

The “Vade Mecum Slide Rule” designed expressly for the timber trade by George Bousfield

Jane Rees

On 9 August 1887, George Bousfield obtained a patent in London for “Improvements in slide rules specially applicable for reducing from and into St Petersburg Standards and Aliquot parts.”

Bousfield, who, in the patent, gave his occupation as “Commercial Traveller in the Timber Trade” seems to have made considerable efforts to market the rule which was titled “The Timber Merchants and Builder’s Vade Mecum” and, in the 1890s it was sold, with the book of instructions, for 21 shillings (£1.05).

Description

The rule is boxwood, of flat section, marked both sides (Figures 1 and 2, which will be found on the inside front cover). Like many other slide rules, the stock formed with the two pieces joined at the ends with brass strips. It is 12 in. long and 2 in. wide with a 13 in. slide. However, there are several features that are immediately noticeable as unusual.

- The centre slide is very wide, taking up half the width of the whole rule.
- The slide rule is boldly marked along its length with the words “THE VADE MECUM SLIDE RULE DESIGNED EXPRESSLY FOR THE TIMBER TRADE BY GEORGE BOUSFIELD GRIMSBY PATENT 12806”.
- The rule is marked to read when the rule is held vertically rather than the normal horizontal position.
- The rule is extensively divided and numbered, perhaps the most extensively of any rule I know.
- There is a single bevelled edge, marked with drawing scales.

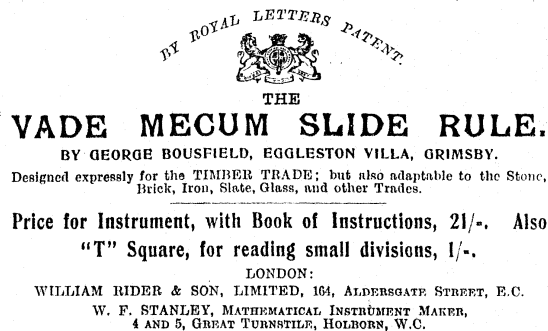


Figure 3. The title page of the instruction booklet, advertising the “T” square available as an extra. Note that W.F. Stanley’s name appears on this page.

On the cover of the instruction booklet it states that for the sum of one shilling a “T” square could be purchased for reading the small divisions. I am not aware that any examples of this that have survived.

At least one Vade Mecum rule has been found marked RAWDON in lieu of GRIMSBY. Rawdon is a small village north-west of Leeds. However, the connection with George Bousfield is not known.

sms

George Bousfield

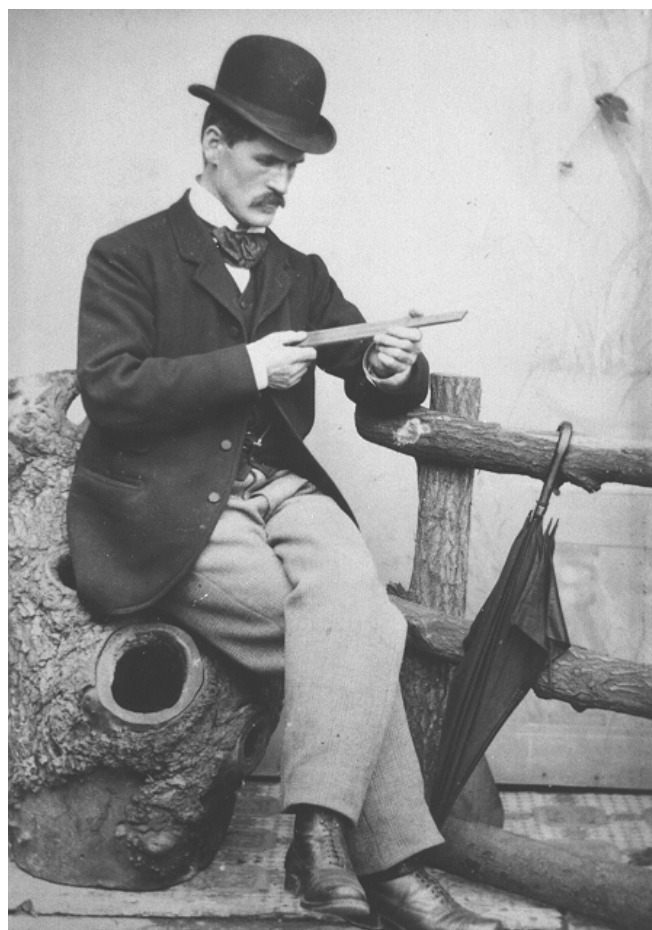


Figure 4. George Bousfield demonstrating the use of his rule.

I am indebted to Robert Bousfield, George Bousfield’s great-grandson, for the following family history, although it is evident that, even to his family, he is something of a shadowy figure.

George Bousfield was born on 10 June 1856 into a family of Plymouth Brethren belief. He married Harriet Ann Ward, the daughter of an estate carpenter who

came from Burton Agnes near Bridlington. When he applied for the patent for the rule in 1886 his address was given as No. 3 Sylvan Crescent, Hainton Street, Great Grimsby and his occupation as Commercial Traveller. In the 1890 Grimsby Street Directory he is listed at 250 Hainton Street, the same date that he sold the copyright of the 5th edition of the instruction booklet to William Rider & Sons, London publishers but by the time of the 1891 census, this property was unoccupied. In the 6th edition, also published by William Rider & Sons, his address is Eccleston Villa, Grimsby. He died on 22 February 1902.

Not very much is known of his business activities but he did have a business partnership at some time, which is thought to have been connected with the timber trade. This business went bankrupt (probably due to his partner's activities) and, in keeping with his religious beliefs, he, and in due course, his widow continued to pay off his debts using some or all of the royalties from the slide rule.

Four of his eight children worked in the timber trade in Humberside. One, Rex, around 1950 set up his own timber merchant business, Rex Bousfield Ltd., which is still run by the family.

Although not much is known of Rex's life, we are lucky enough to have a photograph of him – using his slide rule. (Fig. 4.)

Units of Measurement

The most widely used large quantity unit in Europe for softwood was the St Petersburg Standard (Hundred) which was originally one hundred pieces of timber, sized 1 in. x 11 in. x 12 ft., except that it was actually a "long hundred" of 120 pieces. The volume is 165 cu. ft. and over the years, the St. Petersburg Standard came to represent 165 cu. ft. of timber of any merchantable size.

But there were also many other standards; most were only of local significance and the only two referred to by Bousfield in his instructions are the St Petersburg Standard and the Irish and London Standard of 270 cu. ft.

There are also various other measures applicable to the timber trade which are used in the instruction booklet.

Fathom: the cubic fathom ($6 \times 6 \times 6$ ft. = 216 cu. ft.); used for goods such as pulpwood, firewood, lathing and pit props and poles that were not amenable to measurement by other means.

Bundle: The quantity measure used for laths. A bundle is 500 ft. run.

Load: Probably the oldest measure, the meaning literally being the quantity of timber that could be carried on a cart. By the 17th century the quantity had become more precise and was thereafter generally taken to be a fixed number of cubic feet. Bousfield took a load to be 50 cu. ft. but loads were sometimes reckoned at 40 cu. ft. or even 30 cu. ft.

Cubic Measurement: The cubic foot or foot cube; the most understandable unit of measurement for small and medium quantities.

"Liverpool Sale Measure": The practice of allowing the purchaser rebates in the measure on what he bought was widespread in the timber trade. Such arrangements, originally developed to compensate for faults, became widespread and institutionalised. For example, in the mahogany trade "Liverpool measure" meant that the purchaser only paid for $10\frac{1}{2}$ in. for each 12 in. of width measured, the Liverpool measure therefore being only 85% of the actual measure.

A Square: An area used in the building industry from the 17th century until recently, being 10 ft. x 10 ft. i.e., 100 sq. ft.

The Patent

*Date of Application, 8th Oct., 1886.
Complete Left, 8th July, 1887.
Complete Accepted, 9th Aug., 1887.*

A.D. 1886, 8th OCTOBER. N^o 12,806.

PROVISIONAL SPECIFICATION.

Improvements in Slide Rules Specially Applicable for Reducing from and into St. Petersburg Standards and Aliquot Parts.

Figure 5. The provisional patent application, giving the dates of application and acceptance. There were no changes to the provisional specification in the complete application.

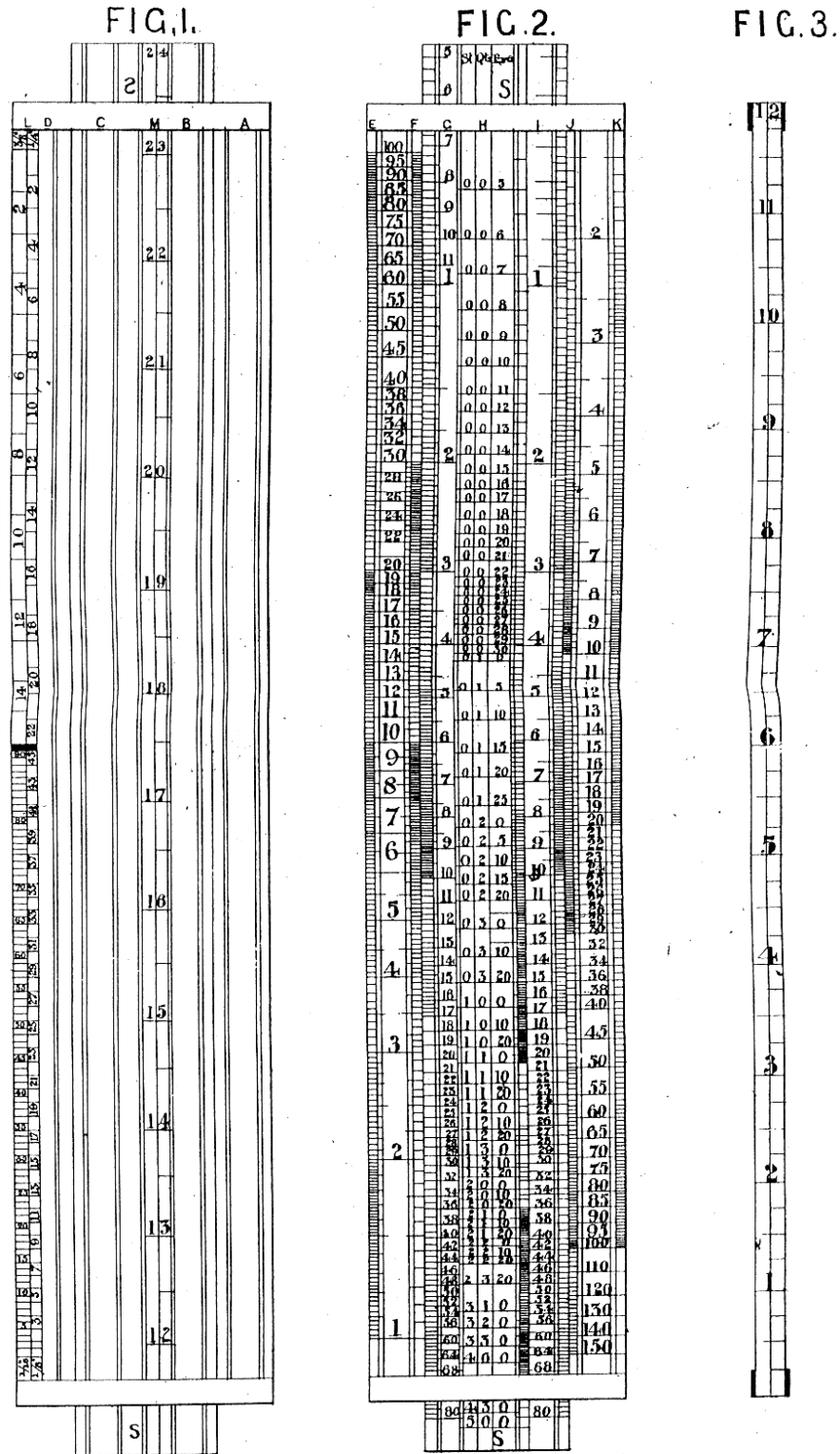


Figure 6. The three drawings of the rule submitted with the patent application. There are no significant variations between these drawings and the rule that is the subject of this article. The two minor variations are that different scales were chosen for “L” and “H” is headed St., Qts., Prts. whilst on the rule theses are headed “C”, Qpr., Pts. and that the measure on the edge were marked vertically in the patent drawing but horizontally on the rule.

The patent application was made on 8 October 1886 and is for “Improvements in Slide Rules Specially Applicable for Reducing from and into St. Petersburg Standards and Aliquot Parts”. (Figure 5.) It consisted of one and a half pages of description plus three figures which show each side and one edge of the rule. (Fig. 6.) Numbered 12,806, it was granted on 9 August 1887. The claim reads

“In a slide rule the combination of a scale for taking off quantities from plans, a decimal slide for solving the various problems now obtained by the ordinary brass slide in slide rules, a duodecimal scale for cubing round square and unsquared timber or scantling, and a graduated scale of standard measure for shewing [sic] without calculation a comparison between lineal superficial and cubic feet of any size and the relative St. Petersburg Standard measurement, the instrument also serving the purpose of an ordinary two foot rule substantially as set forth.”

Detailed description of rule

Front face: five decimal scales, reading vertically:

- Labelled **A**: two cycles of logs, numbering from 1 to 100 which is marked twice, (side by side).
- Labelled **B**: two cycles of logs numbering from 1 to 100.
- Unlabelled: marked in inches from 12 to 24. Used in conjunction with the scale marked on the side of the rule, this enables to rule to be used as a straight 2 ft. measure.
- Labelled **C**: two cycles of logs numbering 1 to 100.
- Labelled **D**: this is set out as girt line with the four gauge points necessary for the four types of measurements set out above marked with an asterisk and labelled 113, 144, 183 and 233 respectively. (See end note on timber measurement.)

According to Bousfield the above scales were “constructed on precisely the same principles as the ordinary brass slide in a Carpenter’s Slide Rule, with the exception that the brass slide works horizontally, and this works vertically, and the figures, being large, are more easily discerned...”

Bevelled edge: marked with drawing scales of 1/4 in.; 1/8 in.; 3/8 in. and 3/16 in.

Reverse face: seven scales divided duodecimally. This division not only enabled calculations to be carried out in feet and inches, but also in shillings and pence. (In pre-decimal currency, there were 12 pence in a shilling.) Reading vertically:

- Labelled **E**: a log scale numbering from 100 to 1.
- Labelled **F**: the same scale but differently subdivided.
- Labelled **G**: a log scale that ranges from 5 in. to 80 ft.
- Labelled **H**: a log scale of [St. Petersburg] Standard ranging from 3 parts to 5 Standards. Each Standard is divided into quarters and parts with 30 parts to each quarter, giving 120 parts per Standard. (The division into parts is well known but I have not been able to find any reference to quarters suggesting that this might have been an improvement introduced by Bousfield. In both the instruction book and the patent it is stated that 3 parts equates to 18 lineal feet of 3 in. by 1 in. timber.)
- Labelled **I**:
- Labelled **J**: a log scale numbering from 1 in. to 50 ft.
- Labelled **K**: the same scale but differently subdivided.

Instructions for Using Rule

The rule came with a 41-page booklet of instructions. This box was small, 4 in. by $2\frac{3}{4}$ in. After a short introduction by George Bousfield, two contents pages and a four-page description of the rule, the remainder of the book consists of a forty-one problems with an explanation of the solution together with a worked example. (Figures 7A and 7B.) As with many special purpose slide rules the instruction book was essential to fully understand the use of the rule.

CONTENTS.

PROBLEM:--	PAGE
1. To Ascertain Cubic Contents of Round or Square Timber by the Quarter Girth, 144 Divisor	10
2. Actual Contents of Round or Square Timber by the 113 Divisor	12
3. Cubic Contents from Diameter, equalling Quarter Girth, 144 Divisor	13
4. Actual Contents do. do. Customs Measure, 183 Divisor	13
5. Superficial Contents from length and breadth	14
6. Cubic Contents of unsquared Timber or Scantlings	15
7. Cost of a piece of Timber or Scantling at a given price per Cubic ft.	15
8. Equivalent per Lineal ft. of Scantling at per Cubic ft.	16
9. Cubic Contents and Standard Quantity of any Lineal ft. of Timber, Deals, Scantlings, or Boards at one operation	17
10. Value of an Aliquot part of a Standard or any number of Cubic ft. at any price per Standard	18
11. Equivalent per ft. run, and per Standard of given size	19
12. To Reduce London or Irish Standards or Aliquot part thereof to Petersburg Standard	20
13. Price per Standard at so much per Cube ft.	20
14. Price per Load of 50 Cubic ft. at any price per Standard	21
15. Number of Running ft. in a Square of any given width	21
16. Number of do. in a Square yard of any width	22
17. Number of Cubic ft. contained in any Standard quantity	23
18. Cost per Cubic ft., at any price per Load of 50 ft., or vice versa	24

Figure 7A. List of problems in the instruction booklet.

6	PAGE
PROBLEM No. 19. Relative Value between Petersburg and London or Irish Standards (120-12 3x9)	25
20. Price per London or Irish Standard at any price per Cube ft.	25
21. Do. Fathom at per Cube ft.	26
22. Number of Lineal ft. of any size to Standard quantity, or vice versa	27
23. Cost of Laths per Standard at per Running ft. of Bundle	28
24. 100th parts of a Standard	29
25. Cubical Contents of Brickwork and the number of Bricks contained on any dimension of Walling	29
26. Price per cwt. at any price per lb.	31
27. Weight Avoirdupois of any quantity of Gallons, Liquid Measure	31
28. Amount of interest due on any £'s at 5 per cent. for any number of days... ..	32
29. Circumference of a Circle the Diameter given	32
30. Side of a Square equal in area to any Circle... ..	33
31. Number of Squares to Standard Measurement, or vice versa	34
32. Relative price per 120 Lineal ft. of any size, at per Standard	35
33. Relative price per Gross pieces of any Scantling at a given price per Standard	36
34. Relative price per 100 Lineal ft. of any size, at per Standard	37
35. Relative price per 144 Lineal ft. of any size, at per Standard	38
36. Number of Lineal Feet in a Square of any size	38
37. Number of Lineal Feet in a Cubic Foot of any size	38
38. Number of Cube Feet contained in any Block of Stone	39
39. Relative cost per Extreme Measure as compared with L'pool Sale Measure	40
40. To calculate Measurement Weight of Deals for Railway Carriage	40
41. To reduce Lineal Feet of given size to Superficial Feet of 1 inch	41

Figure 7B. List of problems (continued).

Some did not require the use of a gauge point. For example, when calculating the cubic content of a piece of timber of a given size. By setting the size in feet on scale **G** to the size of one side in inches on **F**, the reading on **I** that is opposite the size of the other side, in inches, on **J** will be the cubic content in cu. feet.

However, other calculations did require a gauge point and these could only be found by reading the instruction book. An example of this (Figure 8) is when calculating prices from a known price per cubic foot, when the gauge point required was 12.

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PROBLEM No. XII.

To reduce the London or Irish Standard or aliquot part thereof to Petersburg Standard.

Set the London or Irish Standard quantity opposite 11 on J, and against 18 on J will be found the Petersburg Standard quantity equal to it.

Example.—Reduce St. 0.3.24 L and I Standard to Petersburg Standards.

Set St. 0.3.24 on H to 11 on J, and against 18 on J will be found Standard 1.2.6 $\frac{9}{11}$ on H.

PROBLEM No. XIII.

To ascertain the price per Standard at so much per Cube foot.

RULE.—Set 12 on I to 84 (or £3 5s.) on J and against any price in pence on I will be found the relative value per Standard in pounds on J.

Example.—What is the relative cost per Standard at 2s. 4d. per Cube foot?

Set 12 on I to £3 5s. on J, then against 28 on I will be found £10 5s. per Standard on J.

Figure 8. Problems No. XII and No. XIII being calculations concerning Standards.

Some of the other timber calculations covered were; to reduce any number of lineal feet to Standard quantity; to ascertain the relative value between the St. Petersburg and the London and Irish Standard (see Figure 9); calculate the number of running feet in a Square of given timber size such as 6 in. floor boarding; to show the rela-

tive cost of an actual measure of mahogany compared to the Liverpool sale measure; and to calculate the weight of deals in order to cost carriage by rail.

In the introduction Bousfield states that the rule “is capable of an exhaustive variety of uses, in the computation of all the various and abstruse calculations found not only in the timber but all the other kindred trades, such as Brick, Stone, Iron, Glass, etc.” and the subjects covered included the cubic content of a brick wall of given size; ascertaining the price per hundredweight, given the price per pound and finding the amount of interest on a set sum at a given percent for any number of days.

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PROBLEM No. XXVI.

To ascertain the price per cwt. at any price per Pound.

RULE.—As 15 on A is to 7 on B, so is the price per lb. on A to the value per cwt. on B.

Example.—At 10d. per lb., what is that per cwt.?

Set 15 on A) then against 10 on A
to 7 on B) . . is . . . £4 13s. 4d. on B

PROBLEM No. XXVII.

To ascertain the weight avoirdupois of any quantity of Gallons, liquid measure.

RULE.—As 112 on A is to 9 on B, so is the number of gallons on A to the weight in cwts. on B.

Example.—What is the weight of 63 gallons avoirdupois?

Set 112 on A) then against 63 on A
to 9 on B) . . is . . . 5 cwt. 0 qr. 7 lbs. on B

Figure 9. Problems No. XXVI and No. XXVII being calculations concerning price and conversions.

Manufacture and sales

To the best of my knowledge, no *Vade Mecum* rule has been reported with a maker's name. However, the 6th edition of the instruction booklet appears to have been jointly published by William Rider & Sons and W.F. Stanley. The assumption must be that at least for some period Stanley were the makers of the rule. (Fig. 3.)

The only basis upon which the sales of rules can be judged is the frequency with which they are found today. In collecting terms, this rule is not common but neither is it rare. I have seen or am aware of maybe twenty examples.

Publicity

George Bousfield was apparently realised of the need to advertise his invention and a short announcement of the successful patent application was published in the *Grisnby News* on 23 September 1887.

A considerably longer article about the rule can be found in *The Illustrated Carpenter and Builder* of 20 January 1888. This sets out in some detail the calculations that can be carried out using the rule and concludes by endorsing the inventor's claim that “The superiority of instrumental mathematics over the tedious process of the orthodox system is at once discernible, for the same

operation which produces one result and that with the slightest mental exercise) is also capable of producing fifty more without even disturbing the slide.”

There is also a passing reference to W.F. Stanley in the article providing additional evidence of the involvement of this firm.

A similar rule

The only other rule I know of that resembles the *Vade Mecum* is one by Aston & Mander. This is marked on the edge “DESIGNED REGISTERED AND MADE ONLY BY ASTON & MANDER 25 OLD COMPTON ST., SOHO, LONDON”. Aston & Mander worked at this address from 1870 until well into the 20th century so it is no help in determining which rule came first. It is rather simpler than the *Vade Mecum* rule but the most striking similarities are that this rule is also designed to be used vertically and the centre slide is again particularly wide, although not as wide as that in Bousfield’s rule. One side is marked for timber and has five scales, marked INCHES WIDE, FEET LONG, ST. PETERSBURG STANDARD, FEET CUBE, INCHES THICK. However, the reverse side of the rule is devoted exclusively to brickwork and includes scales for calculating the number of bricks required with relation to the height and thickness of a wall.

Acknowledgements

I would like to thank Robert Bousfield of Rex Bousfield Ltd. for telling me about, and then kindly giving me, a copy of the photograph of his great-grandfather. I am also most grateful to him for providing me with the family history.

Further Notes on Units

Measuring timber: As with all gauging, the aim was to combine a system of measurement that was easy to take (particularly in the field) with a calculation that, by means of gauge points, can be carried out with only one step on the slide rule. For timber this required gauge points that took account of the fact that the length was measured in feet whilst the diameter or circumference was measured in inches. For assessing timber in the log, there were four commonly used methods. None gave an exact measurement but all produced an answer that was

considered acceptable for the use to which that measurement was put. All these measures were based on the formula for the cubic content of a cylinder, i.e., the cross sectional area multiplied by the length ($\pi r^2 l$).

Customs string measure: Based on the traditional practice of using the quarter girth of a log taken by using a piece of string. Once the girth had been measured at the centre point or, if the log be somewhat irregular, at an average point, the string was folded into four and the quarter girth determined. The volume was then calculated using a divisor of 113, thus the calculation is $v = lx(C/4)^2x1/113$.

Quarter Girth measure: The long established and accepted system of measurement, used by Edward Hoppus in 1736 in his book *Practical Measuring Now Made Easy to the Meanest Capacity...*

This is the same as the Custom’s string measure but uses a divisor of 144, which gives approximately 20% under measurement, a fact that the timber trade were well aware of, but whether the vendors of trees were is less certain. When Henry Coggeshall published *Timber Measure* in 1677 he clearly understood that the quarter girth squared method of calculating the volume for round logs was flawed, referring to this as the “country measure” or “the common way”, i.e.

$$v = l \times \left(\frac{C}{4}\right)^2 \times \frac{1}{144}$$

Diameter measure: This is the quarter girth measure but using the diameter (taken with a calliper) instead of the quarter girth. The divisor is 233 and again gives approximately 20% under measure, the calculation being

$$v = l \times d^2 \times 1/233$$

Customs (King’s) calliper measure: The log is measured with callipers at the mid point and the volume calculated as if it were a perfect cylinder of the measured diameter times the length. This was a quick and easy method for HM Customs which gave a reasonably true measure. The divisor is 183. That is,

$$v = l \times d^2 \times \frac{1}{183}$$