Celebrating the 400th Anniversary of William Oughtred's Invention of the Slide Rule

Robert G. De Cesaris

October 2025

Celebrating 400 Years Since the Invention of the Slide Rule

October 23 - 26, 2025

INTERNATIONAL MEETING 2025
Cambridge/Boston MA

John Napier, Baron of Merchiston (1550 – 1617)

Mirifici Logarithmorum Canonis Descriptio

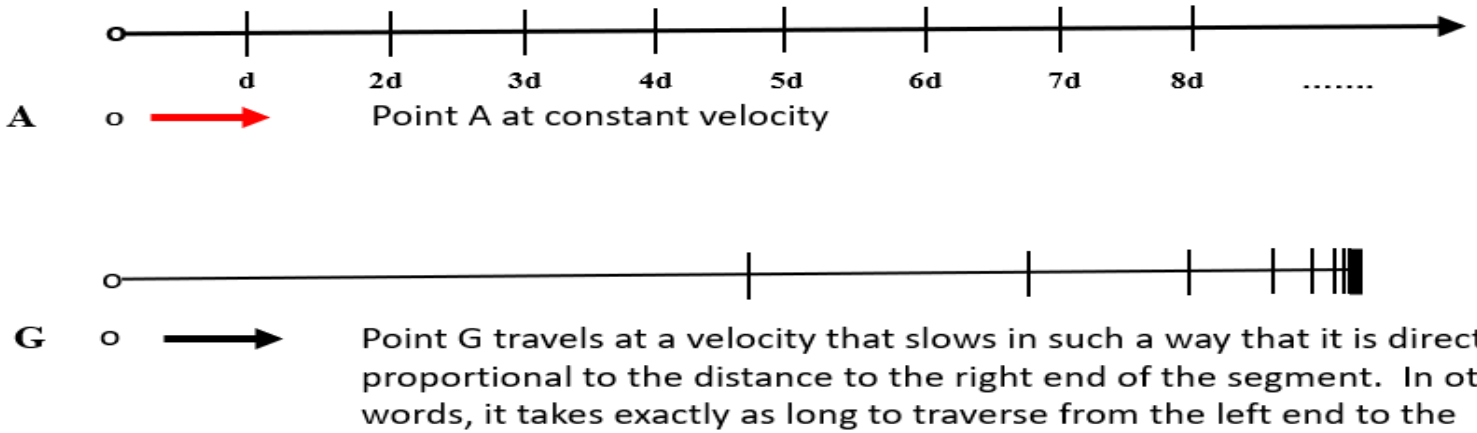
- Born in 1550, in Edinburgh, Scotland.
- Better part of his life focused on theology, developed strong anti-papal stance.
- In 1593, published his greatest theological work *Plaine Discovery of the Whole Revelation of St. John.* Predicted end of the world would occur in 1688 or 1700.

John Napier (1550 – 1617)

- Took on challenge of finding a better way to ease the tedium of computations around 1594.
- Since he knew astronomers used tables of sines most of all, initial goal was to create a table whereby the multiplication of sines could be reduced to addition.
- Published his seminal work, the Descriptio in 1614, revealing his new invention.
- Approach to describe the relationship between the sequences was one of mechanics and motion and very different from today's interpretation.

John Napier, Baron of Merchiston,
Mirifici Logarithmorum Canonis Descriptio

- Napier approached the problem as two moving points on parallel courses, moving at different velocities. He assumed a parallel ray and line segment and their relationship as follows:
  - Assume a point exists at the left end of ray A and left end of line segment G as shown
  - Now assume the point G moves to the right along the segment and the point A to the right along the ray
    - Point A moves at a constant velocity by traveling distance d in equal time intervals. Note that with each time interval, A therefore represents a constant distance over time, or equivalent to an Arithmetic sequence
    - Point G moves at an ever-decreasing velocity proportions to the distance that remains to reach the right end of the segment



Point G travels at a velocity that slows in such a way that it is directly proportional to the distance to the right end of the segment. In other words, it takes exactly as long to traverse from the left end to the halfway point, from the half-way to three-quarters point, from the three-quarters point to the seven-eighths point, etc ,etc, therefore taking an infinite amount of time to arrive at the right end. This effectively defines a geometric sequence with respect to point A

John Napier, Baron of Merchiston,
Mirifici Logarithmorum Canonis Descriptio

MIRIFICI

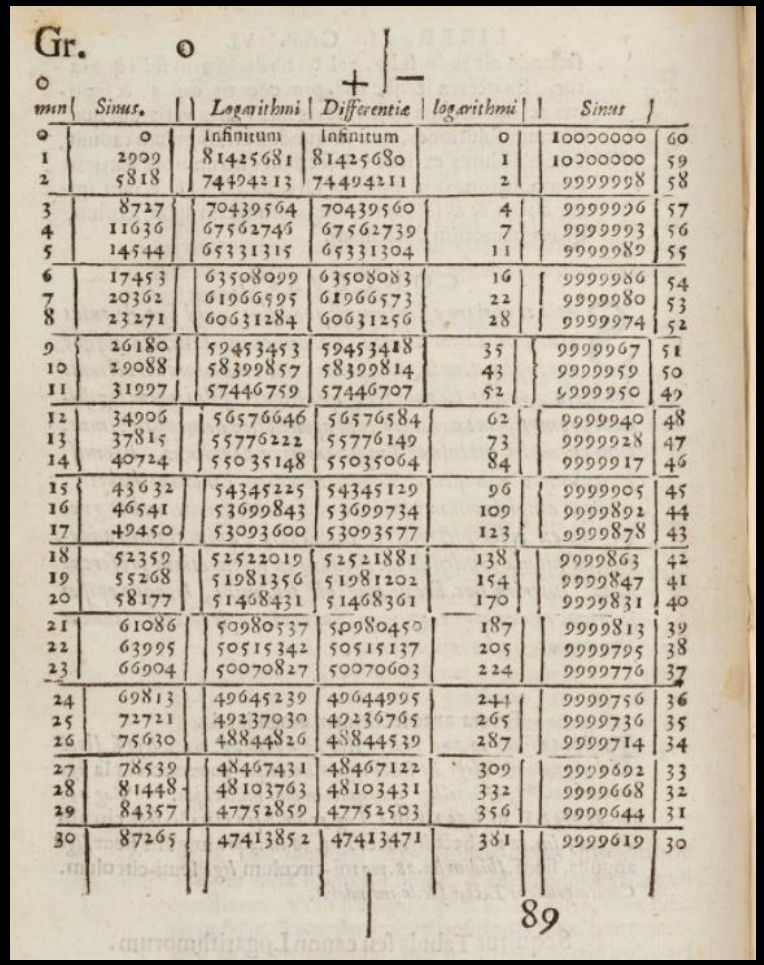
Logarithmorum
Canonis descriptio,

Ejusque usus, in utraque
Trigonometria; ut etiam in
omni Logistica Mathematica,
Amplissimi, Facillimi, &
expeditissimi explicatio.

Authore ac Inventore,
IOANNE NEPERO,
Barone Merchistonii,
&c. Scoto.

EDINBURGI,
Ex officinâ ANDREÆ HART
Bibliopôlæ, CIↃ. DC. XIV.

Title Page of the Descriptio, 1614



Gr. o

min	Sinus.	Logarithmi	Differentiæ	logarithmi	Sinus	
0	0	Infinitum	Infinitum	0	10000000	60
1	2909	81425681	81425680	1	10000000	59
2	5818	74494213	74494211	2	9999998	58
3	8727	70439564	70439560	4	9999996	57
4	11636	67562746	67562739	7	9999993	56
5	14544	65331315	65331304	11	9999989	55
6	17453	63508099	63508083	16	9999986	54
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13	37815	55776222	55776149	73	9999928	47
14	40724	55035148	55035064	84	9999917	46
15	43632	54345225	54345129	96	9999905	45
16	46541	53699843	53699734	109	9999892	44
17	49450	53093600	53093577	123	9999878	43
18	52359	52522019	52521881	138	9999863	42
19	55268	51981356	51981202	154	9999847	41
20	58177	51468431	51468361	170	9999831	40
21	61086	50980537	50980450	187	9999813	39
22	63995	50515342	50515137	205	9999795	38
23	66904	50070827	50070603	224	9999776	37
24	69813	49645239	49644995	244	9999756	36
25	72721	49237030	49236765	265	9999736	35
26	75630	48844826	48844539	287	9999714	34
27	78539	48467431	48467122	309	9999692	33
28	81448	48103763	48103431	332	9999668	32
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First Page of the Tables from Napier's Descriptio

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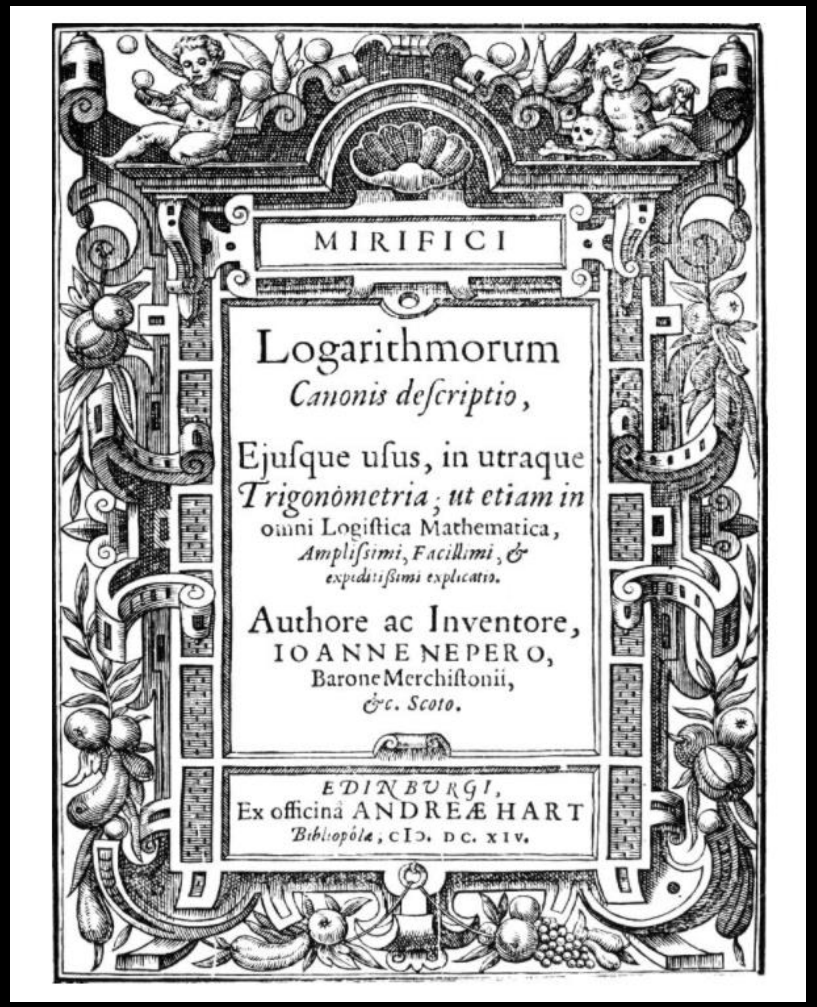
John Napier, Baron of Merchiston,
Mirifici Logarithmorum Canonis Descriptio



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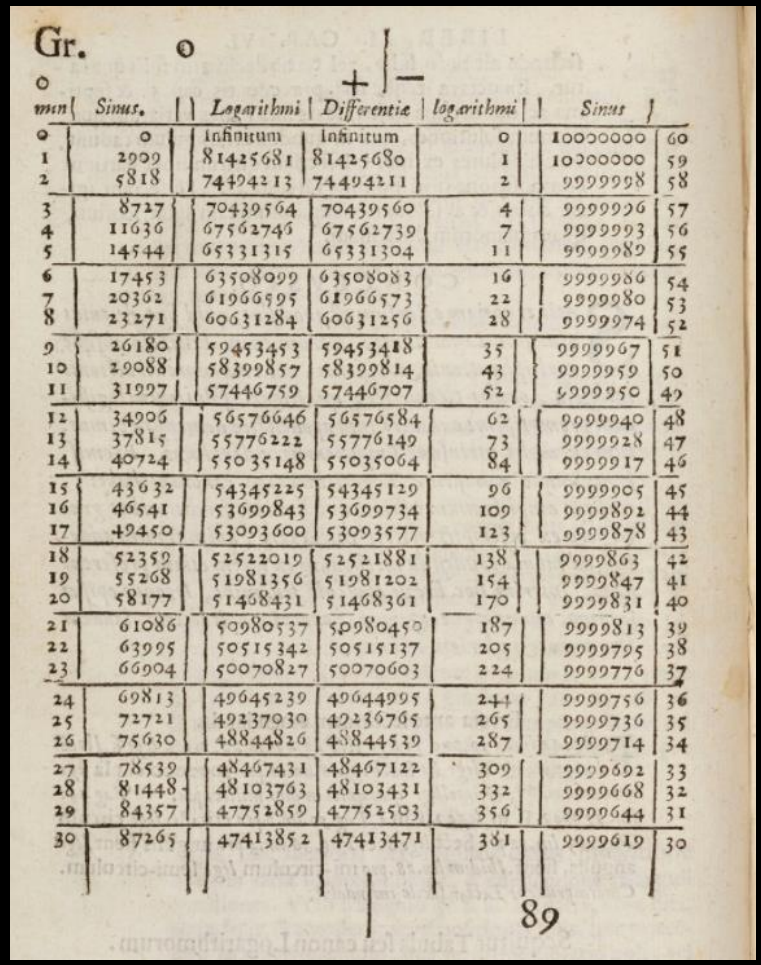

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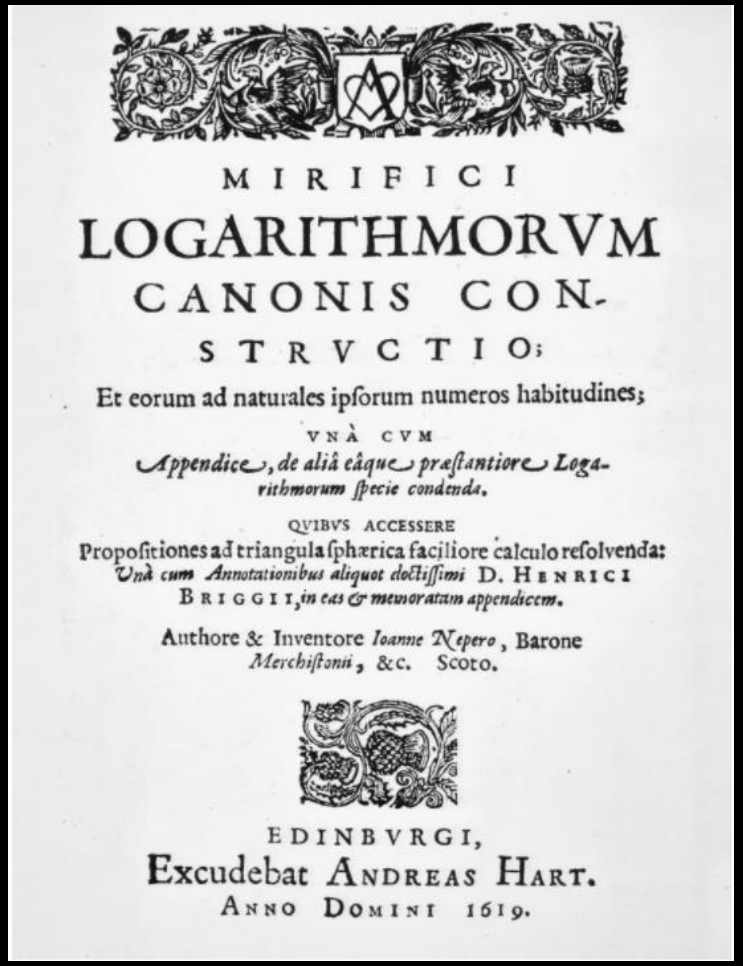

MIRIFICI
LOGARITHMORVM
CANONIS CON-
STRVCTIO;

Et eorum ad naturales ipsorum numeros habitudines;

VNÀ CVM
Appendice, de aliâ eâque præstantiore Logarithmorum specie condenda.

QVIBVS ACCESSERE
Propositiones ad triangula sphærica faciliore calculo resolvenda:
Vnà cum Annotationibus aliquot doctissimi D. HENRICI BRIGGII, *in eas & memoratam appendicem.*

Authore & Inventore *Ioanne Nepero*, Barone *Merchistonii*, &c. Scoto.

EDINBVRGI,
Excudebat ANDREAS HART.
ANNO DOMINI 1619.

***The Construction of the Wonderful Canon of Logarithms*, 1619, Establishing Napier's Derivation and Description of the Logarithm**

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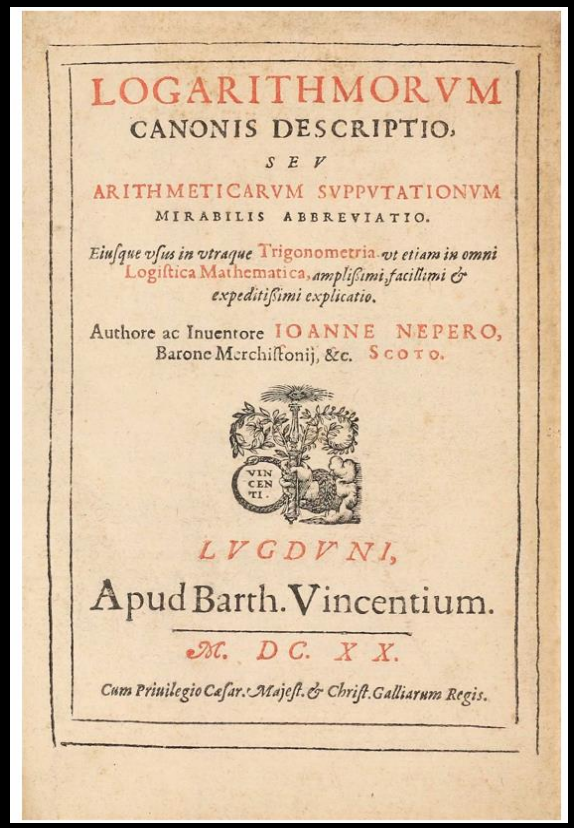
John Napier, Baron of Merchiston,
Mirifici Logarithmorum Canonis Descriptio

- Descriptio contains 90 pages of tables and 57 pages of text describing their utility
- News spread quickly and importance recognized by mathematicians Henry Briggs and Edward Wright. Early Latin editions published 1614, 1619, and 1620.
- Briggs' visited Napier in 1615 and 1616 to discuss rescaling the tables to make them easier to use, ' including defining the logarithm of 1 equal to 0 and that of 10 as 1, 'common' logarithms as we know them today.
- With Napier's death in 1617, project of completing new tables left completely to Briggs. Briggs published the first 3 sections (of 10) with the title *Arithmetica Logarithmica,* in 1624.

Henry Briggs (1561 – 1630)



LOGARITHMORVM
CANONIS DESCRIPTIO,
SEV
ARITHMETICARVM SVPPVTATIONVM
MIRABILIS ABBREVIATIO.

Eiusque vsus in vtraque Trigonometria: vt etiam in omni Logistica Mathematica, amplissimi, facillimi & expeditissimi explicatio.

Authore ac Inuentore IOANNE NEPERO, Barone Merchistonij, &c. SCOTO.

LVGDVNI,
Apud Barth. Vincentium.
M. DC. XX.

Cum Priuilegio Cæsar. Majest. & Christ. Galliarum Regis.

1620 Edition of Napier's Descriptio, Earliest Tables Commonly Available to Collectors

Edmund Gunter (1581 – 1626)
Inventor of the Gunter Scale

- Rector of St. George's Church in Southwark and Professor of Astronomy at Gresham College
- Published his first set of logarithm tables in 1619.
- Felt that logarithm tables were cumbersome and recognized that many simple navigational problems did not require extreme accuracy.
- Being familiar with the use of dividers for making calculations using a sector, he devised a new set of scales where the numbers were separated by logarithmic scale distances.
- Called his new basic logarithmic scale the 'Line of Numbers' and also proposed adding logarithmic sine and tangent scales so that the important navigational 'Line of Sines' could be easily calculated.

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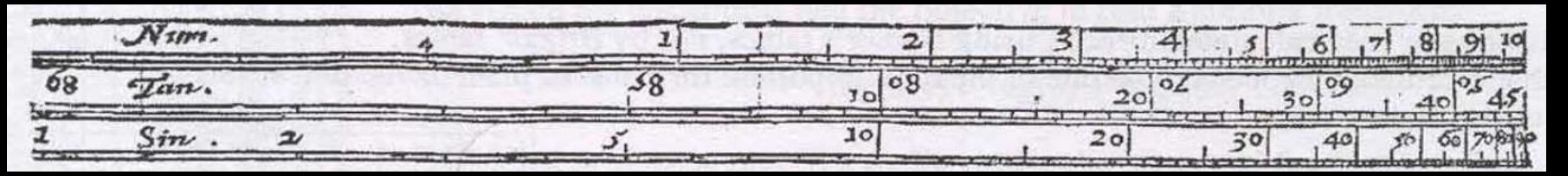
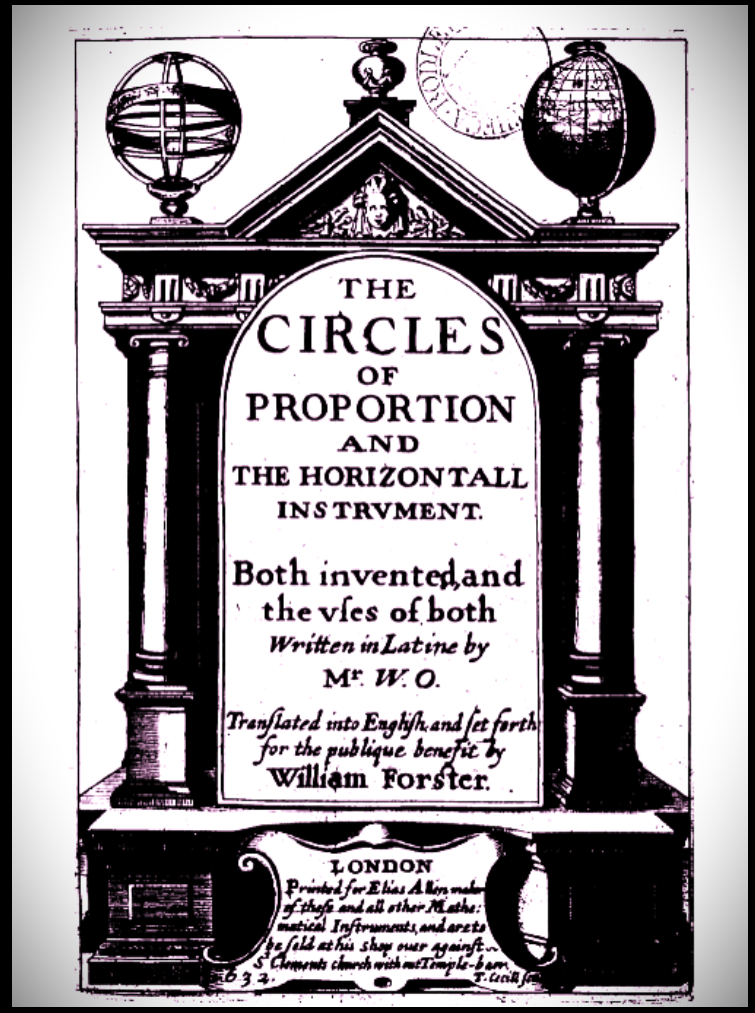


Original Drawing of Gunter's Scale with Three Types of Logarithmic Scales

Example of a Typical 19th Century 20 Inch Gunter Scale with Gunter's Initial Scales and Numerous Other Additional Scales Later Proven Useful in Navigation

William Oughtred (1574 – 1660)
Inventor of the Logarithmic Slide Rule

- Anglican clergyman and English mathematician
- First to recognize that two equivalent Gunter scales in circular form or as straight scales could be used to perform multiplication and division.
- Oughtred used this strictly as a tool for teaching mathematical concept with no pursuit of other practical applications
- Published *The Circle of Proportion and the Horizontall Instrument* in 1632
- In his publication he refers to a horizontal sundial integrated into the reverse side of the Circle of Proportions.
- In his 1632 work he refers to having conceived of the circle some years earlier, but without specifics as to actual year.



The Circle of Proportions and the Horizontall Instrument that Introduced the Slide Rule to the World (1632)

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- In his publication he refers to a horizontal sundial integrated into the reverse side of the Circle of Proportion.
- In his 1632 work he refers to having conceived of the circle some years earlier, but without specifics as to actual year.
- It is well-known that he was using this concept as a teaching tool with his students in the second half of the 1620's.
- Best estimation is concept occurred between 1622 and 1628.....so we celebrate 400 years in 2025!

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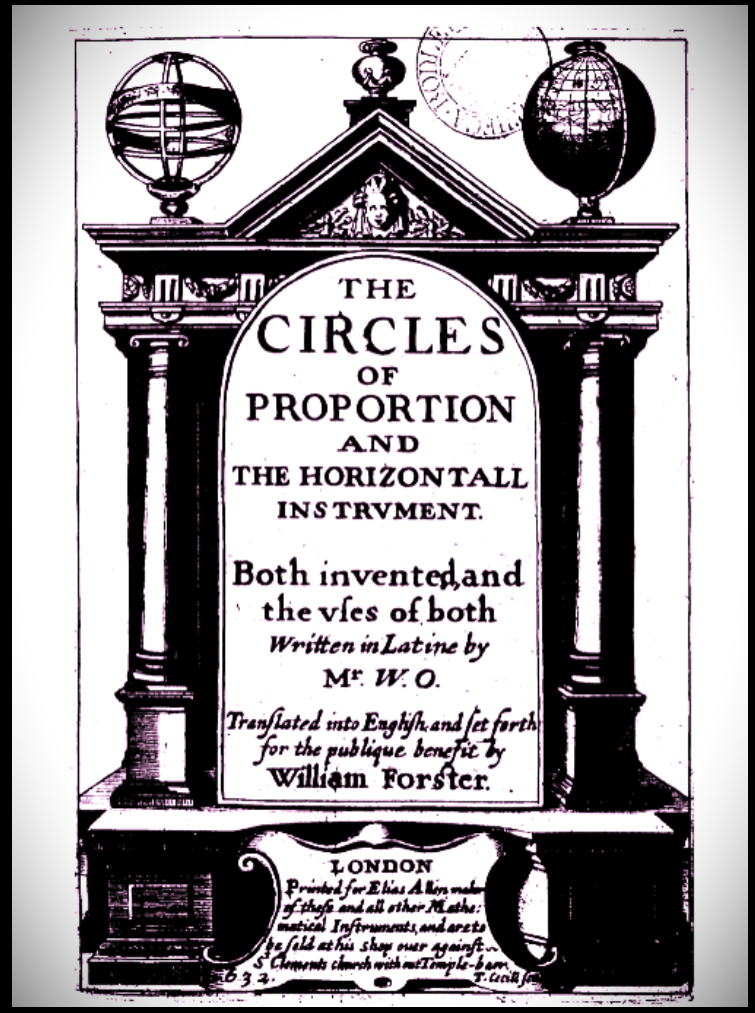

THE
CIRCLES
OF
PROPORTION
AND
THE HORIZONTALL
INSTRVMENT.

Both invented, and
the vſes of both
Written in Latine by
Mr. W. O.

Tranſlated into Engliſh, and ſet forth
for the publique benefit by
William Forster.

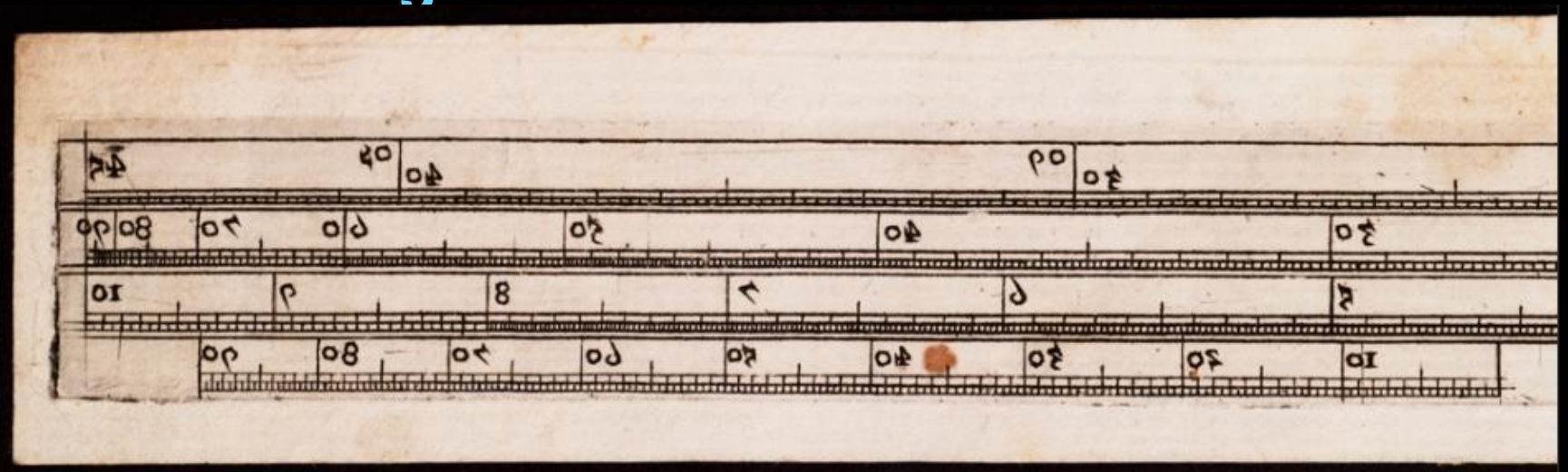
LONDON

The Circle of Proportions and the Horizontall Instrument that Introduced the Slide Rule to the World (1632)

The ‘Circle of Proportion’

An Early Example of Oughtred’s ‘Circle of Proportion’, by Elias Allen, c. 1633 – 1640 **[Harvard University Putnam Gallery]**

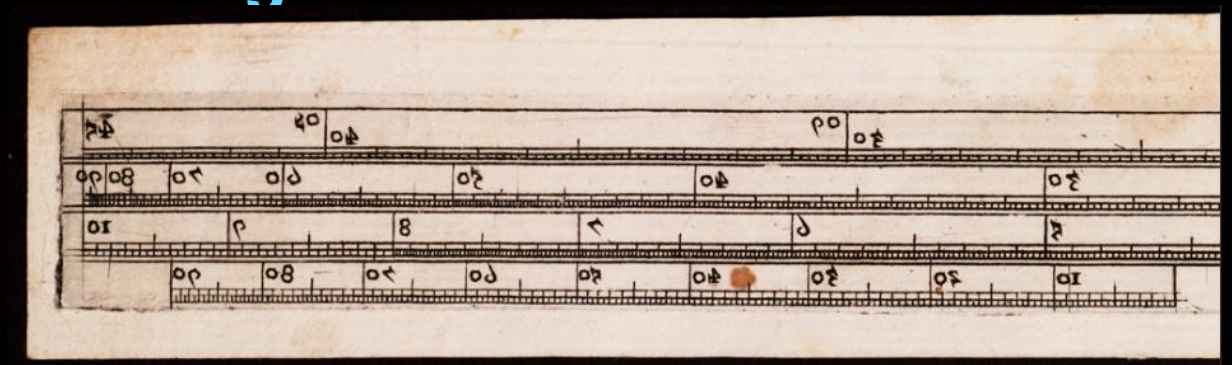
Oughtred's Linear Slide Rule



Reverse Print by Elias Allen, Part of Oughtred's First Linear Rule [Macclesfield Collection, Cambridge University Library

- An important letter from 1638 was recently discovered as part of the Macclesfield Collection in the Manuscripts Room of Cambridge University Library.
- The letter, from William Oughtred to instrument maker Elias Allen, was accompanied by the reverse print above which is a reverse ink print of the earliest discovered example of Oughtred's linear slide rule.
- The letter describes the linear rule and notes that he (Oughtred) 'would gladly see one of [the two parts of the instrument] made of brass.

Oughtred's Linear Slide Rule



The Official Story of it's Discovery (from Cambridge University Library):

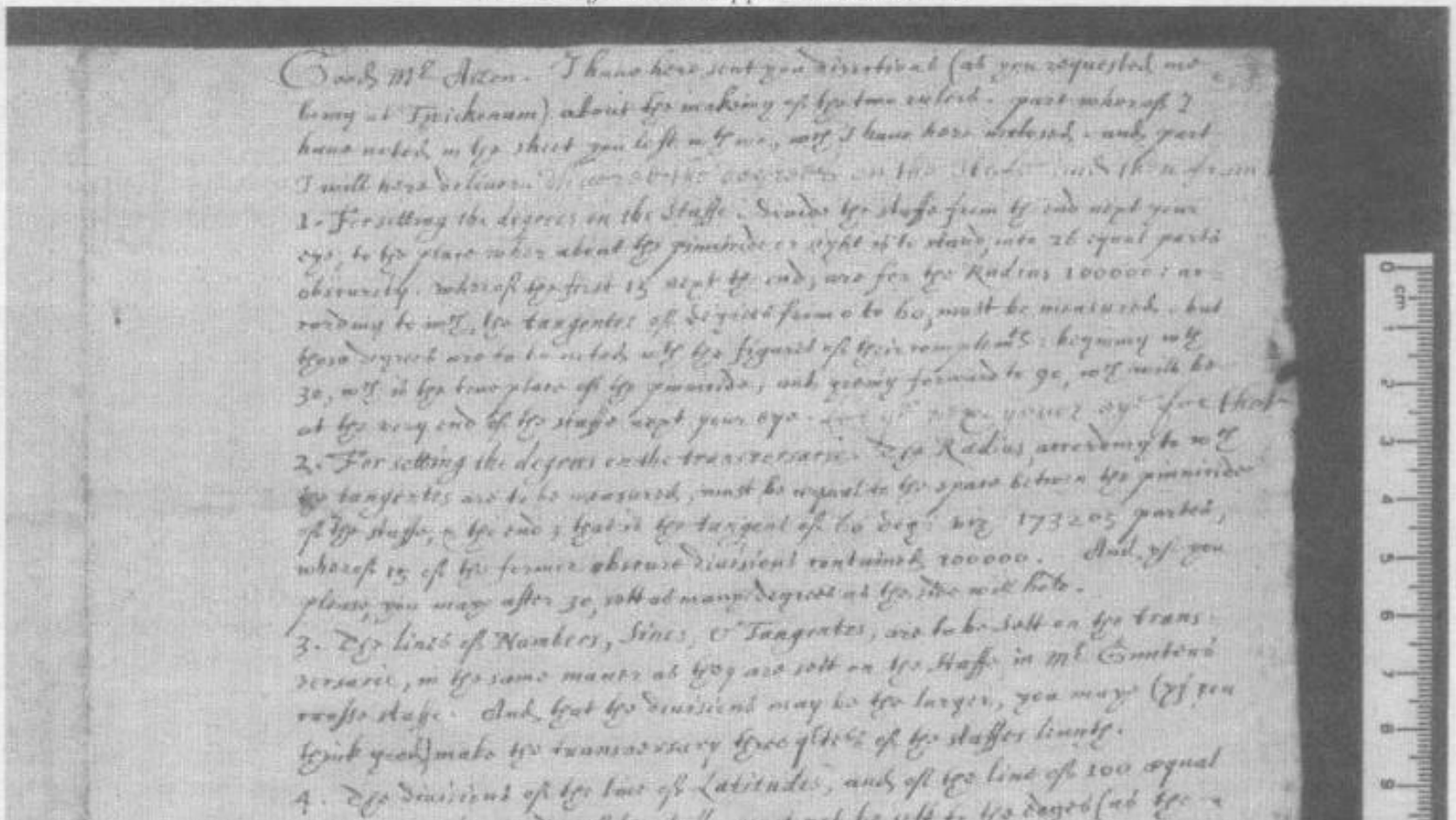
"Dr Boris Jardine's Munby Fellowship was held during the 2014-2015 academic year. His project focused on "The book as instrument 1570-1720," exploring the interplay between printing, engraving, and scientific instruments like slide rules. During this time he made key discoveries of William Oughtred's linear slide rule in the Macclesfield Collection, finding the earliest known example of Oughtred's linear rule, a reverse paper print made by the instrument maker, Elias Allen."

Oughtred's Linear Slide Rule

The Same Discovery from an Oughtred Society Perspective:

A Letter of 1638 From William Oughtred to Elias Allen

Edited by Peter Hopp and Bob Otnes



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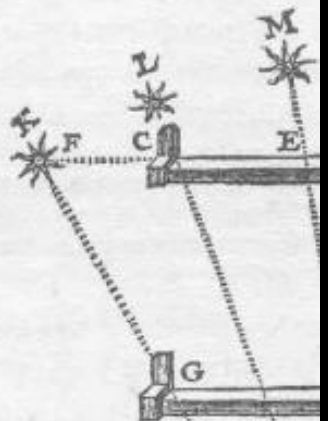

Oughtred's Linear Slide Rule

The Same Discovery from an Oughtred Society Perspective: JOS Spring 2008!!

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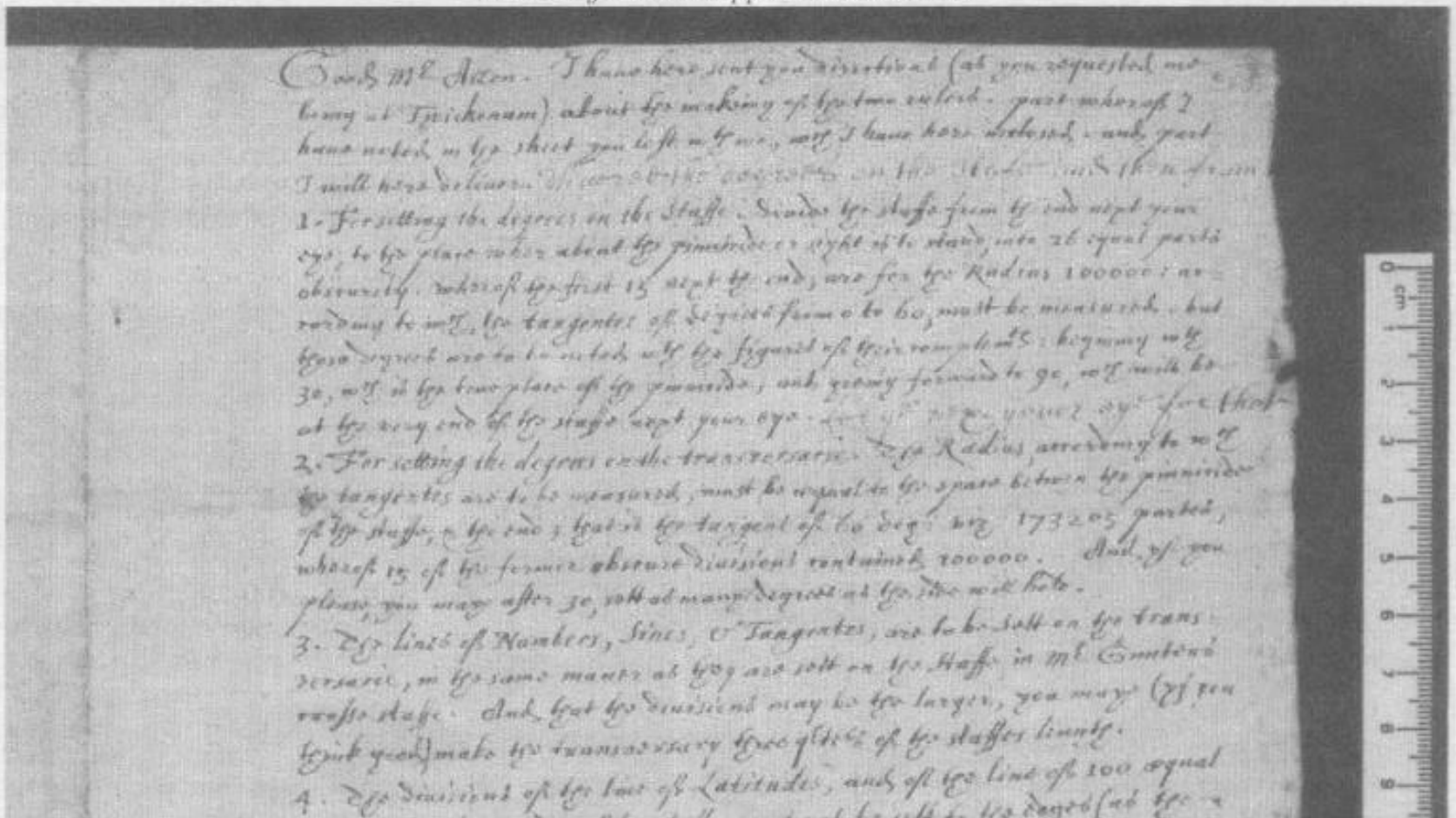

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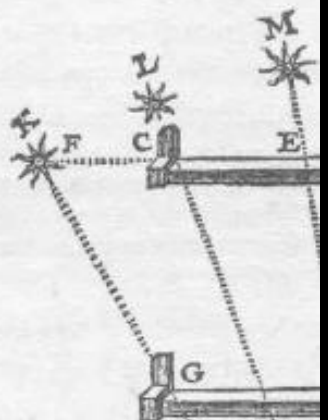

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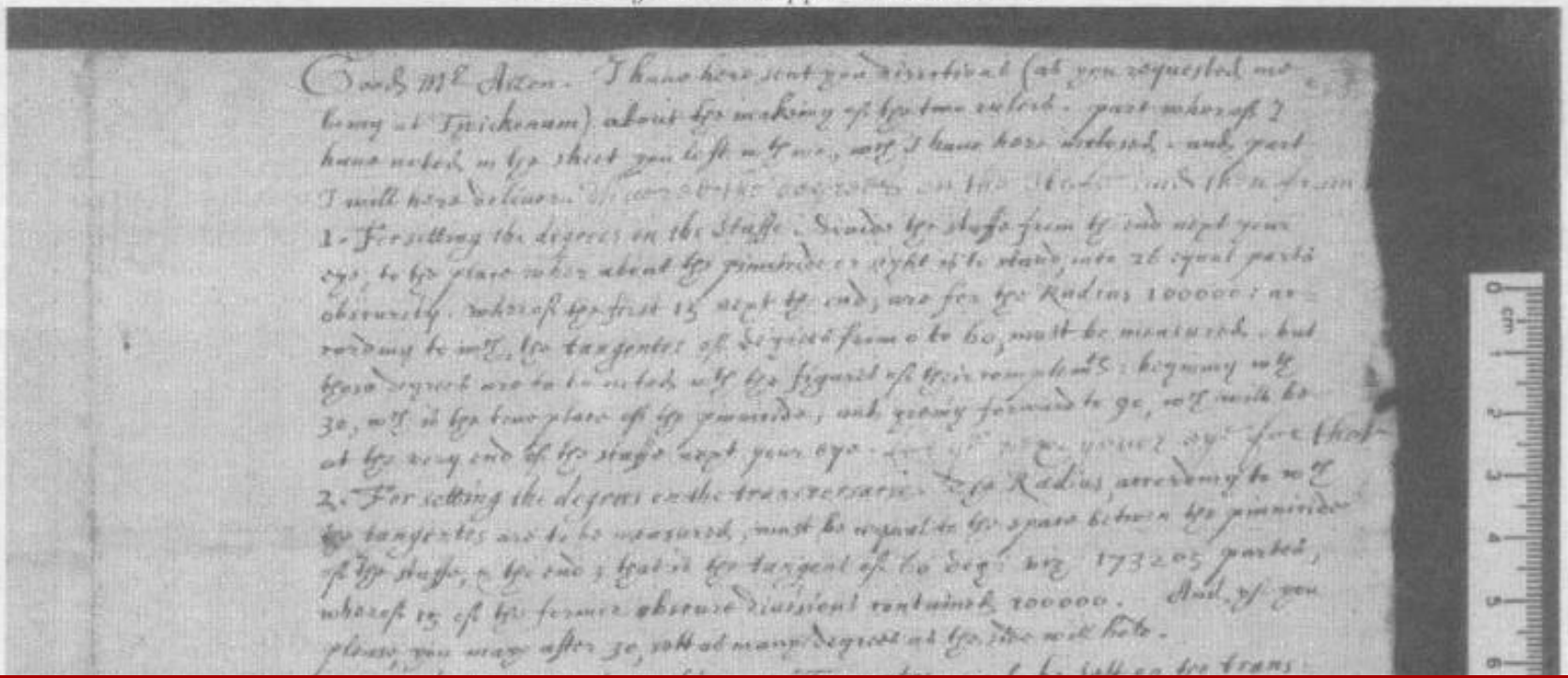

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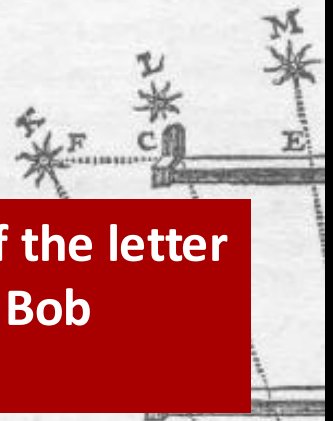

JOS Vol. 17 No.1 (Spring 2008) pp28-30....a three-page article covering the discovery of the letter from the Macclesfield Collection along with the reverse print at the CUL discovered by Bob Otnes the article authored by Peter Hopp and Bob Otnes

Oughtred's Linear Slide Rule

The Same Discovery from an Oughtred Society perspective: JOS Spring 2008!!

other divisions now) but in the [midle] close togethr: that the one may show [the other]. The rest is plainly enough sett downe.

5. The line of Æqual parts on the fourth side of transversary, from the unite line, to [the end] of the ruler, is to be divided into parts $17^{2}/_{3}$(sic): [viz] at 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 10, 9, 8, 7, 6, 5, 4, 3, $2^{1}/_{3}$: wherof the tenn first, from 10 to 10, [be] æqual to the space from 1 to 1, in the line of numbers. As also it appeareth thus in the [??].

6. The sorketz must be soe made that they may easily be taken off: and that the transversary maye stand on the right hand of the staffe: soe that both the lines of degrees may be close together.

I think you will make no doubt of any thing about the rulers. I would gladly see one of them when it is finished: [which] yet I never have done. [Nowe] I will put you in mind of my compasses: [and] soo for this time take my leave: and [make] my [love] & best wishes to you and yours, I rest

Aug: 20 1638 Your so very [loving] friend and servant

William Oughtred of etc. [Old Bayley]
[Reformed] that the [Sub]
[dewards] [mostrato]

End of material on the face of the letter.

The following was on the back of the letter as an address:

To my very [loving] friend Mr
Elias Allen [dwelling] over against
The great South doore of St
Clementz church

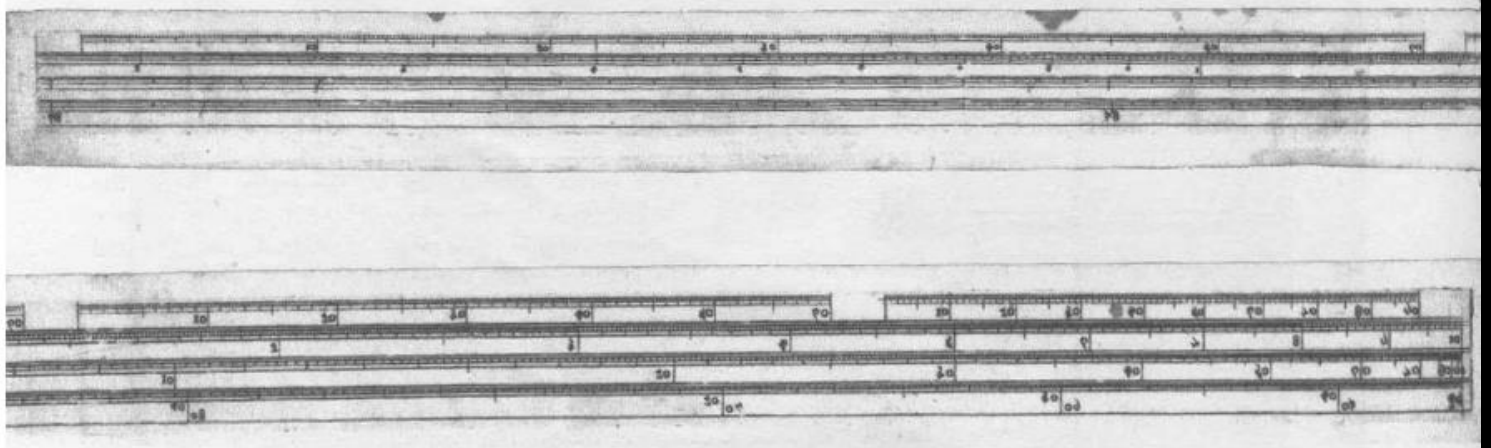

Figure 3. The drawing in Oughtred's letter

Oughtred's Linear Slide Rule

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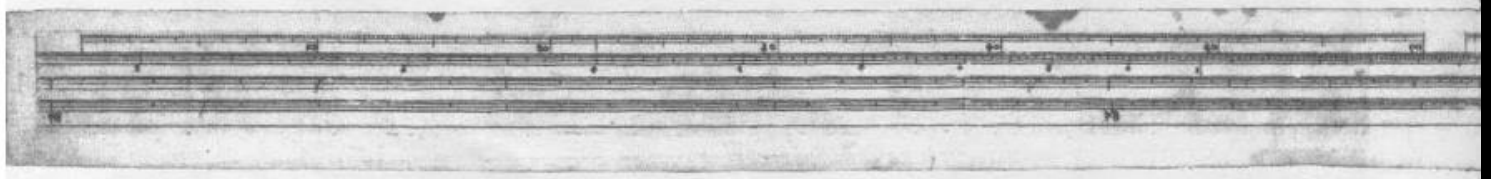
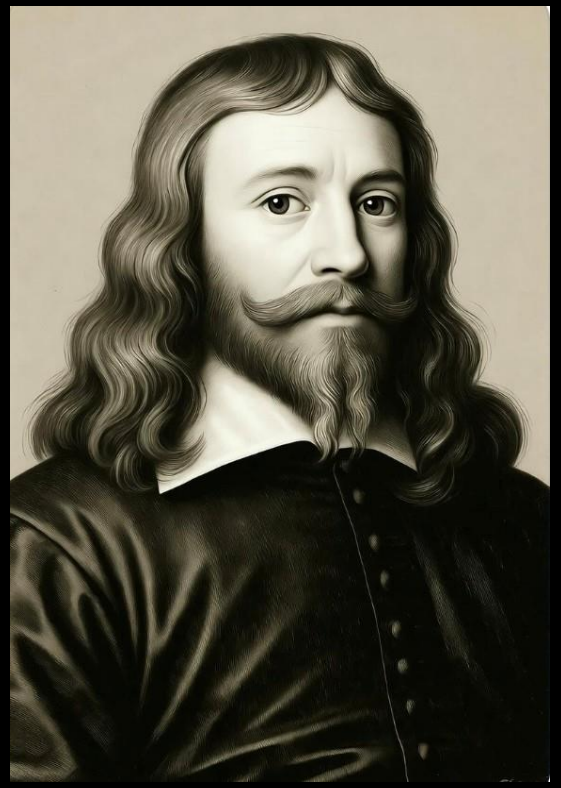


Figure 3. The drawing in Oughtred's letter

....so now you know 'the real the story"!

The Controversy Over Invention

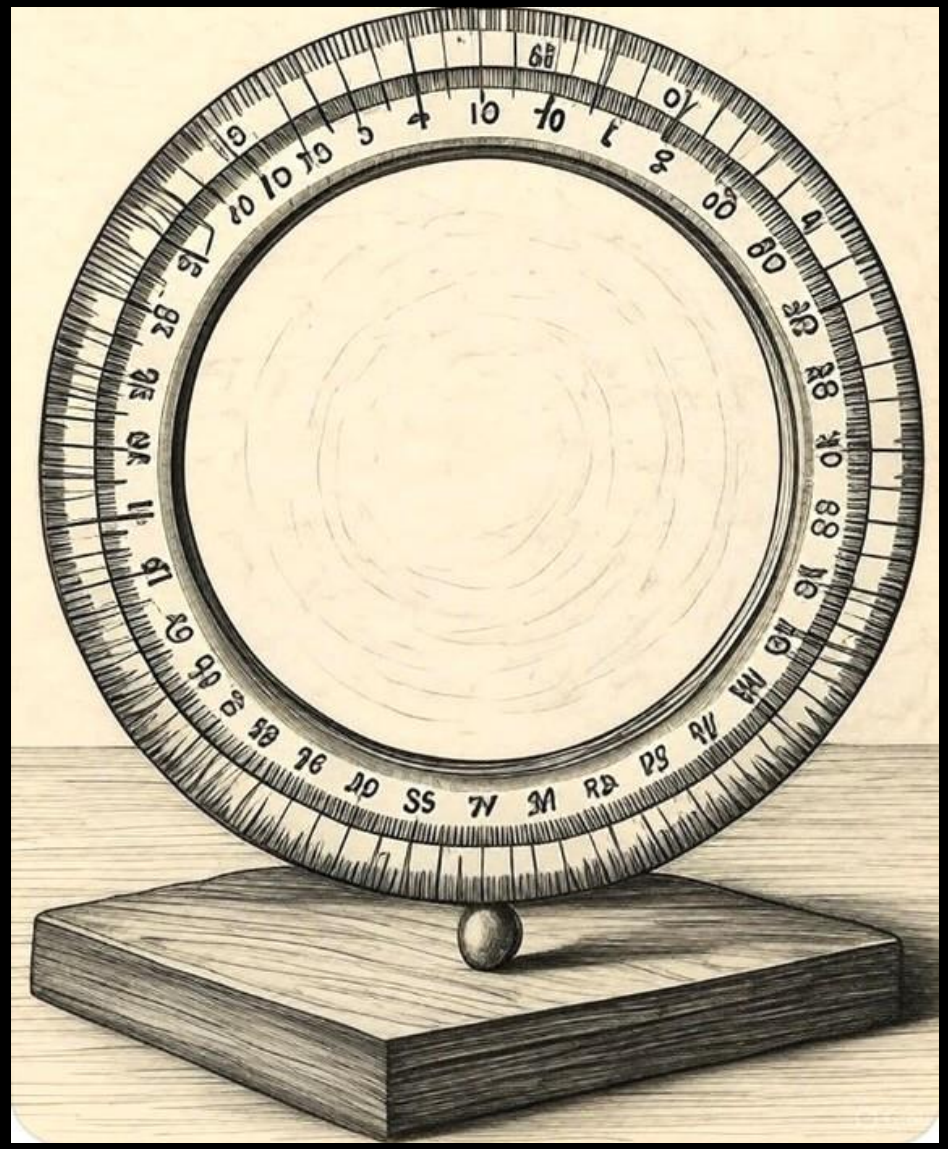
- A very bitter and prolonged struggle, ripe with accusations between Oughtred and Richard Delamain, took place in the 1630s over priority of invention
- Oughtred routinely shared his circular rule prototypes privately with his students in the mid-to-late 1620's with the goal of mathematical instruction.
- Fortunately, Oughtred also shared his ideas with renowned instrument-maker Elias Allen (but did not publish at the time)
- Richard Delamain, a mathematician 26 years younger and a student of Oughtred's in the 1620's, in 1629 sent a manuscript entitled *Grammelogia or The Mathematical Ring* to King Charles I.
- He then formally published his work in 1630, claiming invention of this instrument, including designs for circular slide rules



Richard Delamain (1600-1644)

The Controversy Over Invention

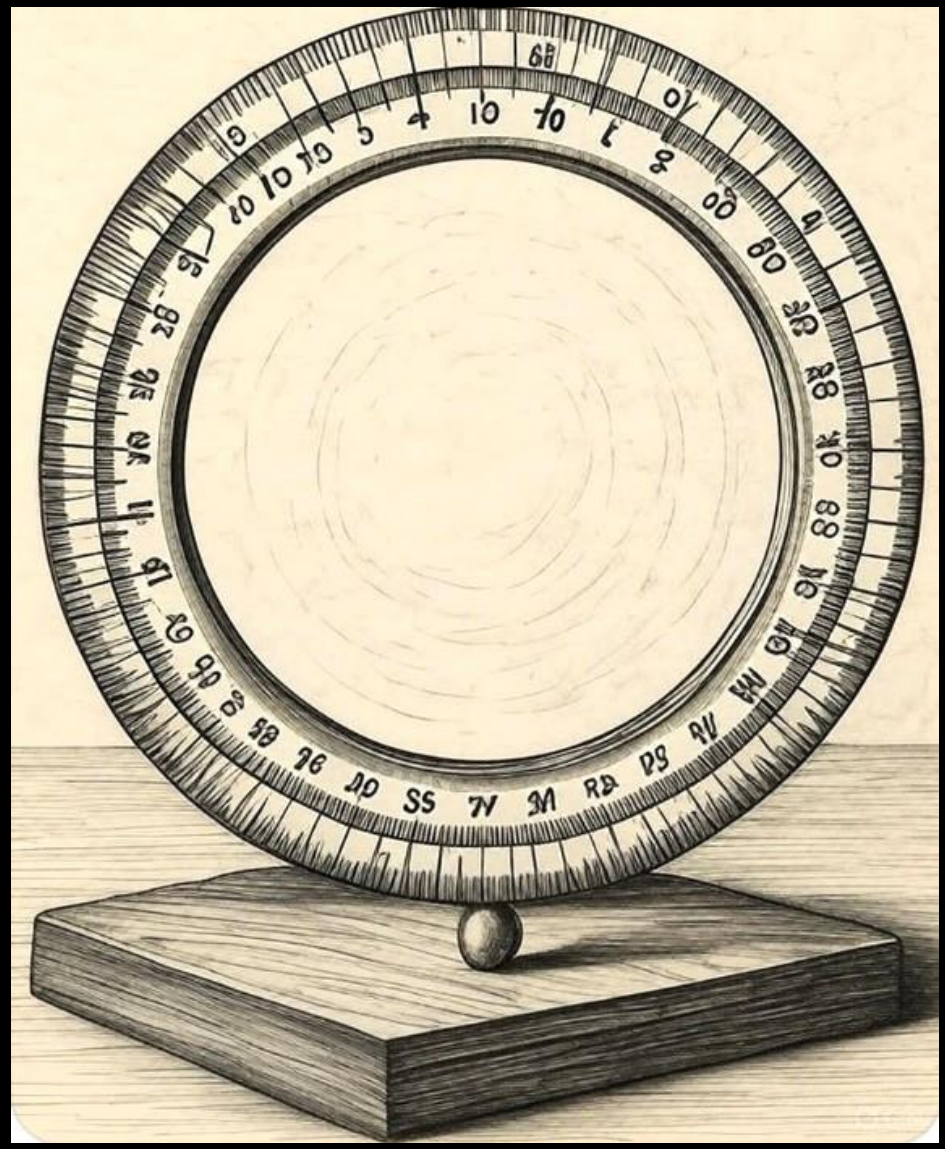
- Delamain demonstrates his invention to King Charles I who grants him a 10-year Royal Patent and appoints him as Royal Engineer and tutor to the King.
- Oughtred privately accuses Delamain of theft.
- William Forster, a loyal student of Oughtred's, translates Oughtred's unpublish Latin manuscript into English and publishes *The Circles of Proportion and the Horizontall Instrument* in 1632. In it, an unnamed rival (obviously Delamain) is accused of attempting to 'preocupate' Oughtred's work after confidential sharing of his ideas.



Richard Delamain's 'Grammelogia or The Mathematical Ring' 1630

The Controversy Over Invention

- **Delamain fights back by publishing three new editions of his Grammelogia, adding sine/tangent circles and claiming accuracy enhancements. Independently, he accuses Oughtred of false timelines and a false disdain for practical instruments.**



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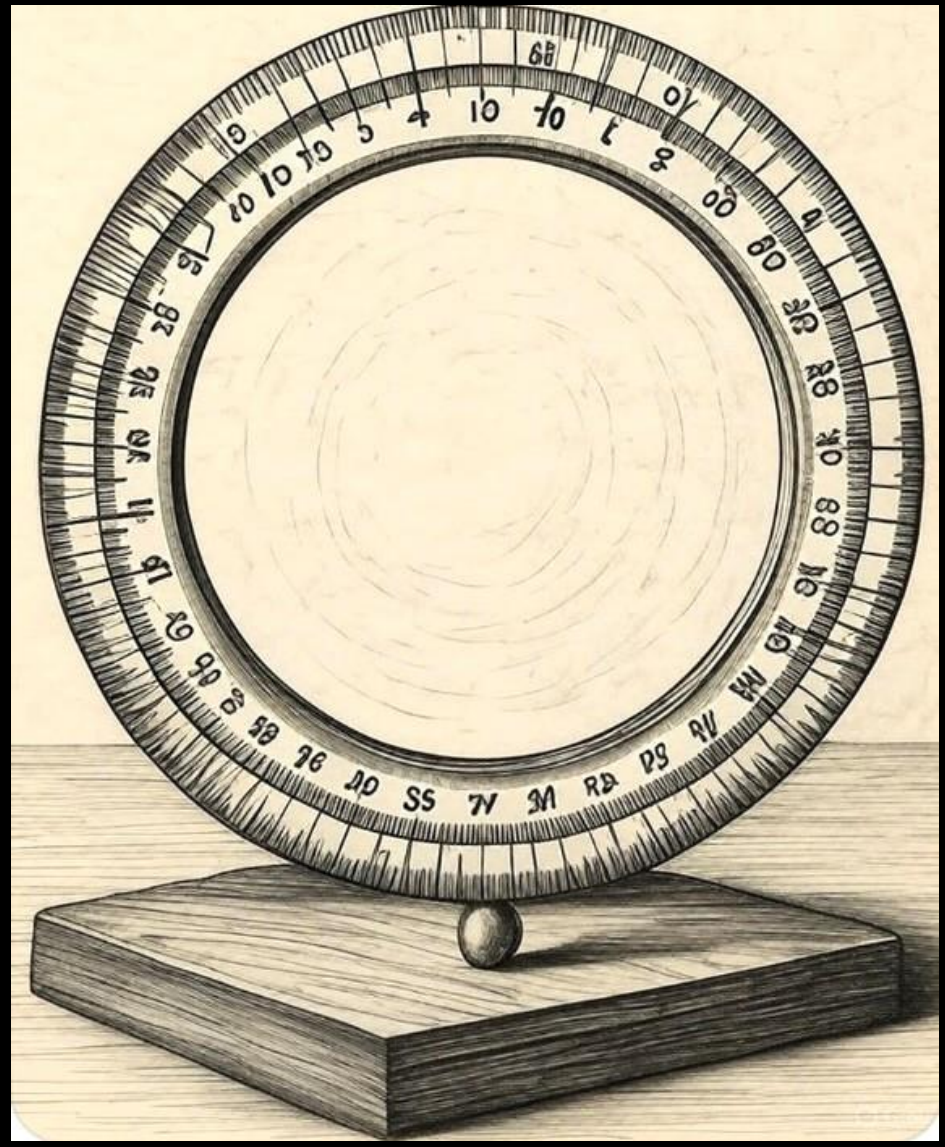
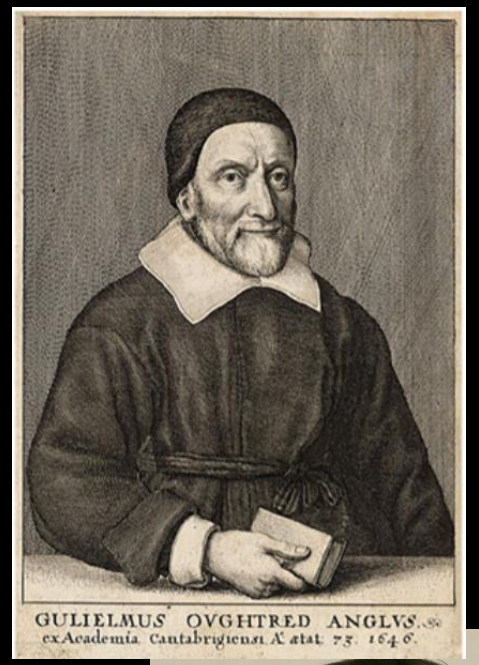
- Oughtred publishes *An Addition vnto the Vse of the Instrument called the Circles of Proportion* where he also expands on his ideas of the linear rule.

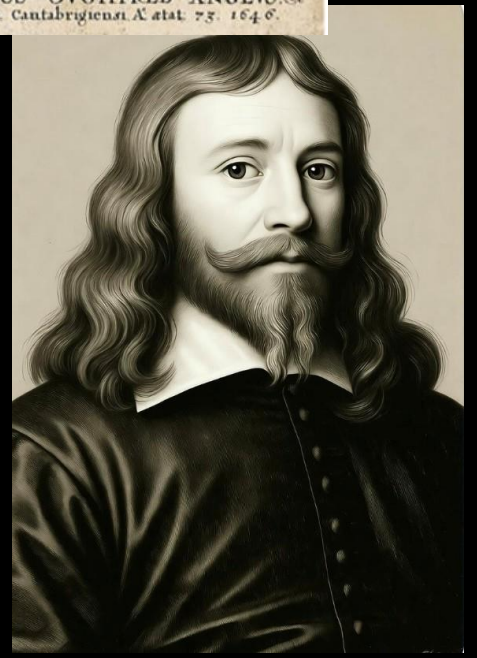


Richard Delamain's 'Grammelogia or The Mathematical Ring' 1630

The Controversy Over Invention

- **Excerpts from Oughtred's *Apologeticall Epistle*....**
  - **'To the English Gentrie and all other studious of the Mathematicks, which shall bee Readers hereof. The just Apologie of Wil: Oughtred, against the slanderous insimulations of Richard Delamain, in a Pamphlet called Grammelogia or the Mathematicall Ring...'**
  - **[Delamain is] 'already corrupted with doting upon instruments, and quite lost from ever being made an Artist'**
  - **'His Booke is an untimely birth, a hotch-potch of confusion full of grosse errors and absurdities'**





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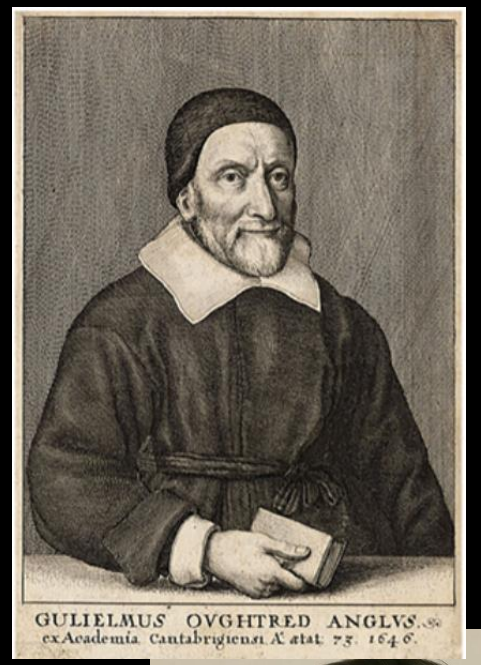
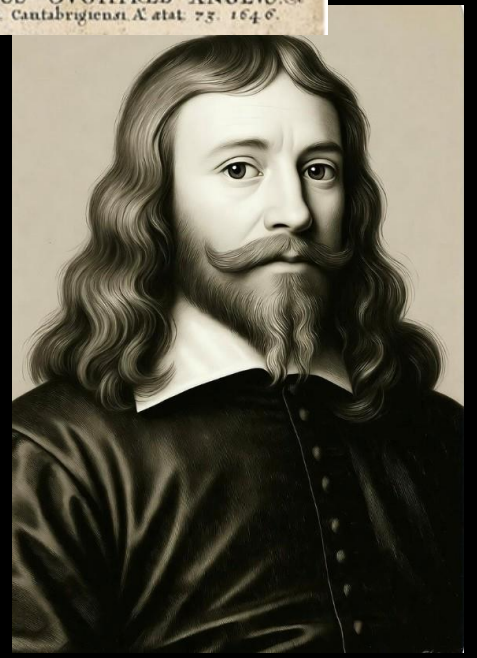
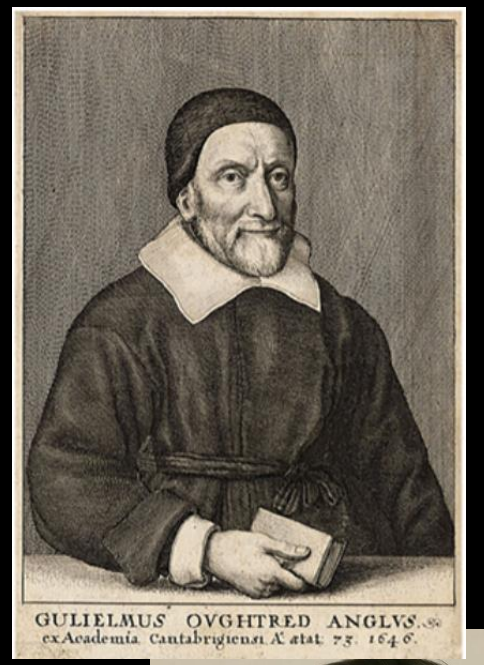
  - **'His Booke is an untimely birth, a hotch-potch of confusion full of grosse errors and absurdities'**
  - **'What he hath done is but a shadow of my work, patched together with stolen fragments... a pickpurse of another man's wit'**

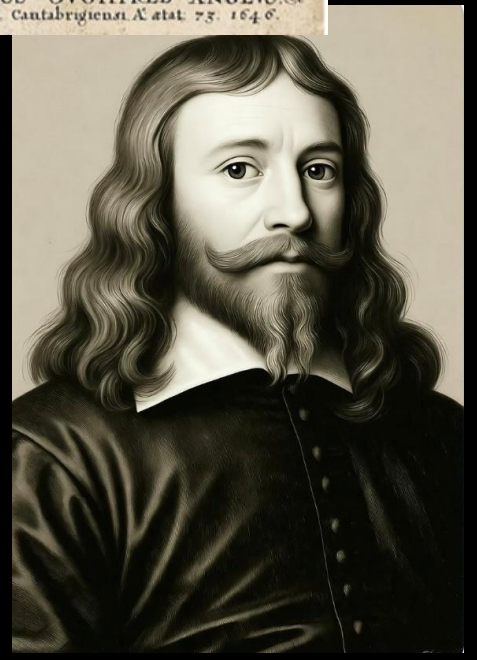




The Controversy Over Invention: Conclusion

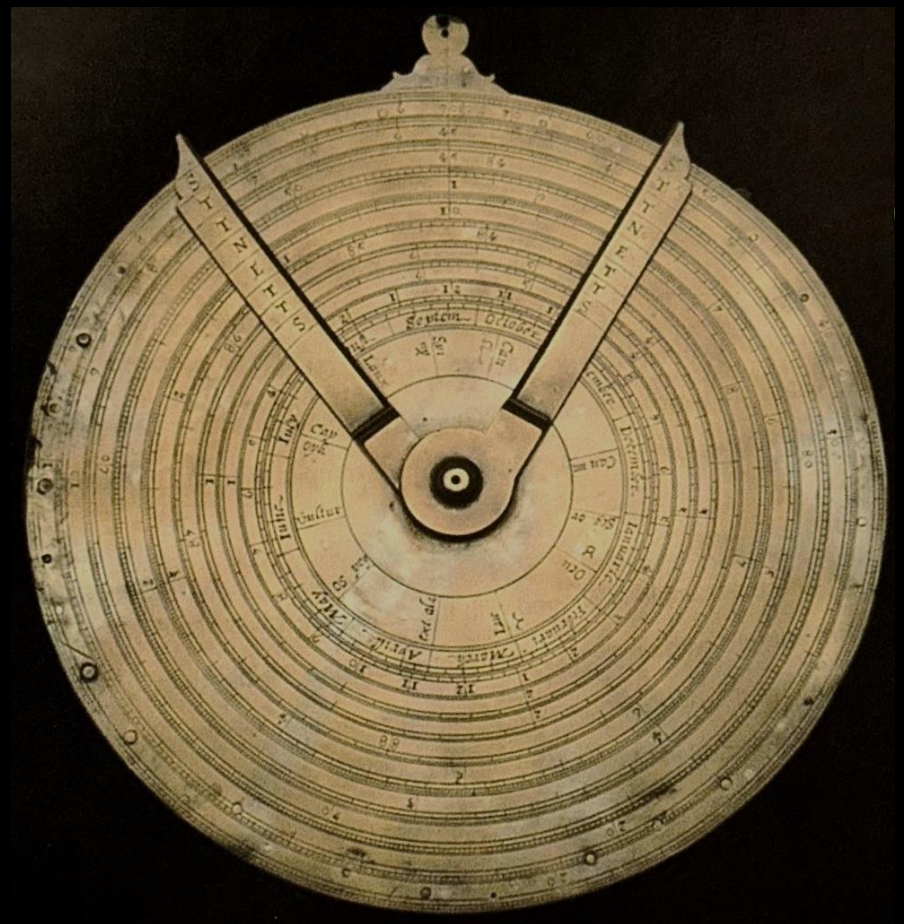
- Based on several important mathematicians who backed Oughtred's claim to earlier conceptual priority, invention of the slide rule is widely attributed to Oughtred
  - Supported by William Forster, Elias Allen. John Brown and later important figures such as William Leybourn, Robert Boyle and Isaac Newton
- King Charles favored Delamain, appointing him as Royal Tutor at a salary of £100 per year (£29000 or $39000 in 2025). He was impressed with Delamain's pamphlets and his gifts which included a silver ring-sundial and other instruments.
- Prominent historian Florian Cajori summarized the conclusion well: though Delamain was first to publish with a focus on practical application, Oughtred proved conceptual priority for both the circular and linear slide rule as evidenced by his mastery and by key witnesses.





William Oughtred's Legacy.....

Another beautiful example of Oughtred's Circle of Proportion



Circle of Proportion by maker Robert Davenport ca. 1650
[National Museum of Scotland}

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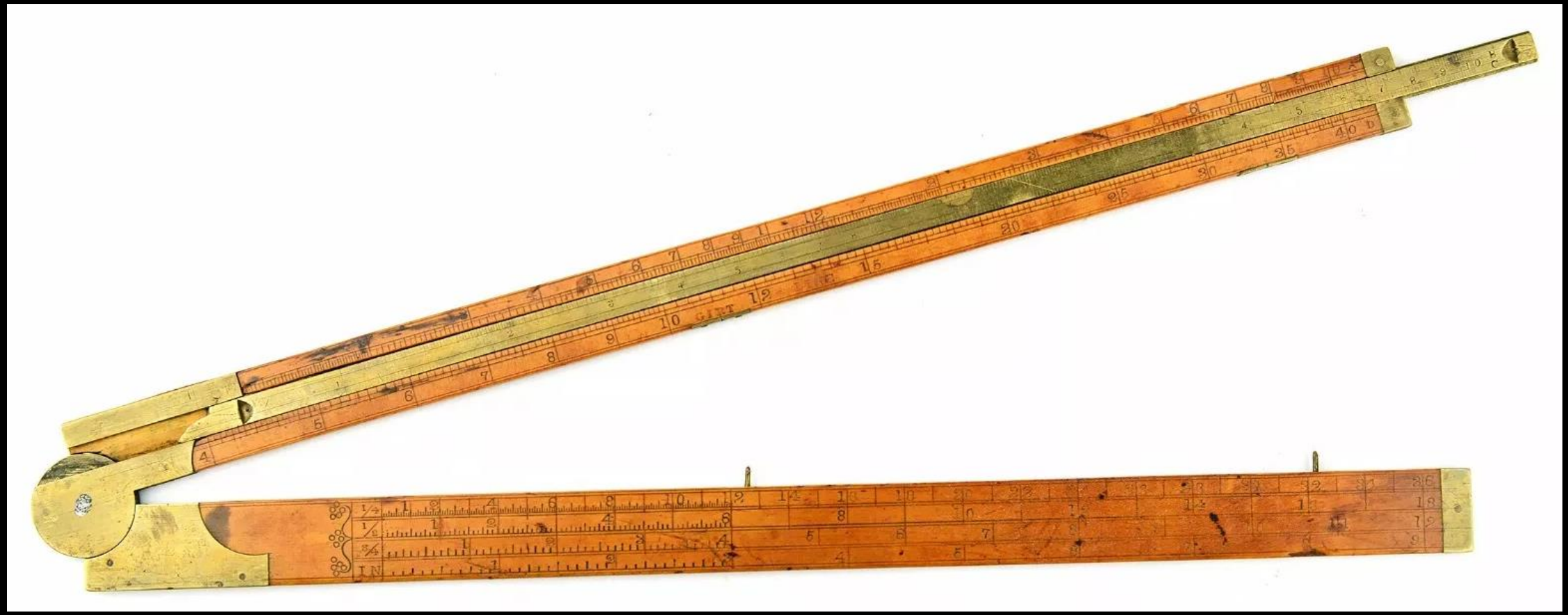
William Oughtred's Legacy.....

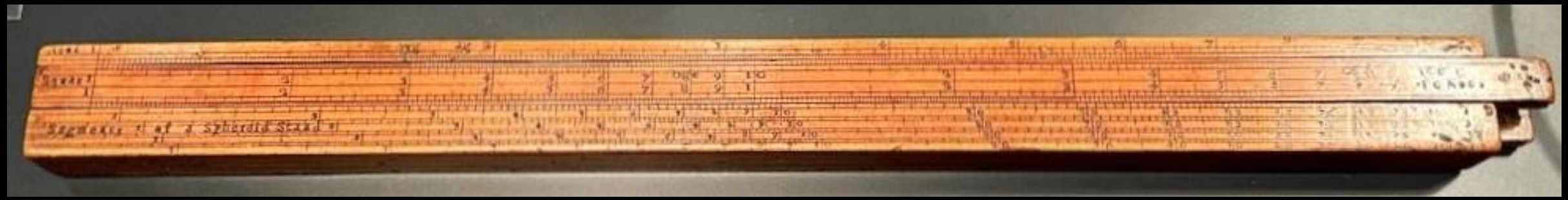
The Coggeshall or Carpenter's Slide Rule, 1677

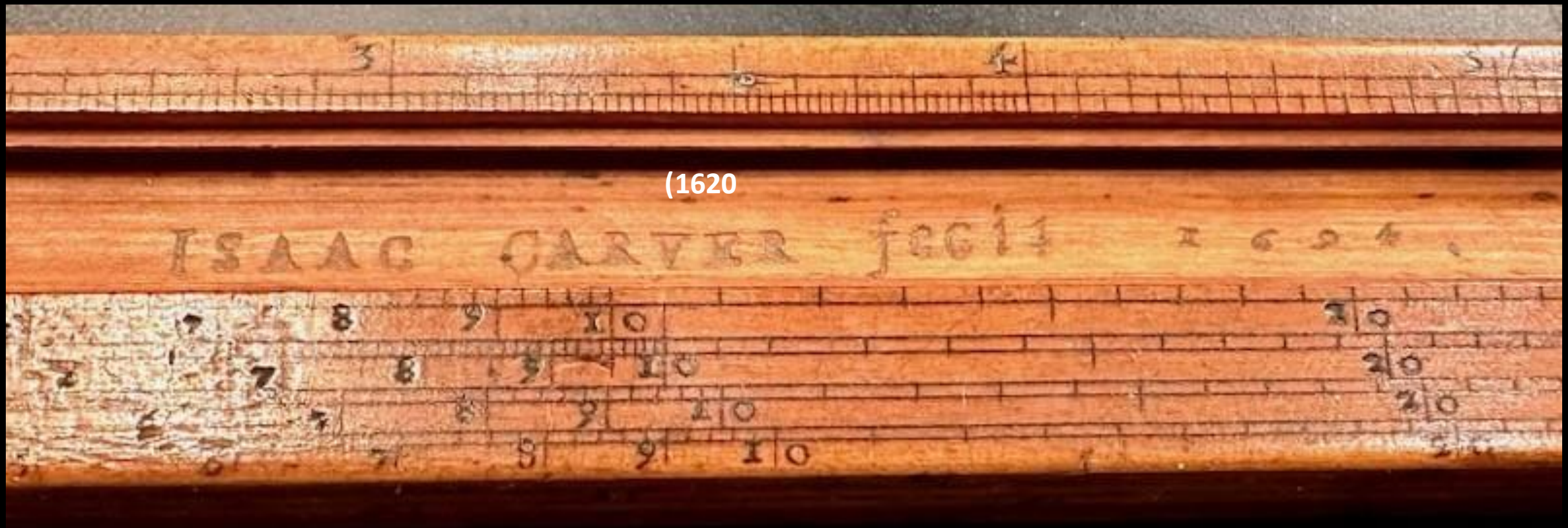
Henry Coggeshall (1623 – 1690)



William Oughtred's Legacy.....

The Everard Gauging Rule, 1683, Thomas Everard (1620 - 1680)



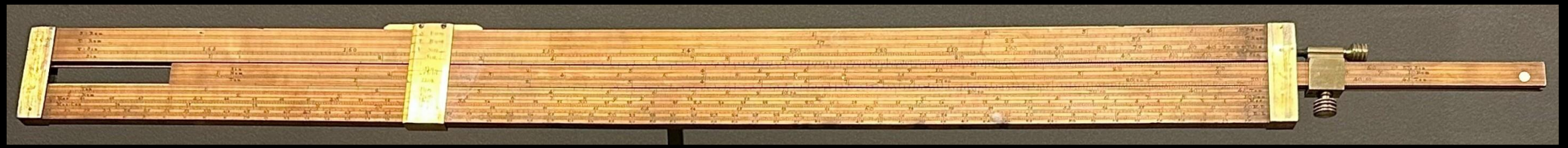


William Oughtred's Legacy.....

A Variety of Everard Excise Rules from the Late 17th to the Mid-19th Centuries

William Oughtred's Legacy.....

Defined Clear Stator and Slide 1657, Seth Partridge (1603 – 1686)



The Sliding Gunter, 1775, John Robertson (1712 – 1776)

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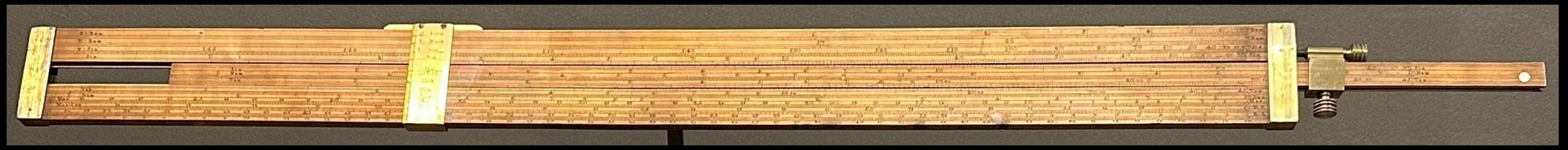

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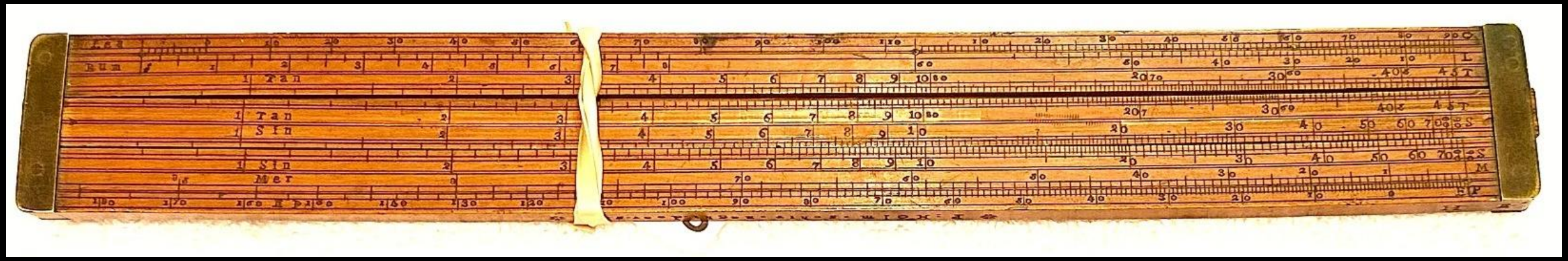
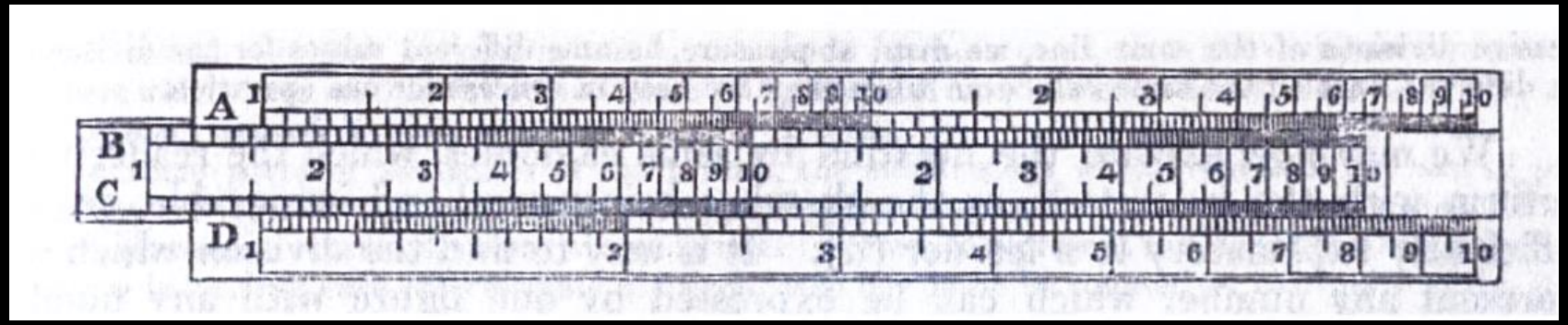


William Oughtred's Legacy.....

The Soho Slide Rule (Engineer's Rule), 1770's
James Watt (1736 – 1819)



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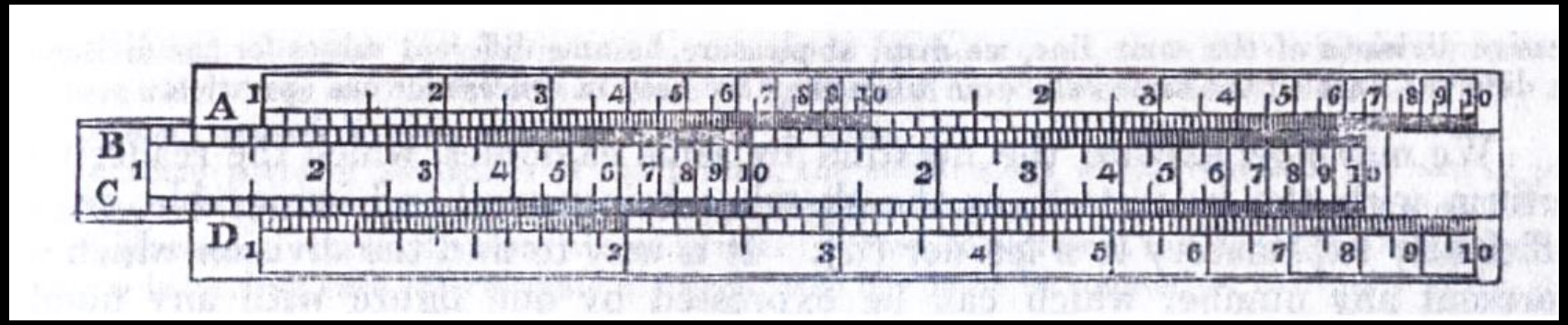
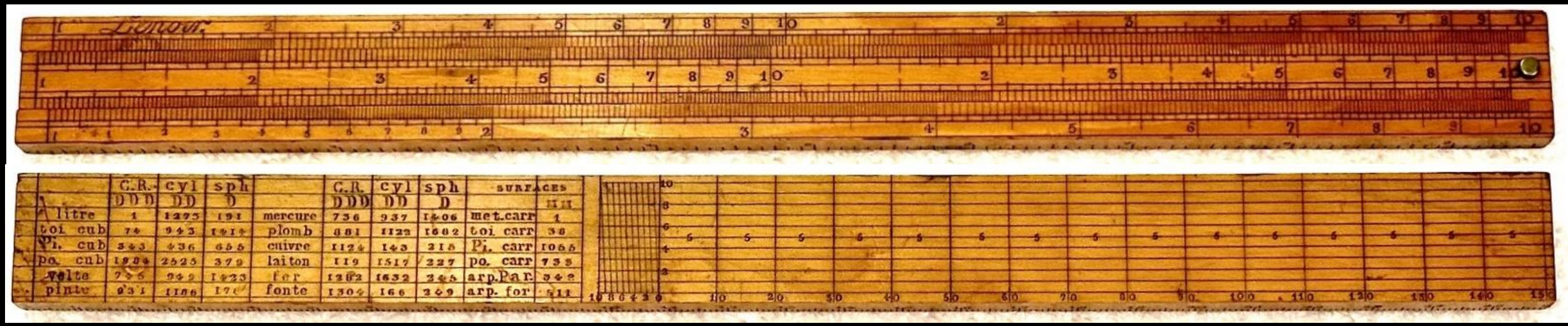
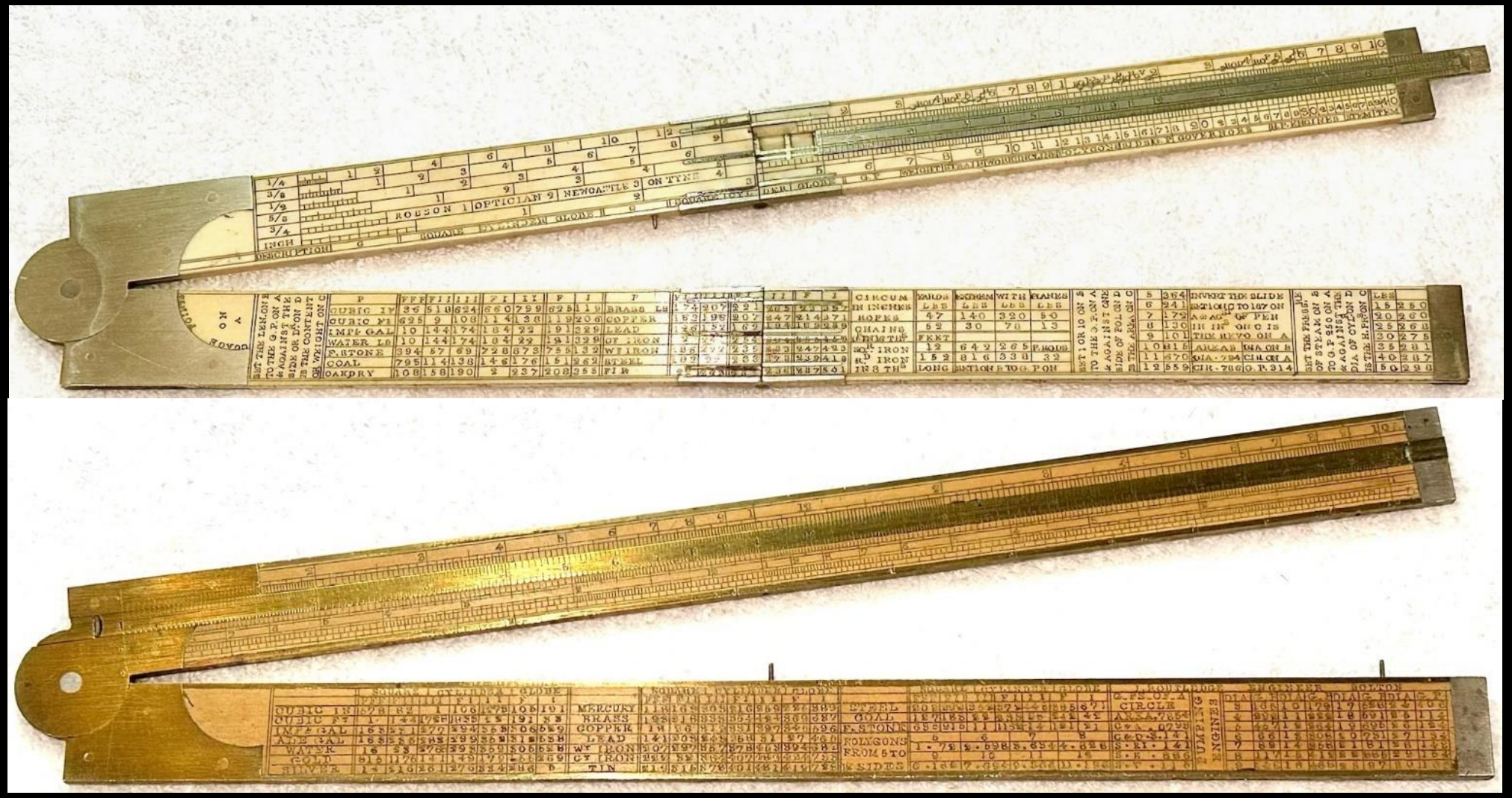




William Oughtred's Legacy.....

Routledge Engineer's Rule 1809
Joshua Routledge (1773 – 1829)



William Oughtred's Legacy.....

The Mannheim Slide Rule, 1859 Amadee Mannheim

Amédée Mannheim
(1831 – 1906)

William Oughtred's Legacy.....

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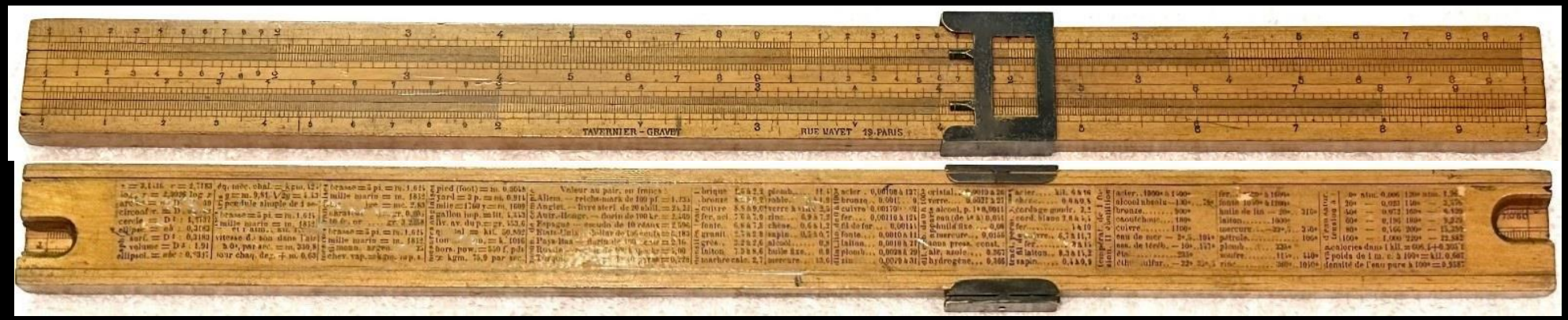

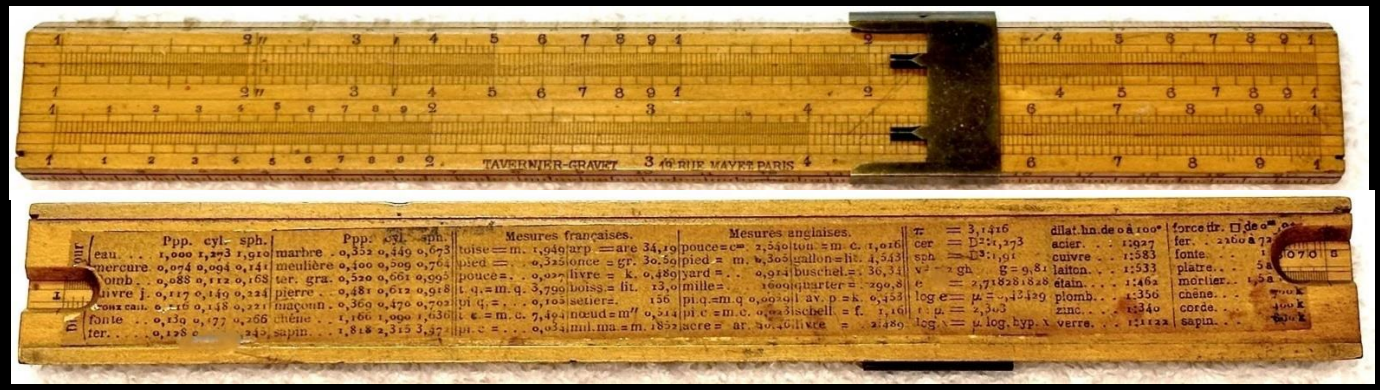

Amédée Mannheim
(1831 – 1906)

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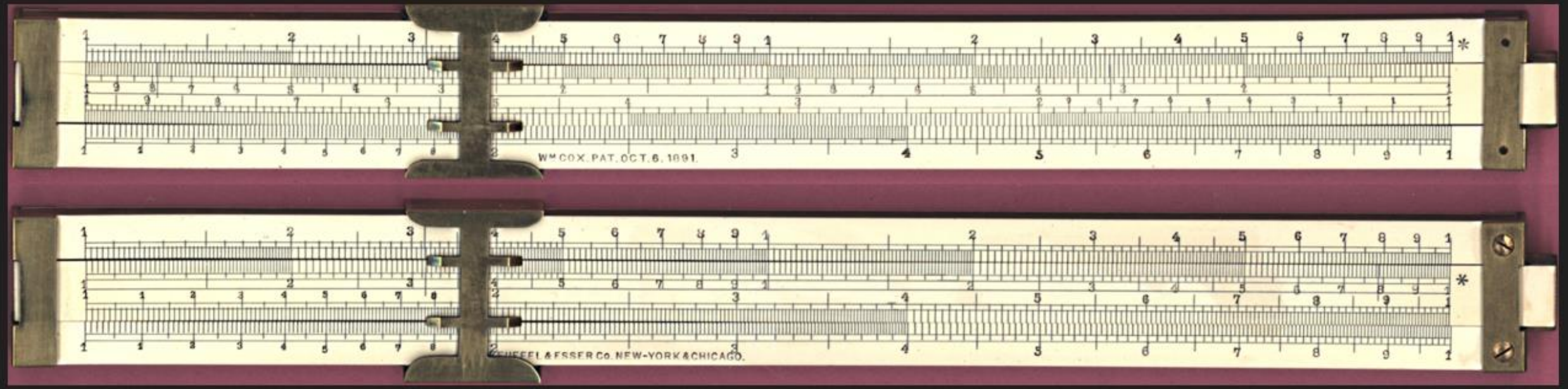
William Oughtred's Legacy.....

The Duplex Slide Rule, 1891 William Cox (1848 – 1907)



William Oughtred's Legacy.....

The Fuller Cylindrical Calculator, 1878, George Fuller (1829 – 1907)

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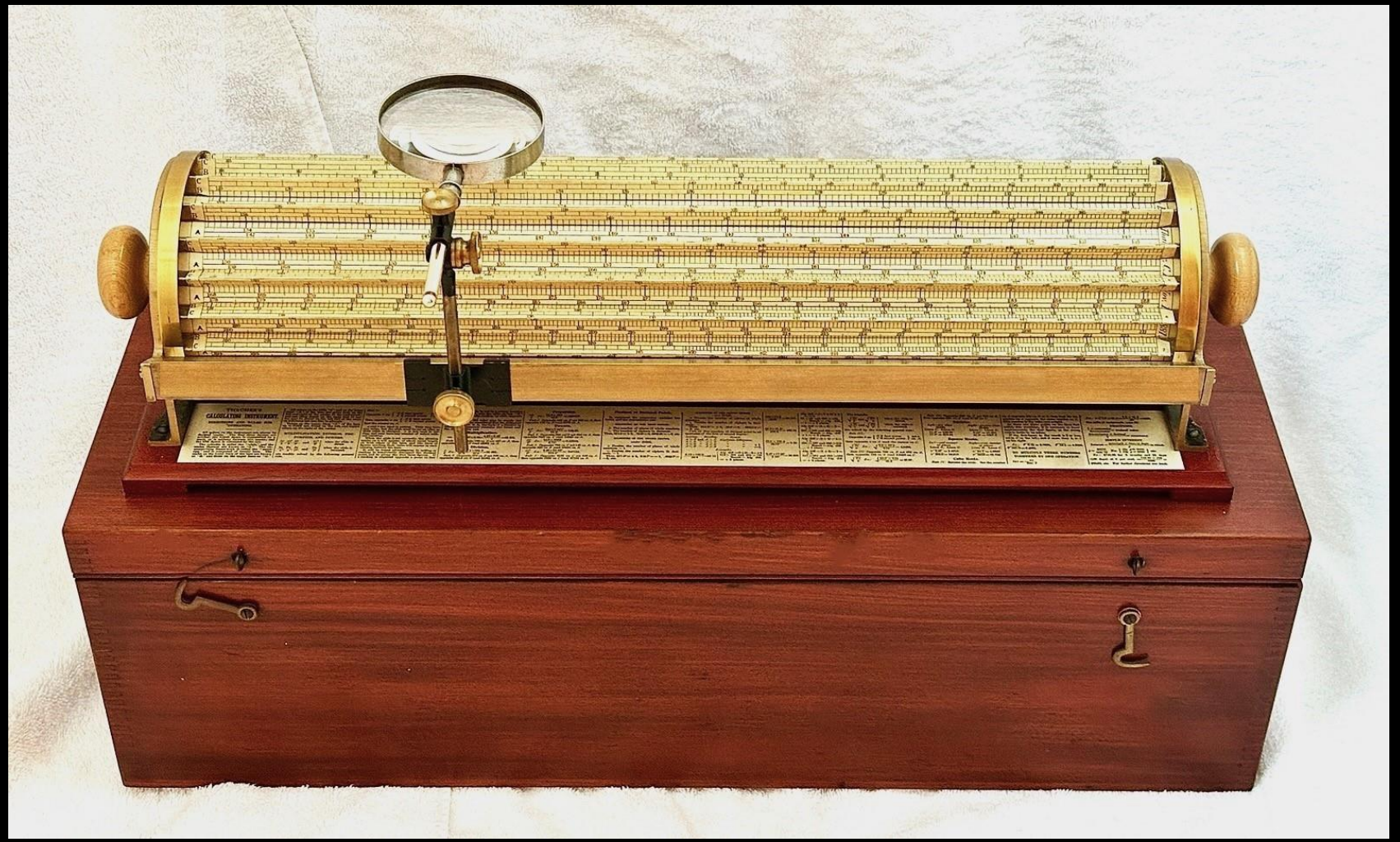
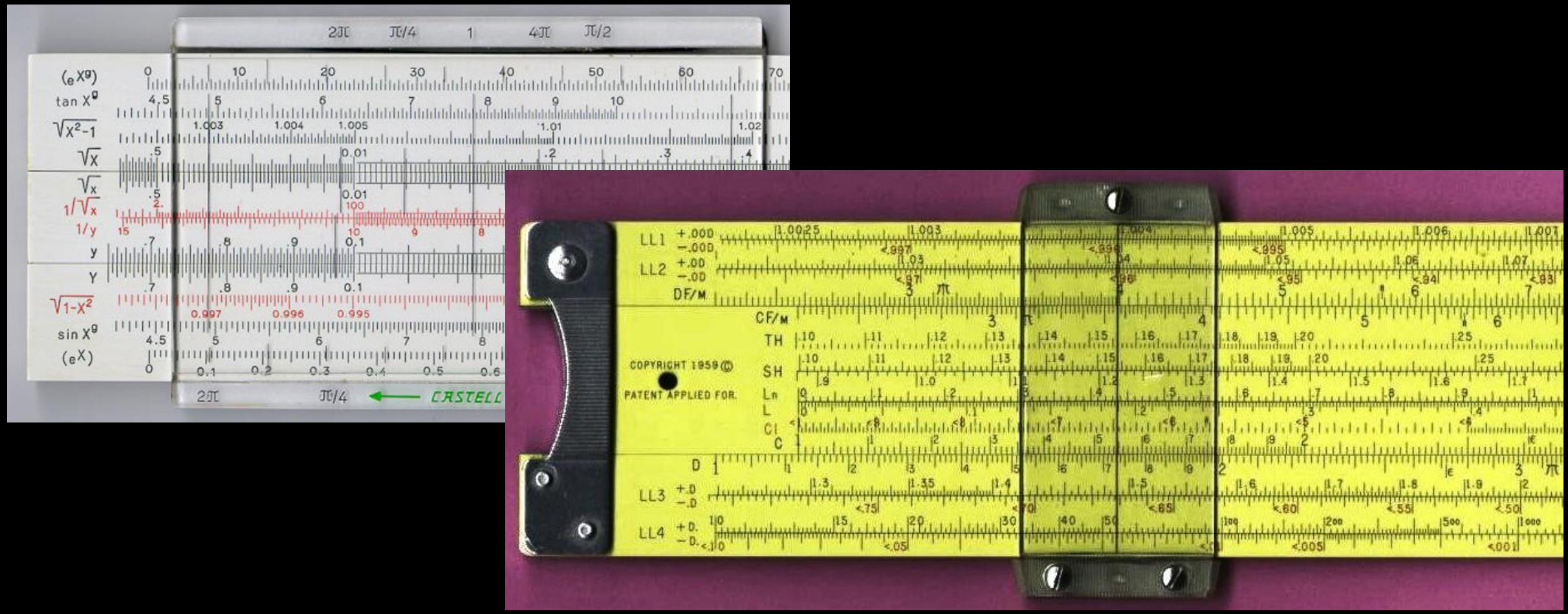
William Oughtred's Legacy.....

The Thacher Calculator, 1881, Edwin Thacher (1839 – 1920)



William Oughtred's Legacy.....

Two Interesting Complex Rules in Production in the mid-20th Century



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William Oughtred's Legacy.....

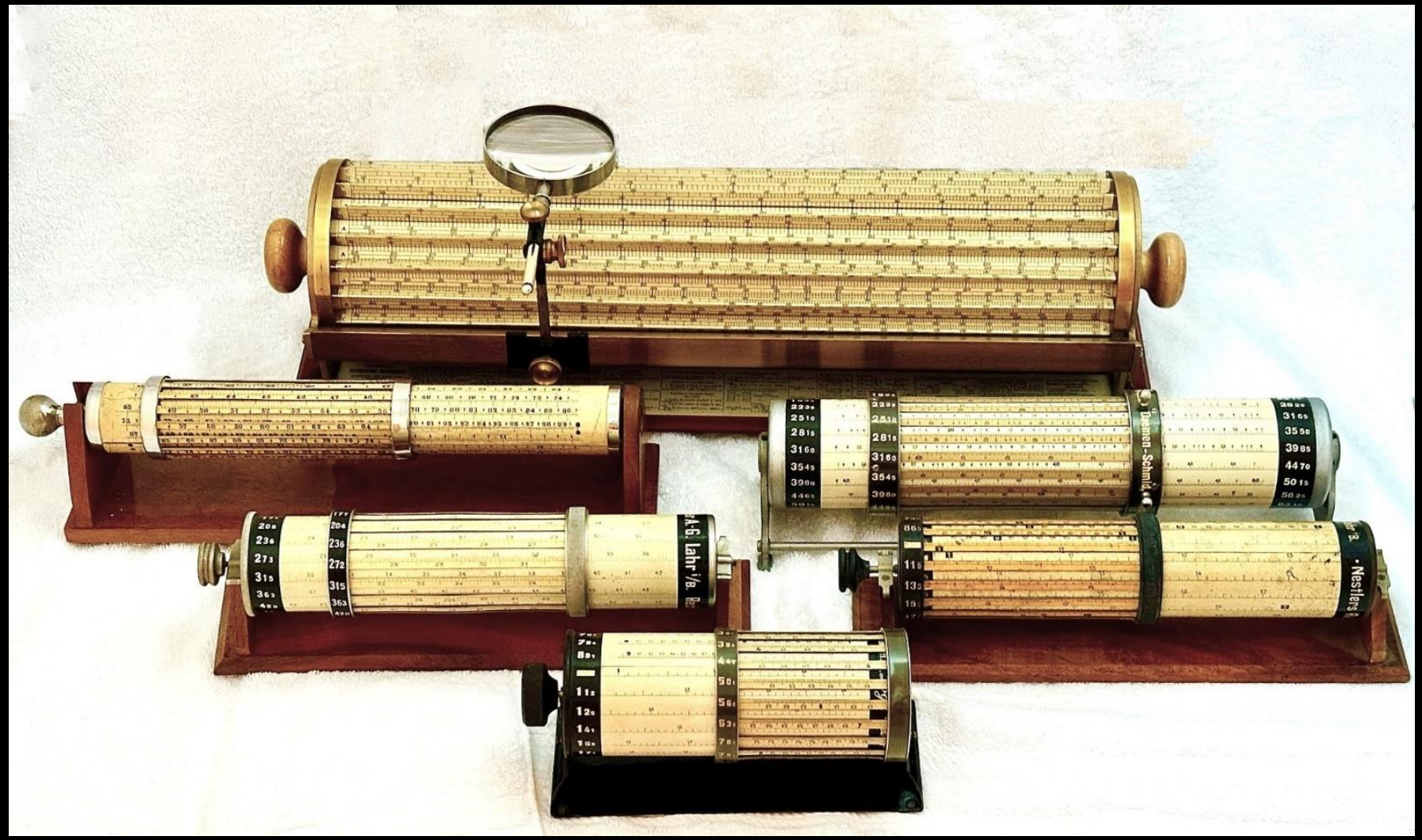
Different Varieties of Circular Rules Manufactured Over the Years...

William Oughtred's Legacy.....

...and, of course, cylindrical slide rules of all types and sizes.....

William Oughtred's Legacy.....

.....and more cylinders.....



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Some Interesting Specialized Slide Rules....
.....and Some Significant 'First's'

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John Suxspeach and the Catholic Organon, 1753

- Schoolmaster from Middlesex, England ,invented and had manufactured what is likely the most complete and complex slide rule ever developed..
- Total of 86 scales cover the areas of gauging, navigation, mathematics, astronomy, dialing (determining position with sundial and astrolabe),, and other areas..

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- Peter Hopp's research indicates up to 16 examples were made, each numbered and dated between 1 September 1752 and the last known number 16, case only, in 1755.

Some Interesting Specialized Slide Rules....

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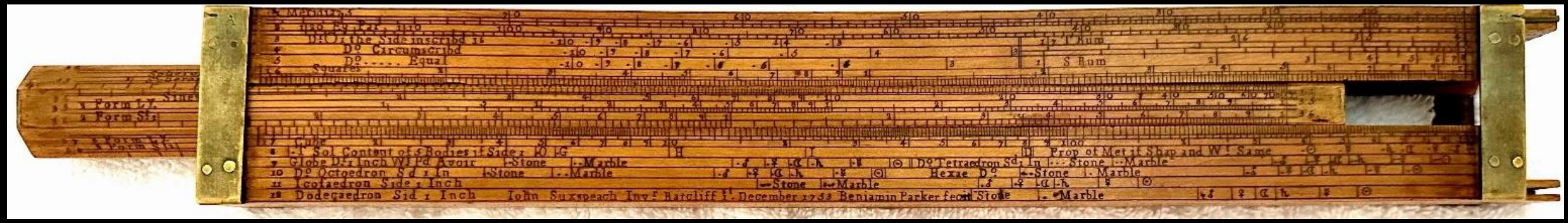
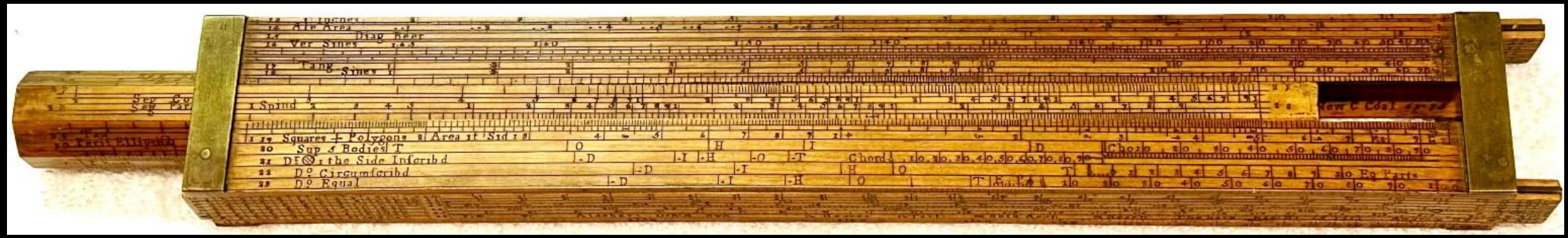
John Suxspeach and the Catholic Organon, 1753





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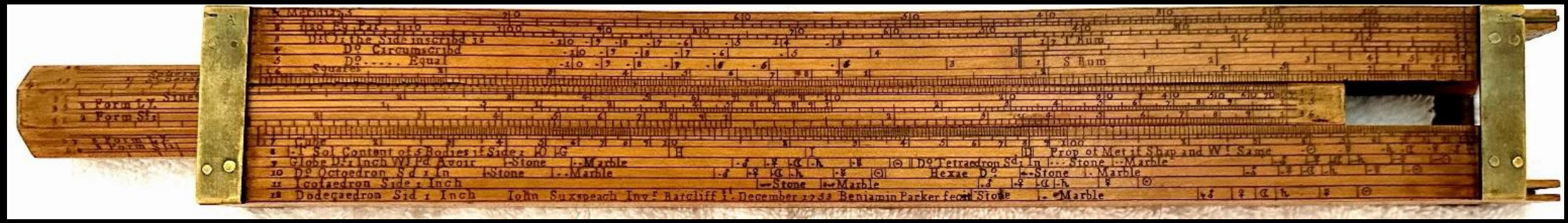

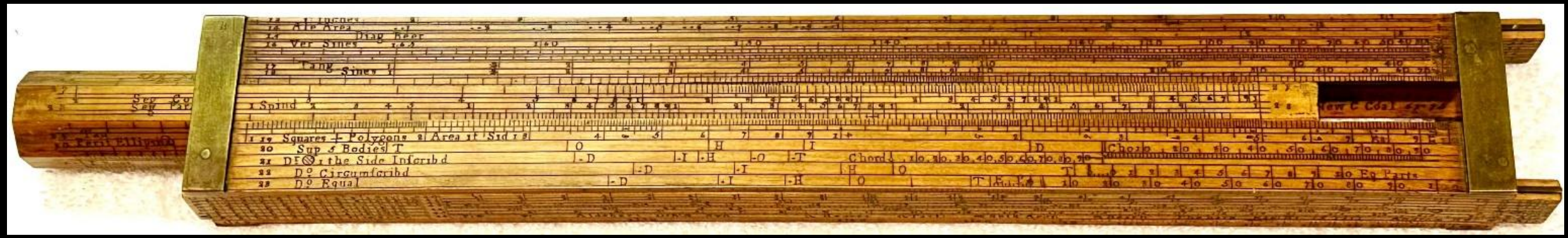

As of Oct 2025, seven examples have been identified, four in museum collections [Museum of History of Science in Oxford, Whipple Museum in Cambridge, Macleay Museum in Sydney, Arithmeum in Bonn], three in private collections.

Some Interesting Specialized Slide Rules....

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John Suxspeach and the Catholic Organon, 1753

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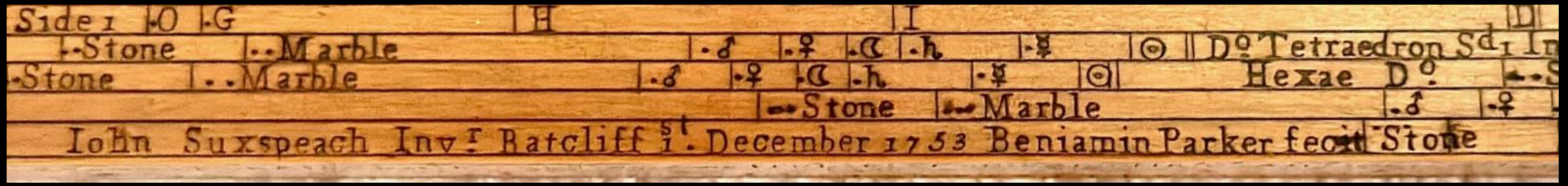

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Palmer's Computing Scale, 1841, Aaron Palmer and George G. Smith

Some Interesting Specialized Slide Rules....

.....and Some Significant 'First's'

Palmer's Computing Scale, 1841, Aaron Palmer and George G. Smith

Widely recognized as the first slide rule manufactured in the United States, prototype 1841, copyrighted in 1843

Additional Fuller's Time Telegraph added in 1845 (John E. Fuller)

Rule did not sell as well as expected and Palmer considered the venture a failure.

General acceptance of the use of a slide rule did not occur until the 1880's in America, a more than 40 year gap from the introduction of the Palmer's Scale

Some Interesting Specialized Slide Rules....

.....and Some Significant 'First's'

Nystrom's Calculator, 1851, John W. Nystrom (1825 – 1885)

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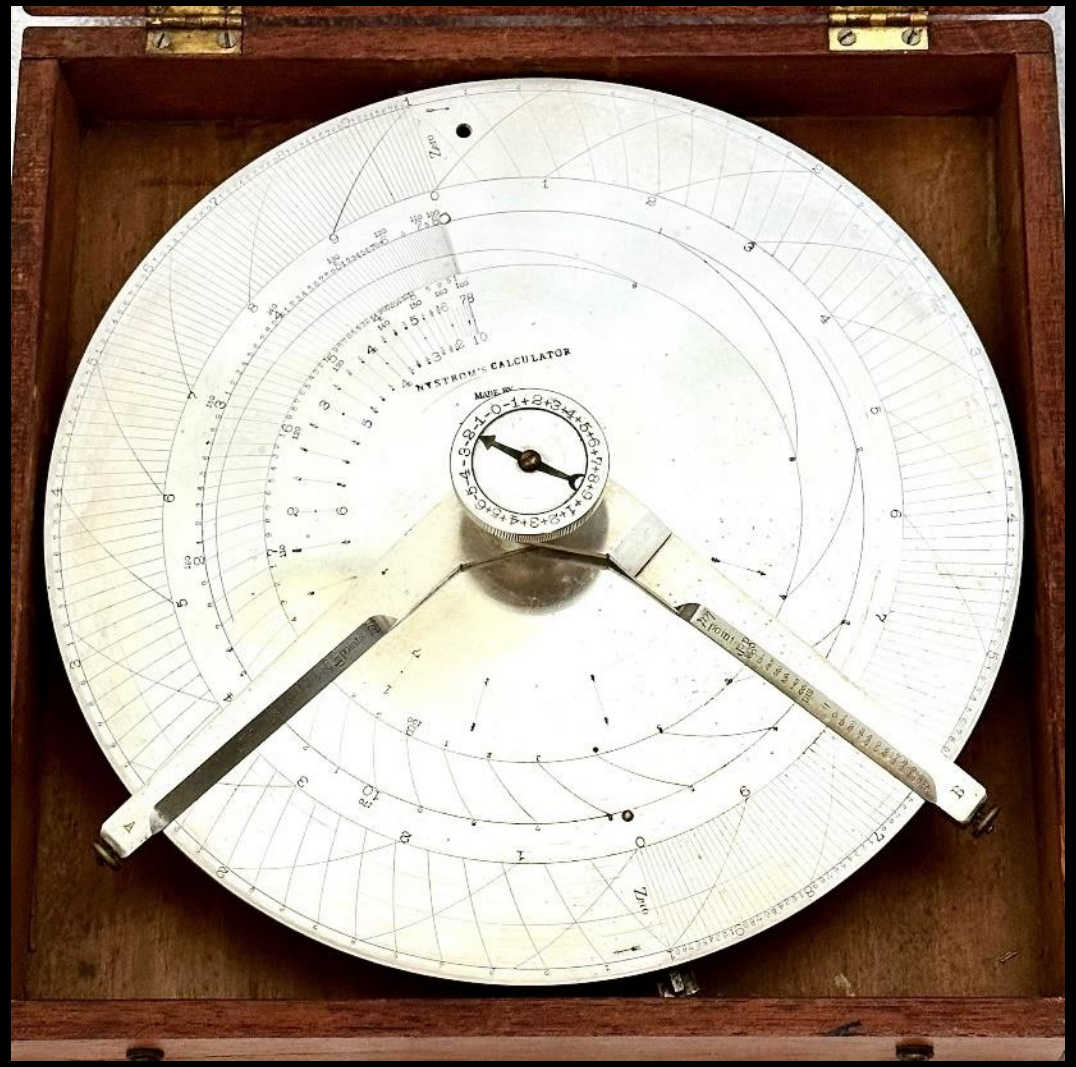

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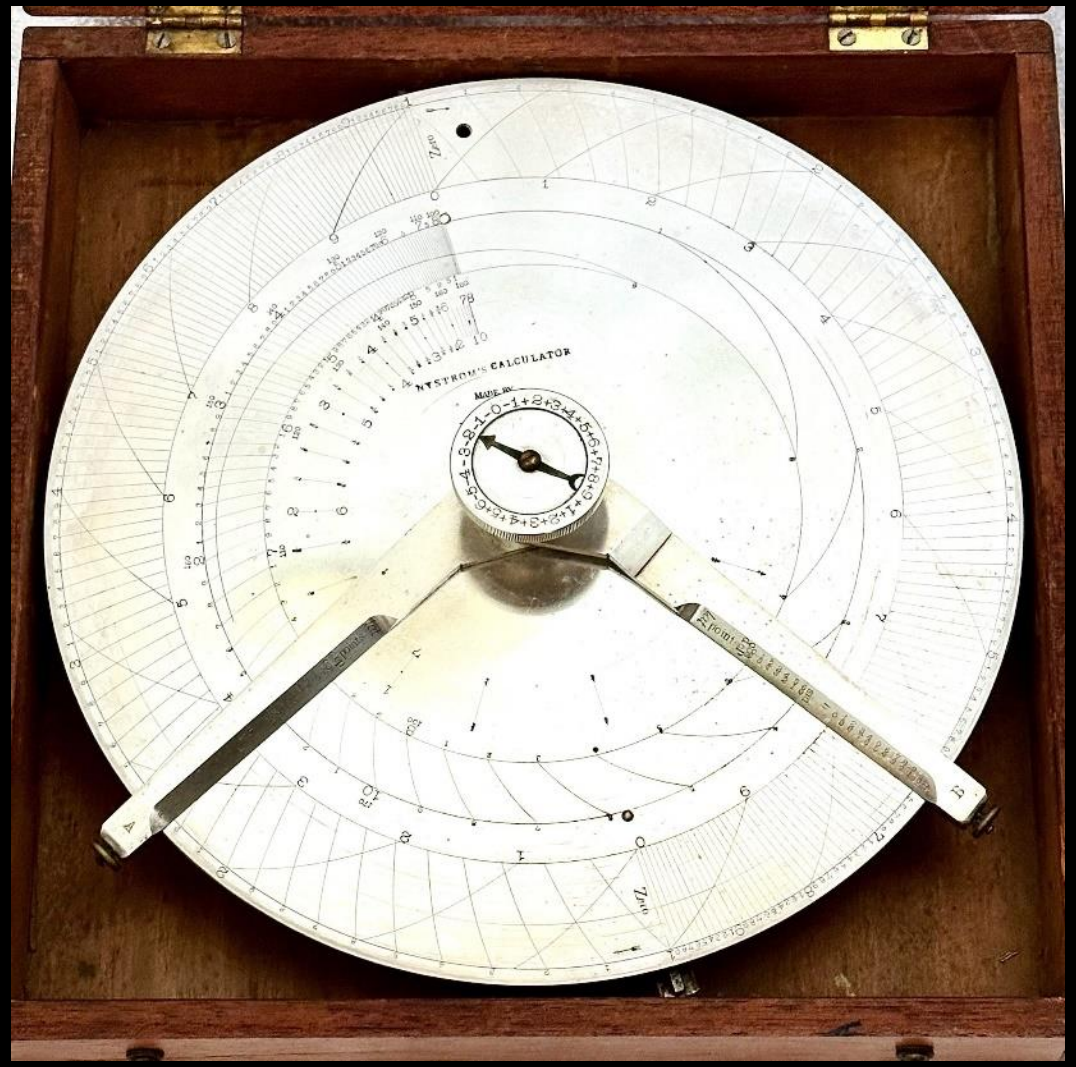
First patented American slide rule,
US Patent No. 7961 March 4, 1851



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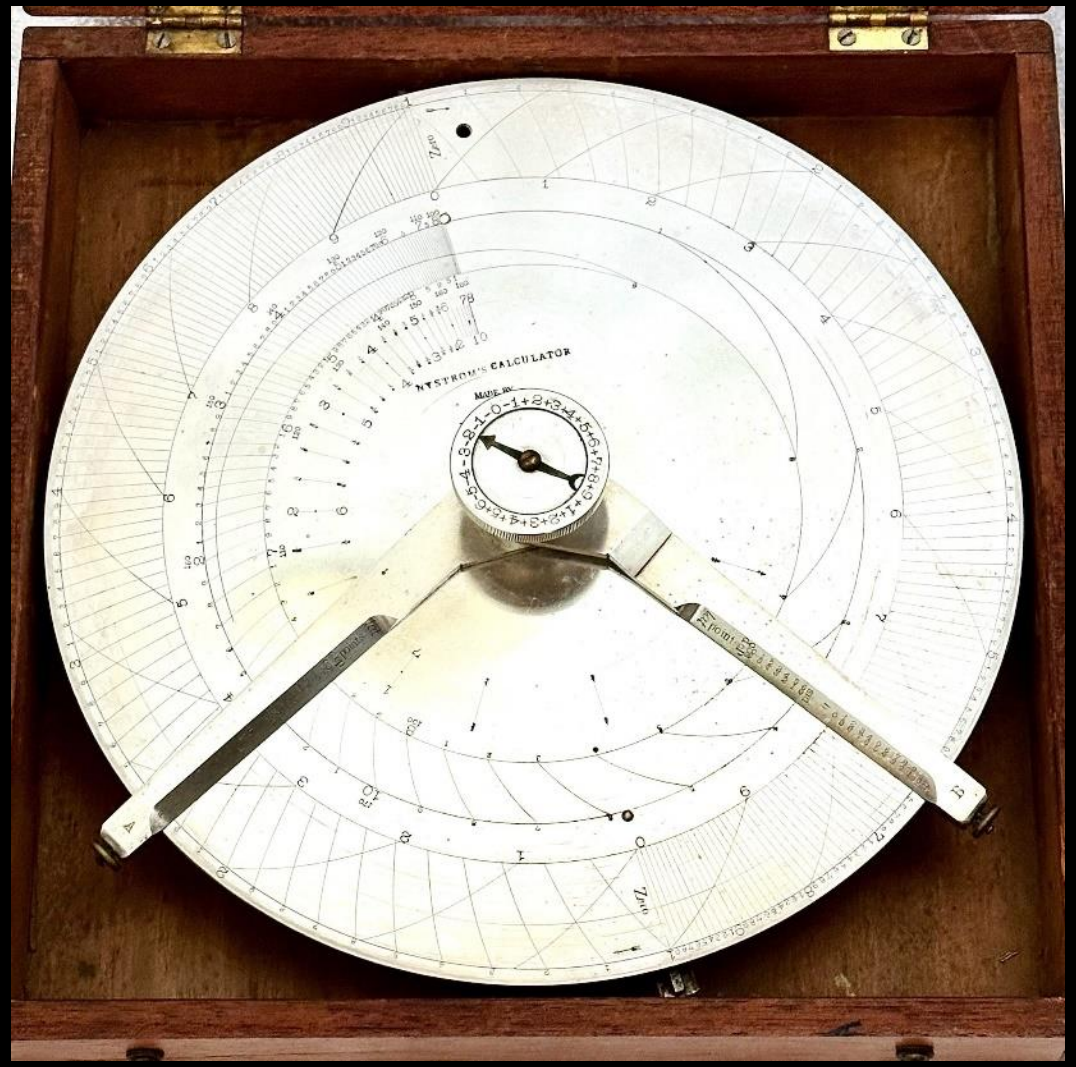
Nystrom's Calculator, 1851, John W. Nystrom (1825 – 1885)

First patented American slide rule, US Patent No. 7961 March 4, 1851

Received many awards and high praise but at $20 it was not successful as a commercial venture

Less than 100 were ever sold; five are firmly identified today, three in museums [patent model Smithsonian National Museum of American History, University of Mississippi Museum in Oxford MI, Arithmeum in Bonn], two in private collections



Summary and Some Final Thoughts

- **Invention of logarithms is a top mathematical achievement of the past 1000 years. Critical in simplifying and speeding complex and precise calculations required in astronomy, they become a key tool of the Scientific Revolution.**
- **Edmund Gunter recognizes that a scale calibrated logarithmically can be a very useful tool for navigation,, where often extreme precision is not necessary.**

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- Edmund Gunter recognizes that a scale calibrated logarithmically can be a very useful tool for navigation,, where often extreme precision is not necessary.
- William Oughtred conceives of his Circle of Proportions in the 1620's and his work is published in 1632, but not before his pupil Richard Delamain publishes a pamphlet claiming prior invention of the slide rule, leading to a bitter debate for the next decade. Oughtred also invents a linear slide rule in the early 1630's. Delamain becomes the King's tutor.
- Oughtred and his supporters are able to verify through documentation to several mathematicians, and including tool maker Elias Allen, that he was first to conceive of the idea.

Summary and Some Final Thoughts

- **Over the next 350 years, slide rules become a key tool of the Industrial Revolution.**
- **Rules are developed for the timber trade, calculating excise taxes, navigation, dialing, efficient steam engines, building buildings and bridges, and many other trades, eventually in sending a man to the moon. and many other trades. Slide rules become a key tool of the Industrial Revolution.**

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- The very technological revolution that the slide rule helped to fuel eventually set the expiration date for its demise.
- Advent of the inexpensive hand held calculators in the 1970's brought 350 years of continuous development and variety to an abrupt and conclusive end.
- **But for us, these rules are exceptional works of technology... yes, even beautiful works of art....a lasting testament that continues to flourish and be very much appreciated and admired to this day!**