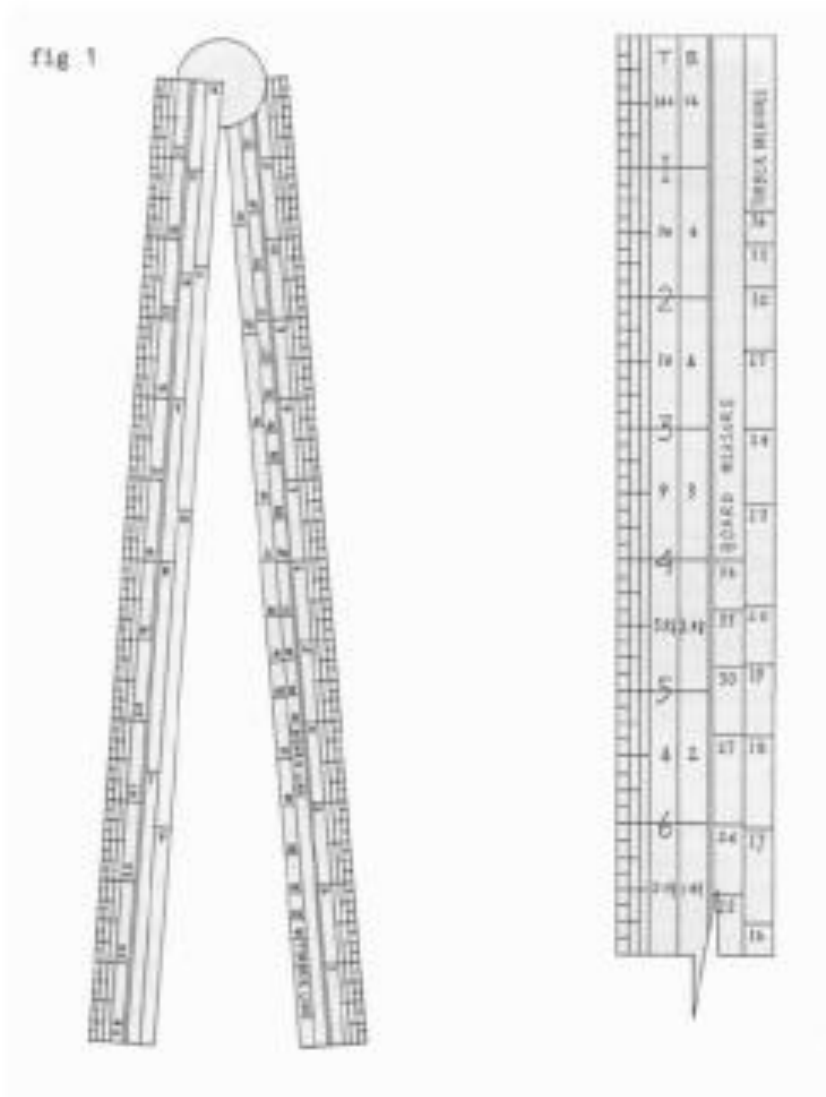


ARTICLE THE CARPENTER'S RULE

Richard Knight

Probably invented in the 16th century, the carpenter's rule was a device to help a man who could not multiply to find the area or the volume of his wood. In its original form, it gave at a glance either the length to make a square foot of a board of given width, or the length to make a cubic foot of a piece of square (or equivalent square) cross-section. Writing in 1651 of "carpenters and other artificers", Thomas Stirrup tells us that "... few of them can write and of them few that can write not one in ten hath arithmetic". So the need for such devices was very real.

Fig.1 is an abstraction from an early rule showing a line of board measure and a Line of Timber measure running inversely alongside a line of inches. The board line is so divided that the product of any number upon it by the adjacent number on the line of inches is everywhere 144, the number of square inches in a square foot. Then, against the width of the board line is the length to make a square foot on the line of inches. Similarly, the timber line is divided so that the square of any number upon it, when multiplied by the adjacent number on the line of inches, gives 1728, the number of cubic inches in a cubic foot. For example, if the timber is 11" square in section, the cross-sectional area is 121 sq" and the length to make a cubic foot $1728/121$ or approximately 14.3", a result seen at a glance on the rule. The first written account of such a rule is probably that of Leonard Digges in 1556, but whether he invented the principle of it is open to question. He says that "... the ruler of tymbber measure which the most part of them hath is not made by right arte...". hinting that some such rule was already in existence. However, the rule he describes is based on the tables of his own calculation which were uniquely reliable in his day. Of his timber table he say



"This table of tymer measure standeth in the place of a good rule, well decked with true measures. By this ye may make or correct rulers at pleasure".

Digges reconmended a rule 2' long, 2" wide and 1/4" thick; there is no mention of a joint and the board and timber lines were drawn along the edges. The thickness suggests that he had wood in mind for its construction and there was a small surveyor's quadrant on the back - hence the width. A fine brass rule for surveyors with board and timber line on the face, made by Humphrey Cole in 1574. is now in the Whipple Museun. Cambridge, and is illustrated by J A Bennett in "The Divided Circle". A weakness of these board and timber lines is that they cannot deal with board less than 6" wide or timber less than about 9" square - i.e with problems to which the answer is greater than their full length of two feet. Digges gave the missing information in a pair of tables marked down the middle of the rule as shown in Fig.2, which is a sketch of the first few inches of Humphrey Cole's rule. Above each number in the line of inches, in the column headed T, is the length of a cubic foot of timber with that side of square cross-section. For example, for a side of 5" the length is 6'9 1/8" ($1728/25 = 69.12$). Likewise, the column headed B gives the length of a square foot of 5" board as 2'4 4/5"

fig 3

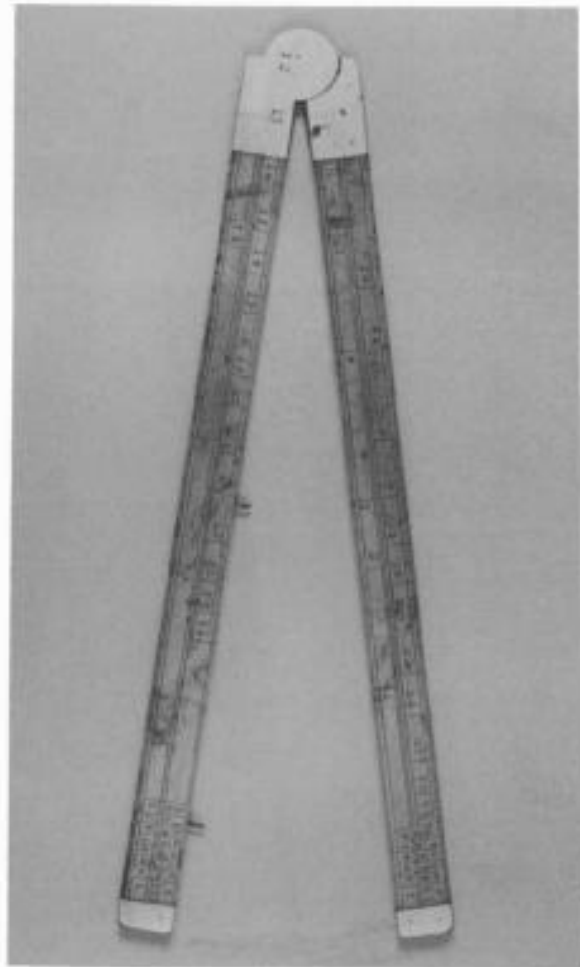
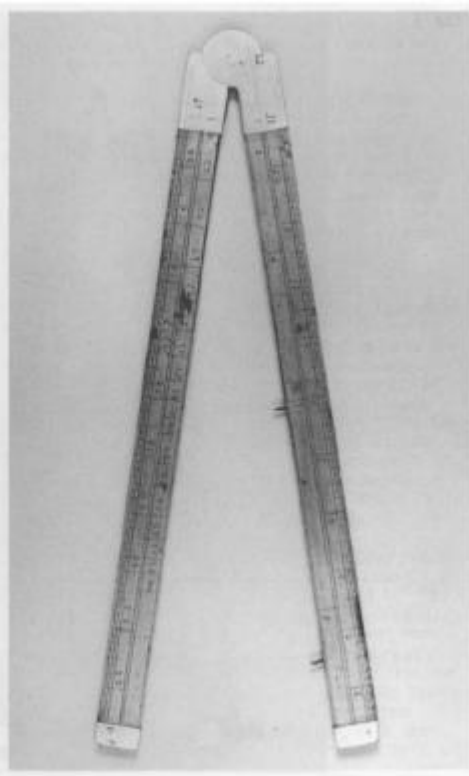
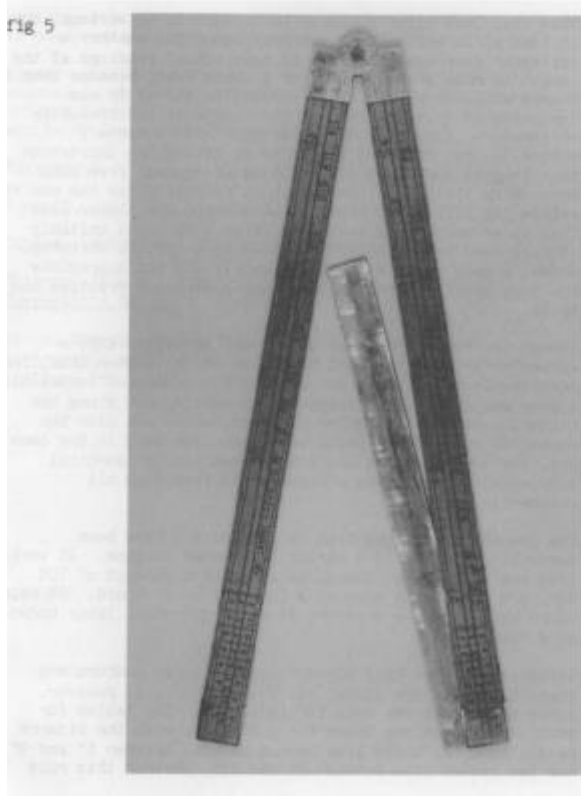


fig 4





This dual loss might at first be thought to be serious, but in fact it is not. It is extremely doubtful whether a carpenter ever used the rule to take actual readings of the length to make a square foot or a cubic foot, because such a figure would have been quite useless to him if he was incapable of dividing it into the length of his timber by arithmetic. Edmund Stone, a formidable 15th century authority, has confused the issue by giving the impression that lengths were read off the line of inches, from zero when using the board line (which by tradition was the one to retain its place) and from 24" when using the timber line. This is so untidy and liable to error that it is unlikely ever to have been standard practice in a typical workshop. Stone, a good mathematician, evidently did not appreciate how tidy and free from arithmetic the workshop practice had to be.

Though the printed sources do not say so explicitly, a carpenter probably set his compasses on the timber line, for example, from its upper end down to the number of inches his timber was square, and stepped this setting out along the timber, counting the number of steps, which was also the number of cubic feet. With the board line used in the same way, the two processes would have been neatly identical, independent of the line of inches and free from all arithmetic.

The fourth line on the 17th century rule I have been describing (Fig.4) is a rarity of unknown purpose. It works like the board line, though to a constant product of 108 sq", 3/4 sq' or the area of a foot run of 9" board. Perhaps there was already a standard 9" width softwood, later known as a "deal". Carpenter's rules have not survived in large numbers and those that have are almost all 2'

long. Fig.5. however. shows an unusual one only 18" in length. The tables for small dimensions are those for a 2' rule. with the bizarre result that the board line cannot be used between 6" and 9" nor the timber line between 8" and 11". Whether this rule was in some way the work of an uncomprehending maker or designed for use in some peculiar circumstances is not at present clear.

Sincere Thanks are due to Dr. J.A, Bennett for a rewarding visit to the Whipple Museun. to Mr Stephen Johnston of the Science Museun. London, for specially helpful correspondence and to Mr George Nicolle for the photographs.

References

Bennett. J A **The Divided Circle** (Phaidon-Christie 1987)

Digges, Leonard **Tectonicon** (London 1556)

Stirrup, Thomas **The Artificers Plain Scale or ye Carpenters New Rule** (London 1651)

Stone. Edmund translation of Bion's **Mathematical Instruments** of 1758, with addenda on English instruments (Holland Press 1972)