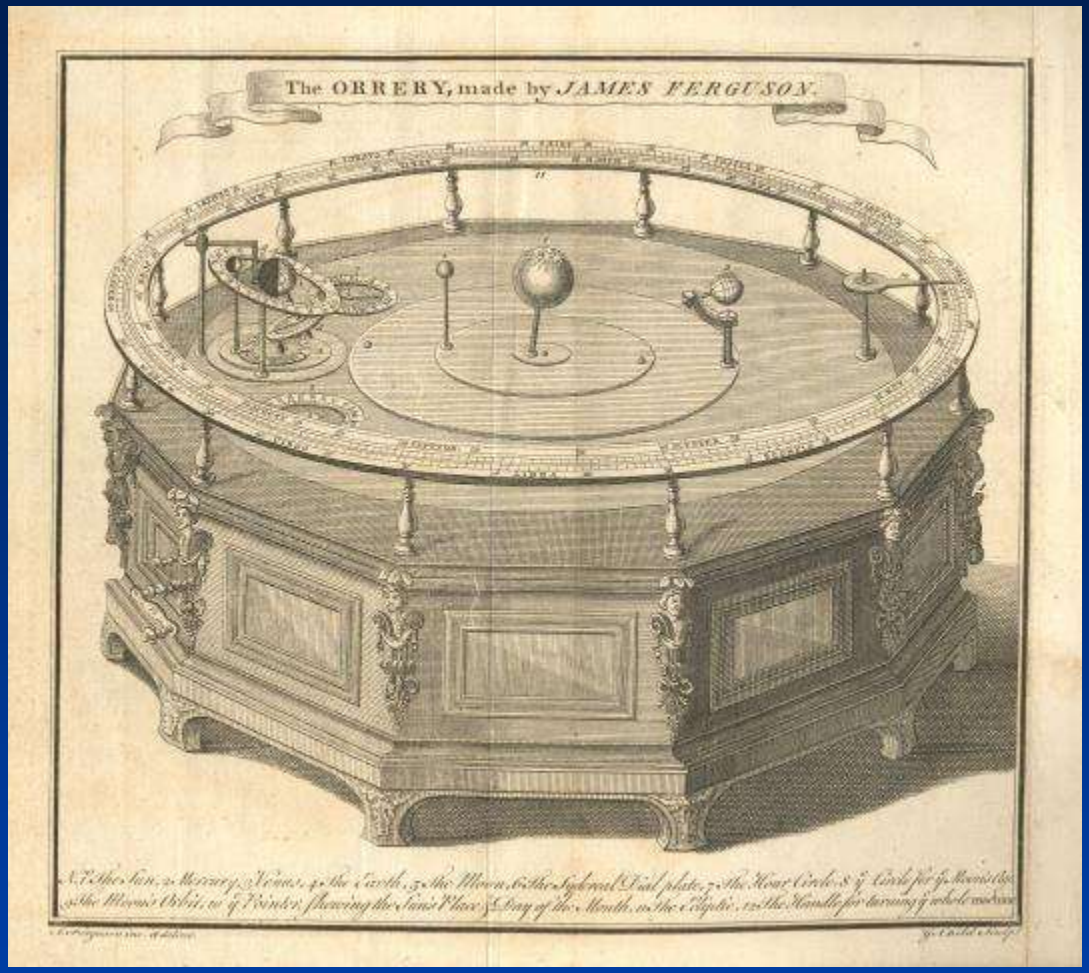


Figure 9. The upper part of Ferguson's *Astronomical Rotula* (reduced). The original is approximately 18 x 12 inches (450 x 300mm) overall. National Museums of Scotland, Inv. No. F.32.1.

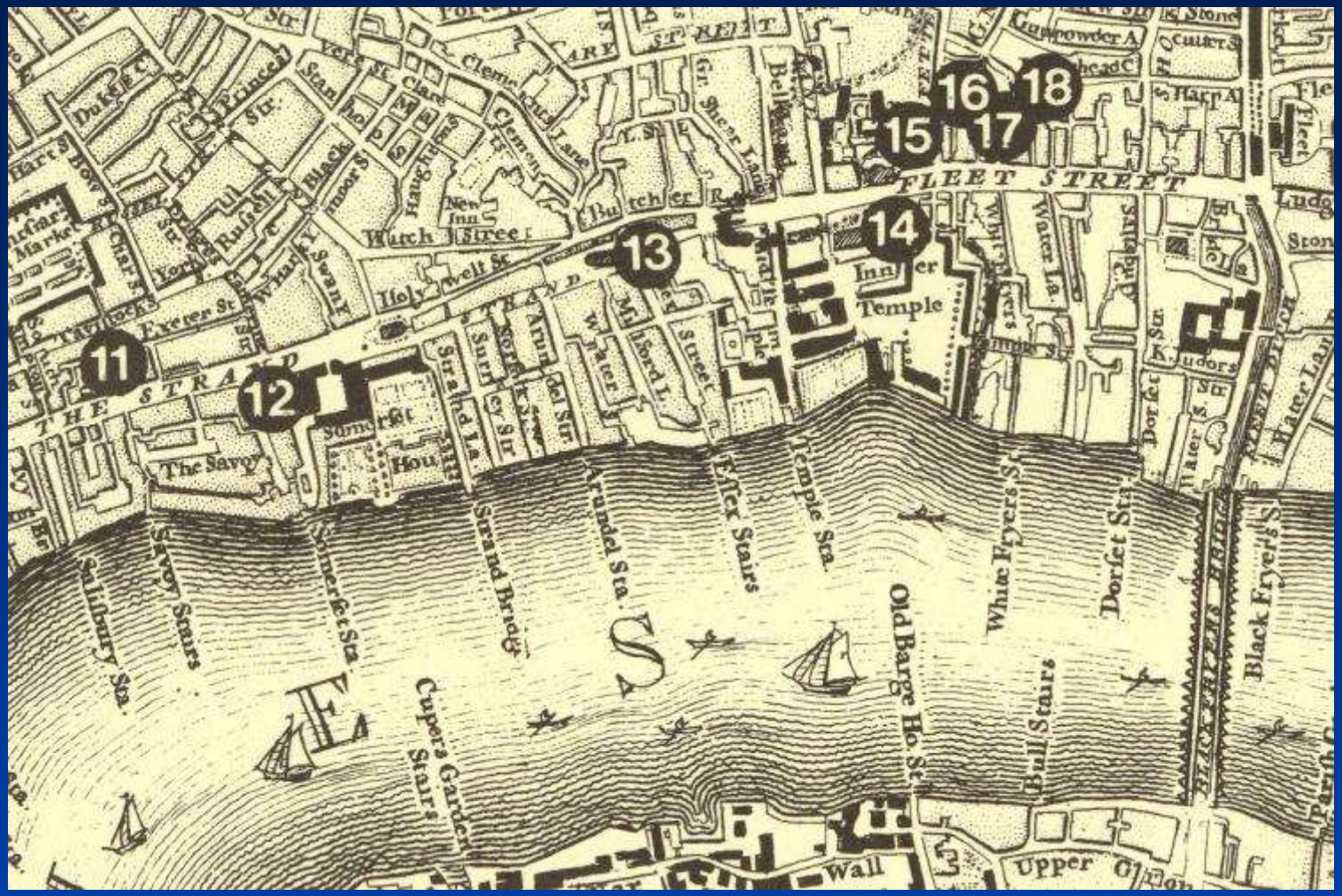
[Millburn]

The *Rotula* showed "The place of the Sun, Moon, and Moon's nodes . . . every day of the year; the true time of all the eclipses of the Sun and Moon from 1730 to 1800 inclusive; the day of the month, Moon's age and southing; high water at several ports; . . . rising and setting of the Sun at Edinburgh; the motions . . . of the planets" and tables for finding the true time of New Moon and Full Moon. It sold well until 1752 when the calendar style changed. It was subsequently modified.



[First published 1746 and from 1756 in *Astronomy Explained*, 1757]

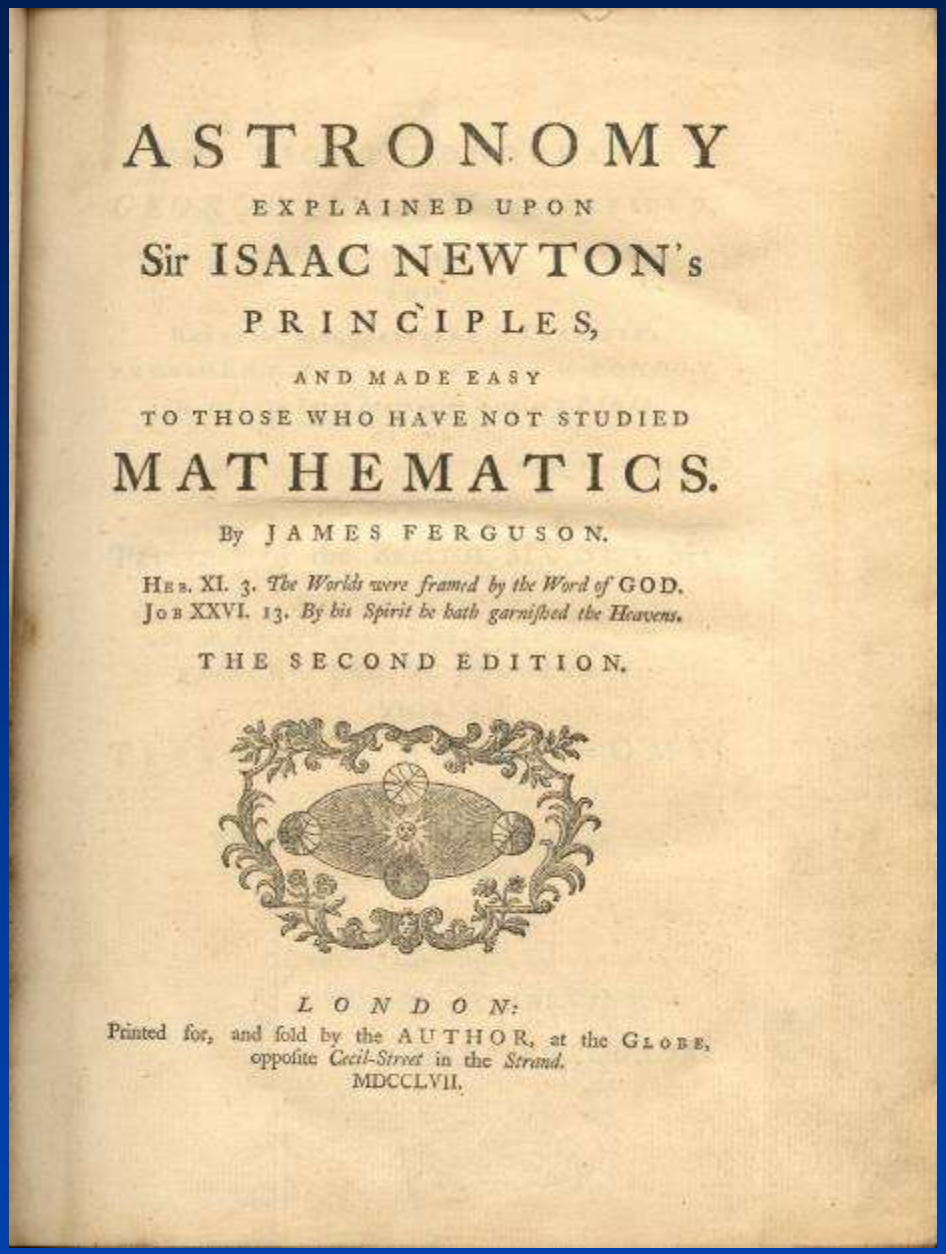
By 1742 Ferguson, encouraged by an orrery in Professor Maclaurin's possession, had completed his first demonstrated to Maclaurin's class and then presented to his friend 'the Reverend and ingenious Mr. Alexander Irvine, at Elgin' [Ferguson]. From 1743 on moving to London he made several more orreries, including the above of wood.



[Millburn]

Ferguson locations in The Strand and Fleet St. 1756-7

The Globe 1756-58 **11**, Millar's bookshop **12**, Senex's globe and print shop **14**, Royal Society Crane Court **16**, Red Lion Ct 1758-62 **17**, Bolt Ct 1768-76 **18**.



ASTRONOMY

EXPLAINED UPON

Sir ISAAC NEWTON's

PRINCIPLES,

AND MADE EASY

TO THOSE WHO HAVE NOT STUDIED

MATHEMATICS.

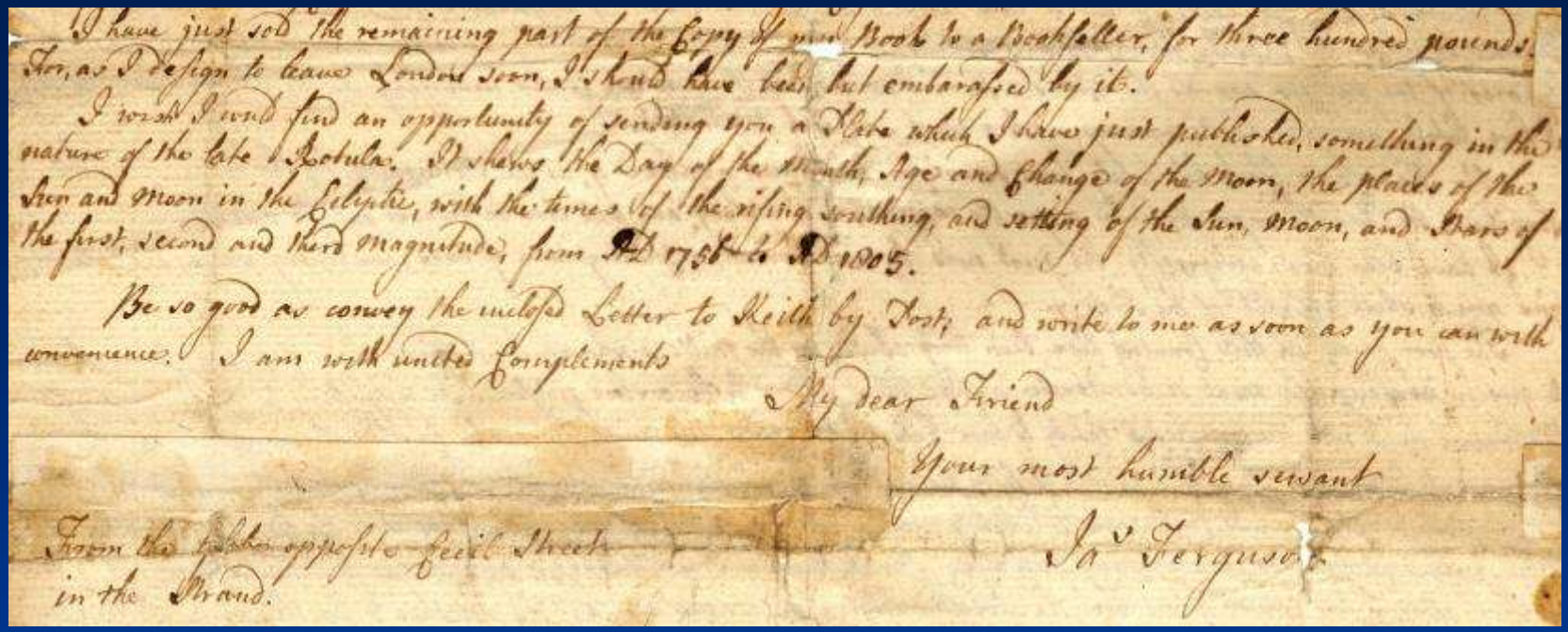
By JAMES FERGUSON.

HEB. XI. 3. *The Worlds were framed by the Word of* GOD.
JOB XXVI. 13. *By his Spirit he hath garnished the Heavens.*

THE SECOND EDITION.

LONDON:
Printed for, and sold by the AUTHOR, at the GLOBE, opposite *Cecil-Street* in the *Strand.*
MDCCLVII.

Ferguson's first major publication *Astronomy Explained*, 1756. The 2nd ed. 1757 of which, from Ferguson's letter below, it is seen that the part remaining unsold in January 1758 was sold for £300 [to bookseller and publisher Andrew Millar].



I have just sold the remaining part of the Copy of my Book to a Bookseller, for three hundred pounds. For, as I design to leave London soon, I should have been but embarrassed by it.

I wish I could find an opportunity of sending you a Plate which I have just published, something in the nature of the late Ephemeris. It shews the Day of the Month, Age and Change of the Moon, the places of the Sun and Moon in the Ecliptic, with the times of the rising southing, and setting of the Sun, Moon, and Stars of the first, second and third magnitude, from A.D. 1758 to A.D. 1805.

Be so good as convey the inclosed Letter to Keith by Post, and write to me as soon as you can with convenience. I am with united Compliments

My dear Friend

Your most humble servant

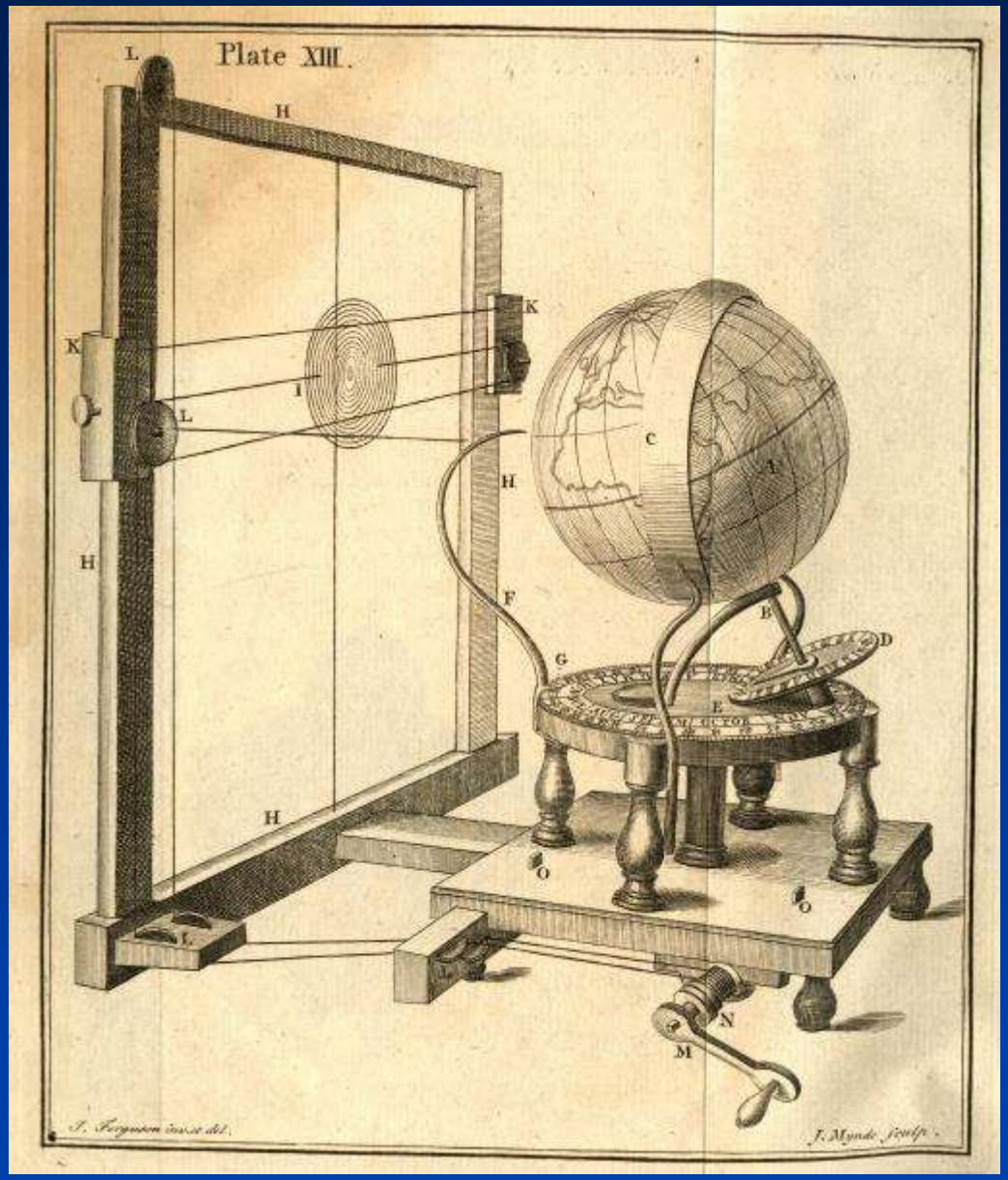
Jas Ferguson

From the Globe opposite Exeter Street in the Strand.

[Private collection]

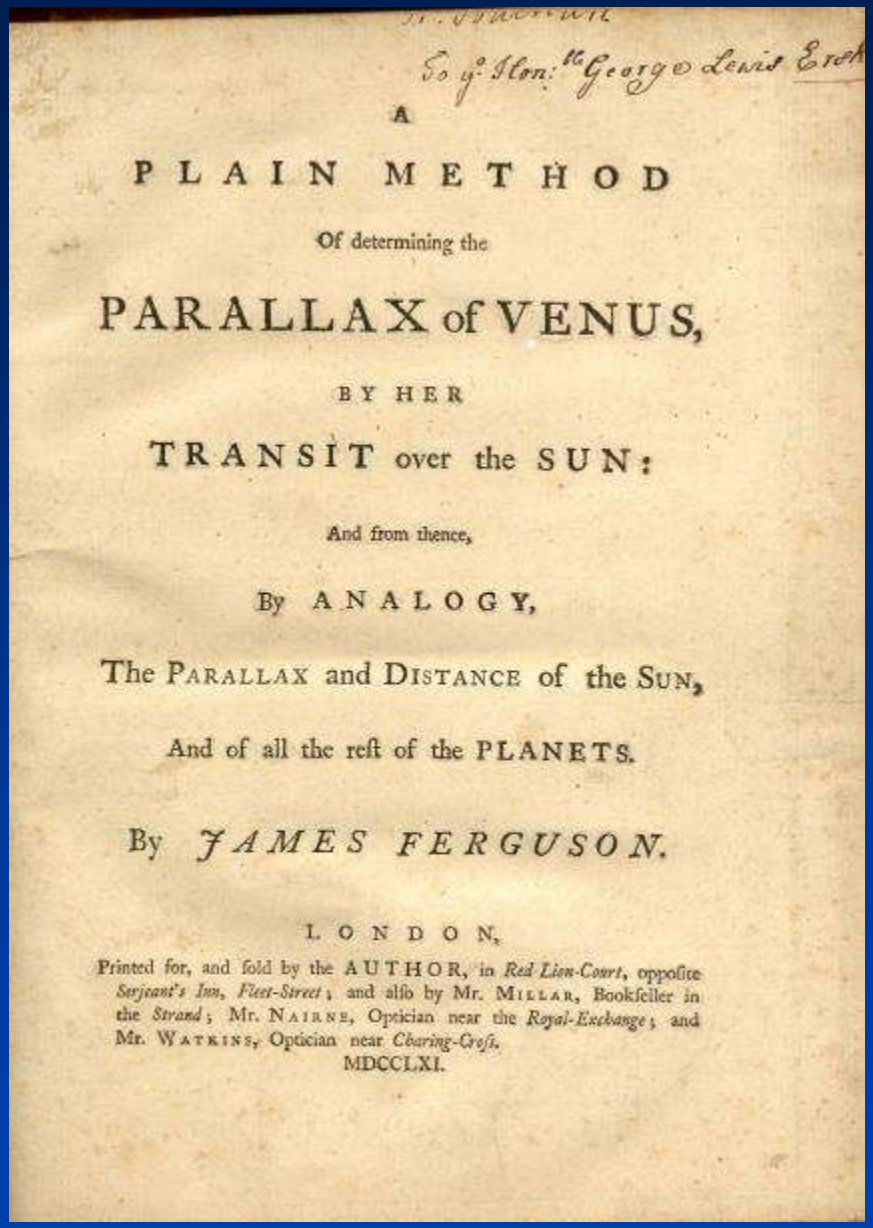
Ferguson letter of January 1758 to Rev. Alexander Irvine, Elgin (d.1758).

“I have just sold the remaining part of the copy of my book to a bookseller for three hundred pounds. For as I design to leave London soon I should have been but embarrassed by it”.



Ferguson's Eclipsareon for "Exhibiting the Time, Duration and Quantity of Solar Eclipses at all places of the Earth . . . the best machine I ever contrived"

[Ferguson, *Astronomy Explained*]



To ye Hon:ble George Lewis Erskine

A

PLAIN METHOD

Of determining the

PARALLAX of VENUS,

BY HER

TRANSIT over the SUN:

And from thence,

By ANALOGY,

The PARALLAX and DISTANCE of the SUN,

And of all the rest of the PLANETS.

By *JAMES FERGUSON.*

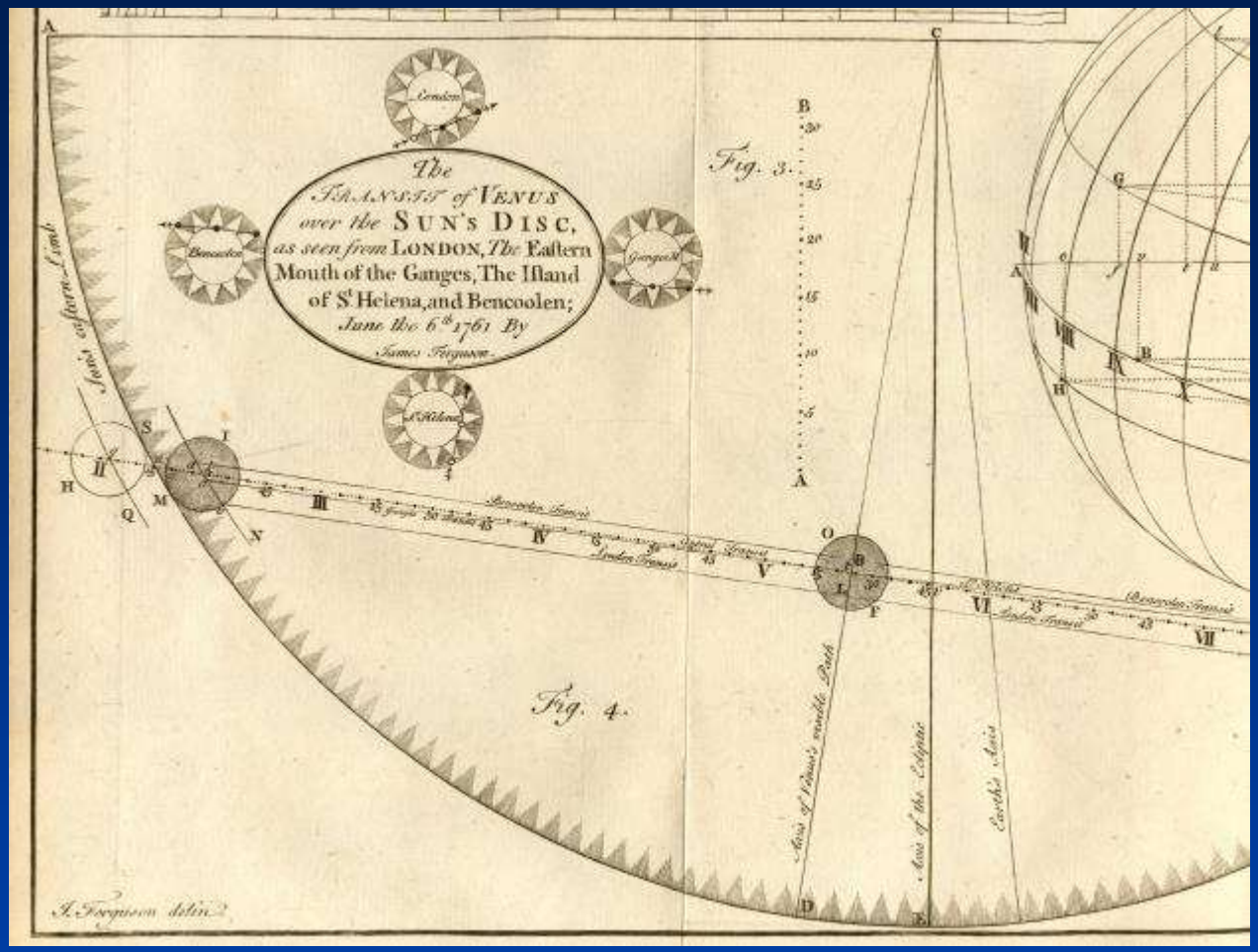
LONDON,

Printed for, and sold by the AUTHOR, in *Red Lion-Court*, opposite *Serjeant's Inn, Fleet-Street*; and also by Mr. MILLAR, Bookseller in the *Strand*; Mr. NAIRNE, Optician near the *Royal-Exchange*; and Mr. WATKINS, Optician near *Charing-Cross*.

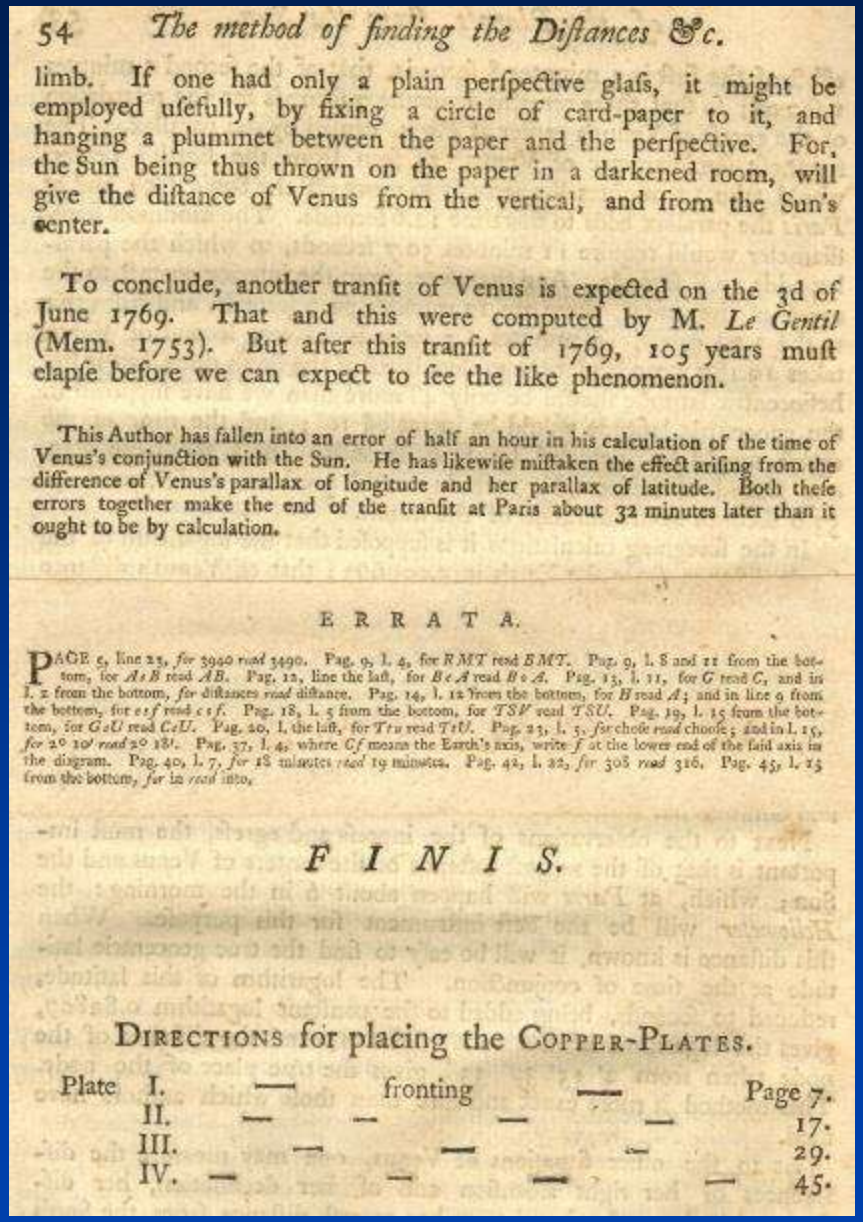
MDCCLXI.

[Private collection]

This 4to tract first published in 1761 helped establish Ferguson's reputation. Its content was incorporated into *Astronomy Explained* from the 3rd ed. onwards. This copy is inscribed "To ye Honble George Lewis Erskine" (d.1764), third son of the 9th Earl of Buchan.
One of four plates shows -



The transit of Venus as seen from London, India, St. Helena and Bencoolen. Measuring its parallax by means of a telescope and chronometer enabled the distance of the sun to be estimated.



54 *The method of finding the Diſtances &c.*

limb. If one had only a plain perſpective glaſs, it might be employed uſefully, by fixing a circle of card-paper to it, and hanging a plummet between the paper and the perſpective. For, the Sun being thus thrown on the paper in a darkened room, will give the diſtance of Venus from the vertical, and from the Sun's center.

To conclude, another tranſit of Venus is expected on the 3d of June 1769. That and this were computed by M. *Le Gentil* (Mem. 1753). But after this tranſit of 1769, 105 years muſt elapſe before we can expect to ſee the like phenomenon.

This Author has fallen into an error of half an hour in his calculation of the time of Venus's conjunction with the Sun. He has likewiſe miſtaken the effect ariſing from the difference of Venus's parallax of longitude and her parallax of latitude. Both theſe errors together make the end of the tranſit at Paris about 32 minutes later than it ought to be by calculation.

ERRATA.

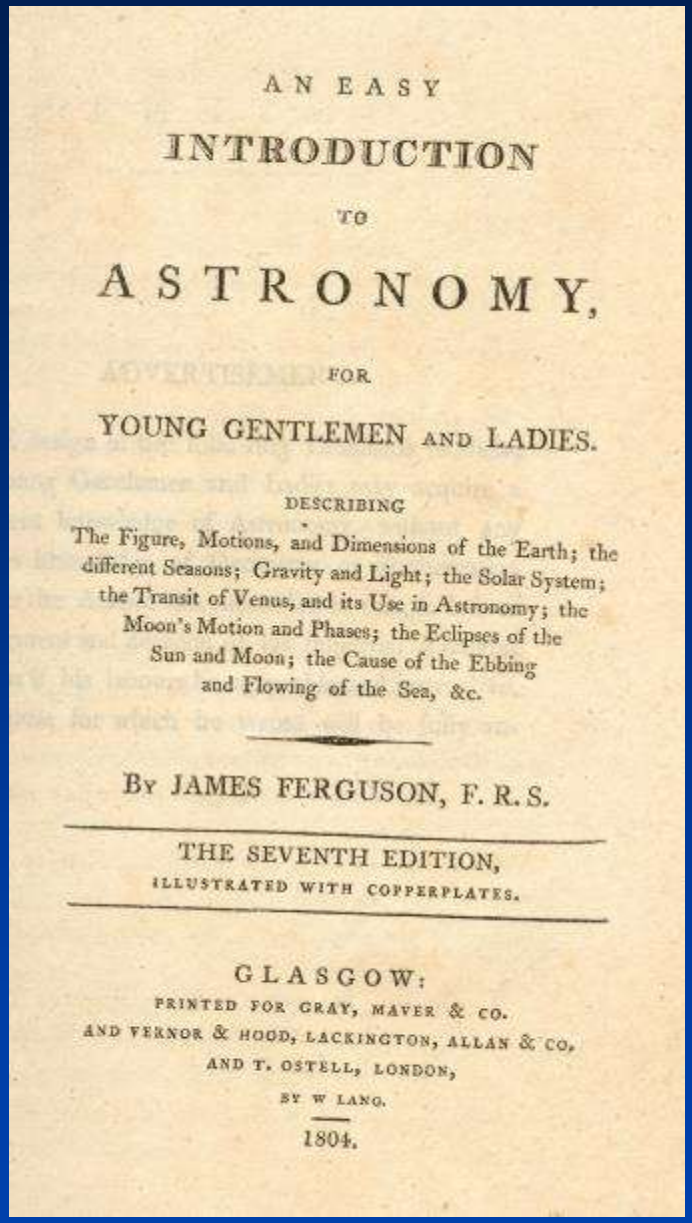
PAGE 5, line 23, *for* 3940 *read* 3490. Pag. 9, l. 4, for *RMT* read *BMT*. Pag. 9, l. 8 and 11 from the bottom, for *AsB* read *AB*. Pag. 12, line the laſt, for *BcA* read *BoA*. Pag. 13, l. 11, for *G* read *C*, and in l. 2 from the bottom, *for* diſtances *read* diſtance. Pag. 14, l. 12 from the bottom, for *H* read *A*; and in line 9 from the bottom, for *ecf* read *cef*. Pag. 18, l. 5 from the bottom, for *TSV* read *TSU*. Pag. 19, l. 15 from the bottom, for *GcU* read *CcU*. Pag. 20, l. the laſt, for *Ttu* read *TtU*. Pag. 23, l. 5, *for* choſe *read* chooſe; and in l. 15, *for* 20° 10′ *read* 20° 18′. Pag. 37, l. 4, where *Cf* means the Earth's axis, write *f* at the lower end of the ſaid axis in the diagram. Pag. 40, l. 7, *for* 18 minutes *read* 19 minutes. Pag. 42, l. 22, *for* 308 *read* 316. Pag. 45, l. 25 from the bottom, *for* in *read* into.

F I N I S.

DIRECTIONS for placing the COPPER-PLATES.

Plate	I.	fronting	Page 7.
	II.	—	17.
	III.	—	29.
	IV.	—	45.

Layout of final page in which Ferguson takes M. Le Gentil to task for two errors making the end of the transit at Paris about 32 minutes later than it ought to have been. Note the errata paste down and directions to the binder.



AN EASY

INTRODUCTION

TO

ASTRONOMY,

FOR

YOUNG GENTLEMEN AND LADIES.

DESCRIBING

The Figure, Motions, and Dimensions of the Earth; the different Seasons; Gravity and Light; the Solar System; the Transit of Venus, and its Use in Astronomy; the Moon's Motion and Phases; the Eclipses of the Sun and Moon; the Cause of the Ebbing and Flowing of the Sea, &c.

BY JAMES FERGUSON, F. R. S.

THE SEVENTH EDITION,

ILLUSTRATED WITH COPPERPLATES.

GLASGOW:

PRINTED FOR GRAY, MAVER & CO.

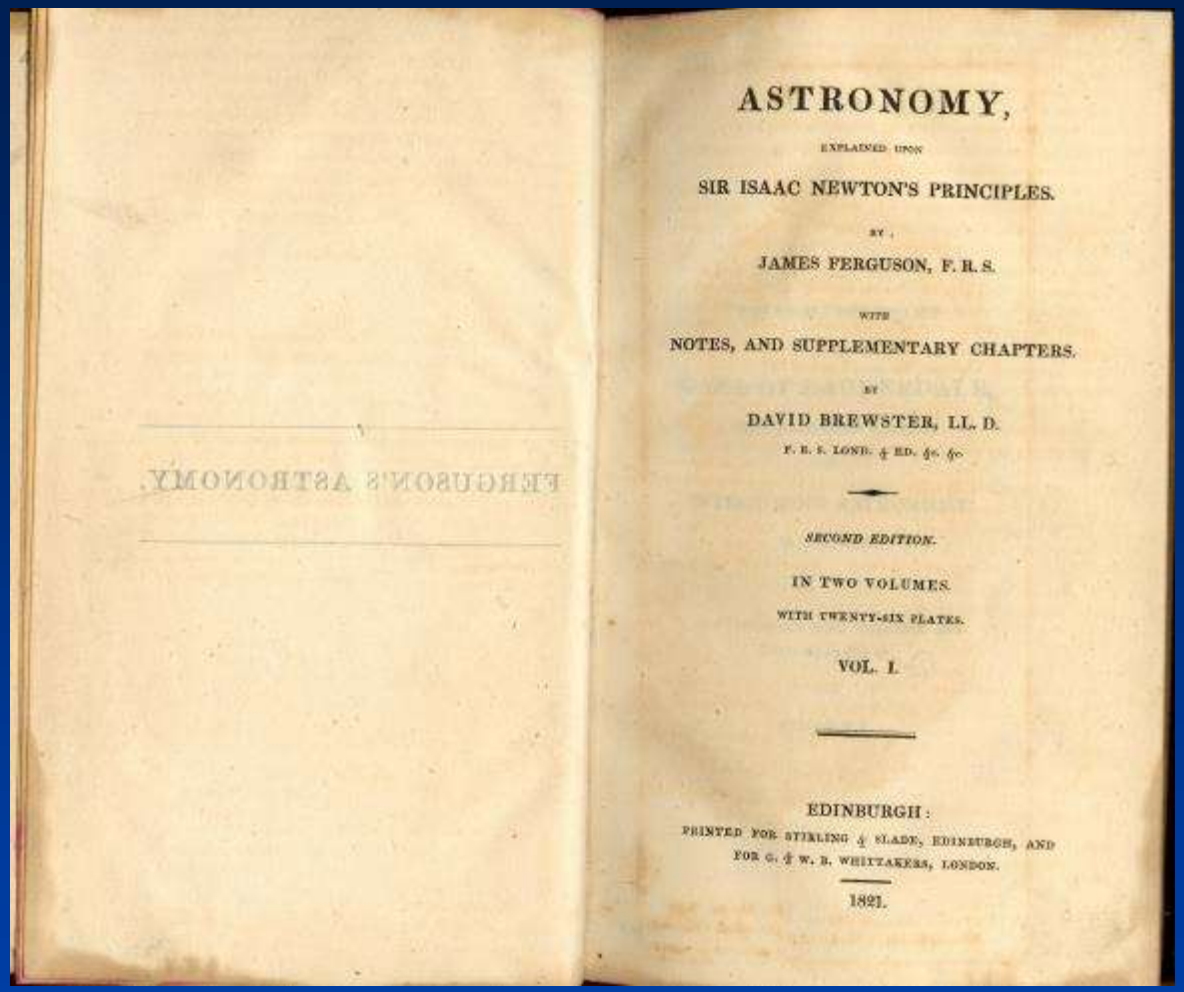
AND VERNOR & HOOD, LACKINGTON, ALLAN & CO.

AND T. OSTELL, LONDON,

BY W LANG.

1804.

Ferguson's *Easy Introduction to Astronomy* – a Glasgow edition published nearly three decades after his death



ASTRONOMY,

EXPLAINED UPON

SIR ISAAC NEWTON'S PRINCIPLES.

BY

JAMES FERGUSON, F. R. S.

WITH

NOTES, AND SUPPLEMENTARY CHAPTERS.

BY

DAVID BREWSTER, LL. D.

F. R. S. LOND. & ED. &c. &c.

SECOND EDITION.

IN TWO VOLUMES.

WITH TWENTY-SIX PLATES.

VOL. I.

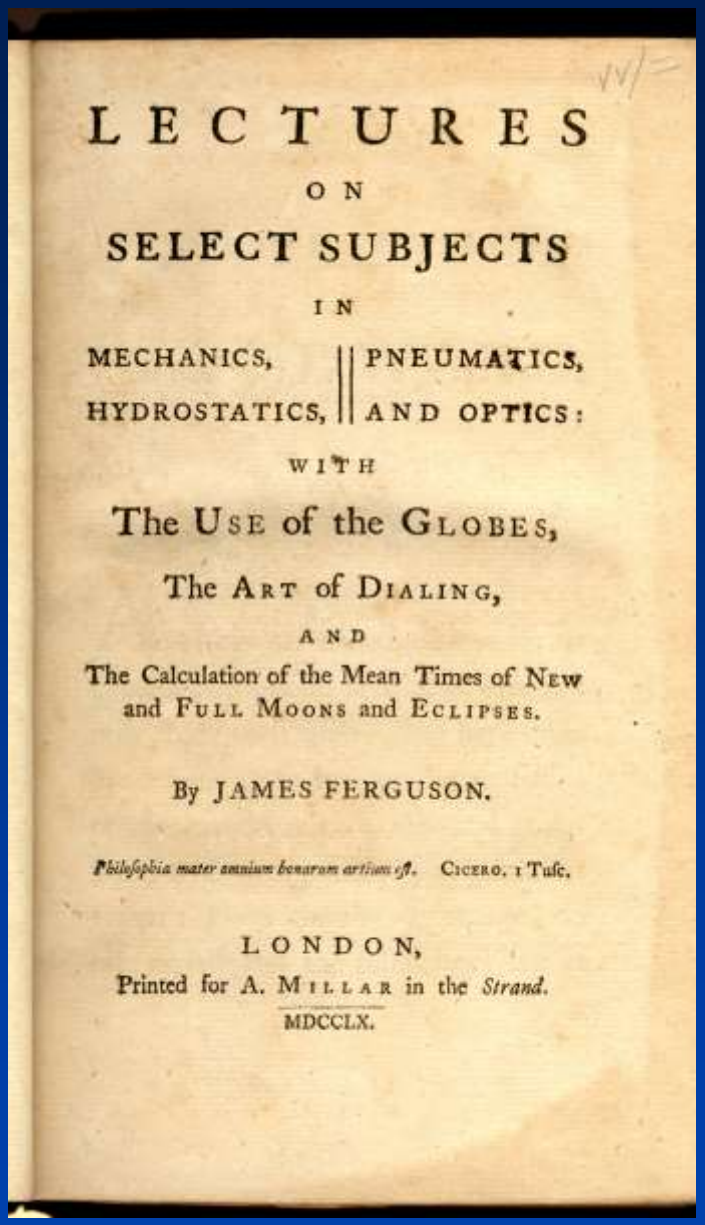
EDINBURGH:

PRINTED FOR STIRLING & SLADE, EDINBURGH, AND

FOR G. & W. B. WHITTAKERS, LONDON.

1821.

The life of this work was extended by David Brewster in Edinburgh editions of 1811, 1821 and 1841. There were at least 3 American and German editions.



LECTURES

ON

SELECT SUBJECTS

IN

MECHANICS, PNEUMATICS,
HYDROSTATICS, AND OPTICS:

WITH

The USE of the GLOBES,

The ART of DIALING,

AND

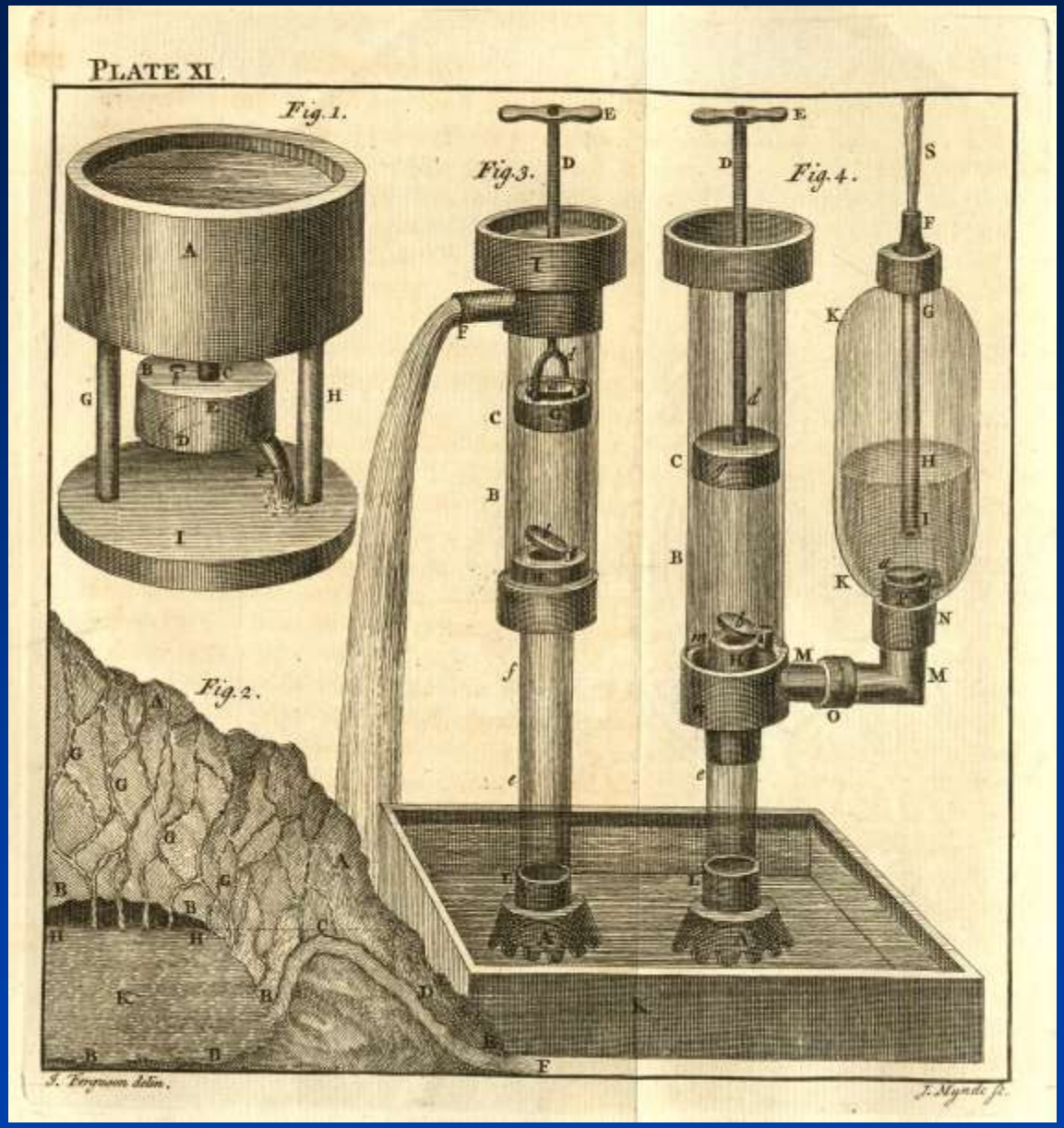
The Calculation of the Mean Times of NEW and FULL MOONS and ECLIPSES.

By JAMES FERGUSON.

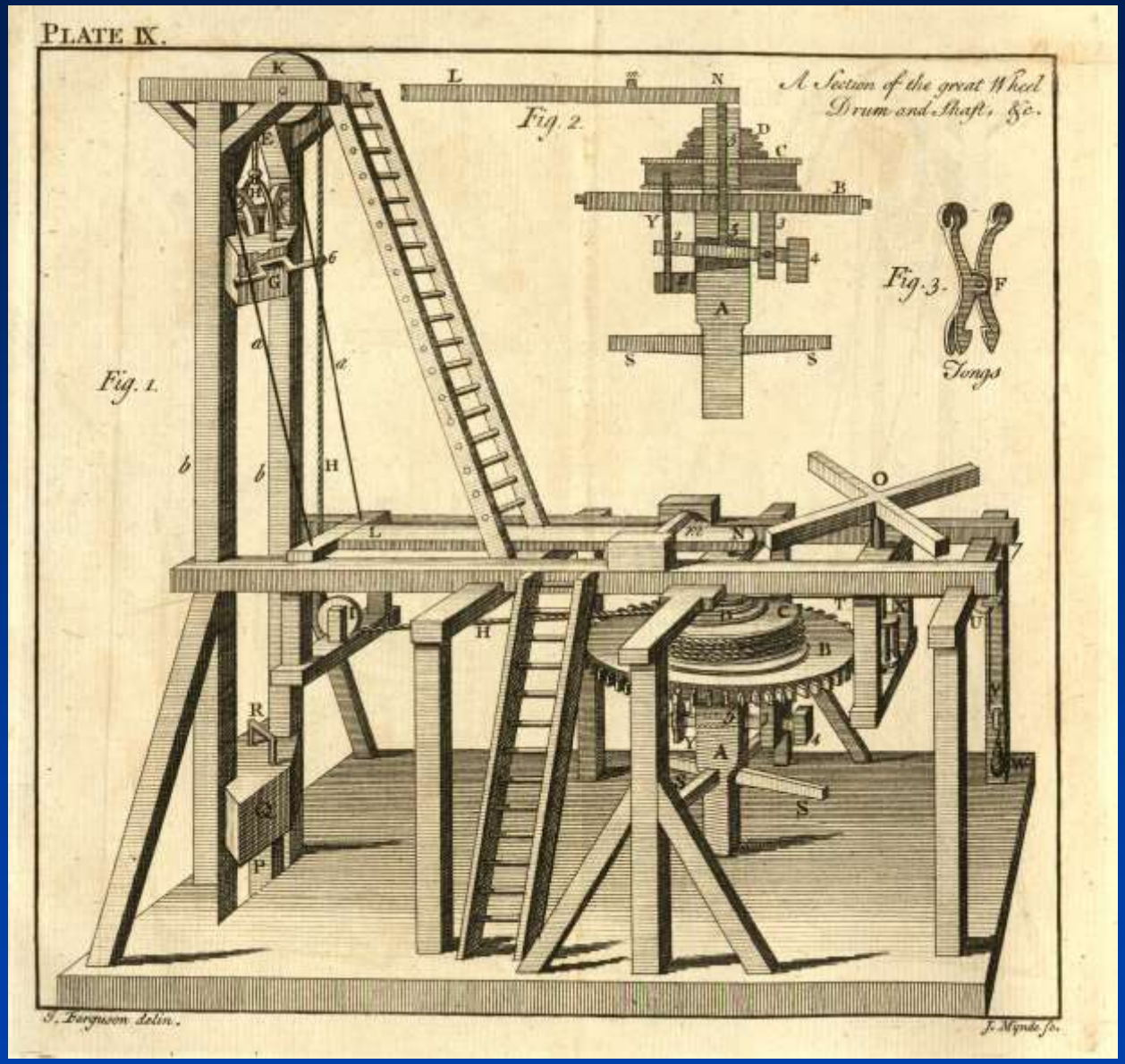
Philosophia mater omnium bonarum artium est. CICERO, 1 Tusc.

LONDON,
Printed for A. MILLAR in the *Strand*.
MDCCLX.

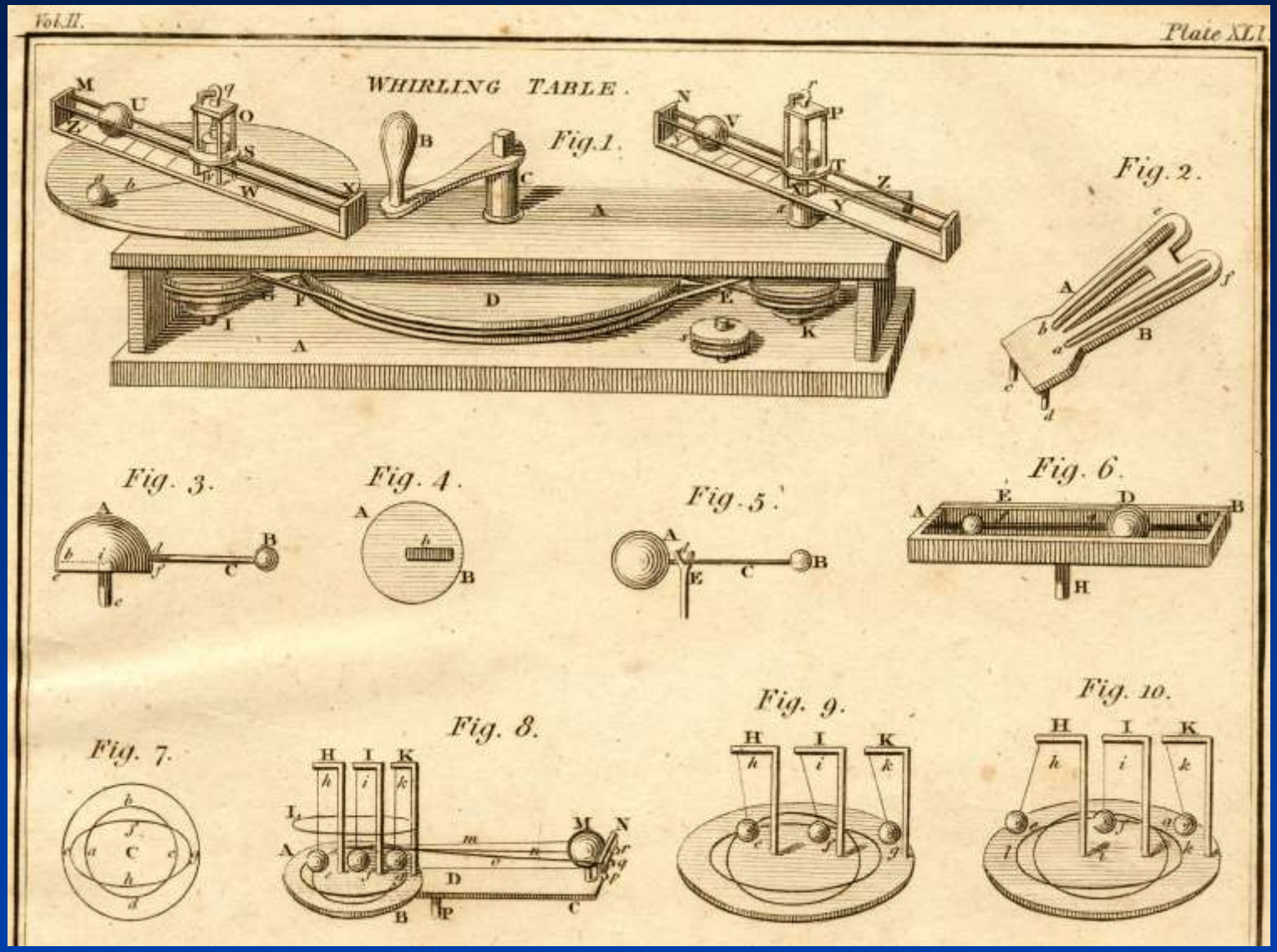
1st edition of Ferguson's *Lectures* 1760, which established his reputation in these subjects and served for nearly a century.



Typical plate – showing pumping (glass tubes) – Ferguson model

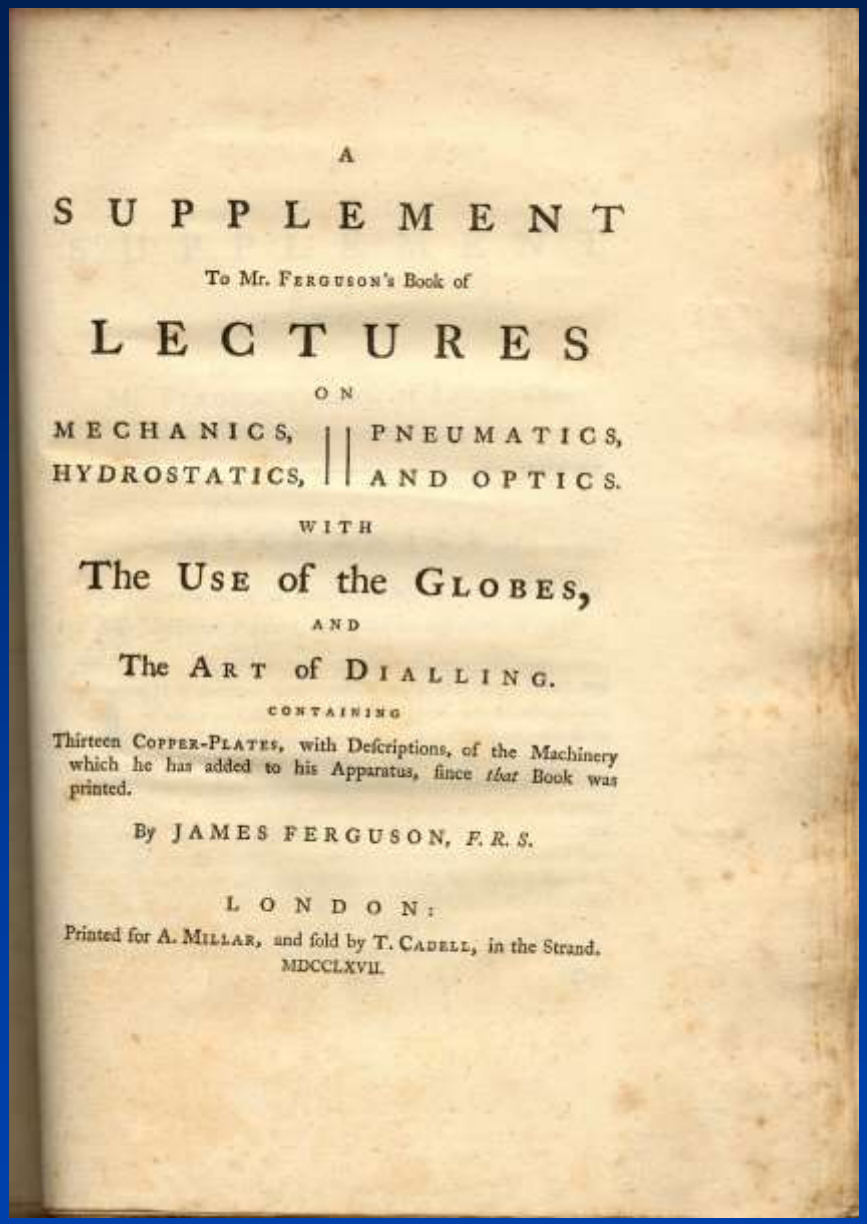


Valoue's piling engine at Westminster Bridge (1738-50) – Ferguson model



Ferguson's improved whirling table first published in 1760

Ferguson’s improved whirling table first published in 1760 to demonstrate the laws by which the planets move and are retained in their orbits; that the sun and all the planets move round their common centre of gravity; that the earth and moon move round their common centre of gravity once every month: that the earth moves round the sun in common with the rest of the planets, and that the power of gravity diminishes in proportion as the square of the distance from the attracting body increases, and much else. From Charles Hutton’s *Mathematical Dictionary* 1796 and 1815. Hutton knew Ferguson well and thought him of ‘very uncommon genius especially in mechanical contrivances and executions . . . his constant method being to satisfy himself, as to the truth of any problem, with a measurement . . . He was a man of a very clear judgement in anything he professed, and of unwearied application to study: benevolent, meek, and innocent in his manner as a child: humble, courteous, and communicative: instead of pedantry, philosophy seemed to produce in him only diffidence and urbanity.’



A

SUPPLEMENT

To Mr. Ferguson's Book of

LECTURES

ON

MECHANICS, HYDROSTATICS, PNEUMATICS, AND OPTICS.

WITH

The Use of the Globes,

AND

The Art of Dialling.

CONTAINING

Thirteen Copper-Plates, with Descriptions, of the Machinery which he has added to his Apparatus, since *that* Book was printed.

By JAMES FERGUSON, *F. R. S.*

LONDON:

Printed for A. Millar, and sold by T. Cadell, in the Strand.

MDCCLXVII.

A 4to edition of the lectures was published in 1764 to which was added this supplement in 1767 with 13 additional plates.

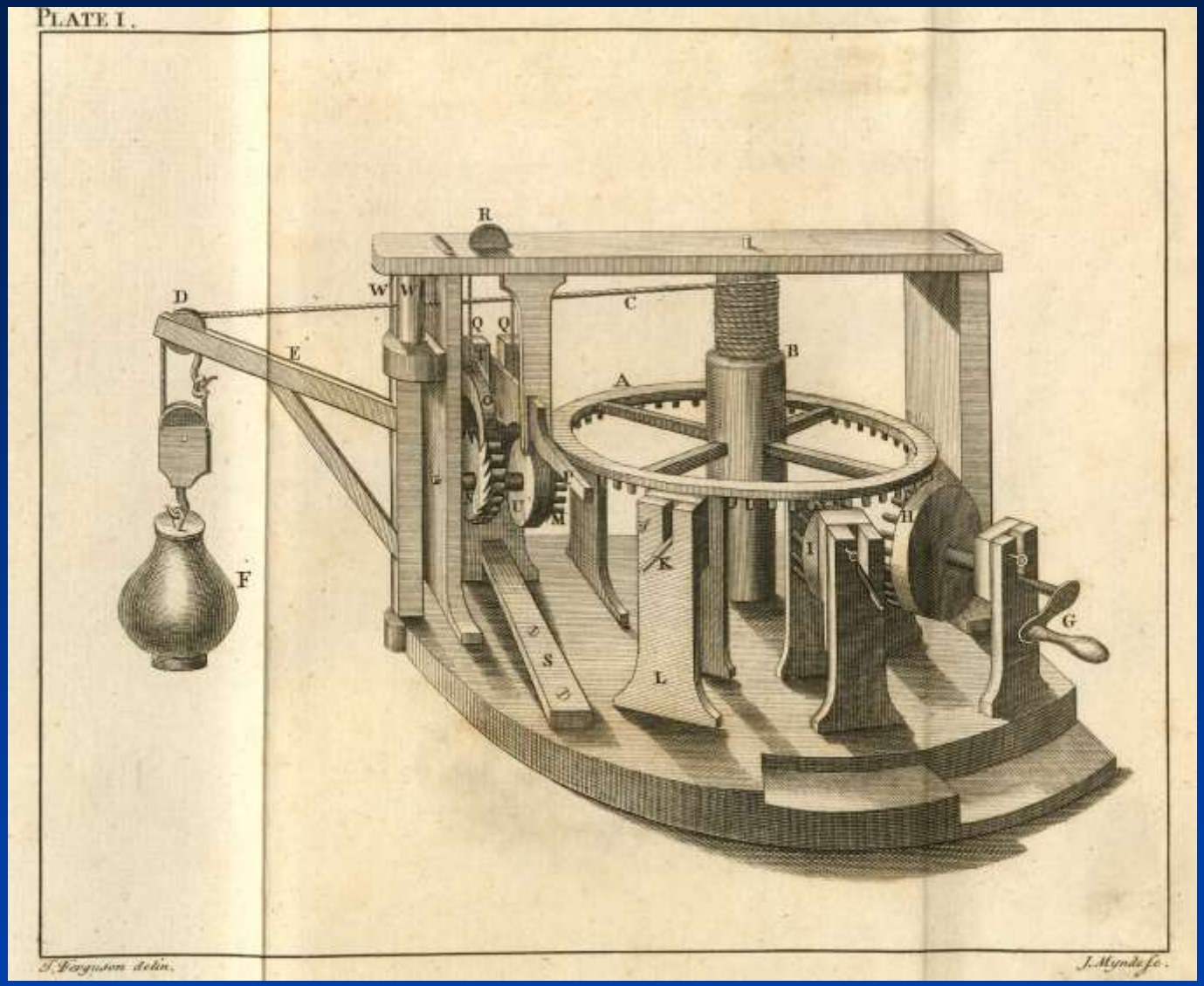


Plate 1 Ferguson’s improved safety crane – model made.

Published by the same Author.

1. ASTRONOMY explained upon Sir ISAAC NEWTON's Principles, and made easy to those who have not studied *Mathematics*. To which is added, the method of finding the Distances of the Planets from the Sun, by the TRANSIT of VENUS over the Sun's Disc in the Year 1761. These Distances deduced from that Transit; and an account of Mr. HORROCKS's Observations of the Transit in the Year 1639: Illustrated with 18 Copper-plates. A New Edition, Octavo.

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WITH

The USE of the GLOBES,

The ART of DIALING,

AND

The Calculation of the Mean Times of NEW and FULL MOONS and ECLIPSES.

With the SUPPLEMENT.

By JAMES FERGUSON, *F. R. S.*

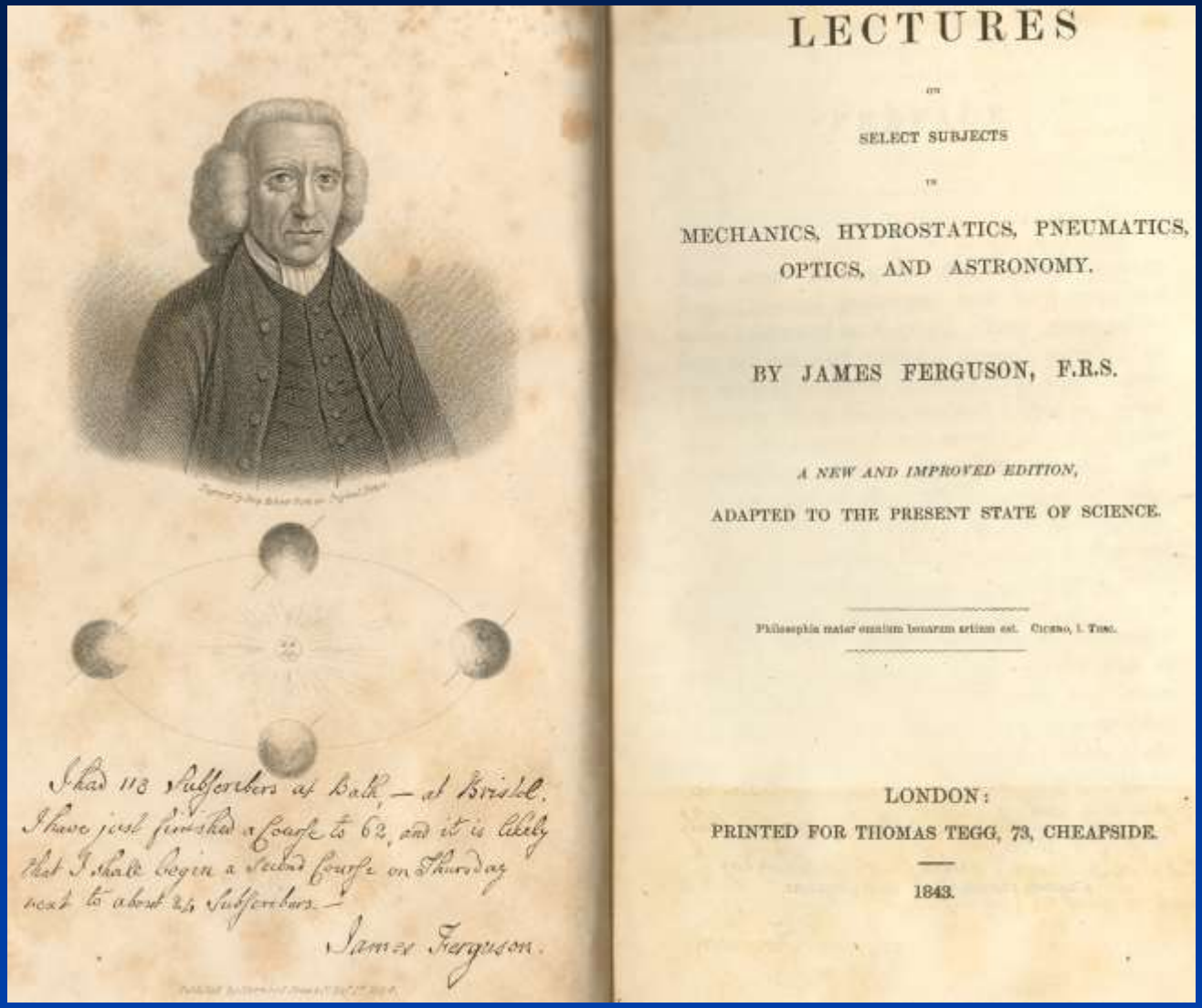
THE SECOND EDITION.

Philosophia mater omnium bonarum artium est. CICERO. 1. Tusc.

LONDON:
Printed for W. STRAHAN, J. and F. RIVINGTON, J. HINTON, L. HAWES and Co. W. JOHNSTON, S. CROWDER, T. LONGMAN, B. LAW, ROBINSON and ROBERTS, and T. CADELL. MDCCLXX.

Strahan's 2nd 8vo ed. of the complete work, 1770

In 1805 scientist David Brewster in editing an edition of Ferguson's *Lectures on Mechanics* wrote, "The writings of Mr. Ferguson have been long and justly distinguished for their perspicuity and plainness. It seems to have been the chief object of his labours to give a familiar view of the various branches of physical science, and to render them accessible to those who are not accustomed to mathematical investigation; and the favourable reception which his works have everywhere experienced, are satisfactory proofs that he did not labour in vain . . . he had a peculiar talent for rendering intelligible what was abstracted". Brewster published further editions in 1806 and 1823.



I had 113 Subscribers at Bath, — at Bristol. I have just finished a Course to 62, and it is likely that I shall begin a second Course on Thursday next to about 24 Subscribers. —

James Ferguson.

LECTURES

ON

SELECT SUBJECTS

IN

MECHANICS, HYDROSTATICS, PNEUMATICS, OPTICS, AND ASTRONOMY.

BY JAMES FERGUSON, F.R.S.

A NEW AND IMPROVED EDITION,

ADAPTED TO THE PRESENT STATE OF SCIENCE.

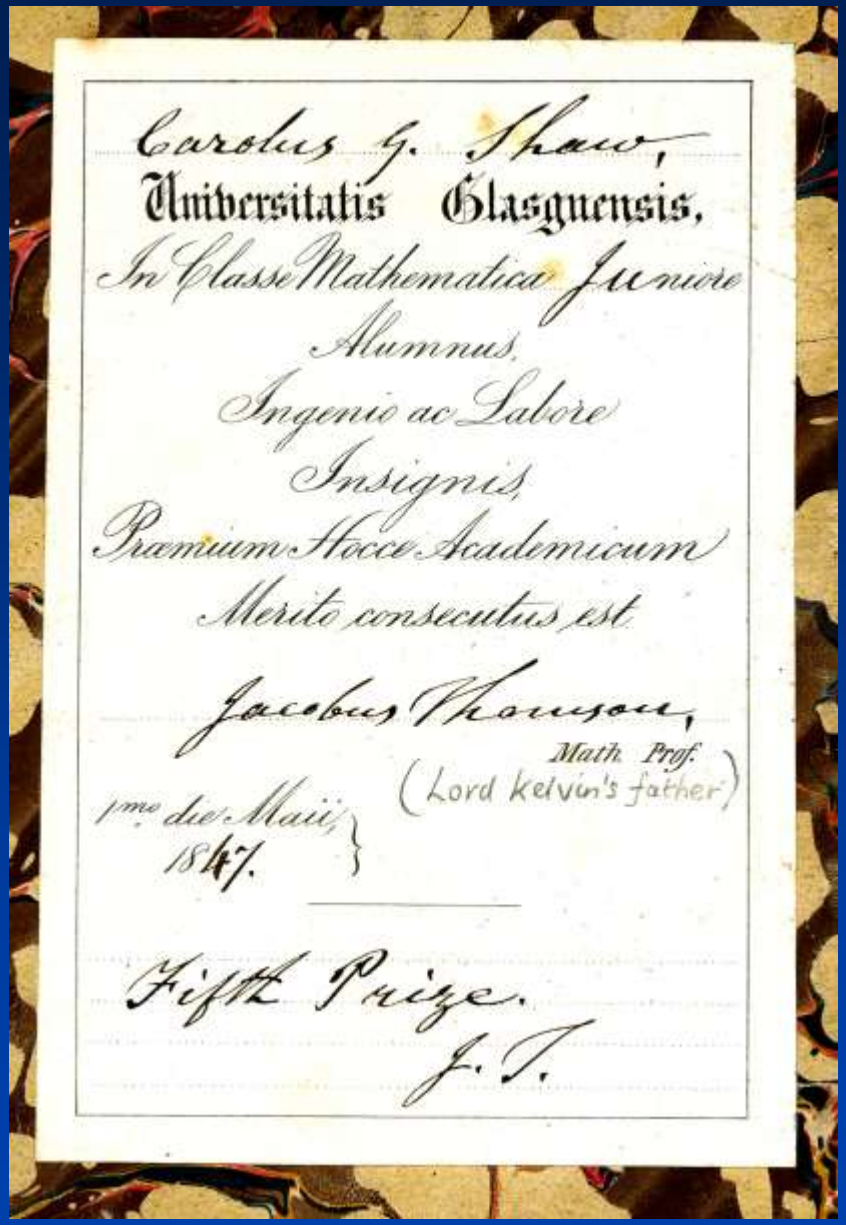
Philosophia mater omnium bonarum artium est. Cicero, l. Tusc.

LONDON:

PRINTED FOR THOMAS TEGG, 73, CHEAPSIDE.

1843.

Partington 1843 reprint – the last?



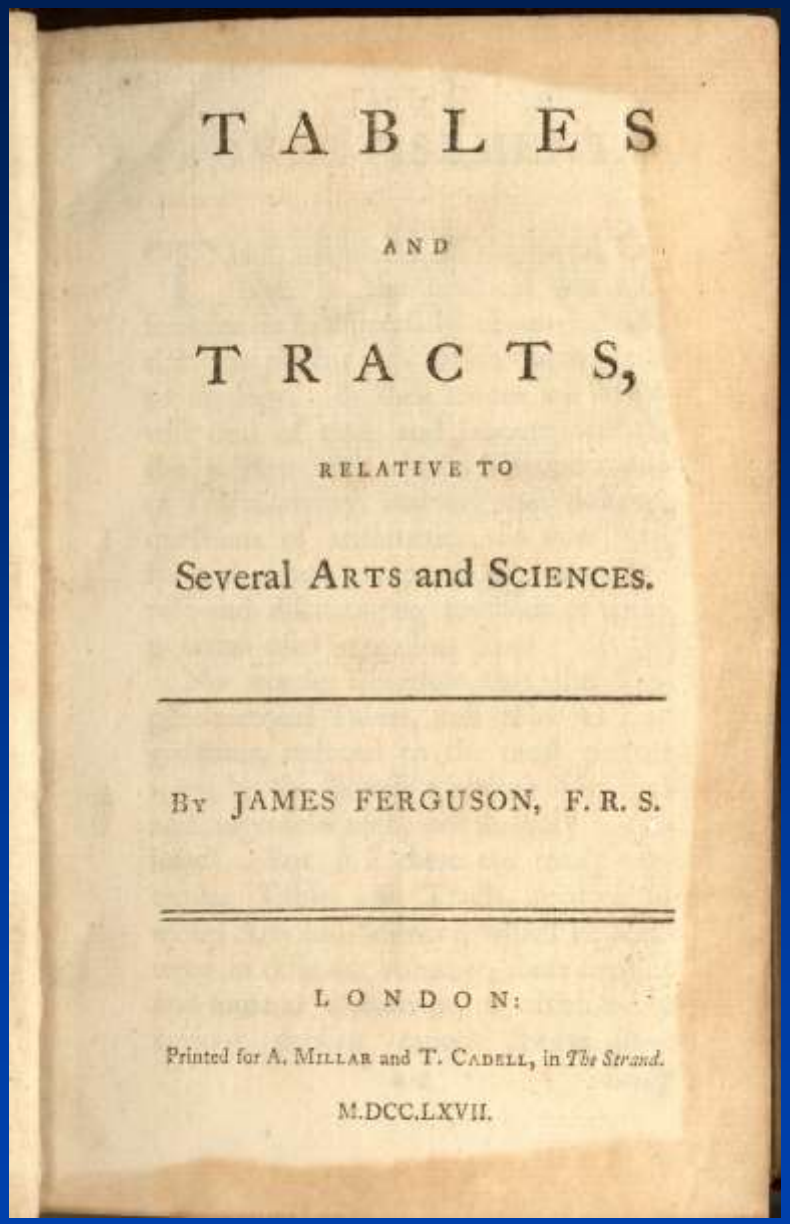
Carolus G. Shaw,
Universitatis Glasguensis,
In Classe Mathematica Juniore
Alumnus,
Ingenio ac Labore
Insignis,
Præmium Hocce Academicum
Merito consecutus est.

Jacobus Thomson,
Math. Prof.
(Lord kelvin's father)

1mo die Maii,
1847.

Fifth Prize.
J. T.

The University of Glasgow was still giving the *Lectures* as prizes in 1847 via James Thomson [Lord Kelvin's father]



TABLES

AND

TRACTS,

RELATIVE TO

Several ARTS and SCIENCES.

BY JAMES FERGUSON, F. R. S.

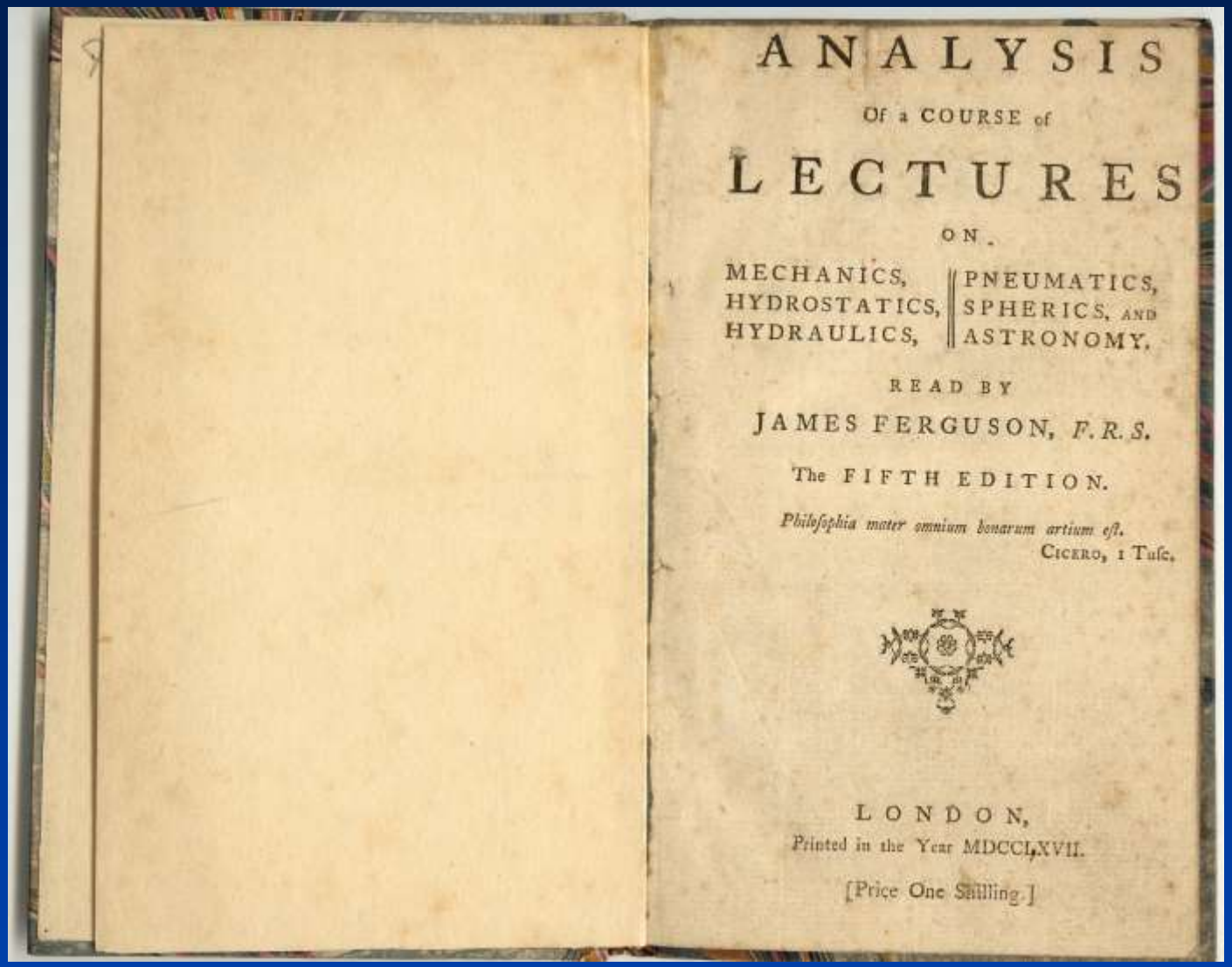
LONDON:

Printed for A. MILLAR and T. CADELL, in *The Strand.*

M.DCC.LXVII.

1st ed. Contains an extraordinary assortment of 76 items ranging “from tables of lunar motions, to how to gauge a common cask; from an account of Mr Villette’s burning mirror, to tables of Jewish dry measures; from a dissertation on eclipses, to instructions for drawing a meridian line . . . mechanical devices such as clocks and orreries . . .” [Millburn 216]

Ferguson’s FRS [1763] is added to this title.



ANALYSIS

Of a COURSE of

LECTURES

ON

MECHANICS, HYDROSTATICS, HYDRAULICS, PNEUMATICS, SPHERICS, AND ASTRONOMY.

READ BY

JAMES FERGUSON, *F.R.S.*

The FIFTH EDITION.

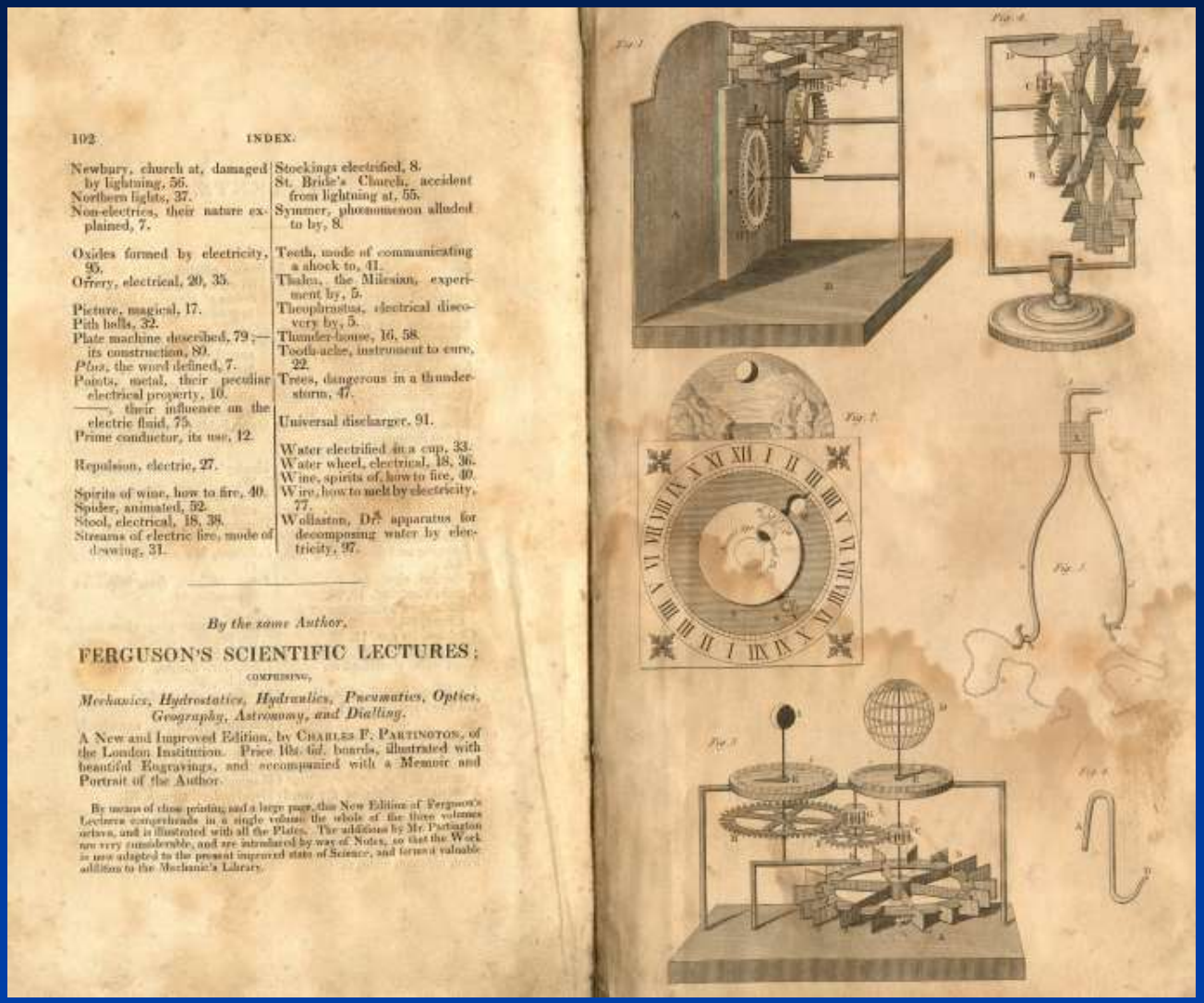
Philosophia mater omnium bonarum artium est.
CICERO, 1 Tusc.

LONDON,
Printed in the Year MDCCLXVII.

[Price One Shilling.]

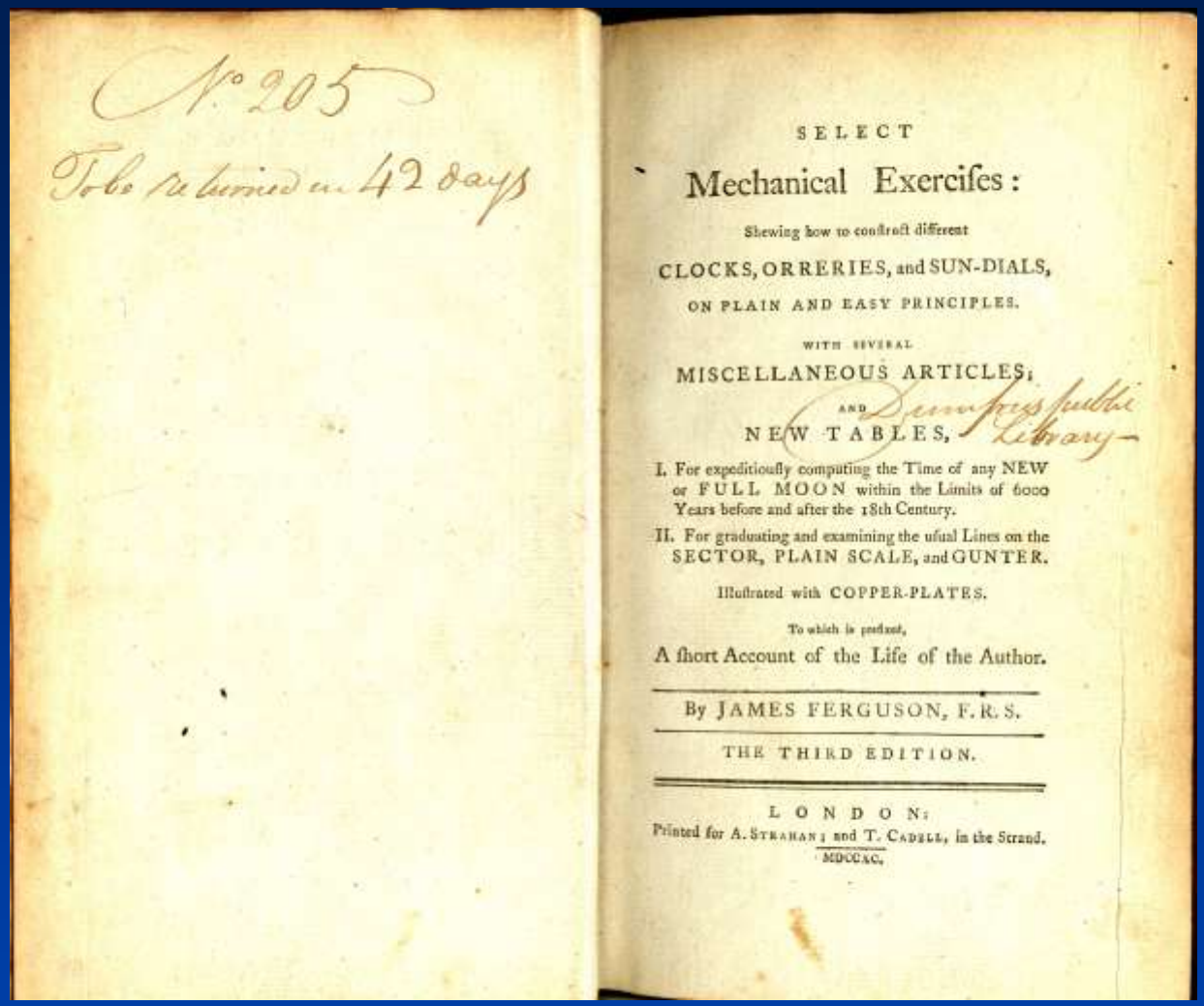
Analysis of a Course of Lectures 1761-76

Ferguson, with more than 60 models and instruments, gave courses of twelve lectures at many centres throughout England and Scotland. To promote these he published a 48-page *Analysis of a Course of Lectures* from 1761-76. ‘Electricity’ first appeared in the 6th ed. 1769 following its successful introduction in Edinburgh and his having made a model of a water mill operated by electricity. Ferguson gave details of this model and an electric clock he had made in a letter of 27 February 1769 to his friend Hugh Girvan (d. 1770), tutor at Makerstoun House near Kelso. Also of an electrical model crane that raised a half a pound weight, an electrically operated orrery, and having cured his wife “of a rheumatic pain in one of her shoulders and of a chilblain in one of her toes, only by taking sparks from the affected places, without shocks.”



102 INDEX.

Ferguson's electrically operated mill, clock and orrery models. From Partington's edition of Ferguson's *Electricty* 1825, substantially similar to the four earlier editions from 1770.



No. 205

To be returned in 42 days

SELECT

Mechanical Exercifes:

Shewing how to conftruct different

CLOCKS, ORRERIES, and SUN-DIALS,

ON PLAIN AND EASY PRINCIPLES.

WITH SEVERAL

MISCELLANEOUS ARTICLES;

AND

NEW TABLES,

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To which is prefixed,

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By JAMES FERGUSON, F.R.S.

THE THIRD EDITION.

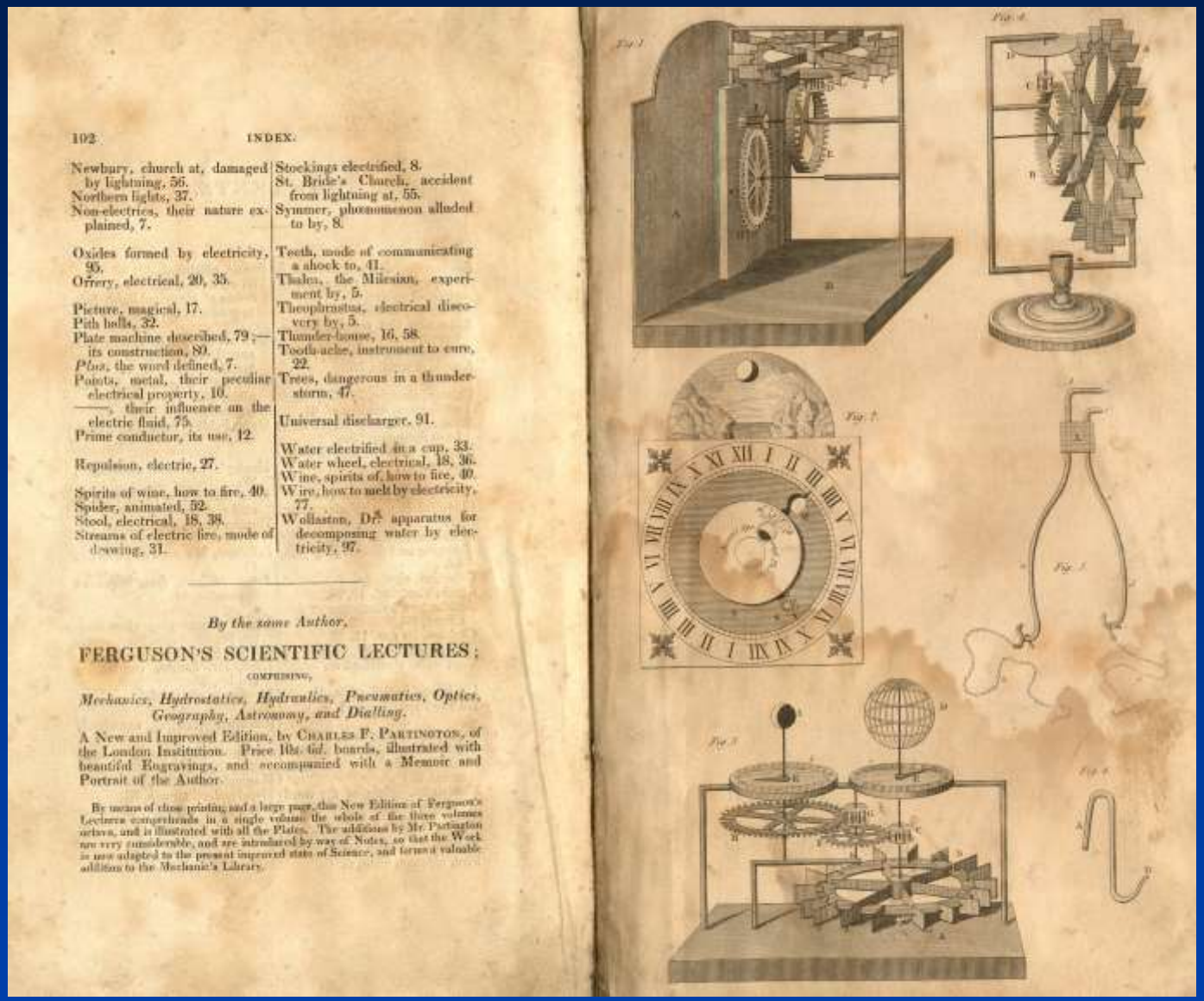
LONDON:

Printed for A. STRAHAN; and T. CADELL, in the Strand.

MDCCXC.

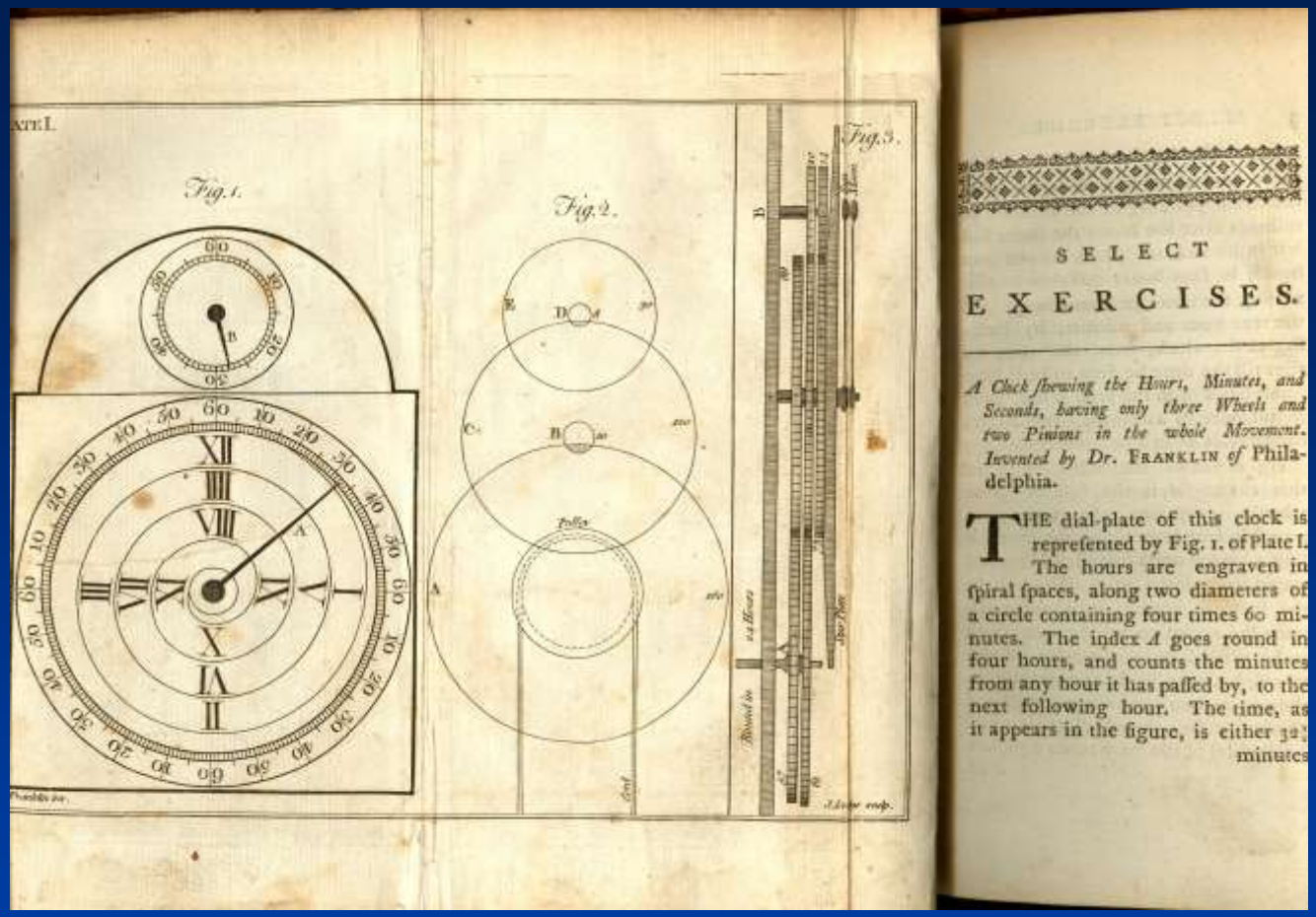
Ferguson's work on clocks, orreries and sundials 1773-1778-1790.

This copy ex libris Dumfries Public Library, book No. 205 – "to be returned in 42 days".



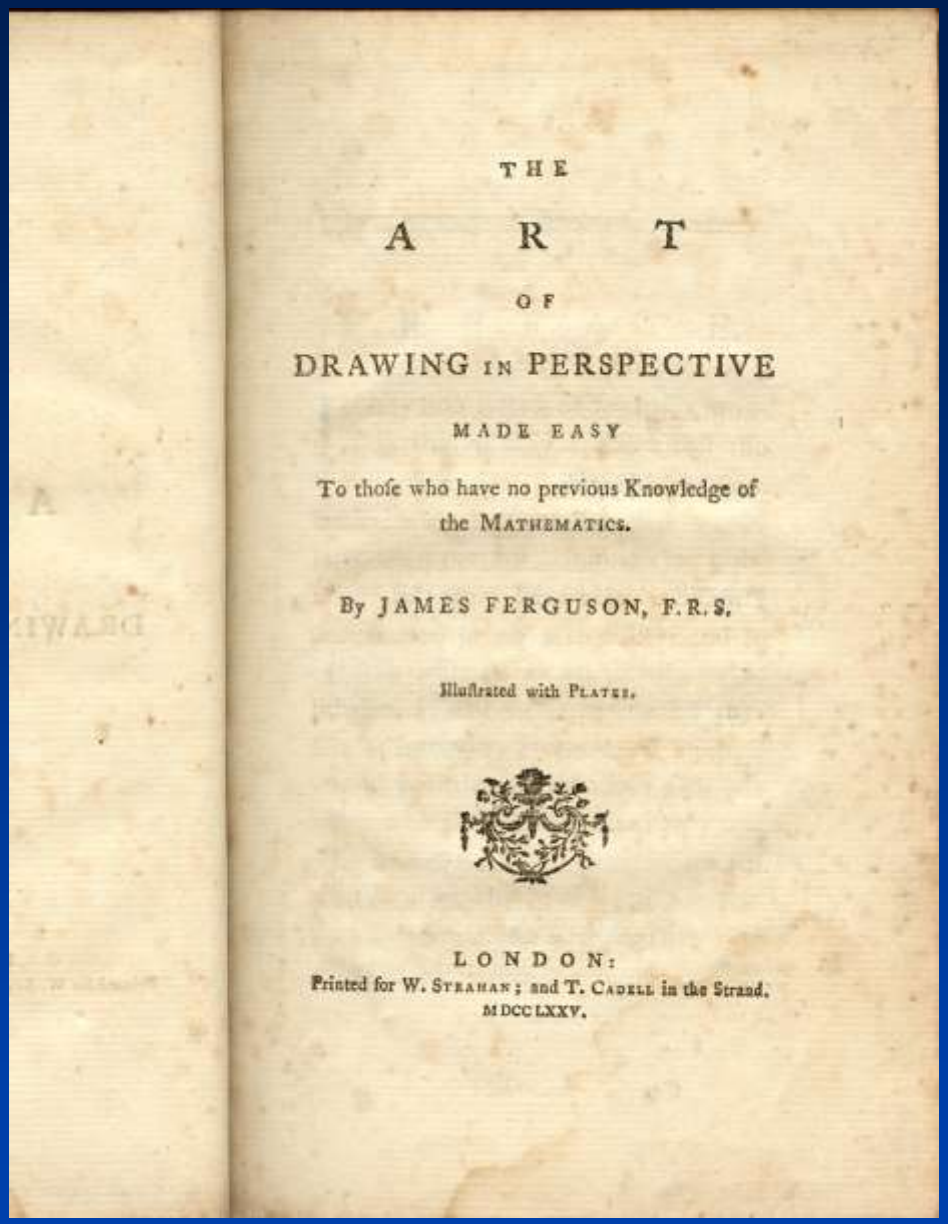
102 INDEX.

Plate 1. Benjamin Franklin's three-wheeled clock.



Select Mechanical Exercises, Plate IV. Ferguson's astronomical Clock with star plate rotating about North Pole.

Franklin was in London for most of the time from 1757-75. Ferguson is thought to have met Franklin in 1757 and they became firm friends. Unfortunately no correspondence between them seems to have survived.



THE

A R T

OF

DRAWING IN PERSPECTIVE

MADE EASY

To those who have no previous Knowledge of the MATHEMATICS.

By JAMES FERGUSON, F.R.S.

Illustrated with PLATES.

LONDON:
Printed for W. STRAHAN; and T. CADELL in the Strand.
MDCCLXXV.

Ferguson's last major work, *Perspective,* 1st ed. 1775 which ran to at least 10 editions or reprints, the last by Brewster in 1823.

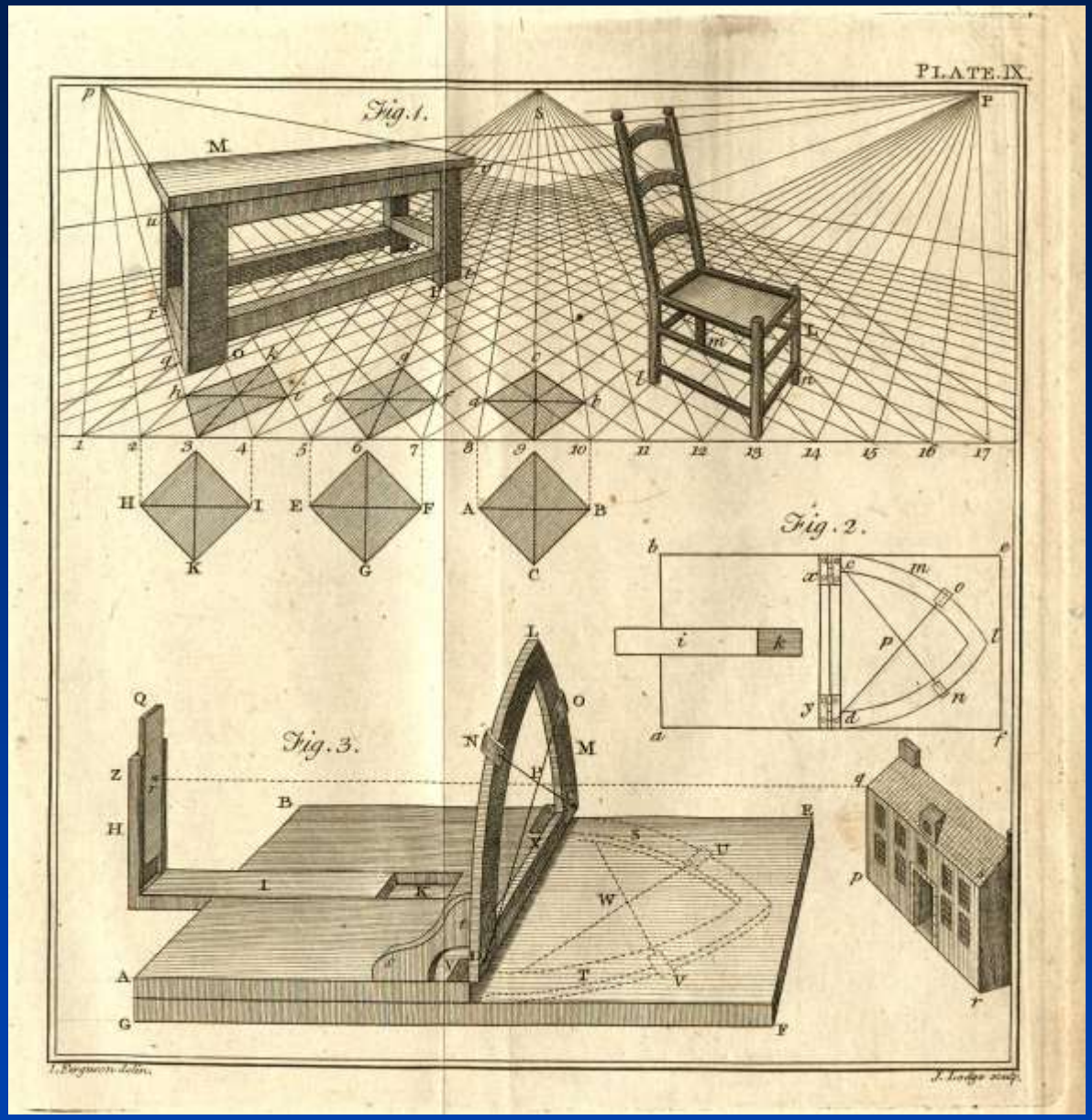
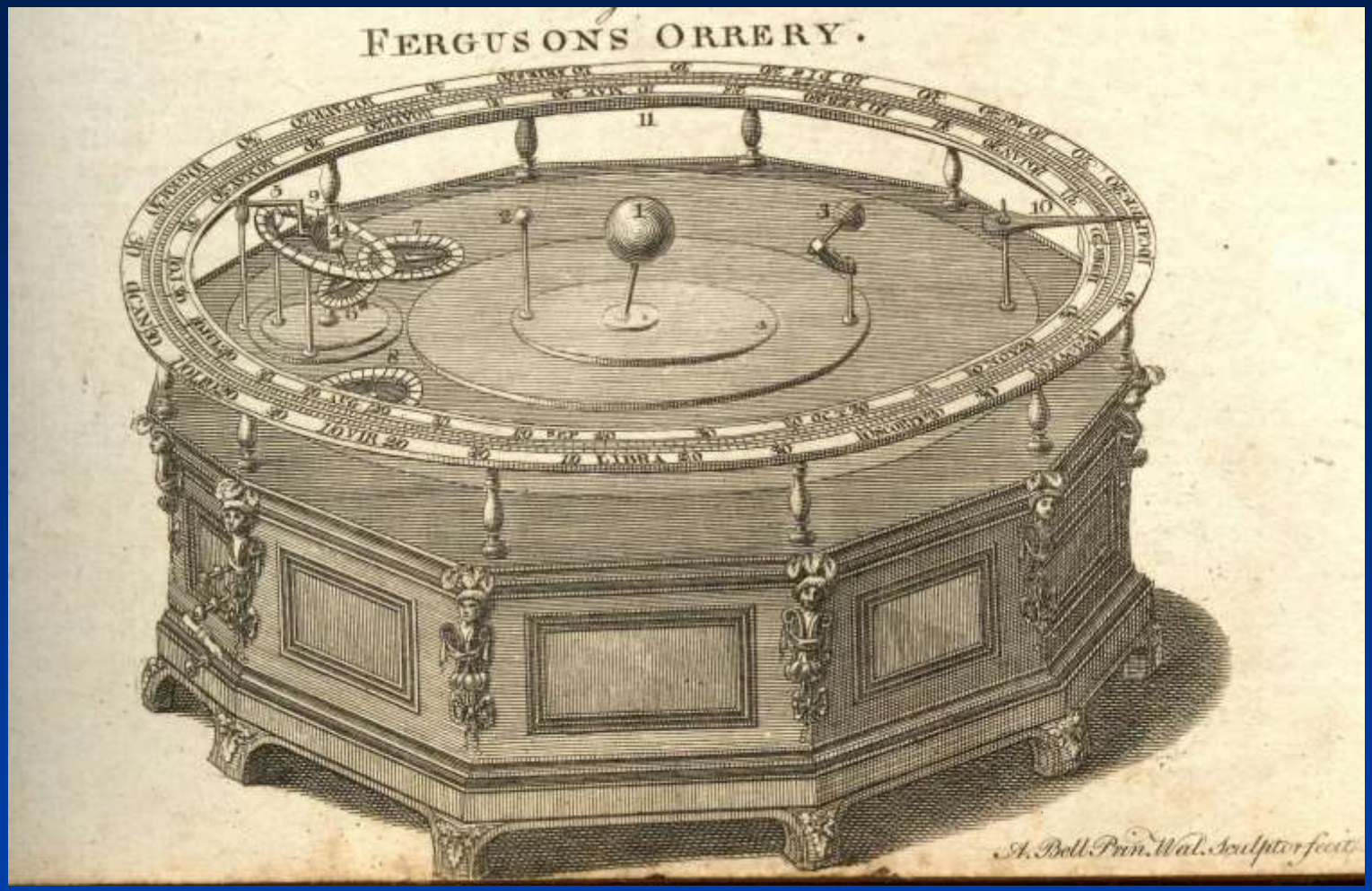
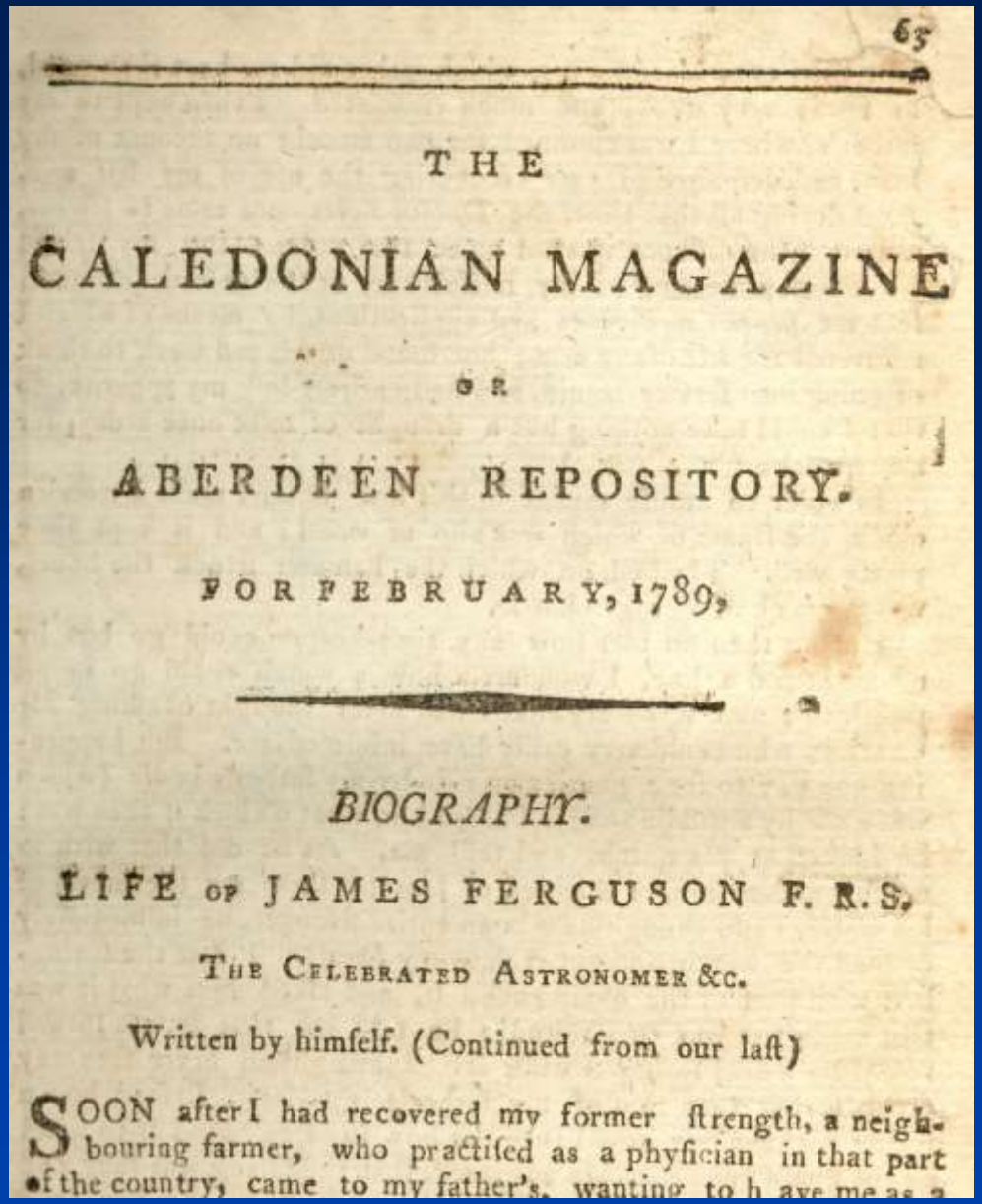


Plate IX from *Perspective* - With furniture from Ferguson's kitchen? The portable folding instrument was to assist with perspective drawing by following mathematical rules of proportion.



Ferguson's devices were widely propagated in contemporary encyclopaedias. This orrery image (1745) is from *Encyclopaedia Britannica*, 2nd ed. 1797. Also in 1st ed., 1769.



65

THE

CALEDONIAN MAGAZINE

OR

ABERDEEN REPOSITORY.

FOR FEBRUARY, 1789,

BIOGRAPHY.

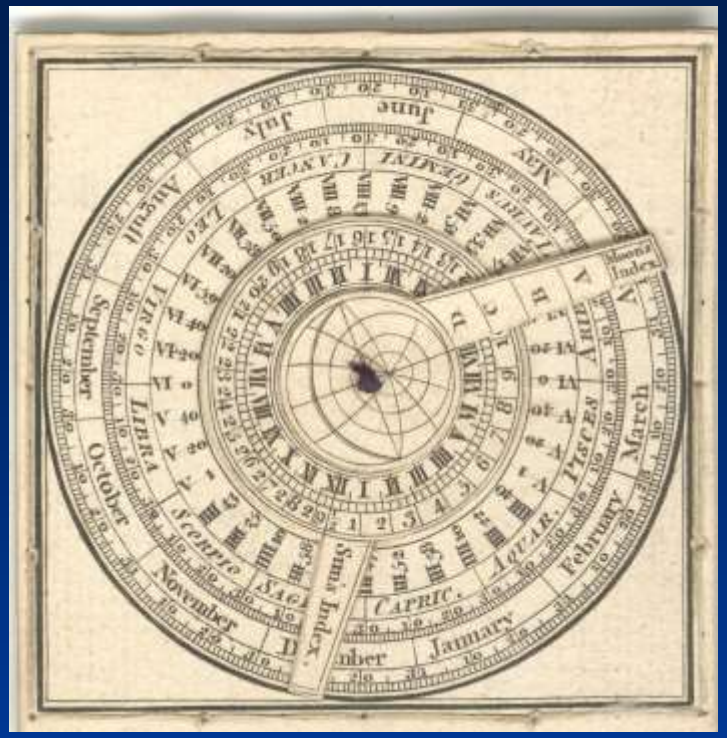
LIFE OF JAMES FERGUSON F. R. S.

THE CELEBRATED ASTRONOMER &c.

Written by himself. (Continued from our last)

SOON after I had recovered my former ſtrength, a neighbouring farmer, who practiſed as a phyſician in that part of the country, came to my father's, wanting to have me as a

An 1789 Aberdeen edition of Ferguson's autobiographical memoir first published in 1773. Editors Alexander Leighton & Andrew Shirrefs, 1786-7.



[Private collection]

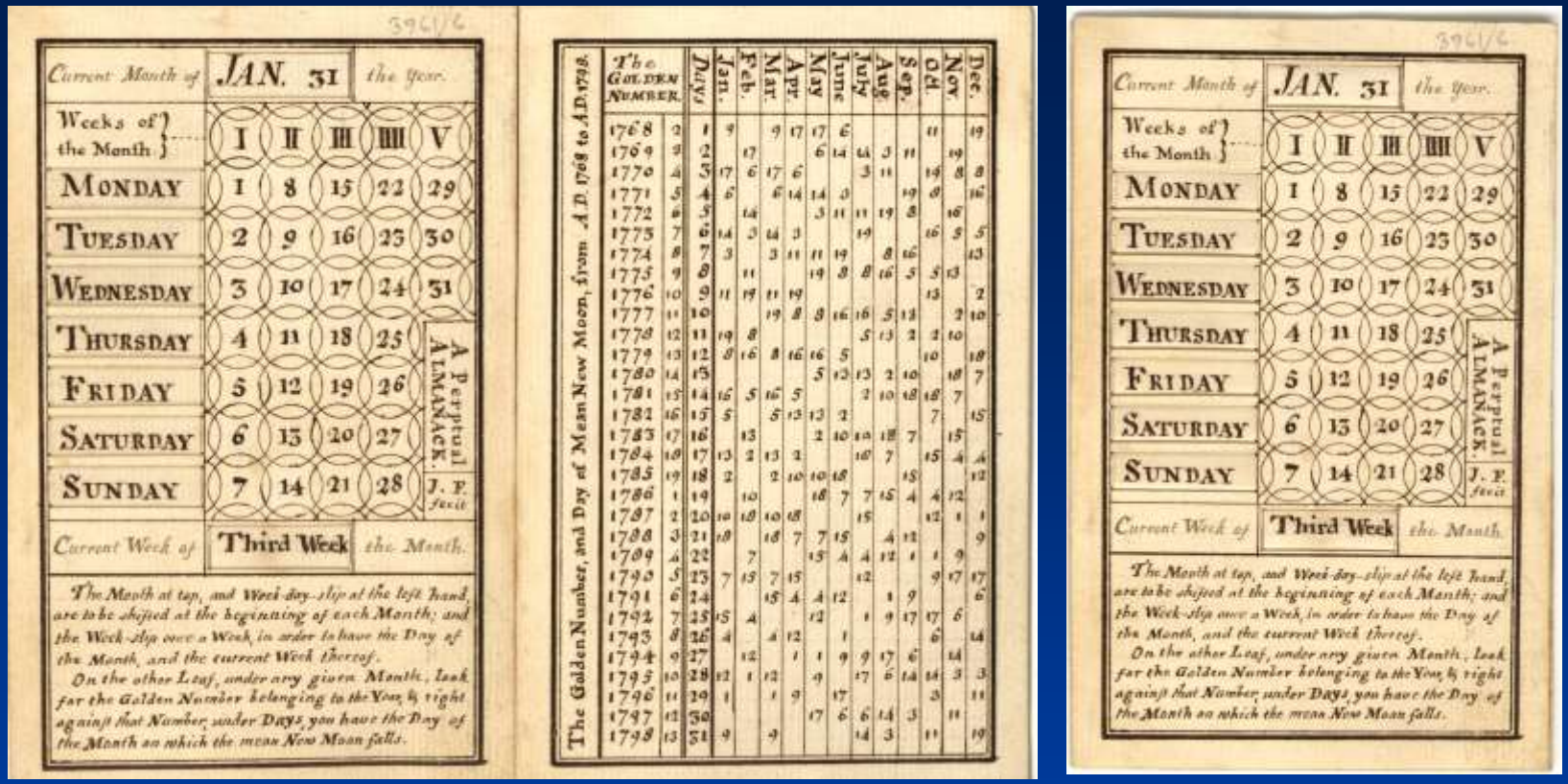
Luminarium from Ferguson to Hugh Girvan (d.1770), tutor to Henry Hay Makdougall, Makerston House 27 Feb 1769

Operating instructions for luminarium –

“You are to shift the inner plates towards the left hand, through the whole openings, every Sunday morning; and then you have the day of the month and the age of the moon for every day of that week: Only you must remember to shift it one day over and above at the end of every month of 30 days, and two days or three occasionally at the end of February that the next month may begin right. But as the moon’s age-plate contains 29½ days it will keep right through the whole year by shifting it through the whole space of the opening every Sunday, which is to be done with the point of a pin or pen knife held in your right hand.

On the other side set the sun’s index to the day of the month, and it will cut his place in the elliptic in the circle marked A (on the moon’s index) and half the time of his staying above the horizon in the circle B.

Keeping the sun’s index there set the moon’s index to the day of her age in the circle C and it will cut the time of her coming to the meridian in the circle D, and the hours & minutes of her semi-diurnal arc in the circle B, which arc counted backward in ye circle D from ye time of ye moon’s coming to the meridian, gives ye mean time of her rising, & counted forward therefrom in ye same circle gives ye mean time of her setting. J. Ferguson inv. B. Cole Sculp.”



Current Month of JAN. 31 the Year.

Weeks of the Month	I	II	III	IIII	V
MONDAY	1	8	15	22	29
TUESDAY	2	9	16	23	30
WEDNESDAY	3	10	17	24	31
THURSDAY	4	11	18	25	
FRIDAY	5	12	19	26	
SATURDAY	6	13	20	27	
SUNDAY	7	14	21	28	

A Perpetual ALMANACK. J. F. fecit

Current Week of Third Week the Month.

The Month at top, and Week-day slip at the left hand, are to be shifted at the beginning of each Month; and the Week-slip once a Week, in order to have the Day of the Month, and the current Week thereof.

On the other Leaf, under any given Month, look for the Golden Number belonging to the Year, by right against that Number, under DAYS, you have the Day of the Month on which the mean New Moon falls.

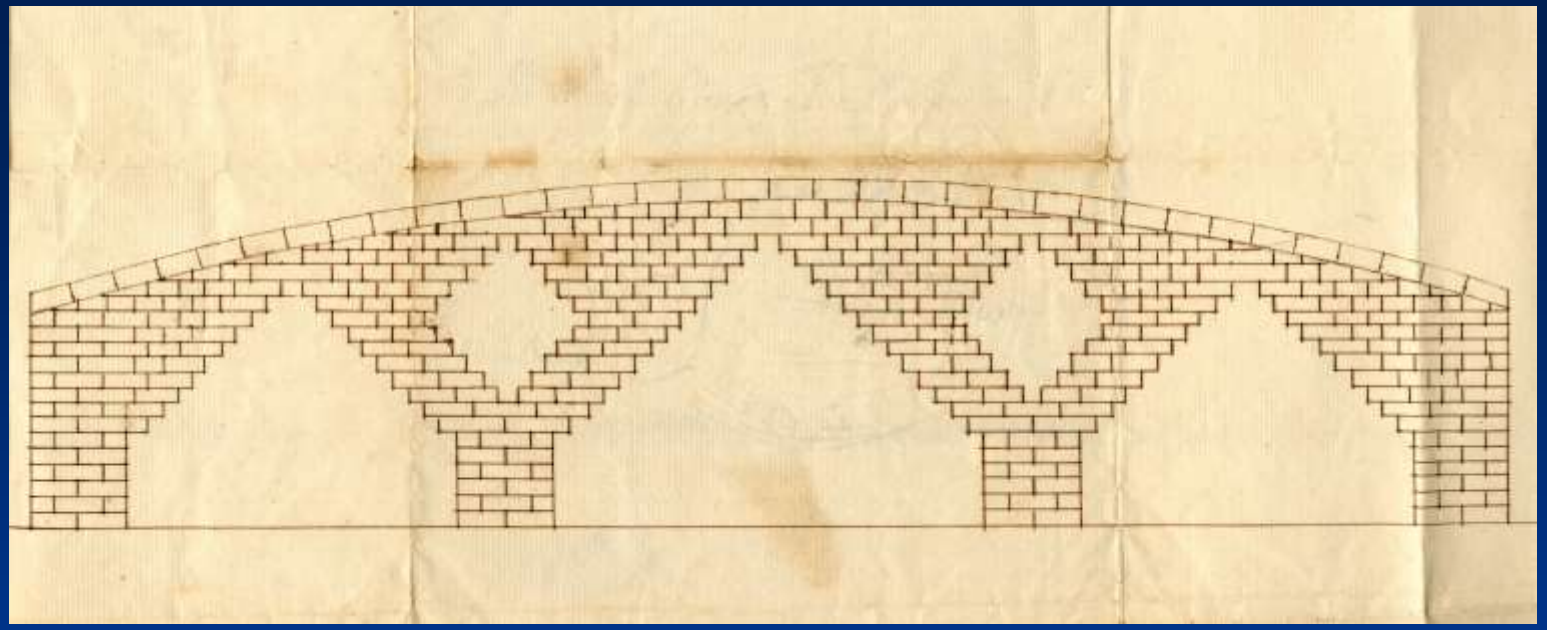
The Golden Number, and Day of Mean New Moon, from A.D. 1768 to A.D. 1798.

	The GOLDEN NUMBER.		DAYS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1768	2		1	9		9	17	17	6				11		19
1769	3		2		17			6	14	4	3	11		19	
1770	4		3	17	6	17	6			3	11		19	8	8
1771	5		4	6		6	14	14	3			19	8		16
1772	6		5		14			3	11	11	19	8		16	
1773	7		6	14	3	14	3			19			16	5	5
1774	8		7	3		3	11	11	19		8	16			13
1775	9		8		11			19	8	8	16	5	5	13	
1776	10		9	11	19	11	19						13		2
1777	11		10			19	8	8	16	16	5	13		2	10
1778	12		11	19	8					5	13	2	2	10	
1779	13		12	8	16	8	16	16	5				10		18
1780	14		13					5	13	13	2	10		18	7
1781	15		14	16	5	16	5			2	10	18	18	7	
1782	16		15	5		5	13	13	2				7		15
1783	17		16		13			2	10	10	18	7		15	
1784	18		17	13	2	13	2			10	7		15	4	4
1785	19		18	2		2	10	10	18			15			12
1786	1		19		10			18	7	7	15	4	4	12	
1787	2		20	10	18	10	18			15			12	1	1
1788	3		21	18		18	7	7	15		4	12			9
1789	4		22		7			15	4	4	12	1	1	9	
1790	5		23	7	15	7	15			12			9	17	17
1791	6		24			15	4	4	12		1	9			6
1792	7		25	15	4			12		1	9	17	17	6	
1793	8		26	4		4	12		1				6		14
1794	9		27		12		1	1	9	9	17	6		14	
1795	10		28	12	1	12		9		17	6	14	14	3	3
1796	11		29	1		1	9		17				3		11
1797	12		30					17	6	6	14	3		11	
1798	13		31	9		9				14	3		11		19

[Private collection]

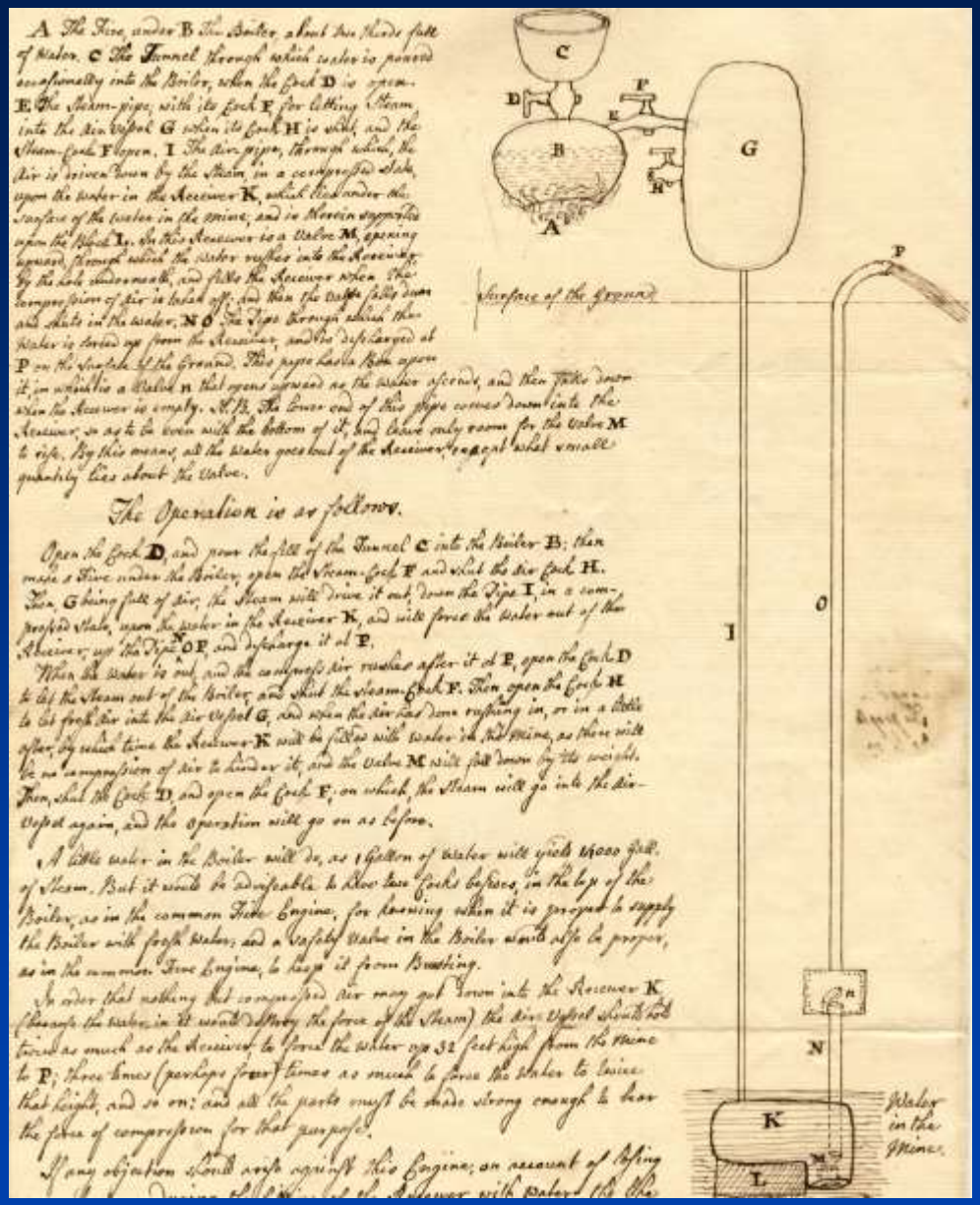
New Moon Calendar 1768-98 sent by Ferguson to Hugh Girvan at Makerston in 1769

Makerston about 5 miles ESE of Kelso (where Ferguson may have lectured in Spring 1768?)



[private collection]

Ferguson’s proposal of 29 Sept.1769 to Hugh Girvan for a stone bridge to be erected without centering. Based on the cantilever principle. Unlikely to have been successful on this scale. Later used independently by Telford for 5ft spans.



The Operation is as follows.

Open the Cock D, and pour the full of the Funnel C into the Boiler B; then make a Fire under the Boiler, open the Steam-Cock F and shut the Air Cock H. Then G being full of Air, the Steam will drive it out, down the Pipe I, in a compressed state, upon the water in the Receiver K, and will force the water out of the Receiver, up the Pipe O P, and discharge it at P.

When the water is out, and the compressed Air rushes after it at P, open the Cock D to let the Steam out of the Boiler, and shut the Steam-Cock F. Then open the Cock H to let fresh Air into the Air Vessel G, and open the Air Cock some crushing in, or in a little after, by which time the Receiver K will be filled with water in the Mine, so there will be no compression of Air to hinder it, and the Valve M will fall down by its weight. Then, shut the Cock D, and open the Cock F, on which, the Steam will go into the Air-Vessel again, and the operation will go on as before.

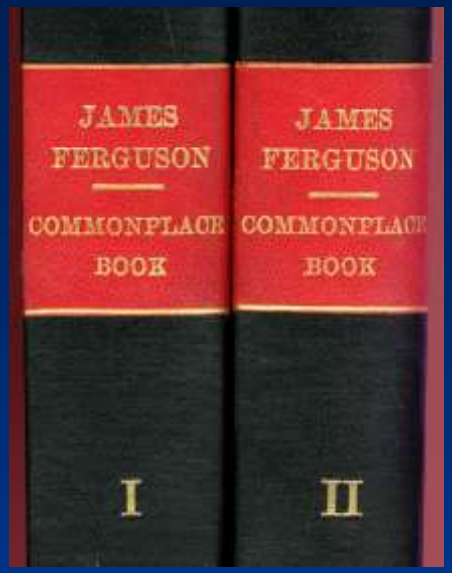
A little water in the Boiler will do, as 1 Gallon of water will yield 1000 Gall. of Steam. But it would be desirable to have two Cocks besides, in the top of the Boiler, as in the common Fire Engine, for knowing when it is proper to supply the Boiler with fresh water; and a Safety Valve in the Boiler would also be proper, as in the common Fire Engine, to keep it from Bursting.

In order that nothing but compressed Air may get down into the Receiver K (though the water in it would obstruct the force of the Steam) the Air Vessel should be bored as much as the Receiver to force the water up 32 feet high from the Mine to P; three times (perhaps four times as much to force the water to twice that height, and so on: and all the parts must be made strong enough to bear the force of compression for that purpose.

If any objection should arise against this Engine; on account of being [illegible] the Receiver with water, the the

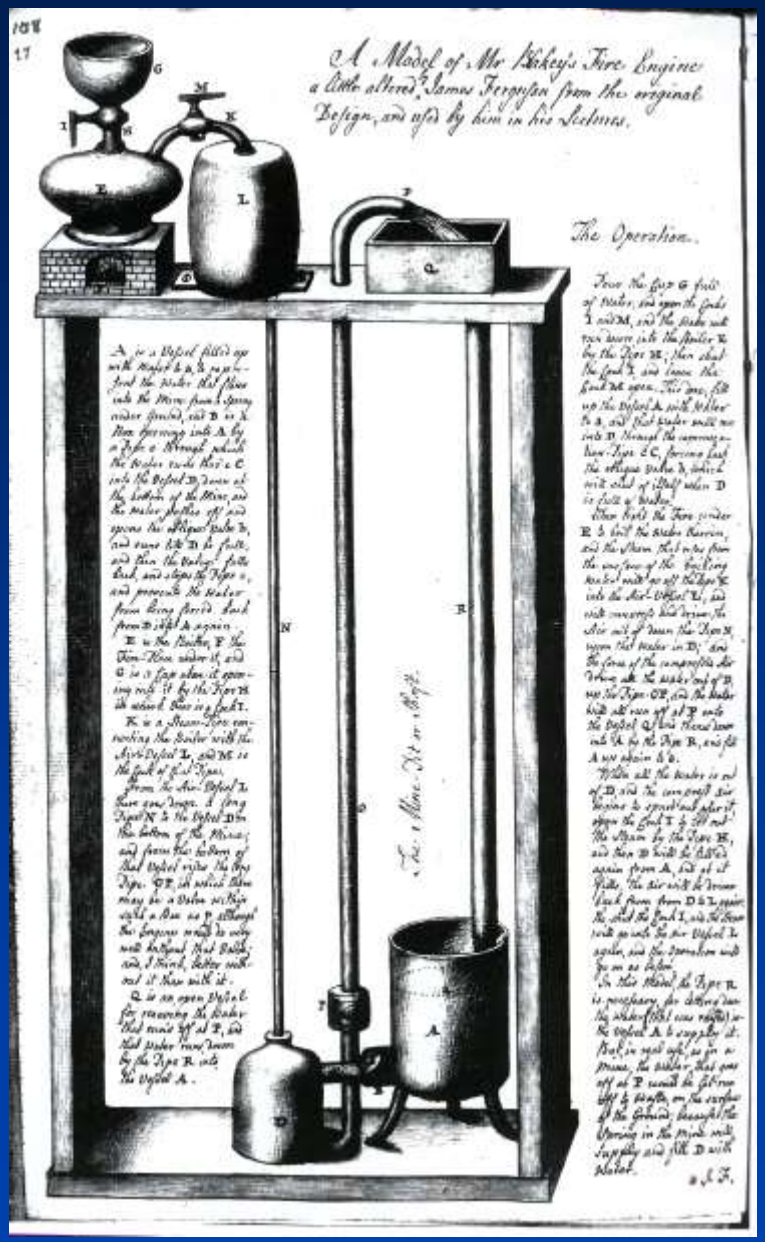
[Private collection]

Ferguson's improvement of Blakey's steam engine sketched in a letter to Hugh Girvan at Makerston 1769



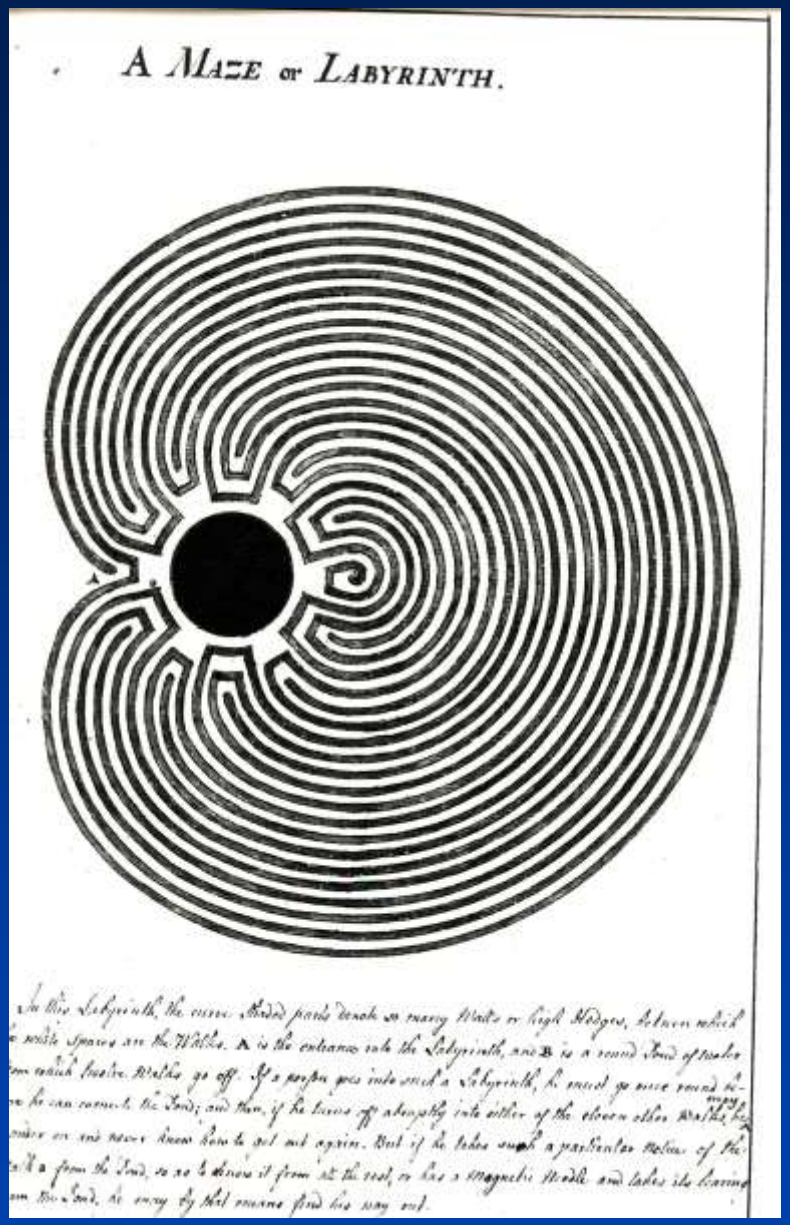
The “COMMONPLACE BOOK” [1756-76] turned up in Edinburgh in 1865 and was bequeathed to and deposited in the College Library, Edinburgh, soon after. In 1833 it had been deposited in the chambers of Mr. Balderstone, in Edinburgh, where when occupied by his successors Scott, Moncrieff, & Dalgety, W.S., it was found. This is my copy from the original. Henderson noted it “has 276 pages, with several interleaved ones of a quarto size, 184 miscellaneous articles and 108 pen and ink drawings, many of which are very beautiful.”

It starts with the Mosaic account of creation (Gen. 1) showing it to agree with the Newtonian Philosophy, and continues with comment on Daniel’s prophecies, the number of the Beast (Rev.), and Dominical Letters, and a table consisting of 5807 lines, one for each year of the world (to 1800 AD, i.e. 6513 for the Julian Period, also given for the 5807 lines ion the table.



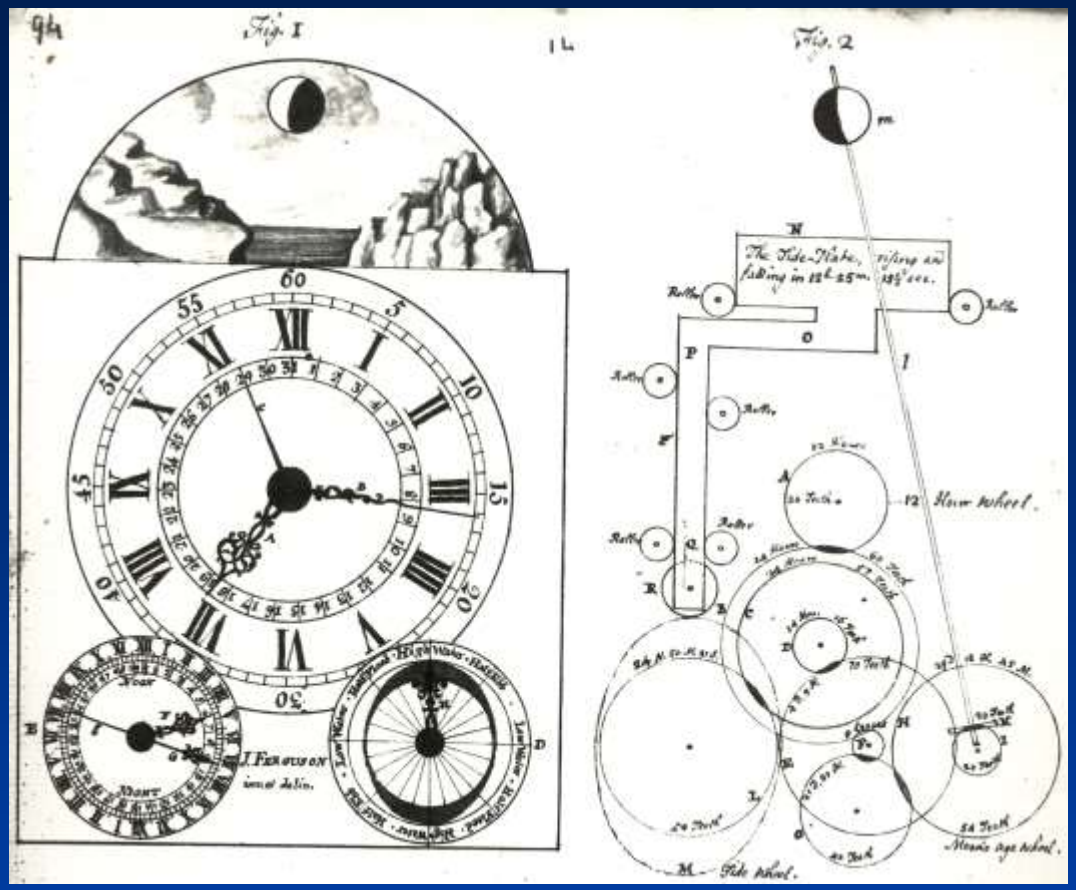
Ferguson wrote on November 16th 1768 “Mr. Blakey has been upwards of two years about this simple machine and has never yet finished one to work.” The image is Ferguson’s modified version of which he made a working model.

[Commonplace Book]



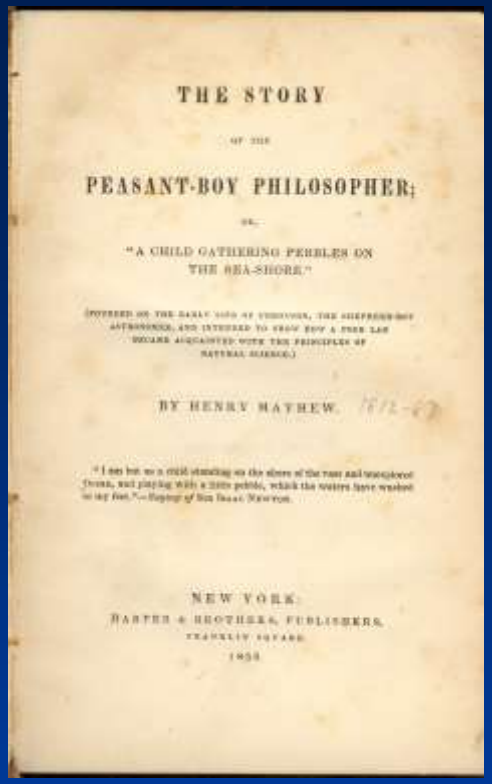
[Commonplace Book.119]

J.Ferguson inv. A is the entrance and B a round pond of water from which 12 walks go off. If a person goes into such a labyrinth, he must go once round before he can come to the pond; and then, if he turns off abruptly into [any] of the 11 other walks, he may wander on and never know how to get out again. But if he takes such a particular notice of the walk ‘a’ from the pond, so as to know it from all the rest, or has a magnetic needle and takes its bearing from the pond, he may find his way out.



[Commonplace Book.94]

A clock contrived by Ferguson in 1764 for the Dock-Master at Liverpool, showing the hour and minute, day of the month, moon’s age, phasing and time of southing, times of high and low water and the state of the tide at any time



THE STORY

OF THE

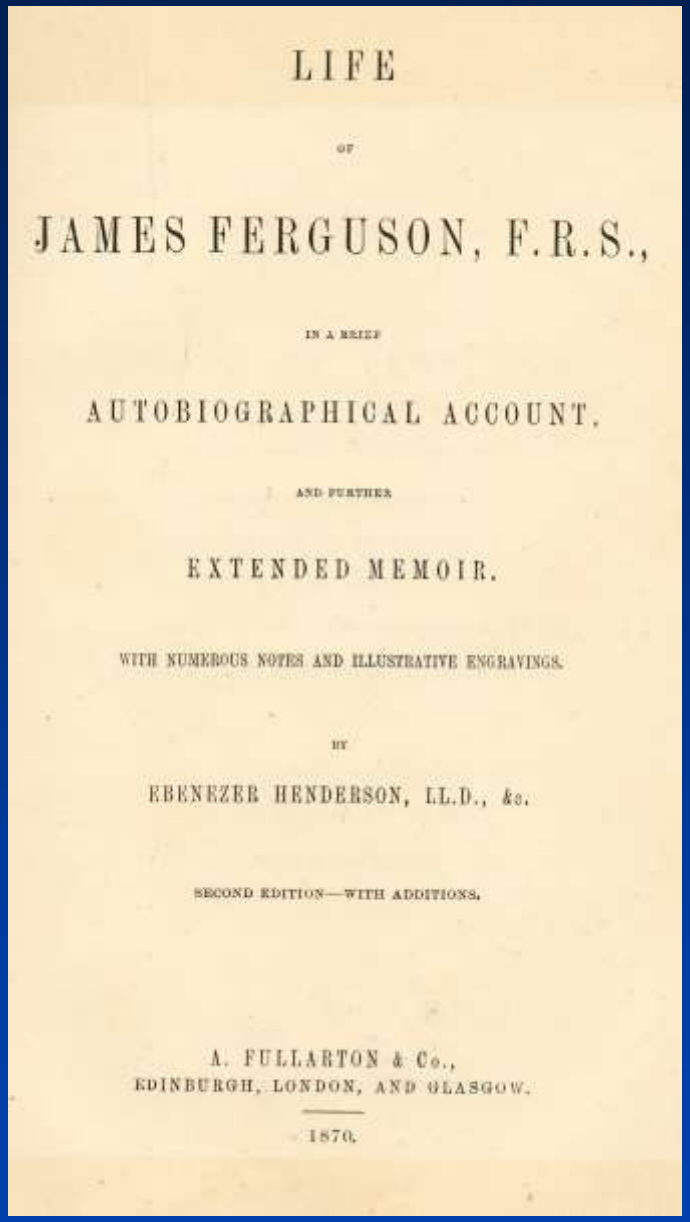
PEASANT-BOY PHILOSOPHER;

OR,

"A CHILD GATHERING PEBBLES ON THE SEA-SHORE."

BY HENRY MAYHEW.

NEW YORK:
HARPER & BROTHERS, PUBLISHERS,
FRANKLIN SQUARE.
1854.



LIFE

OF

JAMES FERGUSON, F.R.S.,

IN A BRIEF

AUTOBIOGRAPHICAL ACCOUNT,

AND FURTHER

EXTENDED MEMOIR.

WITH NUMEROUS NOTES AND ILLUSTRATIVE ENGRAVINGS.

BY

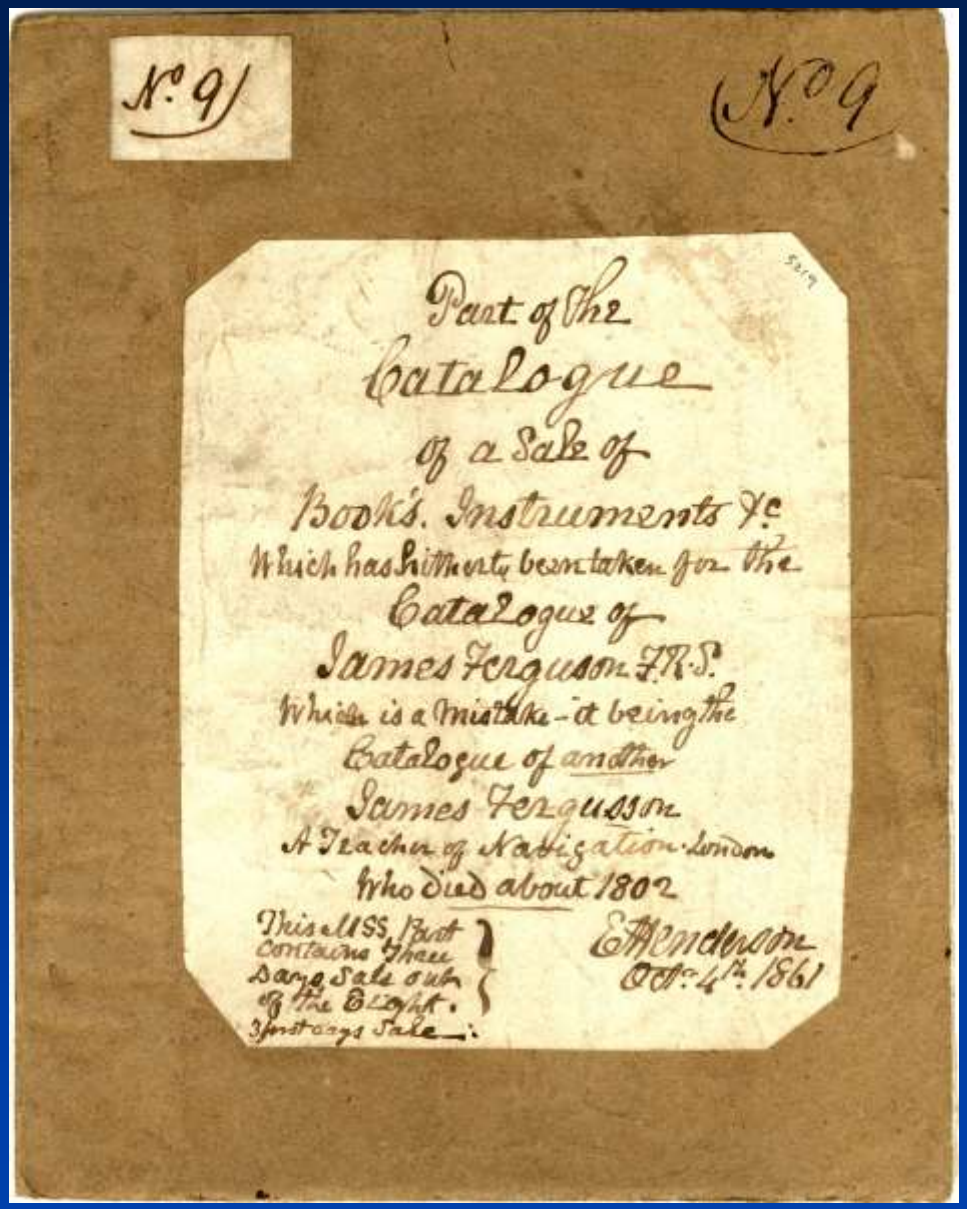
EBENEZER HENDERSON, LL.D., &c.

SECOND EDITION—WITH ADDITIONS.

A. FULLARTON & Co.,
EDINBURGH, LONDON, AND GLASGOW.

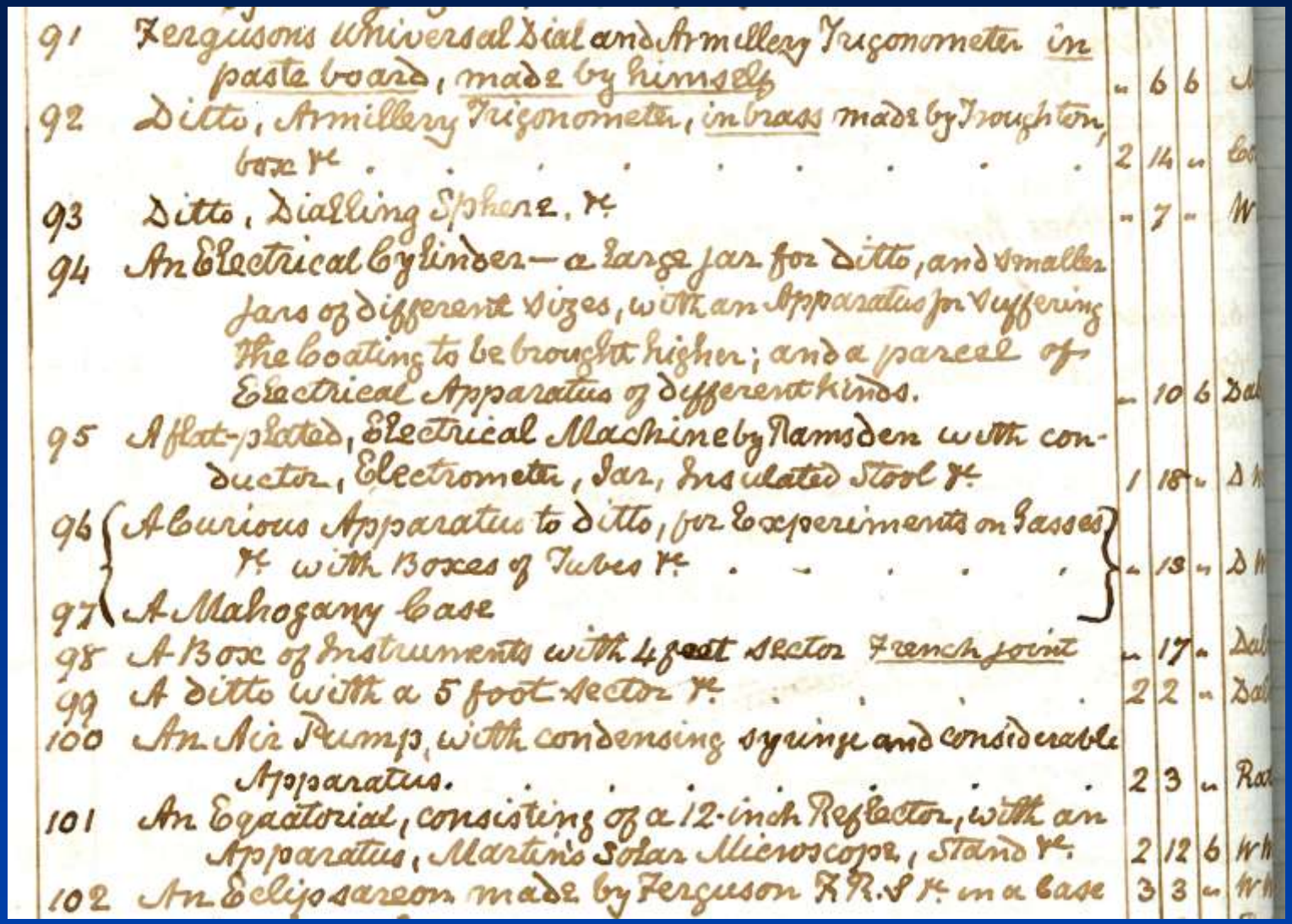
1870.

Ferguson's 'self-help' example was promoted by Henry Mayhew from 1854. Ferguson's life and work received a major boost of attention when Ebenezer Henderson's detailed *Life* was published in 1867, second edition 1870



[Private collection]

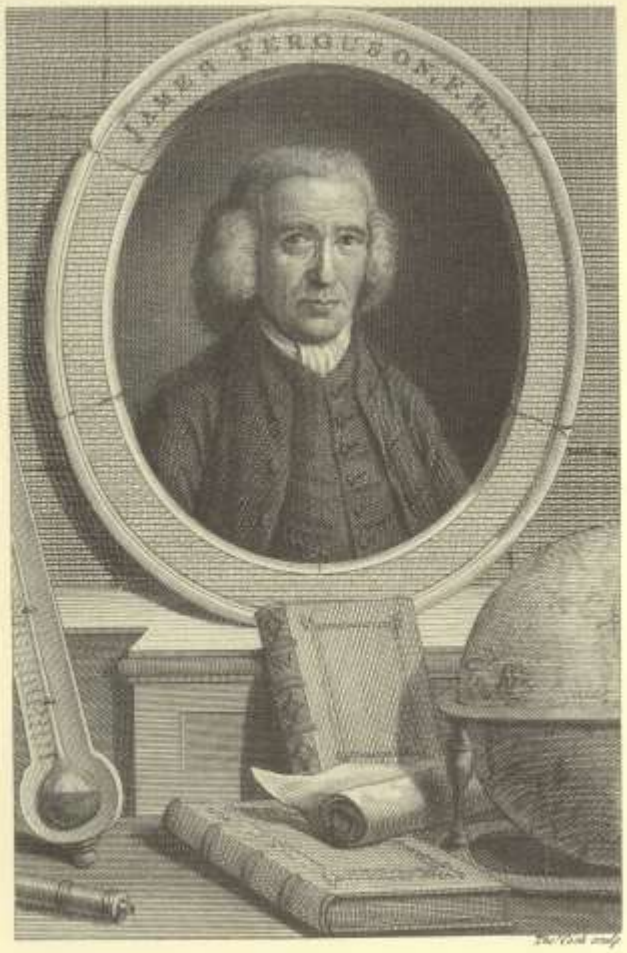
Henderson's holograph catalogue of Oct. 4th 1861 of what he originally thought to be the sale of Ferguson's books and instruments, in which he now makes the case correctly attributing them to James Fergusson (d. c.1802), a teacher of navigation in London. See next for a typical entry.



91	Fergusons Universal Dial and Armillary Trigonometer in paste board, made by himself	–	6	6	[illegible]
92	Ditto, Armillary Trigonometer, in brass made by Troughton, box &c.	2	14	–	[illegible]
93	Ditto, Dialling Sphere, &c.	–	7	–	[illegible]
94	An Electrical Cylinder — a large jar for ditto, and smaller jars of different sizes, with an Apparatus for suffering the coating to be brought higher; and a parcel of Electrical Apparatus of different kinds.	–	10	6	[illegible]
95	A flat-plated, Electrical Machine by Ramsden with conductor, Electrometer, Jar, Insulated Stool &c.	1	18	–	[illegible]
96	A Curious Apparatus to ditto, for Experiments on Gasses &c. with Boxes of Tubes &c.	–	13	–	[illegible]
97	A Mahogany Case				
98	A Box of Instruments with 4 foot sector French joint	–	17	–	[illegible]
99	A ditto with a 5 foot sector &c.	2	2	–	[illegible]
100	An Air Pump, with condensing syringe and considerable Apparatus.	2	3	–	[illegible]
101	An Equatorial, consisting of a 12-inch Reflector, with an Apparatus, Martin's Solar Microscope, Stand &c.	2	12	6	[illegible]
102	An Eclipsareon made by Ferguson F.R.S. &c. in a Case	3	3	–	[illegible]

Catalogue items 91-102 in Henderson's hand –
a Ferguson Eclipsarium made 3 gns.

Henderson’s portrait from *Annals of Dunfermline, 1879*



James Ferguson, FRS
From the frontispiece of the posthumous second edition (1778) of his *Select Mechanical Exercises*, incorporating a portrait based on the Townsend print published in December 1776.

Wheelwright of the Heavens

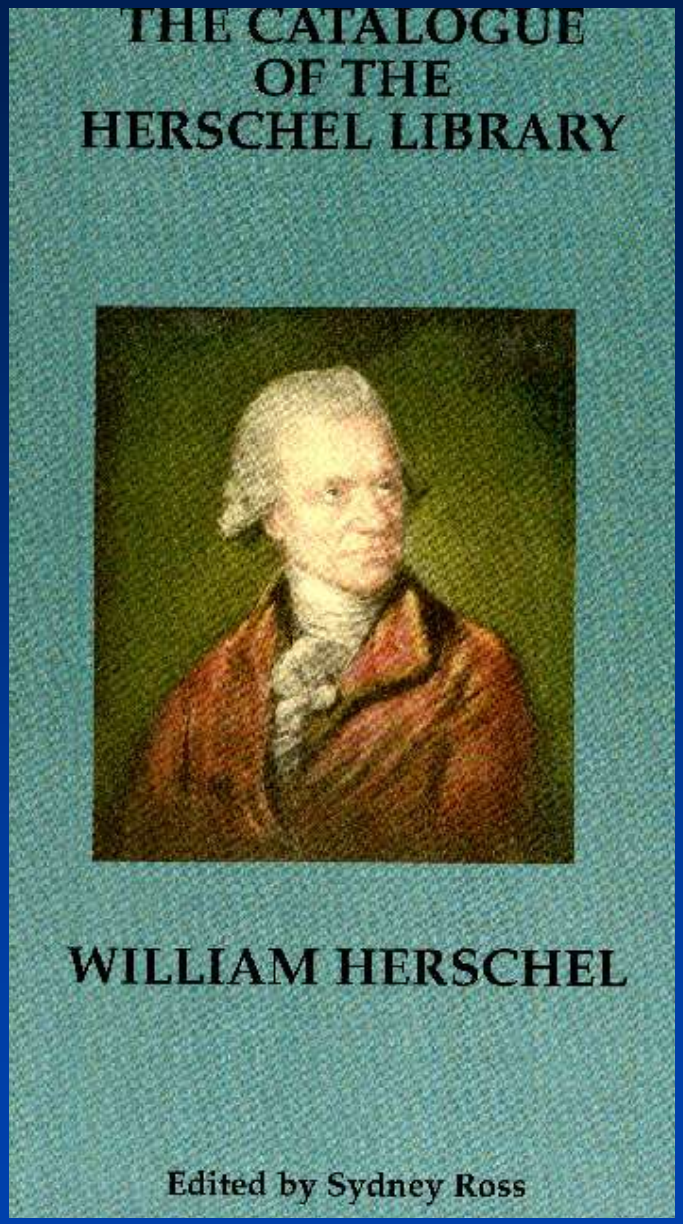
The Life & Work of James Ferguson, FRS

JOHN R. MILLBURN
in collaboration with
Henry C. King

Vade-Mecum Press

Millburn's biography of Ferguson, 1998

After Cadell became Ferguson's publisher, nearly all of his books (but not minor tracts 'printed for the author') were printed by William Strahan, who also took a share in many of them. Strahan's ledgers, now at the British Library, show that the octavo editions were generally printed in 1,000 copies and the quarto in 500, though there were a few exceptions; only 750 copies were printed of the second edition of *Tables and Tracts*, 1771, and of the second edition of *Introduction to Electricity*, 1775, while 1,500 were printed of the 5th edition of *Lectures on Select Subjects*, 1776. (British Library; Add. Mss. 48,801)



Ferguson's lectures in Bath in 1774 which are said to have "enthused [William] Herschel in his voyage of astronomical discovery." * Herschel's copy of Ferguson's *Astronomy*, 7th ed., 1785 bears his holograph inscription to his sister Caroline.

* J Fawcett. Invention and discovery. Bath and the rise of science, ed. P. Wallis, Bath, [co-published by the Herschel Soc.] 2008

INDEX TO PLACES (other than London)

Mentioned in the detailed entries B1-B30; P1-P5; and A1-A19

Millburn's Bibliography [microfiche 1983, p.8] is indicative of the international coverage of Ferguson's work – Ireland(2), Germany(2), India, Italy, USA(4), Australia(2), France, Poland and Sweden. The total number of copies of the various publications containing his work from 1742-1843 is of the order of 200,000.

Conclusion

In the third quarter of the 18th century Ferguson led his field in terms of the popularity of his high quality publications and lectures, with a mainly upper-class take-up. After this, for at least 70 years following his death, his main works continued to be influential, particularly after Waterloo, with their extension to working-class education via colleges and mechanics' institutes.

Millburn's book title 'Wheelwright of the heavens' aptly reflects Ferguson's practical approach to astronomy, but is only a partial job title. Less evocatively, but more fully, Ferguson applied his innate inventive skill to become, *a familiariser second to none of the understanding of astronomy and mechanical science*. An amazing achievement for a self-taught Banff-shire farm lad!

Although Ferguson's genius is little-known or relevant today, except to historians, the tercentenary of his birth has offered this welcome opportunity for the EBS to appreciate it via his printed works, manuscripts and models in the world's great libraries and museums, three close by, and even in a small private collection!

Finis