

Puncheons and Dragons: Renaissance Carpentry and Semantics

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DEFINITION

Dragon beam (or *dragon piece*) refers to a traditional English roof carpentry detail which appears in the time of Inigo Jones and persists into the early twentieth century. But the origins of the detail are unclear, and the term itself has been invested with a number of meanings, so that today it generally evokes something quite different.

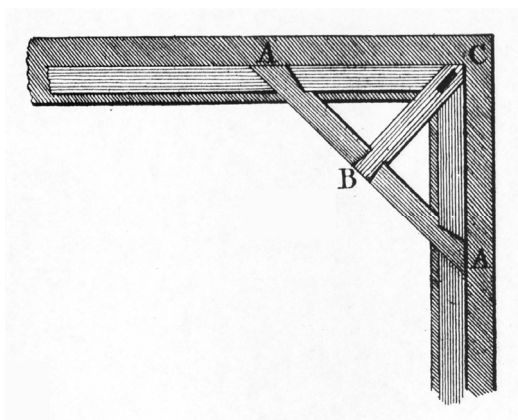


Figure 1. The 'angle brace' (AA) and the 'diagonal piece' (BC), the latter mortised at C to accept the hip rafter (Wood, miscellaneous pl. 1, fig. 7).

In all intelligible eighteenth and nineteenth century references, a dragon beam is a sort of aborted tie beam for the hip of the roof. A short brace runs horizontally at 45° in plan between the top plates at the corner of the building; from the middle of this brace and at right angles to it (that is, under the line of the hip) there extends to the corner junction of the plates a short member, which is mortised at the outer or corner end to take the base of the hip rafter. It seems to have had two purposes. The first is simply to provide a proper base into which this rafter could be tenoned, rather than running it uncomfortably at 45° onto the corner junction of the top plates. The other - though this makes no real structural sense - is to provide the restraint from outward spreading which the hip rafter otherwise appeared to lack, because it was not tied horizontally at the base like the common rafters. As John Wood expressed it, 'The diagonal piece is the abutment to the hip rafter' (1806, p. 12). In the twentieth century G L Sutcliffe said "It is obvious that a hip-rafter exerts an outward thrust on the wall," and explained the dragon beam as a way to "distribute the thrust over as large an area of wall as possible" (1903, V, p. 71) - neither of which is strictly correct.

SOURCES

We can be reasonably sure that the dragon beam is an innovation of the Renaissance. No example has been identified in medieval Europe, and in fact the number of medieval hip-roofed buildings in which the roof frame survives intact and has been reliably recorded is surprisingly small. One can, however, identify countervailing instances, such as the manor of La Pipardière in Normandy, of about 1500-1510, where there is no hint of a diagonal beam (Lescroart 1997, p. 258). There are, however, details which bear some resemblance to the dragon beam, including another form of short diagonal beam to take the base of the hip rafter. At the church of St-Urbain, Mennetou-sur-Cher, France, of about 1216, the wall is thick and each rafter is propped with a wall-piece, as is common in Britain. There is a timber plate along both the outer and inner edge of the wall, and the two plates are linked by a cross-piece below each rafter. At the outer end of the cross-piece is a mortice for the foot of the rafter, and at the inner end another for the wall-piece. At the corner the hip rafter is on the diagonal and so is the cross-piece, which now presents the appearance of a dragon beam, though it does not run into an angle brace (Bontemps 2002, pp. 131-3). Another proto-dragon beam occurs in England in the spire of the thirteenth century church of St Mary Magdelene and St Mary the Virgin, Wethersfield, Essex. Here again the angle beam alone is present with no diagonal brace to support it, because the plates are set in from the edge of the eave, and the proto-dragon beam is able to run back to their point of intersection (Hewett 1980, p. 86).

Even after the Renaissance there is no clear evidence of dragon beams in Continental Europe. Texts on carpentry appear late and generally do not illustrate them. A short diagonal beam like some of the medieval types is recorded in Germany (Schillinger 1745-8, pl x). In France Le Muet (1675), illustrates roof frames but no dragon beams, and the first French carpentry text, by Mathurin Jousse in 1627, is equivocal. Diderot's *Encyclopédie* shows the medieval detail as at St-Urbain, without being explicit about the mortices (1751-80, 'Charpente', pl. xi). Given that the dragon beam is a detail devised for lower-pitched Renaissance roofs, it would not be expected that it would make an appearance in Viollet-le-Duc's *Dictionnaire*, but it is surprising that even its medieval relation is not illustrated (1854-68). Chabat (1875, pp. 376, 39), and Lami in his wake (1881-91, III, p, 119), show an almost full length diagonal beam or *coyer* in this position. It is not quite full-length, because to avoid a complicated joint where the cross-beam, half, beam, two *coyers*, and king-post would meet, the *coyers* stop short on short angle pieces, or *gausssets*.

Jousse's book was published in the time of Inigo Jones, and contains a promising but somewhat obscure reference (1751, pp. 36-8). The relevant illustration is a roof plan in which the presence of a dragon beam is not clear, because it would fall below the hip rafter, though it does seem to show this rafter as stopping a little short of the corner, so that the end of a diagonal member is visible below it. Otherwise all the illustration makes clear, in relation to the following text, is that FF are angle braces, and E is at the very corner. The translation is problematic, and my version assumes that *jambe de force* is used in two different senses – the first for some member such as a stud, below

the plate, and the second for the brace or *entre-toise* itself. The term *nightingale joint*, though obscure, is known in English:

... vous mettre aux Angles E, quatre Entre-toises marquées que vous assemblerez avec Tenons & Mertoises dans les Sablieres du Long-plan, & de la Croupe, les laissant assez courtes, afin qu'elles ne puissent nuire aux Jambes du force qui descendent en bas: Et sur ces Entretoises vous mettrez quatre Blochets marqués E, qui seront través dans les Angles desdites Sablieres, & à l'autre bout, vous laisserez des Tenons faits en queuë d'aronde qui se Joindront dans la Jambe de force avec un Rossignol, qui est un coin de bois, & avec deux chevilles, qui traverseront la Jambe de force.

(... you place at the angles, E, four cross-pieces, which you connect with mortice and tenon joints to the lengthwise and the end wall plates, making them short enough not to overload the studs below. And on these cross-pieces you put the tie pieces marked E, which will span from the angle of the aforesaid plates, and at the other end you will make a dovetail tenon in the brace with a nightingale joint, which is a wooden wedge with two pins which cross the member.)

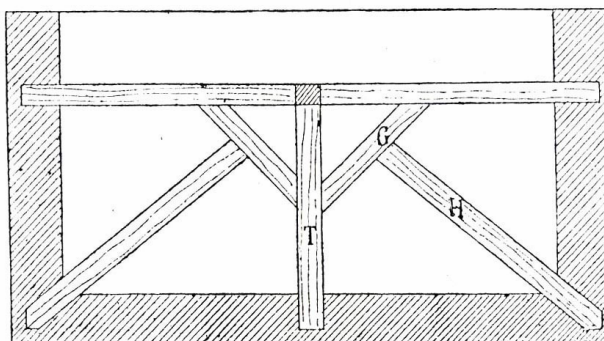


Figure 2 Ceiling for a French hipped roof with *covers* (H) and *gaussets* (G) (Chabat 1875, p. 376).

There is no doubt about the appearance of angle braces here, which is itself significant, and the strong probability is that the dragon beam is referred to as well. But the lack of a clear illustration, the obscure explanatory text, and the fact no other French authority subsequently takes it up, all suggest that this was something relatively unfamiliar in France – perhaps a recent importation from Italy.

The earliest true dragon beam in Britain (and in fact the earliest actual example known anywhere) is in the roof of Inigo Jones's Banqueting House, and might well have derived from Italy, like other aspects of Jones's roof framing. This seems persuasive because it was apparently introduced to suit the low-pitched hip roof of the building, a form which was alien to Britain but traditional in Italy.

In pre-Renaissance England the use of the hipped roof was exceptional in more formal building, whereas in Italy and in subsequent Renaissance work elsewhere it was the norm, so that Godfrey Richards, the first translator of Palladio into English, refers to the 'Italian or hip roof' (Palladio 1733, p. 196). The use of a low pitch was even more unusual in England, and Jones himself said, in marginal notes to his copy of Palladio, "The pich of Roofe ar maad according to the Region high or low", and "In Ittali a low Pich is beast" (Allsopp 1970, p.17). In the Banqueting House, however, the dragon beam is not unique to the corners of the roof. As shown in John Webb's drawing, a similar form of bracing is used also to receive the ends of alternate jack rafters in the end slope, being those which do not fall over a ceiling beam (Yeomans 1992, p. 41). This is a detail which has not been reported in other buildings.

TERMINOLOGY

It is Richards who introduces the term *dragon beam* to the English language, but he does not use it to refer to the aborted diagonal used by Jones at the Banqueting House, and described in subsequent texts. He presents a rather strange diagram in which hips, common rafters and wall plates are all projected into one plane, and it shows no angle braces: instead his dragon beams appear to continue in at 45° and meet each other, and a transverse beam or bressummer, on the axis of the building, and they are thus full length diagonal beams (Palladio 1773, p. 199), much as in the later French texts. He gives the "Rules for framing roofs" at the end of his edition of Palladio, identifying a 'Dragon-beam for the Hip to stand on', and following it with the "Beam or summer, wherein the Dragon-beams are framed" (Palladio 1773, p. 196).

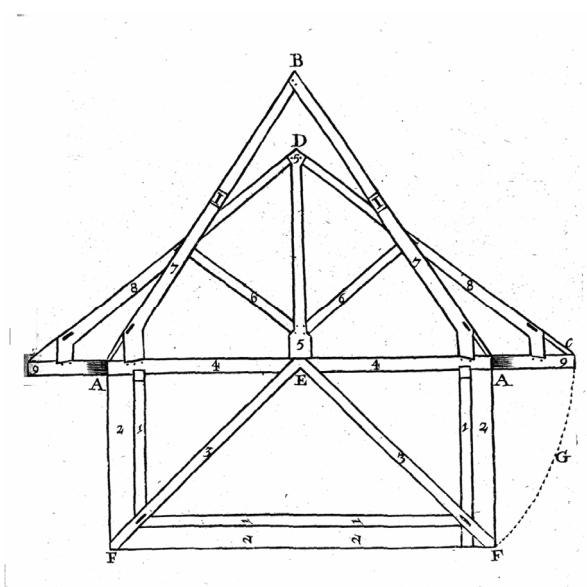


Figure 3 'Of the Italian or hip roof', from Godfrey Richards's edition of Palladio (Palladio 1733, p. 199).

Richards's list of elements is worth quoting in full, in the perhaps vain hope that they will elucidate his diagram:

- AA The breadth of the roof, being 20 feet.
- AB The length of the sleepers or hips, being 18 feet, which is proportionable to the breadth of the house.
- ED The height of the roof perpendicular.
- CD The length of the hip, and the angle which it maketh upon the diagonal line, which is shewed by the pricked line G, from F to C.
- 1, 2. The wall and lintels.
- 3. Dragon-beam for the hip to stand on.
- 4. Beam on [?or] summer, wherein the dragon-beams are framed.
- 5. King-piece, or crown-post.
- 6. Struts or braces from the crown-post to the hip-rafter.
- 7. Hips, as they make the angle equal to the breadth of the house.
- 8. Hips, as they make the angle in the diagonal lines from corner to corner.
- 9. The additional length which the hips make upon the diagonal lines, more than the breadth of the house.

This does not mean that he has derived the detail from Palladio, for his translation was not from Palladio's Italian but from Le Muet's French edition, which diverged considerably. Moreover Richards himself had replaced Le Muet's roof designs with others drawn by William Pope of London, "such as are us'd in England, by the direction of some of our ablest Architects" (Palladio 1773, p. A3), and 'according to the best Manner practised in England" (Palladio 1773, p. 189), a matter discussed by Eileen Harris (1990, pp. 352-5). Though Richards described Pope as "that Ingenious Architect" (Palladio 1773, title page), he was really a carpenter, becoming Master of the Carpenters' Company in 1675 (Colvin 1978), p. 651). It is difficult to believe that Pope was drawing upon some long-standing English tradition of which we have no evidence whatsoever, especially given that there was no English tradition of low-pitched hip roofs, and that Richards himself calls them "Italian". So this English usage was probably of only recent date, and even what Richards calls the dragon beam still seems likely to have been an import. To date, however, I have found no Italian text which describes or illustrates either the dragon beam as I define it or the element referred to by Richards, nor do they appear in the *Glossario dell'Edilizia Romana tra Rinascimento e Barocco*.

The detail which was used by Jones, and which was to become the standard dragon beam, at first bore no name of its own. Francis Price's *British Carpenter*, does not refer to dragon beams or pieces, but simply to 'pieces upon which [the] hips are to stand' (1733, p. 12, pls. F, FG). William Pain (1763, pl. xxxvi & p. 57) and Abraham Swan (1768, plate showing ceiling plan) illustrate

dragon beams but make no reference to them in their texts. John Wood uses no special term, referring simply to a 'diagonal piece' (1781, p. 12). However Batty Langley refers to 'Dragon-pieces to receive the feet of the Hip Rafters' (1756, pl. 2, fig. 3), and the terms 'dragon beam' or 'dragon piece' were applied by Peter Nicholson (1825, pl xxxvi; 1839, p. 136) and most of his successors (Stuart no date, II, sv Dragon-Piece; Loudon 1846, p 1299; Gwilt 1888, p 616; Brees 1853, p. 148; Brooks 1882, pl. xx; Newlands 1861, p. 260; Tarbuck no, p. 168; Eyland, Lightbody & Burn no date, 'Explanation of the Principal Terms, &c', p. 12; Ogilvie 1867, I, p. 606; Burn 1877, pp. 117-8; Sutcliffe 1903, V, pp. 71-2; VIII, p. 418; Collings 1893, p. 127; Passmore 1904, p. 120; Adams no date, pp. 276-7; Boughton no date, II, p. 32; Jaggard & Drury 1945-7, III, p. 24). In his *Dictionary*, however, Nicholson gives separate definitions for the dragon piece, which is the piece for the foot of the rafter, and for the dragon beam. In attempting to explain the dragon beam he quotes Moxon, Neve and Richards, but unhappily (for reasons which will appear below) concludes 'a proper explanation of the word ... has not been given.' (1819, I, p. 411). Elsewhere, however, Nicholson unequivocally uses 'dragon beam' to refer to the element at the foot of the hip rafter ' (1819, II, p. 86 (sv Hip-Roof), & pl. III).

Percy Thomas is exceptional in that he gives two meanings: the true dragon beam and the diagonal cantilevered beam as discussed below (no date, II, p. 448; III, p. 374. Another exception is G L Sutcliffe, who presents a clearly erroneous diagram with no dragon beam, but an angle brace into which an apparently vertical hip rafter is mortised (1909), I, p. 152). The *Shorter Oxford Dictionary* follows Nicholson, and Scott's *Dictionary of Building* gives a similar definition (1964, p. 104). Both elements, the angle brace and the dragon beam, were used in a framed structure prepared in London for Collins's Australian expedition of 1803, and referred to as 'Dragging Tie Beams and Braces' (Irving 1975, p. 465). The term 'dragging piece' appears as late as the 1950s in the fourth edition of Stubbs's *Building Encyclopedia* (no date, I, p. 45), though elsewhere in the same work it appears simply as 'dragon'. The usage 'dragging' suggests an alternative derivation of the term as meaning a piece in tension, or a tie. But this has so far been found only in much later references, and must be assumed to be a spurious back-formation. Sutcliffe (in another work) gives 'drag-baulk' as an alternative term (1903, V, p. 71). Another promising source would be the French word *dragonne*, which can be rendered as *joint strap*, but there is no evidence at all to support this.

DETAILING

James Smith's *Carpenter's Companion* shows all these pieces let into each other in the same plane (1733, pl. 1), a horrendous proposition where the three of them meet at the corner. Batty Langley makes this explicit. When the frame and top plates are in position the transverse beams and the angle braces are "cauked down", an expression (later more commonly "cocked") meaning partly let in, with a dovetail in plan. This is not said of the dragon pieces themselves, but they are illustrated with the dovetail, and are manifestly the same (1756, pl. 2). This arrangement was later regarded by Peter Nicholson as "much inferior to the present practice, where both the angle-tie and the dragon-piece are fixed above the plates" (1852, I, p. 177 & pl. v, fig. 3). George Collings, in 1893,

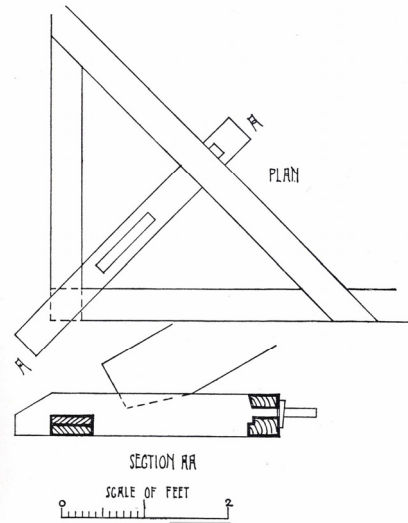


Figure 5. Sutcliffe's rationalised detail (1903, V, p 72).

The dragon beam remained standard in Britain throughout the nineteenth and up to the mid-twentieth century, and it appears twice in Thomas Hardy's architectural notebook, which is mostly of the period 1862-72. In one case it is the standard detail except that the mortice is a little far in from the corner (1966, p. 30), but the other, probably copied from a text, is more interesting. The top plates are mitred at the corner and held together by a bolt across this mitre. The "dragon tie" and "angle tie" are both labelled, and extend about 200 millimetres past the top plate. The angle tie is checked over the top plate by cutting a rebate about 50 millimetres deep on either side of it. The dragon tie is checked over the angle tie in the same manner, and they are bolted together. All the members are 10 x 5 inches [250 x 125 millimetres], the dragon tie being on edge. The base of the hip rafter dies into the dragon tie in a sort of inverted butting joint. (1966, p. 85).

OCCURRENCE

R S Burn explains that the angle brace or 'angle tie' is used even in small buildings, whilst the dragon beam or 'dragon tie' is added in larger roofs, and is connected to the brace with a tusk tenon joint (1877, p. 118). The dragon beam continues to appear in twentieth century texts such as W B McKay's *Building Construction*, which, interestingly, illustrates an example in which the detail performs a real function. The roof in question has a bellcast profile at the base, which has necessitated moving the bottom ends of the rafters in from the edge, and without a dragon beam there would have been no proper fixing for the base of the hip rafters (1944-5, I, p. 75).

In the United States the detail is hardly ever shown in texts, though two exceptions are Sturgis's *Dictionary* (1901, I, pp. 823-4) and Hasluck, *Cassell's Carpentry and Joiner* (1912, pp. 123, 125,

128), the latter clearly of British origin. It occurs in 1820 in the drawings of the Sumter Courthouse, North Carolina, by the English-born architect William Jay (Lerski 1983, p. 178), but not apparently in the work of native-born architects. J I Rempel reports one example in Canada, the E Denis cottage at York Mills, which he believes to be unique in Ontario, and a rare example of persisting British techniques. Although he does not specify the date, it is “early” and unusual amongst such early buildings in that it has a hipped roof (1980, pp. 8-9), which is at least a partial explanation. The detail seems to be regarded as exotic in New Zealand, and Martin Hill, who has found it there, surmises that it was intended to strengthen the building against earthquake, notwithstanding the fact that he himself reproduces an illustration from an (unspecified) English text of 1780 which shows virtually the same detail (1985, pp 19, 21).

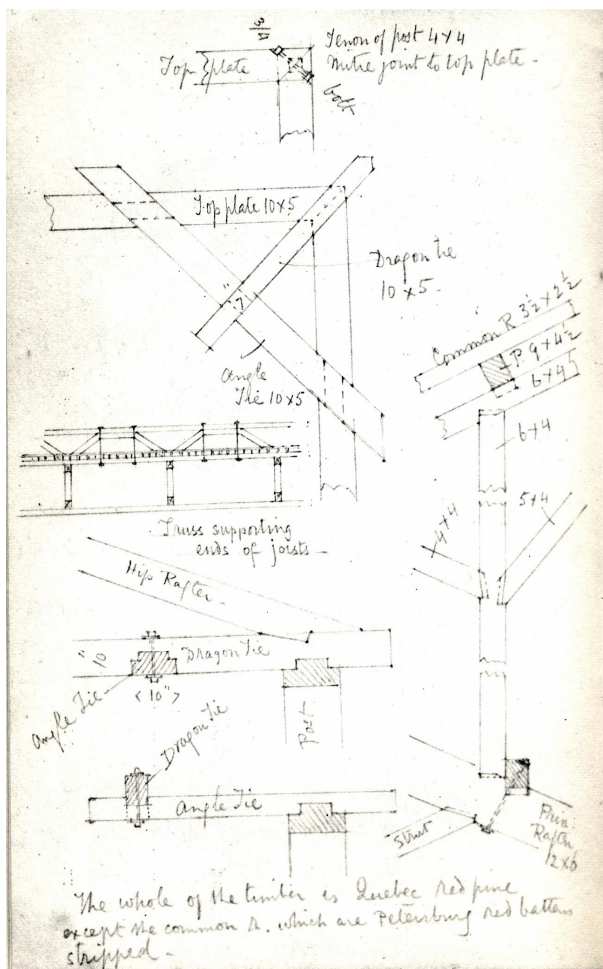


Figure 6. Thomas Hardy's sketch of dragon beams, probably copied from a text (1966, p. 85).

An Australian specification of 1854 calls for “diagonal and dragon pieces” to be four inches by three [100 x 75 mm] (Russell, Watts & Pritchard 1854, p. 8). A barn at “The Mains”, Upper Murray (probably soon after the mid-nineteenth century) has dragon beams but no angle braces. Because the roof is of eaves joist construction, it is possible to take these diagonal members in to meet at an angle with the longitudinal members running parallel with the walls. A grandstand at Kilmore, Victoria, has dragon beams and angle braces, both of which are pieces on the edge, rather than on the flat, with the brace partly let into the beam. Unfortunately we cannot be certain whether the detail dates from the construction of the stand in 1873 or from its removal and re-erection at the present site in 1947. The Roman Catholic church at Morpeth, New South Wales, designed by J W Pender in 1877, had angle braces at the corners of the tower roof, which were probably associated with dragon beams, but this cannot be confirmed because the only drawing of the roof structure is from above, so that the dragon beams, if any, are concealed by the rafters (Pender 1897). A specification of 1878 for a bank in South Australia calls for “Angle ties and Dragon pieces of 4" x 3" framed together, halved, and nailed to plates and hip pieces” (Reed & Barnes 1878, p. 17). A store built in the 1880s at “The Yanko”, New South Wales, has an odd detail involving an angle brace and a dragon beam, plus a vertical strut rising from their junction to the hip rafter - somewhat reminiscent of the medieval ashlar piece.

The angle brace and the dragon beam again appear in Nangle's *Australian Building Practice* from 1900 (p. 122) onwards, and the most surprising survival of the dragon tie or angle brace (but not the dragon beam) is in Norman Wallis's *Australian Timber Handbook*, published by the Timber Development Association in 1956 (p. 292). The diagrams of house construction have angle braces too small to be of much use as braces, and not connected to the hip rafter by a dragon beam or any other means. This form of brace is a truly vestigial trace of earlier building practice. Elsewhere such angle bracing, in realistic sizes, had been very common, especially in buildings designed to be moved about. In Queensland, where it was still referred to as a 'dragon tie', it was used at both ceiling and floor level as an anti-cyclone measure (Virgo 1955, pp. 72-3).

ALTERNATIVE DEFINITIONS

Although the number of examples and the number of textbook references might suggest that the detail and its definition are well understood, that is not in fact the case. Apart from that of Godfrey Richards, there are three other definitions, two of which have enjoyed considerable currency. Robert Plot, apparently quoting Christopher Wren, refers to “two *dragon* (perhaps rather *Trigon*) *beams* or *braces* lying under the *joists*” of Wren's Sheldonian Theatre, Oxford (1677, p. 273). They are in fact two diagonal members running horizontally under the ceiling joists to form a V in plan over the rectangular portion of the building. They are clearly too slender to carry any significant vertical load, and are certainly not beams. As braces to resist horizontal distortion in the building they might be of some theoretical effect, though it is difficult to see that they could really be useful in a masonry building on this scale.

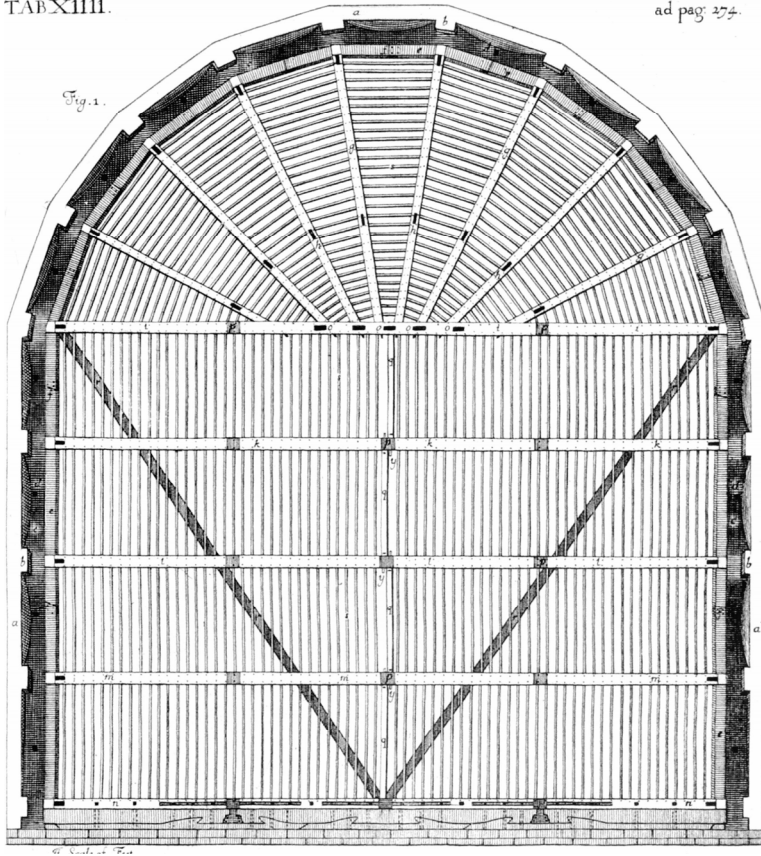


Figure 7. Christopher Wren's dragon beams or diagonals in the roof of the Sheldonian Theatre, Oxford (Plot 1677, pl xiii).

Plot's account does shed light upon the source of the term *dragon*. His *trigon* comes from *trigonalis* and means effectively a triangle. Blount's *Glossographia*, originally of 1656 (1670, p. 659), does not define *trigon* but does define "Trigonal (trigonalis) three cornered, that hath three corners." It seems that Wren (if he was indeed Plot's source) has thought it necessary to distinguish two diagonals which form a V or triangle, from a simple diagonal. The Latin word *diagonalis* was also in common use, and Shute (1563, sv 'Doricus') referred to "a line ouerthwarte from one corner to the other, which line is called Diagonalis". From the same Latin root a diagonal was according to Blount also known as a diagon: "Diagon or Digonal (diagonalis) a line which passeth from one corner or one angle of a Geometric body to another corner or angle of the same" (1670, p. 198), and it seems clear that in the description of the Sheldonian the term *dragon* means *diagon*. But this is not to say that in rendering it as 'dragon' Plot has made an error, for this is a usage which must go back at least to Godfrey Richards.

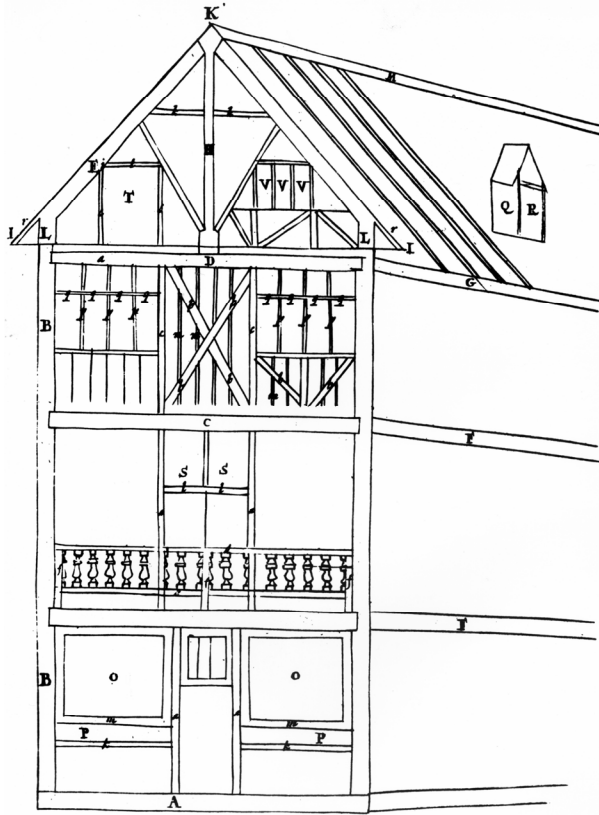


Figure 8. Moxon's diagram with the spurious dragon beams, actually angle struts in the truss (1703, p 160).

At this point we are confronted by a red herring. Joseph Moxon's *Mechanick Exercises*, first published in 1677, produces a naked end elevation of a three storey gabled timber frame building, loosely derived from Richards (Palladio 1733, p 195), but he ignores the terminology of both Richards and Wren, and gives the words a totally different meaning: “*Dragon-beams*, are two strong Braces or Struts that stands [*sic*] under a Bressummer, meeting in a [*sic*] an angle upon the shoulder of the *King-piece*” (1703, p. 160). This makes very little sense, as neither a “king piece” [king post] nor a strut would normally be used under a bressummer. And the mystery cannot readily be resolved by reference to Moxon's illustration, because this is incompletely labeled. However in the key to it the dragon beams seem to be equated to struts, and as they are to rest upon the shoulders of the king piece it is clear that they are the angled struts within the king post truss which he depicts. It is simply that Moxon has mistakenly written “under” rather than “over”. Insofar as these are diagonal members the term “dragon” or “diagon” in Moxon's definition is perfectly reasonable, but is supererogatory, as there were and are other words in more general use to describe such members, such as his own “Braces or Struts”, which he derived from Richards

Richards (Palladio 1733, p 194), and Wren's "Braces or Puncheons" (Plot, 1677, p. 273). On the other hand Neve defines 'punchins' quite differently as

Short pieces of Timber placed under some considerable weight to support it. They commonly stand (upright) between the Posts; they are shorter (and slighter) than either Principal posts, or Prick posts. Those that stand on each side of a Door, are called *Door-punchins*.

(1726, sv. Punchins)

It is here that we come to an almost unbelievable sequence of events. Neve's *City and Countrey Purchaser*, the first English dictionary of architecture and building, almost literally repeats Moxon's definition of the dragon beam – complete with the mistake which renders it meaningless – “Dragon-beams are 2 strong Braces, or Struts, that stand under a Bressummer, meeting in an Angle upon the shoulder of the King-piece” (1726, sv. Dragon-beam). Not only could Neve himself have had no idea what these words were supposed to mean, but his flawed definition was mindlessly followed by others, and is repeated almost verbatim in Chambers's *Cyclopaedia*: “two strong braces or struts which stand under a breast-summer, and meet in an angle on the shoulder of the king-piece” (1788, I, sv. Dragon-beam). Chambers's definition was in turn followed literally by Rees (1819, XII, sv. Dragon Beams) and substantially by Crabb (1823, I, sv. Dragon Beams), Harris (1828, II, p. 862) and Weale (1860, p. 160), none of whom can have had any idea what they were talking about.

However Peter Nicholson, forty years before Weale's publication, had already challenged Moxon's definition of the dragon beam, or in fact Neve's version of it. He did not pick up the mistake of “under” for “over”, and again he cannot have understood what was intended, but he did recognise the misuse of the word “beam” and the inappropriate context for it:

The author of this *Architectural Dictionary* never heard the term applied to story-posts and bressummers, nor has he been able to learn any such application of the term; the word *beam* is improper for any piece of timber, that stands slanting as a brace or strut.

Nicholson surmised that Neve, who claimed to be a “philomath” rather than an architect or tradesman, “might have been misinformed by the workmen, among whom he made his enquiries”(1819, I, p 411). But this is not a sufficient explanation, for Neve had simply copied Moxon, who was a more practical writer. It was Moxon who created what we must assume to be a wrong definition, and who then made the critical mistake in the wording which rendered it not only wrong but meaningless.

Most writers of the later twentieth century have appropriated the term *dragon beam* (but not *dragon piece*) to apply to a diagonal corner beam used to carry a jettied floor out from two adjacent faces of a building. This usage can be traced at least to W C Green in 1908 (pp. 29-30, 33), but it probably

became influential because it was taken up by C F Innocent in 1916. Innocent writes as if as if the meaning were well established: “The beam is called a dragon beam, and it has been assumed that this is an ignorant corruption of diagonal beam: more probably it is the beam upon which the joists seem to drag” (p. 165). Etymologically this was incorrect, though it was an explanation popular since at least 1803.

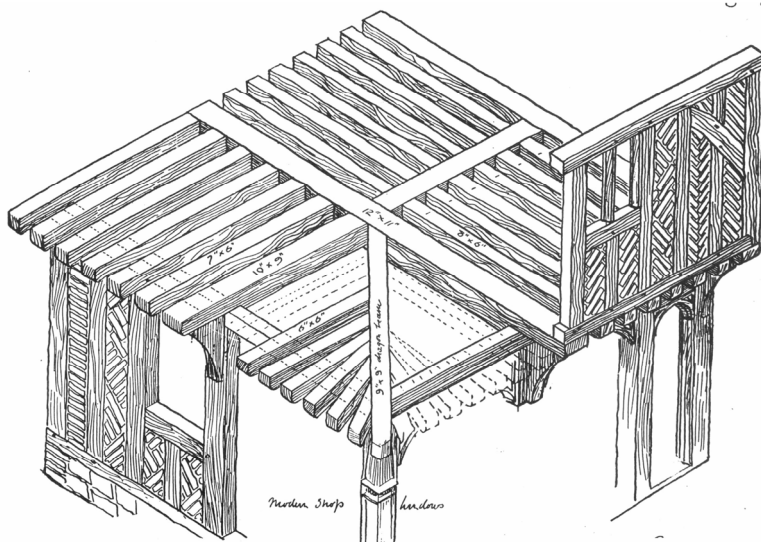


Figure 9. Oversailing storey of a shop in Lingfield, by W C Green: the first identified use of the term 'dragon beam' for a diagonal jettied floor beam. (1908, p 29).

Nor is there any historical foundation for this definition of the dragon beam. In theory it could have derived from Richards, whose full-length diagonal roof beam was not so very different, but his diagram is so incomprehensible that this seems unlikely. More probably it arises from a misunderstanding of the nineteenth century meaning by Green or even earlier writers, which was then taken up by Innocent, then by Batsford & Fry (1938, p. 28), but which became general only in the 1960s (Charles 1967, p. 12; Mason 1969, p. 106; Fleming, Honour & Pevsner 1966, pp. 70, 161-2; Curl 1977, p. 67; Brown 1981, pp. 60, 61 West no date, pp. 41, 67, 90, 129). Hewett gives it as both a floor and a roof member (1980, p. ix). The most authoritative recent work, J S Curl's *Dictionary of Architecture*, draws an elegant but factitious distinction, between a dragon beam, a dragon piece, and a dragon tie. The dragon beam is the diagonal of the jettied upper floor. The dragon piece is the short diagonal piece at the foot of the hip rafter. The dragon brace is an angled piece between a beam and a wall plate, or between two wall plates, where it commonly carries the end of the of the dragon piece (1999, p. 212). Unfortunately, as logical as it may be, no such distinction between the dragon beam and the dragon piece is made in the historical sources themselves.

CONCLUSION

We can now come to some conclusions, both as to the meaning of the term and as to the origins and distribution of the detail. 'Dragon beam' has had a number of meanings

- 1663 Richards: a full-length diagonal beam, receiving the base of the hip rafter
- 1677 Wren/Plot: a diagonal member under ceiling joists, possibly providing bracing in the horizontal plane
- 1677 Moxon: unintelligible, but intended to be a diagonal strut in a kingpost truss
- 1740 Langley: a diagonal beam receiving the base of the hip rafter, but running in only a short distance to meet an angle brace.
- 1908 Green: a full-length diagonal beam in a jettied-out floor.

I have treated Langley's as the correct definition because it is the only one, prior to the twentieth century, to satisfy three major criteria. It (a) makes sense, (b) is used by more than one writer, and (c) refers to a detail found in actual buildings.

Although there are some related medieval details for handling the base of a hip rafter, the true dragon beam is first found in Inigo Jones's Banqueting House. The fact that its intended function is to contain the outward spread of the hip rafter is demonstrated by the use of similar bracing at the foot of every non-tied jack rafter. The low pitched hip roof was a new form for Britain, imported by Jones from Italy, and there seems every probability – despite the lack of evidence to date - that the carpentry came from Italy as well. The dragon beam then continues in use until well into the nineteenth century, and is illustrated in texts up to the mid-twentieth century. From the early twentieth century however historical works, as opposed to building textbooks, increasingly use the words 'dragon beam' for something quite different, apparently based upon a misunderstanding.

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