The Origin and Development of Crown-Post Roofs

By J. M. FLETCHER *and* P. S. SPOKES

THE king-post and crown-post forms of roof-construction constituted one phase in the evolution of timber-framed roofs between the Carolingian renaissance and Tudor times. Though their purpose was functional in the first place, they were adapted to the artistic adornment of halls and churches from the late 13th century onwards. These forms originated in NW. Europe in the closing years of the 12th century; but just as Early English masonry shows differences from continental Gothic of the same period, so this type of timber-framing had an independent development in England. As a consequence, the English form, usually the crown-post roof, differs somewhat from the king-post form more frequently used on the other side of the Channel: the difference between a king-post and a crown-post, i.e. one which does not reach the ridge, will be apparent from the diagrams in FIG. 41.

Both Crossley[1] and Smith,[2] in their accounts of medieval roofs, have stated that the crown-post roof is one form of a general category of ridgeless roofs which have uniform rafters. Some early forms of this category suffered from longitudinal instability, a weakness relieved by the provision of a central purlin, to which the crown-post and its associated tie-beam became adjuncts.

There are several examples of crown-post roofs in ecclesiastic and domestic medieval buildings in the southern, eastern and midland counties of England. Some are often attributed to the 14th and 15th centuries when evidence for an earlier date is lacking. However, crown-post roofs at Charney Bassett, Old Soar, and Chichester have already been correlated[3,4] with buildings belonging to the last half of the 13th century, and additions to these 13th-century examples are being provided as a result of further archaeological investigations.

There are a number of questions about these architectural features which remain to be answered, in particular:

(i) What kind of roof did they supersede?
(ii) When did they come into use in England?
(iii) What forms did they take and what is the chronological significance of these forms?
(iv) When were they replaced and to what extent did they survive in certain areas long after they had been succeeded elsewhere?

1 F. H. Crossley, *Timber-Building in England* (Batsford, 1951).
2 J. T. Smith, *Archaeol. J.*, CXV (1960), 111–149.
3 T. H. Turner and J. H. Parker, *Domestic Architecture of the Middle Ages*, I, (1851).
4 M. E. Wood, *Archaeol. J.*, CV (1950), Supplement.

The purpose of this paper is to provide answers to these questions in the light of early roofs in NW. Europe and of roofs, some hitherto unrecorded, in the south and east of England, in particular, in N. Berkshire and at Ely.

THE LINEAGE OF CROWN-POST ROOFS

The English crown-post roof is derived from a European, the Romanesque, form in which there was no ridge-pole but repeated trusses consisting of pairs of identical rafters supported by some kind of bracing. The other early European form, prevalent in northern latitudes, had principal rafters (or crucks) crossing at their apex and supporting a ridge-pole; it was temporarily submerged in southern and eastern England by the Romanesque form when Norman influences prevailed, but later, towards the end of the medieval period, it re-emerged in the form known as 'double-framing' and supplanted, except in the extreme south-east, the other form, by then anglicized.

FIG. 41
TYPOLOGY OF KING- AND CROWN-POSTS (p. 152)

Examples in Norman (and pre-conquest) England of the Romanesque roof are disappointingly few, in spite of what must have been its widespread occurrence in stone buildings as well as in those of all-timber construction. Little information concerning the original roofs has been provided by those[5] who have studied the remains of Anglo-Norman domestic buildings, even though these include palaces (royal, baronial and episcopal), monastic buildings, and manorial halls; subsequent reroofing or other modifications have removed the earliest timbered roofs[5a] from these as well as from the hundreds of Anglo-Norman consecrated buildings that existed in England towards the end of the 12th century. The 12th-century W. range of the monastic buildings at Ely still has its original pitch of 58°; the general employment of such a steep pitch is shown on the stonework of the towers at Cholsey and Goring churches and at Oxford Cathedral. Howard[6] suggested that there was often a flat ceiling under a gabled roof.

The situation is better for NW. Europe; in Flanders,[6a] Burgundy and France,

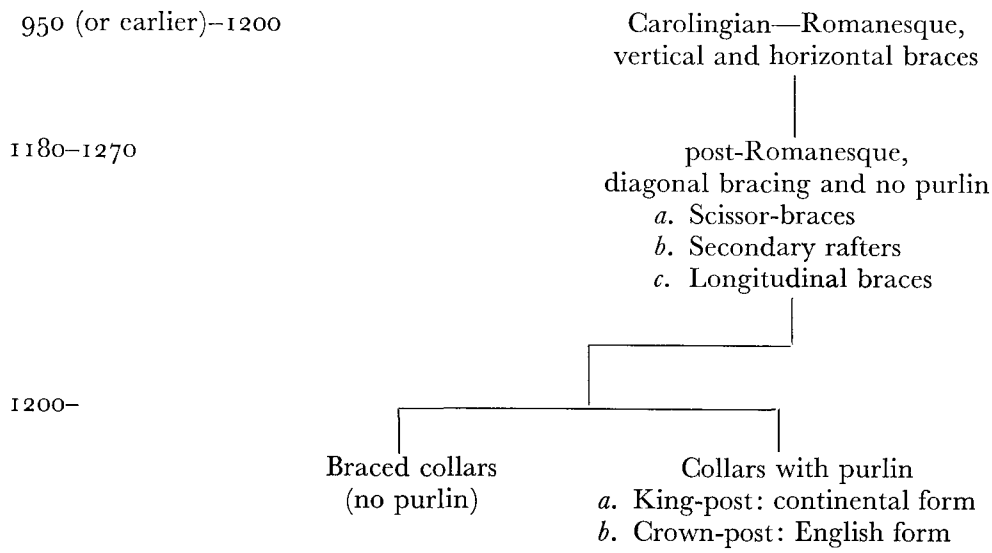
5 E.g. M. E. Wood, *Archaeol. J.*, XCII (1936), 171.

5a An exception may be the roof over the hall at Leicester Castle, see W. Horn, *op. cit.* in note 12.

6 F. E. Howard, *Medieval Styles of the English Parish Church* (Batsford, 1936), p. 49.

6a The recent article by H. Janse and L. Devliegher, *Bull. Commission royale des Monuments et des Sites*, XIII (1962), 299, on roofs in Flanders extends the examples cited by Brigode (*op. cit.* in note 8), which cover Hainault only.

a number of Romanesque roofs earlier than 1200, as well as other types of the late 12th century, have survived. These suggest the following sequence:



Since timber-work as well as masonry was probably much the same on both sides of the Channel from the time of Edward the Confessor until the close of the Anglo-Norman period, the Romanesque form would have been in general use in southern England from 1050 to 1200. It is likely that the first post-Romanesque developments in England were also influenced by those across the Channel.

Before dealing with the various phases of crown-post roofs in England, we therefore examine the Carolingian-Romanesque roof and trace the post-Romanesque development on the continent and in England.

THE CAROLINGIAN-ROMANESQUE ROOF (before 1200)

Attention has already been directed[2] to the measured drawings made by Deneux of medieval roofs in the northern part of France. Even with the additions for other parts of France included in the volumes[7] recently issued by the 'Centre de Recherches sur les Monuments Historiques' only a dozen such pre-1200 roofs have survived and most of these were built in the second half of the 12th century.

However, in other parts of the Frankish kingdom there are examples which demonstrate a common Romanesque roof for about 200 years before 1200, that is, back to the time when a rebuilding phase followed the Viking destructions. The even earlier roof[8] over the Carolingian nave of St. Ursmer at Lobbes in Hainault (FIG. 42)[9] was similar but of less steep pitch.

7 *Charpentes*, Centre de Recherches sur les Monuments Historiques, I and II, *c.* 1959.

8 S. Brigode, *Bull. Commission royale des Monuments et des Sites*, I (1949), 89–345.

9 The situations of this region, and of continental roofs to which reference is made, are shown in FIG. 42.

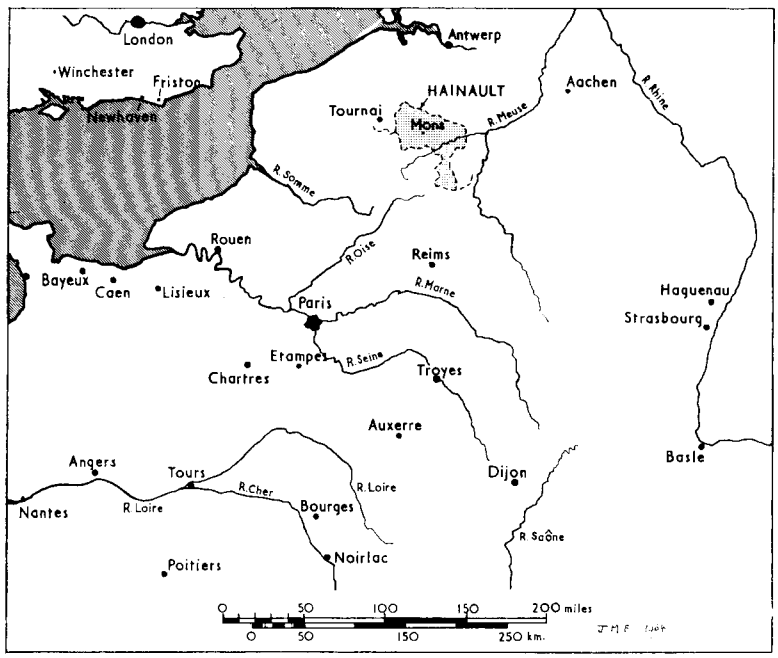


FIG. 42

Map showing positions of continental Romanesque and post-Romanesque roofs (pp. 154 ff.)

The uniformity of the Romanesque work is shown by the similarity of the early roofs[8] over the transepts, *c.* 1000, and nave (FIG. 43, *a*) of the college of St. Vincent[10] at Soignies, with those built much later over the naves of St. Pierre de Montmartre[7] in Paris and of All Saints, Blaton (FIG. 43, *c*). Some examples

TABLE I

SOME ROMANESQUE ROOFS IN NW. EUROPE

Roof	Approx. date	Pitch	Remarks	FIG.
Soignies,[8] transepts, S. and N.	1000	45°, 40°	Wooden ceilings,	
Soignies,[8] nave	11th	45°	but transept	43, *a*
Soignies,[8] choir	Mid 12th	46°	vaulted in 1642	43, *b*
Lessines,[8] nave	11th	49°	Destroyed in 1940	
Paris, St. Pierre de Montmartre,[7] nave	1147	40°		
Horrues,[8] nave	Late 12th	48°	Wooden ceiling	
Blaton,[8] nave, W. end	1200	50°	Wooden ceiling	43, *c*
Tournai Cathedral,[11] between lateral towers of transepts	1190			

[10] Refounded *c.* 957 by Brunon, archbishop of Cologne, on an earlier Merovingian site.

[11] Mémoire-Marie, *Ann. Congrès archéol. et hist. Tournai*, 1949.

of this type, which by the second half of the 12th century must have covered more than a thousand Romanesque buildings in NW. Europe, are listed in Table I. Having no longitudinal members (not even a ridge-piece), it was particularly suited to slow methods of construction, since truss after truss, each separated by some 30 in., could be added as the work proceeded.

THE POST-ROMANESQUE PHASE (1180–1270)

The lavish use of heavy timber necessitated by the Romanesque roof with its tie-beam to *each* pair of rafters was eventually reduced by limiting the tie-beam to every five or six trusses. The roofs which have survived from the latter part of the 12th and early part of the 13th centuries show a remarkable diversity and reflect a vigorous phase of experiment; it is not surprising that these efforts resulted in there being not merely distinct French and English styles, but also regional differences in England in the late medieval period. The uniformity which had for centuries characterized the Romanesque roof disappeared. The

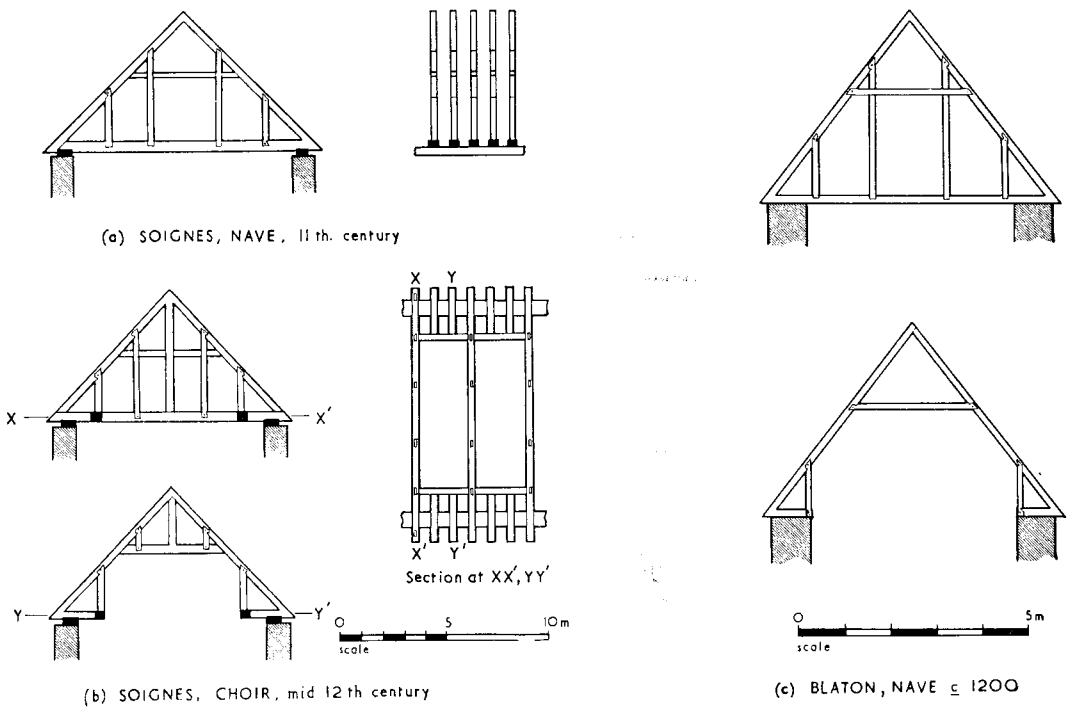


FIG. 43
ROMANESQUE ROOFS IN HAINAULT (pp. 155 ff. and Table I)
After Brigode, *op. cit.* in note 8, figs. 30, 31, 55, 56

master-carpenters applied originality to roof-construction as the master-masons did to tracery. Some of the changes, such as the general use of the mortise-and-tenon joint, which occurs as early as *c.* 1180 at Lisieux Cathedral,[7] resulted from technical improvements. Others, such as a steep pitch to carry heavy coverings of lead or of stone, were imposed by the use of certain materials.

A. CONTINENTAL

At Soignies, where we have already noticed the Romanesque roofs over the nave and transepts, the choir roof,[8] attributed to the middle of the 12th century when a lead covering was added, is informative as it indicates the approximate date at which the ashlar was evolved from the vertical posts used in Romanesque roofs. FIG. 43, *b*, shows the two forms of trusses in this choir roof; one is the typical Romanesque truss with a tie-beam; the other, of which there were two between each tie-beam, consists of an open (pseudo-hammer-beam) truss, from which a truss with ashlars would readily be evolved. Open trusses with ashlars and collars were already being used at Blaton (FIG. 43, *c*) about 1200.

The most important change, however, in this evolutionary phase was the introduction of *diagonal* braces. Varieties of the forms taken by such bracing are:

Scissor-braces (FIG. 44). This form, also known as the St. Andrew's cross, appeared before the close of the 12th century, since it was used between 1171 and 1198 in the transepts at Tournai Cathedral.[11] Some other examples are listed in Table II. Scissor-bracing continued some of the Romanesque traditions: thus the collar was retained and on occasions duplicated to give upper and lower ones at Bayeux Cathedral (FIG. 44, *b*); for roofs of wide span, tie-beams were used for every sixth or seventh truss. At first, although these tie-beams carried vertical posts, there were no collar-purlins (FIG. 44, *b*): these were included at a rather later date, e.g. in the roofs at Tours and Rouen. The medieval barn of the

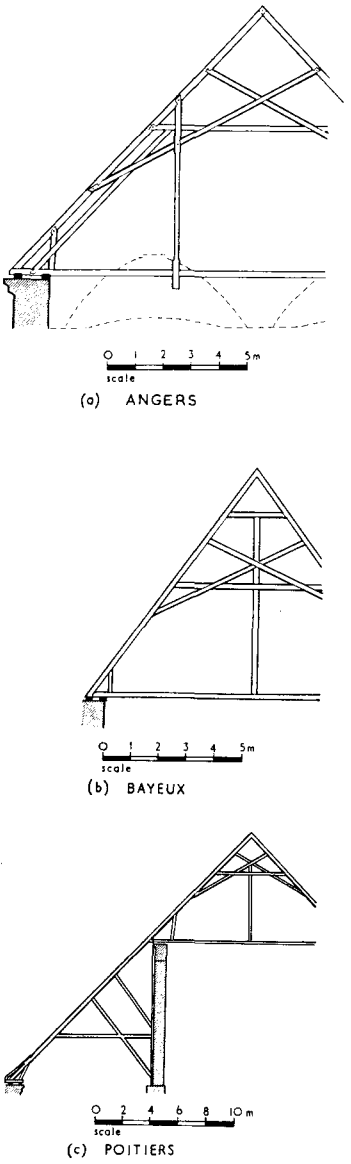


FIG. 44
SCISSOR-BRACING IN FRENCH ROOFS
(p. 157 f. and Table II)

a, Angers, Musée St. Jean; *b*, Bayeux Cathedral, N. transept; *c*, Poitiers Cathedral, choir

After drawings in *Charpentes*, *op. cit.* in note 7

abbey grange at Warnavillers, recorded by Horn,[12] shows that similar forms of roof-construction were used in vernacular buildings of the period: the roofing of this barn may be compared to that of the choir at Poitiers Cathedral (FIG. 44, *c*).

TABLE II

CONTINENTAL ROOFS, POST-ROMANESQUE, SCISSOR-BRACED

Roof	Approx. date or century	Width spanned in feet	Pitch	FIG.
Tournai Cathedral, transepts	1190	*c.* 30	*c.* 53°	
Angers, Musée St. Jean	End 12th	50	46°	44, *a*
Bayeux Cathedral, N. transept	Early 13th	33	53½°	44, *b*
Poitiers Cathedral, choir[b]	Mid 13th	40[a]	46°	44, *c*
Tours Cathedral, choir[b]	1240	24	64°	
Rouen Cathedral, nave (part)[b]	1240	32	52°	
Warnavillers (Oise), barn[b]	Mid 13th?	*c.* 30[a]	*c.* 50°	

a. Aisles excluded. *b.* Also have king- or crown-posts.

Secondary rafters (FIG. 45). This form of diagonal bracing consists of intersecting braces, of comparable length to the scissor-braces but aligned parallel to the rafters from which they are separated by 1–2 feet. They provide an example of the doubling of scantlings to give extra strength, a feature to which Smith[2] has drawn attention. An early instance (FIG. 45, *a*) occurs over the vaulted transept (1150–1160) of the Cistercian abbey of Noirlac;[7] they were also used in the nave and transepts, *c.* 1181, of Lisieux Cathedral;[7] in the Musée St. Jean at Angers[7] (FIG. 44, *a*); and in the choir, early 13th-century, at Etampes,[7] which has a fully developed king-post roof (FIG. 45, *b*).

Lateral longitudinal braces (FIG. 46). Survivals of these, an arrangement of short-lived duration, are relatively rare. These braces provided some longitudinal support between the trusses, and usually span about eight rafters. This innovation appeared late in the 12th century: it was used at this time at St. Georges, Haguenau,[7] the nave roof of which (FIG. 46, *a*) is essentially Romanesque and illustrates the persistence of this form in regions adjacent to the Rhine. Lateral longitudinal bracing was also employed in the 13th century in the roof (FIG. 46, *b*) over the massive choir of Poitiers Cathedral.

The three forms of bracing detailed above were associated with modifications (discussed in detail by Deneux[13] and by Hewett[14]) to the joinery. The general features which differentiate these early roofs from those of the late 13th century and onwards include:

(i) the absence of purlins,
(ii) the use of halved and notched-lap joints,

12 W. Horn, *J. Soc. Archit. Historians*, XXII (1963), 21.

13 H. Deneux, *L'Architecte* (1927), p. 85.

14 C. A. Hewett, *Med. Archaeol.*, VI–VII (1962–3), 240, and *Archaeol. J.*, CXIX (1964), 225. These papers include a glossary in which 'secondary rafters' are termed 'parallel scissors'.

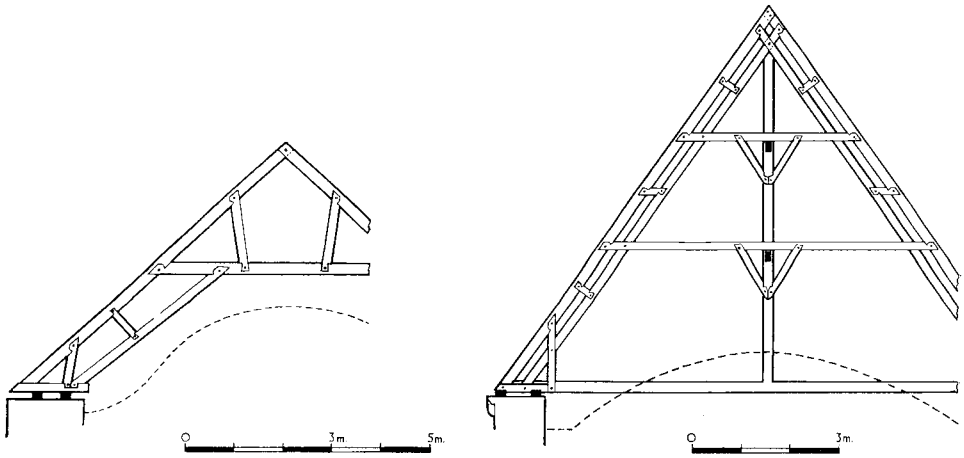


FIG. 45

SECONDARY RAFTERS IN FRENCH ROOFS (p. 158)

a, Abbaye de Noirlac, transept; *b*, Etampes, choir
After drawings in *Charpentes*, *op. cit.* in note 7

(iii) the relative absence of heavy timbers (only the tie-beams exceed 6 in. × 6 in.),
(iv) the straightness of all the members,
(v) the use of undivided timber for tie-beams, the heart-wood being in the centre of each beam, and
(vi) the relative absence of chamfers.

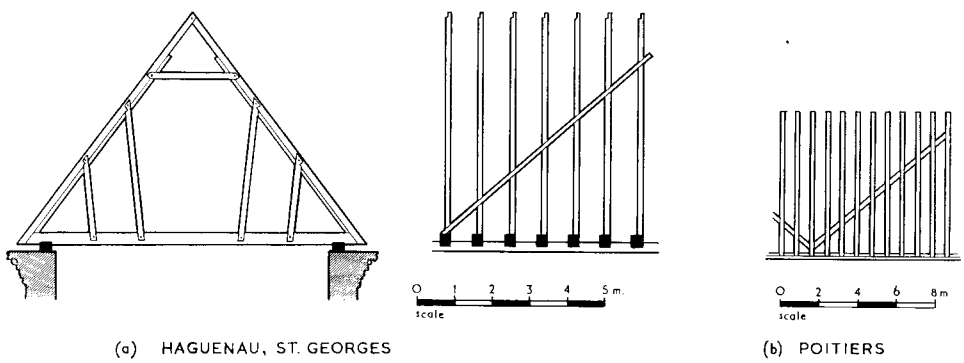


FIG. 46

LONGITUDINAL BRACING IN FRENCH ROOFS (p. 158)

a, Haguenau, St. Georges, nave; *b*, Poitiers Cathedral, choir
After drawings in *Charpentes*, *op. cit.* in note 7

B. ENGLISH

Some English roofs which have the diagonal bracing (scissor-braces, secondary rafters and lateral longitudinal braces) that we have identified with the first post-Romanesque phase, are listed in Table III (see also Addendum, p. 182 f.). They were all given a steep pitch.

TABLE III

ENGLISH ROOFS, POST-ROMANESQUE (DIAGONAL BRACING)

Roof	Approx. date or century	Width spanned in feet	Pitch	Spacing of trusses in inches
A. WITH SCISSOR-BRACES (NO TIE-BEAM)				
Harwell (Berks.), S. transept	1220–1240	16	54°	19
Ely Cathedral, nave	1245	34	58°	30
Blackfriars, Gloucester, S. claustral range	1245–1265	22	53°	26
Lympenhoe (Norfolk), nave	Late 13th(?)	17	57°	21
Merton College, Oxford, chapel choir	1294	30	57°	21
B. WITH SECONDARY RAFTERS				
Fyfield Hall (Essex)[a]	Late 13th	30[b]	51°	—
Stowmarket, Edgar's Farm	Early 14th	20[b]	58°	—
Ely, sextry (tithe) barn	Mid 13th	39½[b]	54°	—
Great Coxwell (Berks.), barn[c]	Mid 13th	38½	57°	—

a. Also has lateral longitudinal braces. *b*. Aisles included. *c*. Also has king-post.

Harwell Church, S. transept (PL. IX, A; FIG. 47). As other roofs in this Berkshire church are used later in this article to illustrate the phases of crown-post roofs, it is appropriate to mention its connexions and setting. It was associated with Oseney Abbey and the Honor of St. Valery, and like many other churches in N. and W. Berkshire[15] was enlarged between 1180 and 1240. The village, some six miles from both Wallingford and Abingdon, was on the main route to the west from Wallingford and lay in an area in which agricultural prosperity was relatively high in the 13th century.

The construction of the present transepts and the addition of the W. tower and aisles formed a series of enlargements, undertaken between 1190 and 1240, to an early Norman church of *c.* 1100. While the roof over the N. transept is a replacement of *c.* 1400, we regard that (FIG. 47) over the S. transept as being original and contemporary with the lancet windows. Its scissor-bracing is not associated with collars, but there is a central purlin, braced from wall-posts at each end of the transept.

Ely Cathedral, nave and choir (PL. IX, B). The roof above the nave was mentioned by the Brandons[16] in 1849 before its 'unsightly' timbers had been hidden from observation below by the boarding inserted by Gilbert Scott in 1857. The Brandons described it as the perfect English example of a trussed-rafter roof

15 C. E. Keyser, *Berks., Bucks. and Oxon. Archaeol. J.*, XII–XXVII (1906–1922).

16 R. and J. A. Brandon, *Open Timber Roofs of the Middle Ages* (1849). The roof is visible in a water-colour of the octagon and nave attributed to J. M. W. Turner.

and referred to the timbers as being 'halved to one another and pinned together with wooden pegs'.

The nave roof (PL. IX, C; FIG. 48) consists of 81 identical trusses, placed at about 30 in. intervals in its length of 203 feet. The timbers, none of which exceed 6 in. × 6 in. in section, are largely the original ones, the occasional replacement and modern packing-pieces being obvious. The rafters, 36 ft. long, are attached to the collars by mortise-and-tenon joints, and to the scissor-braces by notched-laps and barefaced lap-dovetails.[14] The steepness of the pitch (58°) is attributed to the need to span the great width of the nave and to carry the weight of the lead covering.

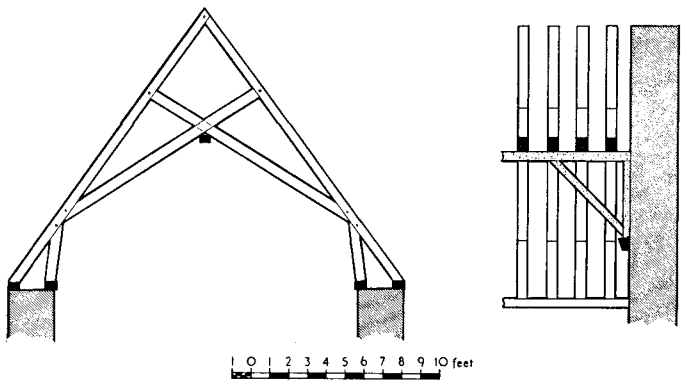


FIG. 47
HARWELL, BERKS.
Scissor-bracing in S. transept of church (p. 160 and Table III)

This Norman nave, although started in the time of Bishop Harvey (1109–1131), was, with the western tower on which it abuts, not completed[17] until the time of Bishop Ridel (1173–1189). Although a timber covering to the nave must have been in existence by 1190, it is almost certain that the present roof was constructed in the time of Bishop Northwold (1229–1254), who built the vaulted six-bay presbytery, which was dedicated in 1252 in the presence of Henry III. A measured drawing of the original roof[18] over the presbytery and choir was made by J. Essex a few years before it was replaced in 1770: it and the existing nave roof were at that time similar, except that over the choir vault there were tie-beams. The reroofing of the nave was probably to enable it to be given a covering of lead (PL. IX, B), this form of covering having been adopted for the new presbytery roof.

While making the measurements, evidence which supports a reroofing of the nave was noticed. There are marks on the masonry of the west tower which

[17] D. J. Stewart, *Architectural History of Ely Cathedral* (1868), pp. 43 and 75.
[18] B.M. Add. MS. 6772, f. 221.

indicate that there had been a roof[19] with a less steep pitch, namely about 50°. Such a roof, if part of the original design, explains both the presence of decorated arches on that part of the tower now hidden by the present roof, and also the existence of Norman corbels. These are no longer functional, as the present roof terminates *on* the walls, an arrangement[20] introduced early in the 13th century and made possible by the use of lead coverings which permitted improved methods for disposing of rainwater.

Blackfriars, Gloucester. This religious house was built[21] between 1241 and 1266.

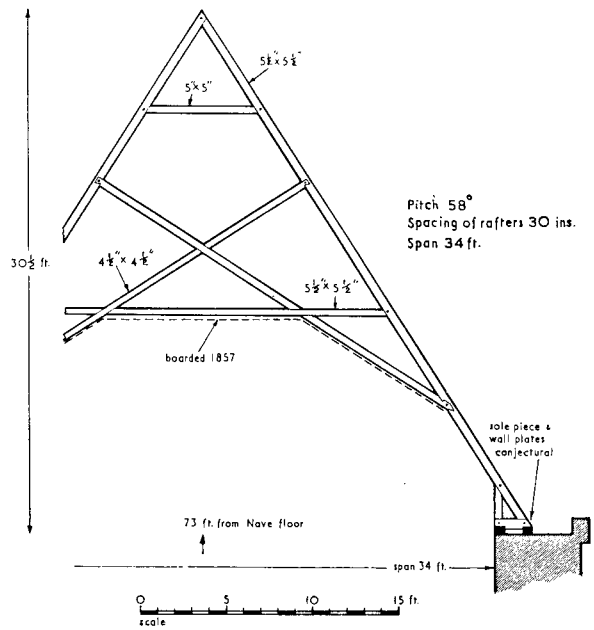


FIG. 48
ELY, CAMBS.
Scissor-bracing in nave of cathedral (p. 161 and Table III)

The buildings were converted in 1539 to domestic and industrial purposes and only the S. range of the cloisters now retains its original roof.[22] The upper part

19 Mr. Reinhard Reuter has informed us (August, 1964) that he has recently noticed that the scissor-braces of the ninth truss from the E. end are reused beams. They may well be two of the rafters of the original Romanesque roof because they have notches to receive lap joints from posts of the type shown in FIG. 43.

20 E. A. Greening Lamborn, *The Story of Architecture in Oxford Stone* (1912), p. 165, places this invention in the latter part of the 13th century; but its employment at Ely and in the cathedrals (*op. cit.* in note 7) of Meaux, Tours and Notre-Dame (Paris) implies that it was introduced soon after 1200.

21 Mr. J. F. Rhodes of the City Museum, Gloucester, has kindly drawn our attention to the records of oaks granted to the friars by the king for timber. These (*Archaeol. J.*, XXXIX (1882), 296) limit the likely date of the building to the period stated.

22 W. H. Knowles, *Trans. Bristol and Glos. Archaeol. Soc.*, LIV (1934), 167. FIG. 49, *a*, is based on fig. 13 of this reference. The dimensions differ in various respects from those in the drawing by J. Buckler of 1820 (J. T. Smith, *op. cit.* in note 2, pl. xiv).

of this range appears to have been used by the Dominicans as study-cubicles, i.e. as a library-chamber. The scissor-braced roof[22] (FIG. 49, *a*) is assembled by mortise-and-tenon joints except for the lower ends of the scissor-braces, which still employed notched-laps. It is significant that roofs of similar construction were used *c.* 1250 in such widely separated cities (FIG. 50, *a*) as Ely and Gloucester; this suggests that crown-post roofs had not come into *general* use in the southern half of England by this date.

Lympenhoe Church, nave. The trusses of this roof with their scissor-bracing and collar were measured and recorded by the Brandons[16] before the restoration of 1881 in which the medieval thatch-covered timbers were replaced. The roof (FIG. 49, *b*) shows one of the several arrangements discussed by Howard[23] for supporting the rafters on the walls, the sole-pieces in this case resting partly on

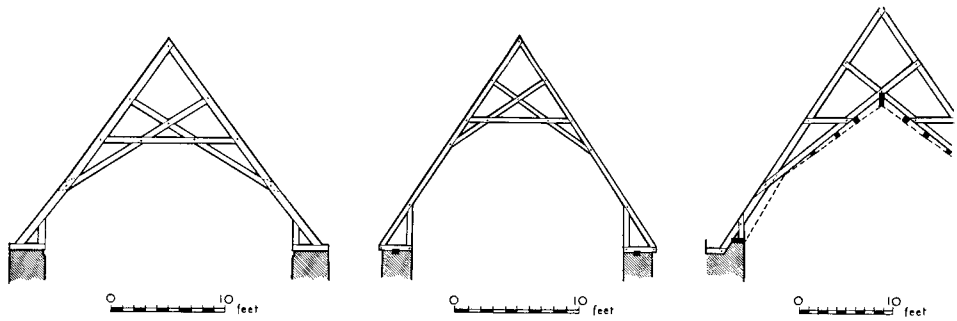


FIG. 49

EXAMPLES OF SCISSOR-BRACING (p. 163 and Table III)

a, Blackfriars, Gloucester, S. claustral range; *b*, Lympenhoe Church (Norfolk), nave; *c*, Merton College, Oxford, chapel choir

the walls and partly on a wall-plate recessed centrally into the wall. The roof truss is also typical of many 13th- and 14th-century church roofs in the manner in which the rafters themselves protrude beyond the walls to form eaves, without the use of sprockets.

Merton College, Oxford, chapel choir. The timber-framing (FIG. 49, *c*) over the boarded ceiling of this choir,[24] 105 ft. long and completed in 1294, indicates that a modified form of scissor-bracing continued to be used for certain major roofs, well after other alternatives had been adopted for 'open roofs'. As in Ely Cathedral, the wide span and the lead covering required a steep pitch.

Fyfield Hall, Essex, and Edgar's Farm, Stowmarket. The medieval aisled halls of these two buildings, separated (FIG. 50, *a*) by a distance of some 40 miles, have been examined and discussed by Smith.[25] They are two of the first domestic examples of secondary rafters to be reported in England. This mode of construction we now know was sometimes used in France from about 1170 to 1240. While

[23] F. E. Howard, *Archaeol. J.*, LXXI (1914), 293.

[24] *City of Oxford* (R. Comm. Hist. Mons., Engl., 1939), p. 76 b.

[25] J. T. Smith, *Archaeol. J.*, CXII (1955), 92; and *Proc. Suffolk Inst. Archaeol.*, XXVII (1958), 54.

this does not mean that these two halls were built in this period, it makes it pertinent to ask whether they belong to the 13th rather than to the 14th century. The *late* 14th-century date ascribed to Fyfield Hall by Clapham has already been revised by Smith to *c.* 1300. Even this date may be rather late, as the roof (FIG. 51, *a*), apart from secondary rafters, has other features—notched joints, flat tie-beams and lateral longitudinal braces—which we have identified as being early.

The roof of Edgar's Farm with its more elaborate mouldings, arched braces and crown-post must be a generation or so later than Fyfield Hall: it illustrates the persistence in Essex and Suffolk of 13th-century traditions that were common to southern England and France.

Ely, sextry (tithe) barn. This massive aisled barn of 11 bays was 220 ft. long. It was measured by Willis[26] just before its demolition in 1842 and was dated from architectural items as mid 13th century. The trusses (FIG. 51, *b*) had secondary rafters and there were two tie-beams to each truss. The two lateral queen-posts[27] carried by the tie-beam are analogous to those in French roofs (discussed in the next section) of the first half of the 13th century. This monastic barn was built about the same time as the roofs above the cathedral nave and choir, provision of the material for the barn being also in the hands of the sacrist (after whose office this barn is named).

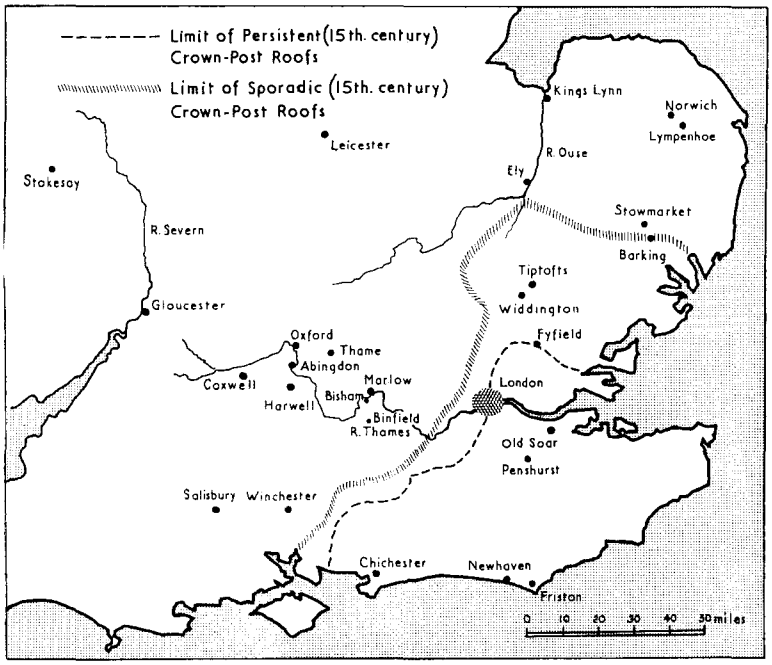
Great Coxwell, barn. This 7-bay, aisled barn,[28,29] 150 ft. long and 40 ft. wide, lies (FIG. 50) at the extreme west of Berkshire. The heavy covering of Stonesfield slate required a steep pitch and effective bracing of the rafters. A 14th-century date, as suggested by Keyser and others, has frequently been repeated in subsequent accounts and references. It was clearly built subsequent to the manor of Great Coxwell being granted by King John to the Cistercian abbey of Beaulieu, and so is later than 1205; its roof (see note 29 for drawings) illustrates the experimentation applied to such large Cistercian barns in the post-Romanesque phase. The problem in these barns was to support the wide roof-span, the overall length from the side walls to the ridge at Coxwell being some 42 feet. As in the barn at Parçay-Meslay (1211–1227) described by Horn,[29] this is achieved at Great Coxwell by the use of several side purlins; these are supported (PL. IX, D) by a variety of braces and struts, and are clasped between the rafters proper and secondary rafters employed with each tie-beam truss. There are, however, intermediate trusses which enable support to be given to the side purlins at 10–11 ft. intervals; these open trusses have the cruck form below the arcade plate, while the secondary rafter above the arcade plate is supported on a small hammer-beam. Here in the same building are the two items, the base cruck and the secondary rafter, from which the English invention of the short principal rafter may have been evolved in the 13th century.

26 R. Willis, *Proc. Cambridge Antiq. Soc.*, I (1843). See also *op. cit.* in note 40.

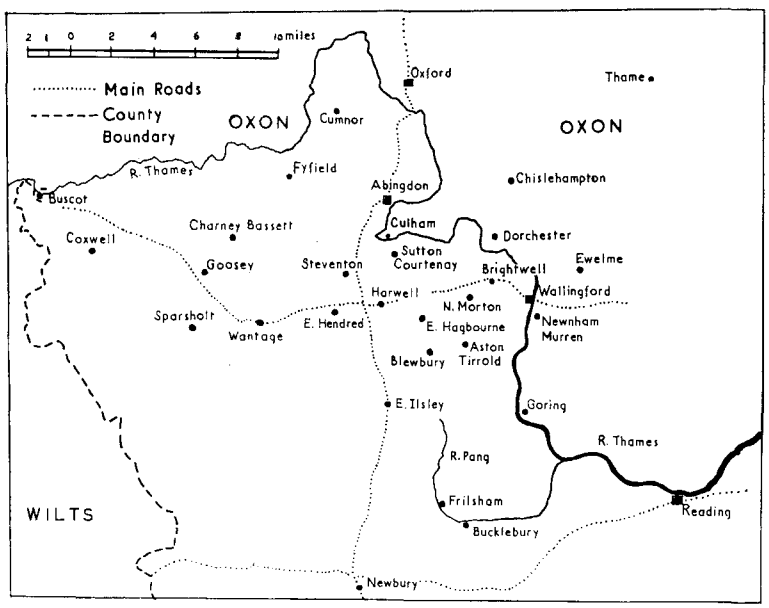
27 This type of early queen-post, which supports directly a longitudinal purlin, must not be confused with the more usual queen-post which appeared in the 15th century and later became so prevalent.

28 *Berks., Bucks. and Oxon. Archaeol. J.*, XIII (1907), 61, and XXVI (1920), 4.

29 *Op. cit.* in note 2, fig. 5, and W. Horn, *J. Soc. Archit. Historians*, XVII (1958), 2, figs. 22–23. Horn *op. cit.*, discusses other early barns.



a

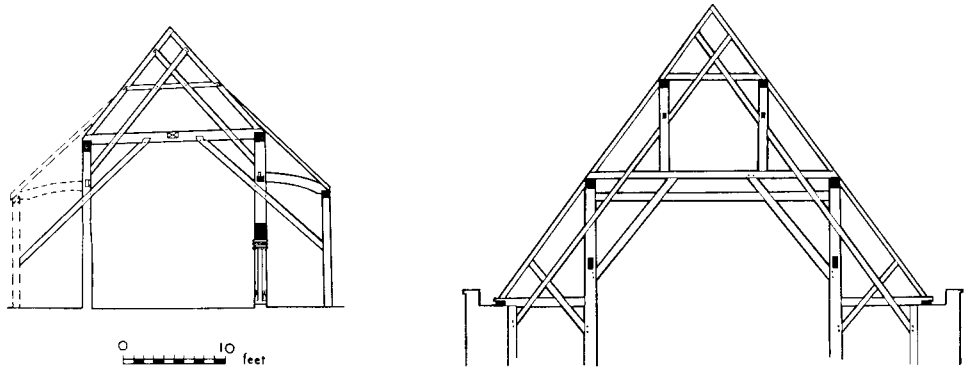


b

FIG. 50

a, Map of SE. England showing limits of crown-post roofs in 15th century (p. 180); *b*, Map of N. Berkshire region showing locations of crown-post roofs (pp. 168 ff. and Tables IV–VI)

The lack of sophistication of the Coxwell barn in comparison with the sextry barn at Ely may represent a somewhat earlier date or merely arise from the difference in geographical location. There are a number of features which suggest a date no later than the mid 13th century:[29a] these include (*i*) the straightness of the braces; (*ii*) the short unstrutted king-post between the collar and ridge; and (*iii*) the use of reversed-assembly,[14] that is the arcade plates lie above, not below, the tie-beams. It is also to be noted that the buttresses are similar to one of *c.* 1260 at Beaulieu Abbey[30] and to others of *c.* 1240 in Great Coxwell Church.



(a) FYFIELD HALL (b) ELY, SEXTRY BARN

FIG. 51
EXAMPLES OF SECONDARY RAFTERS (p. 163 f. and Table III)
a, Fyfield Hall, Essex; *b*, Sextry barn, Ely, Cambs. Sc. applies to *a* and *b*
After Smith, *op. cit.* in note 25, and Willis, *op. cit.* in note 26

KING- AND CROWN-POST ROOFS

A. CONTINENTAL

Early in the 13th century French roofs show an increasing use of purlins, carried sometimes on the collars and sometimes under the collars, in association with king- or crown-posts. Some examples, associated with scissor-bracing, have already been listed in Table II. Usually, as at Etampes (FIG. 45, *b*) the purlins are central, but quite frequently,[7] as over the west part of the nave at St. Nicholas, Haguenau (FIG. 52, *a*), there are two purlins placed symmetrically at each side over queen-posts of the type that occurred in the sextry barn at Ely: this variation is but another instance of the persistence of the vertical posts of the Romanesque roof.

In France, the king-post became more usual than the crown-post and remained in general use for several centuries. The period at which its introduction occurred is indicated in the church, La Madeleine, at Troyes:[7] here it was used

29a W. Horn and E. Bonn, *The Barns of the Abbey of Beaulieu and its Granges of Great Coxwell and Beaulieu St. Leonard* (Univ. of California Press, 1964), assign the barn to the early part of the 13th century.

30 J. H. Parker, *Introduction to Gothic Architecture* (1925), fig. 113.

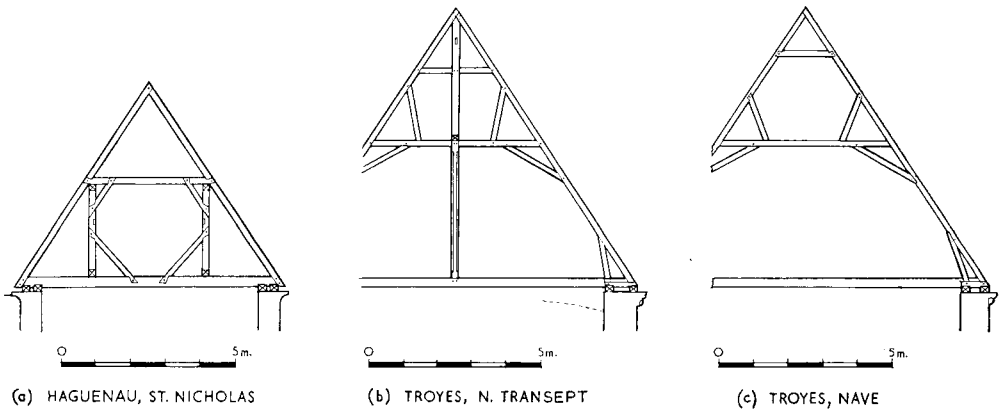


FIG. 52

FRENCH ROOFS SHOWING LATERAL (QUEEN-)POSTS (*a*) AND INTRODUCTION OF KING-POSTS (*b* and *c*) (pp. 166, 168)

a, Haguenau, St. Nicholas, nave; *b*, Troyes, La Madeleine, N. transept, *c.* 1230; *c*, Troyes, La Madeleine, nave, *c.* 1195
After drawings in *Charpentes, op. cit.* in note 7

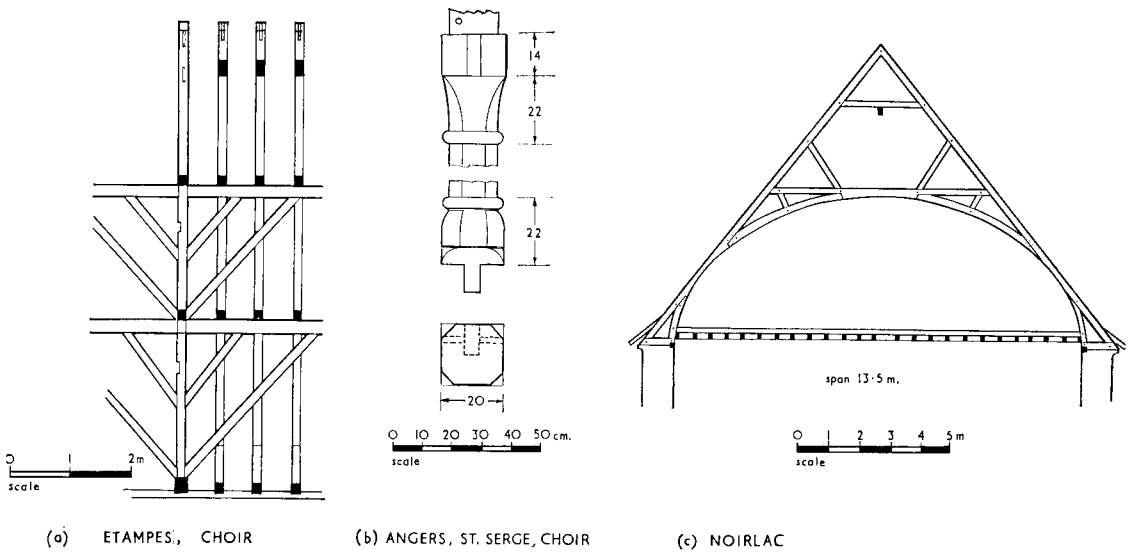


FIG. 53

FRENCH ROOFS SHOWING DETAILS OF KING- AND CROWN-POSTS (*a* and *b*) AND USE OF CURVED BRACES (*c*) (p. 168)

a, Etampes, choir, longitudinal section; *b*, Angers, St. Serge, choir, *c.* 1210; *c*, Abbaye de Noirlac, lay brothers' dormitory, *c.* 1250
After drawings in *Charpentes, op. cit.* in note 7

c. 1230 in the roof over the N. transept (FIG. 52, *b*), whereas it had not been used *c.* 1195 in the nave roof (FIG. 52, *c*), otherwise similar. This king-post roof at Troyes contains no halved or notched-lap joints and it is noteworthy that the lower part of the king-post is already chamfered.

The four-way braces which are so characteristic of English crown-post roofs were not so customary on the continent, where in the first half of the 13th century a large variety of bracing was employed. Thus, from the king-posts at Troyes (FIG. 52, *b*) there are no braces, while from each of those at Etampes[7] (FIGS. 45, *b* and 53, *a*) there are as many as twelve, two to each collar and four to each purlin.

Troyes is not an isolated example of the adaptation of early king- and queen-posts for decoration; chamfered (almost octagonal) posts[7] were used at Angers before 1200 in the Musée St. Jean (FIG. 44, *a*) and *c.* 1210 in the choir of St. Serge; in the latter they are associated with moulded capitals and bases (FIG. 53, *b*).

Another feature of interest in relation to contemporary roofs in England is the date of the appearance of curved members in substitution for the traditional straight braces. This occurred in France shortly after 1250, there being examples[7] of this period at the abbey of Noirlac (FIG. 53, *c*) and in the Department of Yonne.

B. ENGLISH

Whereas the forms taken by diagonal bracing have been shown earlier in this paper to have been similar on both sides of the English Channel in the early post-Romanesque phase, the rather later king- and crown-post bracing shows a divergence between the forms used in England and in France. The English forms are here traced largely by reference to two areas, the N. Berkshire region and Ely, both of which have already provided us with examples of scissor-bracing. These places (FIG. 50, *a*) though some 100 miles apart, are similar both in being on the fringe of the midlands and in lying just on the inside of the arc of the chalk band which curves across southern and eastern England.

At the beginning of the 13th century, the N. Berkshire region[31] and the areas adjacent to it (FIG. 50, *b*) included three important centres: Wallingford, with its royal residence; Abingdon, with its monastic influence; and Oxford—already a centre of learning—with its abbeys of Oseney and St. Frideswide. The area was free from wars from the time of Stephen until the Civil War, and the substantial enlargement of many of the village churches in the early and middle 13th century can be attributed to the agricultural prosperity of the region. Yet the number of crown-post roofs that have survived in the churches are relatively few. Apart from natural decay and the need for replacements, two other factors have contributed to their present rarity:

1. The darkness of the early naves was later relieved by adding clerestories. The original roofs were therefore often replaced, as at East Hagbourne and Sutton Courtenay, by roofs in the Perpendicular style.

[31] See E. M. Jope in *Culture and Environment* (ed. I. Ll. Foster and L. Alcock, 1963), p. 339.

2. There were occasions when the rafters were merely braced by collars and struts and no longitudinal support was provided. This arrangement, a simplification of scissor-bracing, was used in the chapel (*c.* 1240) of the prebendal house[32,33] at Thame, Oxon.; and in the chancel (*c.* 1270) of St. Giles's, Oxford, where the roof (PL. X, A) is now canted as a result of the absence of such support.

The three phases (I–III) of crown-post roofs which can be recognized from a study of ecclesiastical and other buildings are given in Table IV. In the two areas considered, crown-post roofs were being replaced early in phase III by the double-framed form which employed principal rafters, side purlins and wind-braces. This form was already being employed *c.* 1290 at Stokesay Castle (PL. XV, A).[34, 35]

TABLE IV

PHASES OF ENGLISH CROWN-POST ROOFS

Phase	Approx. period	Characteristics		Examples
		Crown-post	Tie-beam	
I	1220–1280	Square or chamfered Braces straight	Uncambered Almost square in section	Harwell, nave Salisbury, Old Deanery
II	1280–1310	Long and octagonal Mouldings to cap and base	Slight camber Roll mouldings	Harwell, chancel Charney Bassett, manor Ely, Black Hostry Sutton Courtenay, abbey grange
III	1310–1360	Short. Braces often curved	Well-cambered Made of divided balks	Blewbury, S. chapel Bisham Abbey Harwell, Brounz's Manor

PHASE I, 1220–1280

Harwell Church, nave. The features of phase I are illustrated by the well-preserved, 4-bay roof (PL. X, B; FIG. 54) over the nave of this church, to which reference has already been made above. The construction of the roof can be placed at the completion (1220–1240) of the sequence of changes (*supra*, p. 160) made to the nave and crossing of this church. The roof, at one time boarded, consists almost entirely of the original timbers. Howard[23] used a measured drawing of this roof to illustrate 'beam roofs with king-post and braced rafters': but he did not record one important item, the prominent jowls on one side of each crown-post. These give additional strength by providing a joint between *each* pair of the three members—post, purlin and collar—which meet at the head of the post.

32 M. E. Wood, *op. cit.* in note 4, pl. iv. The roof is probably the original one.

33 *Archaeol. J.*, LXVII (1910), 319–396.

34 R. A. Cordingley, *The Art Bulletin*, XLV (1963), 91.

35 Some of the features of the double-framed form were already being used for the barn at Great Coxwell: also, it has now been found that the short principal with wind-braces was used *c.* 1260 at the Old Deanery, Salisbury (N. Drinkwater, *Antiq. J.*, XLIV (1964), 41). This roof also includes crown-posts which have the characteristics of phase I; a modified form of scissor-bracing; two collars per truss; king-posts adjacent to the louvres; and horizontal corner braces.

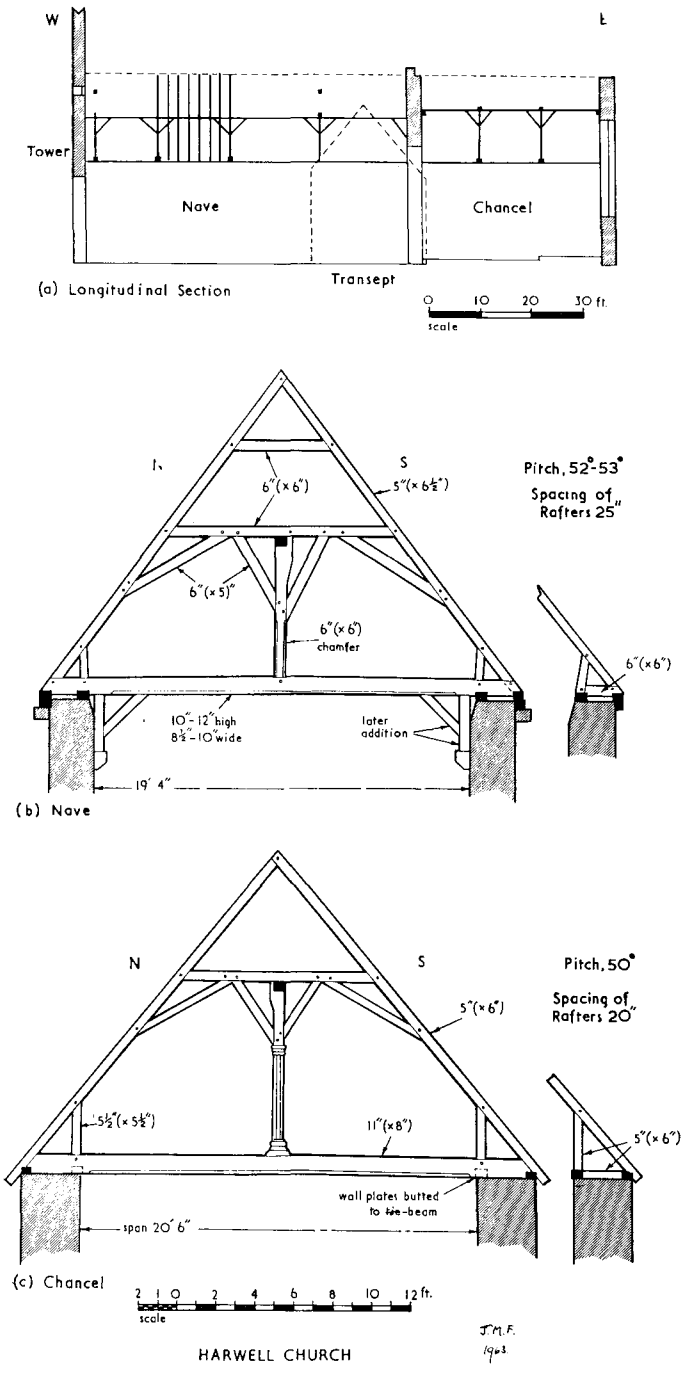


FIG. 54

HARWELL CHURCH, BERKS. (pp. 169, 171 ff. and Table IV)

a, Longitudinal section through nave and chancel;
b, Crown-post roof in nave, *c.* 1220; *c*, Crown-post roof in chancel, *c.* 1305

Such jowls were often used up to *c.* 1320 in Harwell and the immediate vicinity, there being examples in the chancel of the church and at Middle Farm (*infra*, p. 177), and also at the 'Priory' and 107 The Causeway (the Old Vicarage) in the near-by village of Steventon.[36] In Sussex, jowled crown-posts occur in roofs (probably of the second half of the 13th century) over the apse of St. Michael's, Meeching (*alias* Newhaven), and over the chancel (FIG. 55) of Friston Church. A

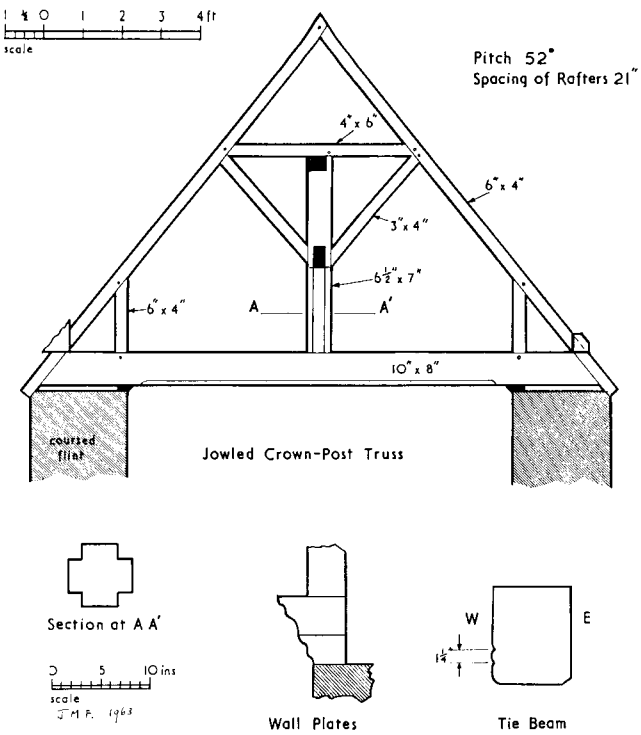


FIG. 55
FRISTON CHURCH, SUSSEX
Crown-post roof in chancel (p. 171)

rather different treatment of the same principle was employed at Etampes (FIG. 45, *b*) and at Tiptofts Hall, Essex (FIG. 56), the head of the king- or crown-post being made to clasp the purlin, thus making a shallow jowl on *both* sides of the post.

Other points of interest shown by the roof of Harwell's nave are: (*i*) the use of two collars between each pair of rafters (cf. FIG. 52, *b*); (*ii*) the shortness and inward slope of the ashlars, showing that they had not yet been developed to their

36 S. E. Rigold, *Trans. Newbury and Dist. Field Club*, x (1958), 4. The second of these two houses is there referred to as the Old Parsonage.

full potential as structural members; and (*iii*) the presence of chamfers on both the tie-beams and the lower part of the crown-posts.

Other churches in the N. Berkshire region. We have examined, with the help of the accounts[15] by Keyser and plates by Adams, some 50 church roofs in this region; there is not one with an original crown-post roof comparable to that over the nave at Harwell, although that over the nave of North Moreton Church, reroofed in 1857 by Street, is probably a copy of the mid 13th-century roof.

There are, however, a few medieval crown-post roofs consisting of undecorated posts usually with braces to the purlin only, which we are unable to date with any accuracy but which probably belong to phase I or II. An example (PL. XI, A) is that over the nave at Newnham Murren, Oxon., a small church near Wallingford and less than a mile from the Berkshire boundary; this roof,[23] which includes one cusped brace, may be contemporary with the changes, of which the windows bear evidence, made to the church *c.* 1260. Other examples, fragmentary owing to replacements, are listed in Table V: the parts of the churches in which the crown-post roofs occur have early or middle 13th-century architectural features. Some of the posts are in two parts; that is there is a division just below the point from which the braces spring: this may have been part of the original design or have resulted from a restoration.

TABLE V

FRAGMENTS OF CROWN-POST ROOFS, PROBABLY 13TH-CENTURY, IN N. BERKSHIRE CHURCHES

Roof	Crown-posts	Replacements
Goosey, nave	Plain (PL. XI, B)	Tie-beams
E. Ilsley, nave[a]	Long and narrow (PL. XI, C)	Tie-beams
E. Ilsley, chancel[a]	One, with 2 braces	Collar-purlin and crown-post
Aston Tirrold, S. transept	One, with no braces	
Buscot, chancel[a]	One, with 4 braces: lower part is a separate post (PL. XI, D)	
Bucklebury, nave[a]	Three, each with 4 braces	Tie-beams

a. Roof now ceiled.

PHASE II, 1280–1310

In this phase there was considerable domestic as well as church building, the latter being directed to the enlargement of chancels and the provision of lofty aisles. Crown-post roofs were adapted to the artistic decorations which prevailed: wall-plates, cornices and tie-beams were moulded, and the long crown-posts were made octagonal and given moulded caps and bases.

Harwell Church, chancel. We have been able to date the E. window of this chancel within a year or two of 1305 by the armorial shields that were in the E. window: one of the shields, that of Gaveston, remains. Although there are architectural items in the chancel characteristic of the 13th century, we assume that the E. window is contemporary with the roof. This roof (PL. X, C; FIG. 54), by comparison with that of the nave, shows some of the features which emerged in this second phase: thus the crown-posts (PL. XII, D) are octagonal in section and

moulded, the jowls reduced in size, and the ashlars high and carried in front of the walls on cornices which have roll mouldings. The span and pitch of the chancel roof are almost the same as that of the nave, but there is only one collar per truss and the rafters are of smaller dimensions and closer together. The domestic roof at Old Soar,[37] Plaxtol, Kent, dated *c.* 1290, is similar.

Viewed from the nave, the tie-beams and crown-posts of this roof present a

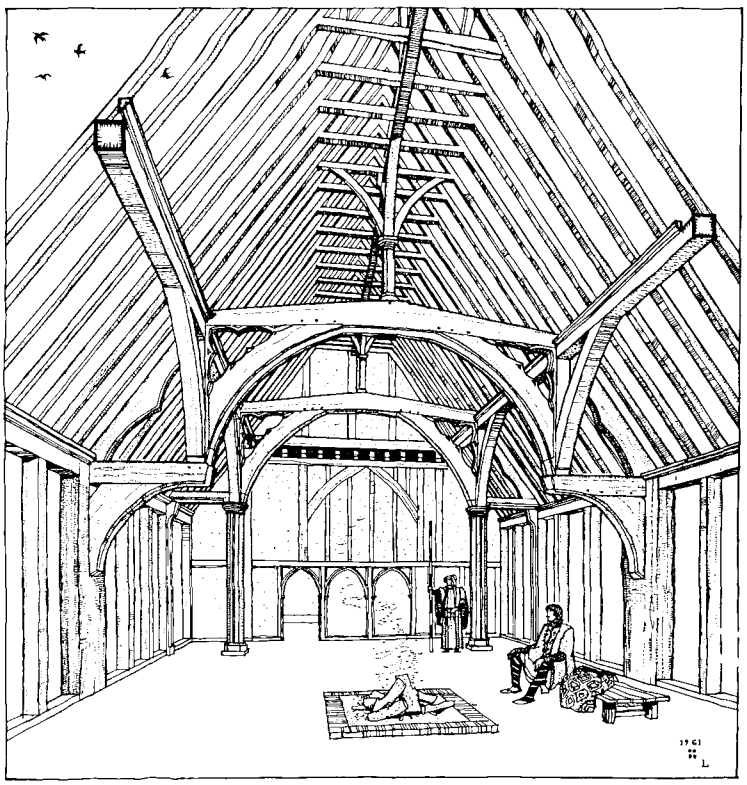


FIG. 56
TIPTOFTS HALL, ESSEX
Reconstruction showing early 14th-century crown-post roof (pp. 171, 174)

prominent silhouette against the large E. window with its decorated tracery. Perhaps because of this disadvantage, crown-posts were frequently omitted in chancel roofs from this time onwards.

Charney Bassett and Sutton Courtenay. In both of these Berkshire villages, Abingdon Abbey had a grange, details of which are well recorded. Both included a stone-walled, two-storied unit, now the solar, with a crown-post roof of three bays.

In the manor at Charney Bassett, dated *c.* 1280,[38] the lateral braces from

37 M. E. Wood, *op. cit.* in note 4, p. 36.
38 M. E. Wood, *op. cit.* in note 4, p. 8, pl. iv.

the crown-posts terminate on the collar-braces (here particularly long) and not on the actual collars. The crown-posts themselves are divided into two parts, the upper part with its braces resting on the capital of the lower part.

In the grange at Sutton Courtenay, the crown-post roof in the solar wing has a span of 17 ft. 8 in., the bays being 15 ft. long. The presence of a 3-ft.-thick stone wall on the S. (hall) side as well as on the N. side suggests that this unit had at first an independent existence. Although now ceiled, the appearance of the open timbered roof was recorded by Turner and Parker.[39] The octagonal crown-posts have mouldings similar to those in the chancel (FIG. 54, *c*) of Harwell Church, some 4 miles away, and the flowing tracery of the windows belongs to the same period as those in the Harwell chancel. A likely date for this unit is *c.* 1300.

The ground-floor hall, of two bays and screens-passage, was probably built a few years later than the N. (solar) wing: it is included here, but its roof belongs more to phase III than to phase II. Illustrations of the interior and roof of this hall have hitherto been limited to Jewitt's woodcuts of 1840 used by Turner and Parker[39] and others.[2,33] Measured drawings (FIG. 57) and photographs (PL. XII, A) show the sophistication of the arch-braced lower collar and the short crown-post of the central truss: but the bracing at the screens-passage (spere-truss) end of the hall resembles late 13th-century work. The massive side purlins (still square to the vertical, cf. arcade plates) are supported at the central truss by wide cruck-type blades (short principals[2]) which rest on the stone walls. Above each of the side purlins are short *upper* ashlars, carried by a cornice. This hall has much in common with that at the timber-framed house, Tiptofts (PL. XII, B; FIG. 56), the main difference being the use of hammer-beams to support the side purlins at the latter.

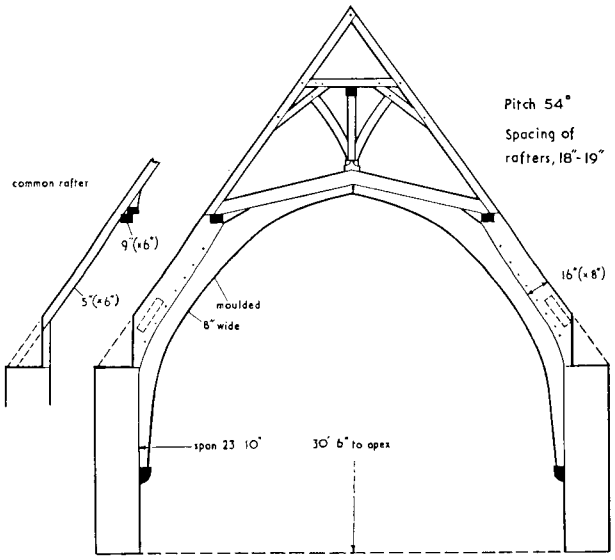
Ely, Black Hostry. This monastic building (PL. IX, B), 44 ft. long and 21 ft. wide, was used for the accommodation of visiting Benedictine monks.[40] It has ground-floor walls of stone, but above, there is stone walling on the north side, timber-framing on the south. The building, apart from the early 13th-century undercroft which occupies one end of the ground floor, has been attributed by Atkinson to that recorded as being built in 1291–2 for £31 9s. 10¼d. The 5-bay crown-post roof (FIG. 58, *a*), now ceiled above the collars, includes the original partition truss[41] in which there are braces from the crown-post *down* to the tie-beam. The longitudinal braces from the crown-posts support the central purlin effectively by springing from the base of the posts. This roof is similar to those in the solar wings at the Benedictine granges of Charney Bassett and Sutton Courtenay, discussed above. A relaxation of the rule[42] which hitherto had confined Benedictine monks to their house may have been one reason for the new building about this time at the granges of Abingdon Abbey and for this hostry at Ely.

39 *Op. cit.* in note 3, II.

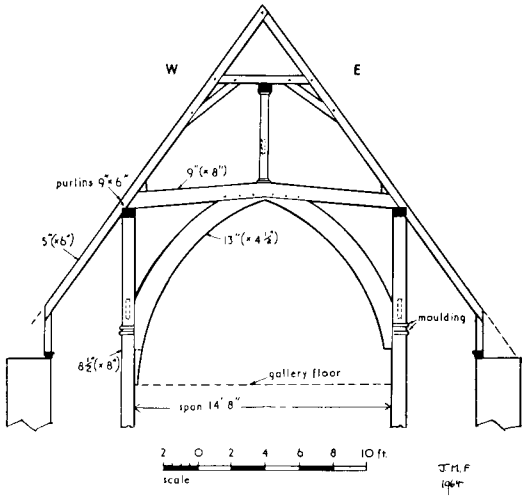
40 T. D. Atkinson, *Monastic Buildings of Ely* (1933).

41 There are sufficient carpenters' marks on the struts to show that all 5 bays and the partition, which provides separate areas with three and two bays respectively, were contemporary.

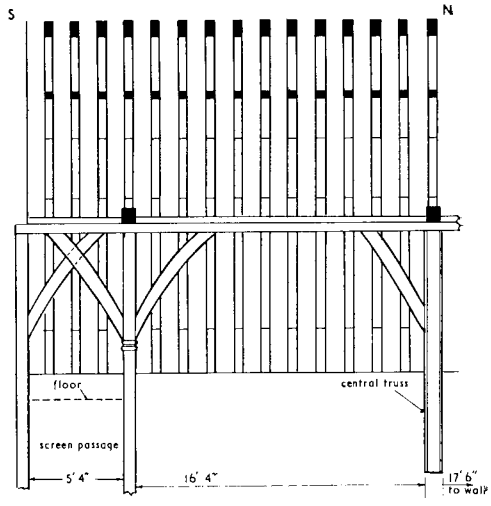
42 At Ely (*op. cit.* in note 40, p. 121) in 1287 the monks were permitted to spend a day and night in convalescence outside the monastery after their six-weekly blood-letting.



(a) CENTRAL TRUSS



(b) AISLED TRUSS AT SOUTH END



(c) LONGITUDINAL SECTION, LOOKING WEST

FIG. 57

SUTTON COURTENAY, BERKS.

Roof of hall of abbey grange, *c.* 1310 (p. 173 f. and Tables IV and VI)

Merton College, Oxford, Warden's Hall. This 2-bay hall[43] is now dated *c.* 1280. The roof (PLS. XII, C, and XIII, A) is unusual on account of: (*i*) its two-tiered structure, there being lateral (queen-) posts on the tie-beams, and crown-posts on lower collars; (*ii*) its profusion of pyramid stops, as at Fyfield Hall, Essex,[25] and (*iii*) the presence of horizontal corner braces,[44] to be seen in PL. XIII, A, between the side

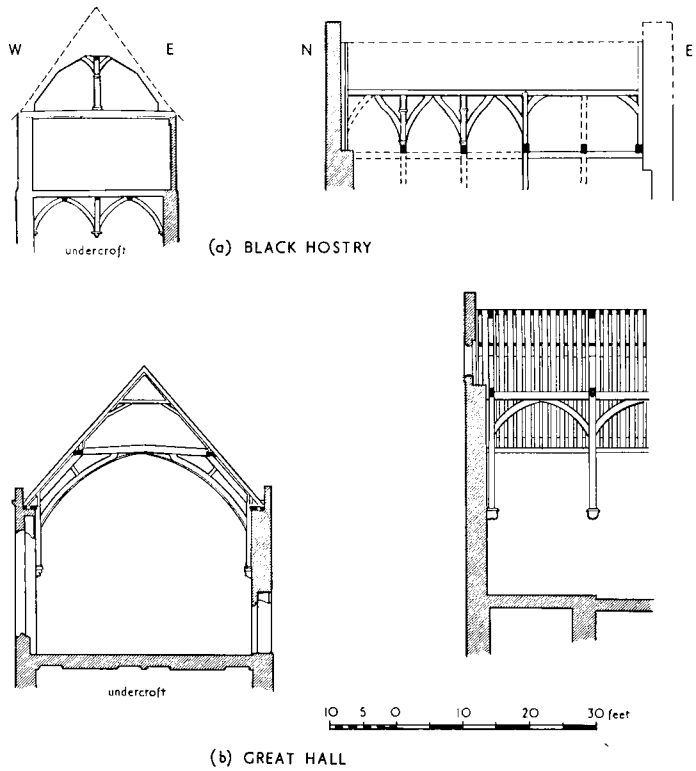


FIG. 58
ELY, CAMBS.
a, Black Hostry, 1291, showing crown-posts of phase II (p. 174 and Table IV); *b*, Great hall, *c.* 1330, showing principal rafters (p. 179)
After Atkinson, *op. cit.* in note 40, plans sheet XV

purlins and collars. A close examination of the roof and the preparation of line-drawings has raised a number of questions[45] which it is inappropriate to discuss in this paper. The evidence suggests that there was an earlier roof, perhaps part

43 W. A. Pantin, *Med. Archaeol.*, VI–VII (1962–3), 209. The crown-post roof at 26 Ship Street, Oxford (*Bodl. Dep. a. 25*, foll. 55–61) also has the characteristics of phase II while that at Camoise Court, Chisle-hampton (*V.C.H. Oxon.*, VII (1962), 7) is rather later, *c.* 1315, and may be regarded as transitional between phases II and III.

44 Similar corner braces occur in the S. wing of Middle Farm, Harwell; at Wellshead Farm, Harwell; and at the 'Priory' and 39 The Causeway, Steventon. These examples are likely to be a generation or two later than the date of *c.* 1260 for the Old Deanery, Salisbury, where they also occur (see note 35).

45 We hope to publish an account of this roof, with drawings, elsewhere.

of a first-floor range built by Master Robert Flixthorp between 1251 and 1268, which was later reroofed by the college in a style appropriate for a ground-floor hall for the warden.

Harwell, Brounz's Manor (*Middle Farm*). This H-shaped manor retains no less than nine original crown-post trusses. It is of interest in relation to the evolution of crown-post structures as it contains the remnants of a ground-floor hall with a crown-post roof of phase II, which some 50 years later was made part of the service wing for a more pretentious hall of phase III. A similar development occurred at Tiptofts.

The earlier structure, built *c.* 1300 when the Bayllol family[46] held the tenement, was a 4-bay structure, the end bays being short and partitioned from the 2-bay hall. The crown-post (PL. XIII, B) at the western partition (the partition itself was removed earlier this century) resembles that at the Black Hostry, Ely; in the centre of what was the hall there is a slightly cambered, chamfered, tie-beam (square in section) on which sits a crown-post (PL. XIII, C) with a short base and with four chamfered struts. Three horizontal corner braces survive.

The later hall, which was ceiled in 1589, has an embattled tie-beam and crown-post structure (PL. XIII, D): it can be attributed to Richard Brounz[46] who acquired the manor *c.* 1350 and became sheriff of Berks. and Oxon. in 1381. His additions may also have included the N. wing; this is of four bays and has a well-preserved roof with cambered tie-beams (made of divided balks) on which are jowled crown-posts with the short bases typical of phase III.

PHASE III, 1310–1360

The vigorous Edwardian developments in roof-construction reached their peak in this phase.

There was an important technical advance by which tie-beams (or lower collars) were often no longer square, with the heart-wood in the centre of the beam, but of rectangular cross-section, the height being considerably greater than the width. The change was made possible by the lateral division of wide balks of wood. This gave two or sometimes three tie-beams (or collars) of identical length and camber. The pit-saws with which the wood was cut were essential for the provision of the thin curved wind-braces which occur as an adjunct to principal rafters at the end of the 13th century. The number of pit-saws suitable for cutting heavy beams must have increased considerably from *c.* 1300 onwards. Henceforth, divided beams became commonplace (see Table VI for examples); they were even used in the cruck-blades of domestic buildings.[47]

We have noticed that by the end of phase II, tie-beams and long crown-posts were becoming visually unsatisfactory in the chancels of churches; equally they were an encumbrance[2] in the domestic halls which were becoming increasingly popular. When crown-posts were used, they therefore tended to be short, as in the central truss (FIG. 57) of the hall at the abbey grange, Sutton Courtenay. As the

[46] J. M. Fletcher, *Harlequin* (Atomic Energy Research Establishment, Spring, 1962). It is hoped to publish measured drawings and details of this and other medieval houses in Harwell shortly.

[47] J. M. Fletcher, *Oxoniensia*, XXVI–XXVII (1961–2), 207.

roofs of such halls were supported by side purlins with wind-braces between them and the principals, it was only a matter of time before the structural significance of the crown-post and its central purlin was questioned. Although crown-post roofs continued in N. Berkshire throughout this phase, some of the more important roofs followed the style used *c.* 1290 at Stokesay Castle (PL. XV, A), in which the crown-post and the central purlin were eliminated as unnecessary. At the same time the side purlins, which at first had been set flat, like their ancestors[2] the arcade plates, were given their logical setting, namely in a position parallel to the rafters. Two examples are as follows:

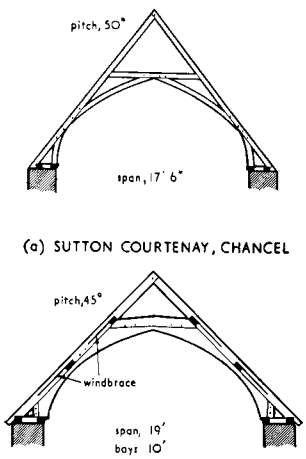


FIG. 59
14th- AND 15th-CENTURY ROOFS
a, Sutton Courtenay, Berks., with arched ashlars and braces, *c.* 1330 (p. 178 and Table VI); *b*, Ewelme, Oxon., showing 15th-century use of arch-braced collars with principals (p. 181). After Howard, *op. cit.* in note 23, figs. 15 and 18

Abingdon Abbey chequer and Fyfield Manor (Berks.). The reroofing (PL. XV, C) applied *c.* 1340 in the creation of the chequer[48, 49] at Abingdon Abbey and the roof (PL. XV, B) over the solar of Fyfield Manor[15, 50] show variants of the new arrangement. The solar, probably a rebuilding of an earlier one, is not later than 1340 and may be a decade earlier, i.e. the work may have been completed and the room ready for occupation at the time when Elizabeth, the heiress of the Fyfields, married, *c.* 1336, Sir John Golafre. The massiveness of the Fyfield roof and its cusped wind-braces show the west-midlands influence. Its tie-beams are of the divided type that we have discussed above and the position of its queen-posts reflects experimentation.

In this phase, three main types of roofing can therefore be recognized in Berkshire. They are:

1. Chancel roofs with uniform rafters (but with no crown-posts) such as were sometimes used in the 13th century (PL. X, A); these were often made elegant by curved ashlars and braces (FIG. 59, *a*).
2. Roofs with short crown-posts in churches, halls, etc.
3. Roofs with arch-braced collars and with side purlins (the latter carried by short principals to which they are also joined by wind-braces) but with no crown-posts.

Examples of the three types are given in Table VI, their geographical positions being shown in FIG. 50, *b*.

48 We assume that this reroofing was done when the first floor, Abbott's Hall, built *c.* 1260, was divided laterally to make two rooms. For details of the building, see *opp. citt.* in notes 4 and 33. Buckler used the term Abbott's Hall in his drawing B.M. Add. MS. 36356, f. 86.

49 The chancel roof (PL. XV, D) of the chapel at Goosey (it and the manor belonged to Abingdon Abbey) is similar and probably of the same date; there are decorated panels on the wall-plates which support the roof.

50 *Country Life*, 5 April 1919, p. 368. It can be seen in the attic above the solar that several original rafters have survived: those at the tie-beam trusses are rather larger than the common rafters.

TABLE VI

ROOF TYPES OF PHASE III, 1310–1360, IN BERKSHIRE

	Roof	Date or century	FIG. or PL.	Note
1. *Chancels, uniform rafters, closely spaced and braced to collars*	Sutton Courtenay[a]	Early 14th	FIG. 59,*a*	15, 23
	E. Hendred	Early 14th		23
	Brightwell	*c.* 1330		15
	Binfield[a]	*c.* 1340		
2. *Short crown-posts*				
(a) In churches over cambered tie-beams placed on high stone walls	E. Hendred, nave[b]	*c.* 1330	PL. XIV, A	15
	Blewbury, lady chapel[c]	*c.* 1330	PL. XIV, D	
(b) In halls over arch-braced, lower collars supported on short principals	Sutton Courtenay, abbey grange	*c.* 1315	FIG. 57	
	Bisham Abbey, Montagu's Great Chamber[c]	1340(?)	PL. XIV, C	51
	Harwell, Brounz's Manor hall[c]	Mid 14th	PL. XIII, D	46
(c) Over cambered (or horizontal) tie-beam in timber-framed buildings	Steventon, 'Priory'[c]	Early 14th		36, 44
	Harwell, Wellshead Farm[c] and Brounz's Manor, N. wing[c]	Early to mid 14th		46
	Long Wittenham, church porch	Mid 14th		23
3. *Principals and wind-braces, without crown-posts*	Fyfield Manor, solar[c]	*c.* 1335	PL. XV, C	15, 50
	Abingdon, chequer[c]	*c.* 1340	PL. XV, B	48
	Goosey, chancel[c]	*c.* 1340	PL. XV, D	49
	Steventon, 39 The Causeway	Mid 14th		36, 52

a. Wagon-shaped, i.e. with curved ashlars and braces.
b. Reroofed when clerestory added.
c. Tie-beams (or lower collars) made of divided timbers.

Ely. We are not aware of any short crown-posts of phase III at Ely, but examples occur in East Anglia, e.g. over the nave of Barking Church[53] in Suffolk. The advent of short principals and highly cambered collars occurred at Ely about the same time as in N. Berkshire. They were used when the great (or guest) hall (FIG. 58, *b*)[40] was remodelled and reroofed *c.* 1330, and slightly later in the mansard roof of the prior's new (small) hall.[40] There is, however, a relatively late crown-post (FIG. 60) over the stone-walled, 167 ft. long, monastic barn, which is now the dining hall of the King's School. Atkinson[40] attributes this barn to the last quarter of the 14th century. The downward braces from the crown-posts are parallel to the rafters and therefore echo the secondary rafters used in the sextry barn in the previous century.

ROOFS FROM 1360 ONWARDS

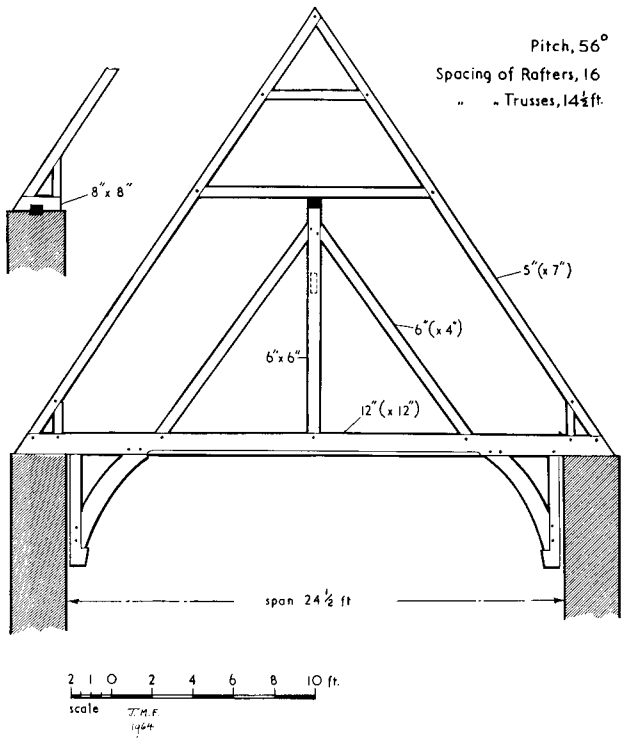
The Black Death and the events which succeeded it had a pronounced effect on building. The attack of 1361 seems to have been particularly severe in the N.

51 *Country Life*, 12 April 1941, p. 320, and *Berks. Archaeol. J.*, XLIV (1940), 101. The crown-post roof at the near-by Old Parsonage, Marlow (Bucks.) is similar, see M. E. Wood, *J. Brit. Archaeol. Assn.*, XI, (1949), 53.

52 This has a crown-post on the north gable.

53 F. H. Crossley, *op. cit.* in note 1, pl. liv, and N. Pevsner, *Suffolk* (Buildings of England series, 1961), pl. xviii, *a*.

Berkshire region, and we are not aware of any building (the library at Merton, and New College, Oxford, excepted) which can be dated with any certainty between 1360 and 1390. Building traditions were frozen for a generation or more, and, when construction restarted, whatever local traditions had prevailed about 1350 were followed. Thus crown-post roofs were built in the south-eastern counties in the 15th century because this was an area to which the use of principal



ELY, MONASTIC BARN

FIG. 60

ELY, CAMBS.

Crown-post roof in vernacular building of *c.* 1380 (p. 179). The roof has ten bays.

rafters had not penetrated by 1350. The extent of this penetration is therefore indicated by the shorter line in FIG. 50, *a*, this line being the boundary of persistent crown-post roofs in the 15th century.[54]

The very occasional crown-post roofs of 1360 onwards that are found in the two areas considered are essentially vernacular. Mention has been made above of one in a barn at Ely. Another, in the 8-bay *necessarium* (PL. XIV, B) built *c.* 1390 at New College, Oxford, can be attributed to its being of Winchester design and so

54 S. E. Rigold, *op. cit.* in note 31, p. 351, fig. 72.

influenced by the crown-post tradition which persisted there till *c.* 1400 and was used in the brewhouse and other buildings at Winchester College.[55]

Roofs in the N. Berkshire area constructed in the middle of the 15th century follow closely the lines of those that had been adopted by 1350. There are well-dated examples over the hall, 1437, of Lincoln College, Oxford; at Ewelme School (Oxon.), *c.* 1445 (FIG. 59, *b*); and at the Chantry House, 1443 (PL. XVI, A), now the White Hart Inn, at Fyfield, Berks. The same style is found in church roofs of this period, e.g. over the nave at Blewbury, reroofed when the W. tower was added, and over the naves of Frilsham and Yattendon churches,[15] both of which are attributed to Sir John Norreys. The roof (PL. XVI, B) over that part of the buildings of Abingdon Abbey, now designated the chequer hall, probably belongs to the same period: the differences between it and that built over the chequer (PL. XV, C) a century earlier are few, the main one being the typical 15th-century custom of using intermediate trusses to divide each bay into two parts.

Finally we must notice the general use of a central (crown-) post, but with no braces or central purlin, as an adjunct to timber-framing in the second half of the 15th century in the N. Berkshire region. This was no revival of the former crown-post roof, but a means, later replaced by queen-posts, of giving support to the collar. Examples occur over the long gallery[33] at Abingdon Abbey (PL. XVI, C); at Culham Manor, opposite Sutton Courtenay; and in the chancel[23] of Newnham Murren Church.

CONCLUSION

By tracing the evolution of roofs forward from the Romanesque form rather than backwards from Tudor forms, we have been able to provide a chronology for the south-eastern half of England which pays due regard to the ecclesiastical building of the 13th century and the domestic building on either side of 1300; some roofs formerly attributed to the 14th century can be placed in the period from 1250 to 1300; that is their date is moved backward in time by a generation or so. This suggestion is in line with some of the recent findings and proposals of Horn[12,29] and Hewett.[14]

The sequence of roof forms between the end of the Romanesque phase and 1350 may help in the dating of buildings,[56] since it provides the medieval archaeologist with a criterion which is additional to the evidence based on other architectural features such as window-tracery and mouldings. Although successive roof forms overlap even in the same area, the general tendency for one form of roof to supplant another is evident: this has become apparent not only with the phases of crown-post roofs but also with scissor-bracing, which we find to be frequent in the 13th century and recessive in the 14th century.

Recent publications giving details of surviving medieval roofs in NW.

55 Information from Mr. J. H. Harvey.

56 One example concerns the hall at Place Farm, Wraysbury (*Records of Bucks.*, XII (1927–33), 157), where the roof has some unusual scissor-bracing but is characterized by a crown-post roof of phase III: it is therefore likely to be of the early or middle 14th century.

Europe have contributed greatly to the chronology developed in this paper. Probably less than 1 % of the roofs built in the 13th century have survived: yet the few that still exist on the two sides of the English Channel show that developments were similar in both regions. The dates attributed to roofs in France which show new items such as scissor-bracing and decorated king- or crown-posts imply that SE. England usually copied France until *c.* 1270. The developments which stand out as English are the Edwardian roof with principal rafters and the short, decorated crown-post found in 14th-century halls and churches.

ADDENDUM

SCISSOR-BRACED TRUSSES AT PETERBOROUGH CATHEDRAL

We are indebted to Mr. R. Reuter of the Technische Hochschule, Darmstadt, for providing the following observations, made in August, 1964, of these scissor-braced trusses. Their form and also their date appear to be earlier than those listed in Table III. The nave of Peterborough Cathedral was completed *c.* 1190 and the narthex with its lateral towers added in the first quarter of the 12th century (FIG. 60 *bis*).

'Above the vaulting of the N. end of the narthex are seven well-preserved trusses each with its original scissor-braces and two collars; they are now supported by four purlins. The joints are halved, those to the rafters being notched laps. However, those joints which are at an acute angle have a special feature, namely the two beams are pinned across their widths by long wooden pegs.

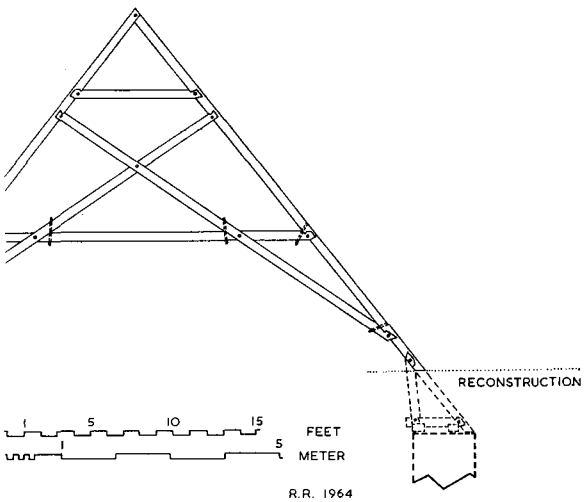


FIG. 60 *bis*
PETERBOROUGH, NORTHANTS.
Scissor-bracing over narthex of cathedral, *c.* 1190

'The trusses span a distance of 32 ft., their spacing is 30 in. and the pitch of the roof is 52°; there are now no ashlars, but it is evident that each rafter has been reduced in length by about 4 ft. leaving near its present base the shape and angle for a halved joint to the former ashlar. This point and the unusual position of the trusses suggest that they have been reused.

'It is significant that their original span and pitch would have been appropriate to the nave, which was reroofed in the 16th century (V. Ruprich-Robert, *L'Architecture Normande*, II (1881), pl. lxxxvi). It is likely that the trusses are reused and taken from the original nave roof, the form and jointing of which they therefore illustrate.'

ACKNOWLEDGEMENTS

We are grateful to Mr. P. Heliot for drawing our attention to references to continental roofs; to Mr. C. A. Hewett for observations and discussions: to the Very Rev. C. P. Hankey, Dean of Ely, for assisting our investigations concerning Ely Cathedral and to Mr. M. Pavey for measurements at Ely used for FIGS. 48 and 60; to Mr. M. C. Fletcher for his observation of the jowled posts in Harwell Church and for assistance with measurements; to Prof. W. Horn for providing photographs of Tiptofts Hall used in FIG. 56 and PL. XIII, B; to the Estates Bursar, Merton College, for the loan of drawings of the chapel used for FIG. 49, *c*; to Mr. F. Kelsall for measurements of the roof of the Warden's Hall, Merton College; to *The Times* for permission to publish PL. IX, B and to *Country Life* for PL. XIV, C; to the occupants of many houses who have given us facilities for measurements and photography; and to many others who have assisted in the preparation of this article.