

Structural Carpentry in Medieval Essex

By CECIL A. HEWETT

A SURVEY of the timber buildings of Essex at first leaves the student with an impression of a single and continuous course of development for both carpentry and carpenters' joints. In many instances different forms of the same joint are seen, and these can be arranged in such orders as give them the appearance of constituting evolutionary sequences, by way of which it may be assumed the joint has attained the form in which it is most familiar in our time. One such joint is the lap-dovetail, another is the scarf, and this latter one will be discussed in that light later in this paper. Some of the evolutionary sequences may be accepted as correct, since joints must to some extent evolve, and it is tolerably certain that joint-forms have appeared in English carpentry during the last five centuries which before then were unknown or unused. One such abutment that is now used in many different joints is the mitre.

The second, and in all probability more correct, impression received is that a number of schools of carpentry existed during the medieval period in Essex, each of which had enduring preferences for the form, number, and categories of joints to be used in a given structure, in addition to deep-seated convictions regarding the best and most enduring order of assembly for that structure's parts. There are timber-framed buildings still standing in the county that may be representative of the methods of carpentering peculiar to as many as eight schools of thought. If this is so, the number of schools existing in Essex during the middle ages would, so far as their origins are concerned, involve studies outside Great Britain and reaching back well before the medieval period. It seems probable that many developments in timber-framing were imported from Europe, and it is equally probable that certain advances were achieved in England and crossed into Europe, but a far-reaching survey of timber buildings in many countries would be necessary to verify any such occurrences. One important piece of evidence for the assumption that the continent may occasionally have imported joints from England is the X-shaped lap-joint found in the belfry at West Hanningfield, Essex,¹ and Rufford Old Hall, Lancashire, belonging to *c.* 1270 and *c.* 1370 respectively. The joint does not seem to appear later than that in England. Deneux² noted this joint in France, in the area between Dunkirk and the Loire, and that it did not appear there until the seventeenth century.

Mere differences in jointing can often be found, and often neither of two methods can be stated to be better than the other in terms of mechanical efficiency. Two such disparate methods of jointing tiebeams to top-plates, both of which seem to have been practised for centuries by the adherents of their schools, were

¹ C. A. Hewett, *Trans. Anc. Monuments Soc.*, n.s. ix (1961), 39.

² H. Deneux, 'L'évolution des charpentes du xie au xviiiè siècle,' *L'Architecte*, July 1927, p. 85.

those of the barefaced and the full lap-dovetails. One source of explanation for slight, but nonetheless noteworthy, variations in structural tradition is the monastic influence, which must have been considerable during the widespread and intensive agricultural development of lands pertaining to monastic foundations, such as the abbey of Waltham. Most large barns in Essex no longer bear names showing whether they were lay or monastic undertakings, yet it is clear that a very large proportion of them must be attributable to the monastic orders. One example which will be described is firmly associated with Europe by monastic possession. This is the barn at Prior's hall in Widdington. According to Morant³ this manor belonged, during the reign of Edward the Confessor, to the monastery of St. Valery in Picardy, and he later says that 'this estate, as belonging to a Priory alien, was seized by King Edward III during his wars with France . . .'. Such associations with the continent may well help to explain some minor variations of timber building-method.

Finally, the apparently evolutionary sequences of joint-form may be traced through the different methods of framing noted, apparently in chronological succession. It is probable in some instances that particular joints, such as the scarf, were coherently perfected by several schools, inasmuch as such joints must have been equally necessary to all of them. The scarf-joint will be discussed in the light of that possibility. However, some description and illustration of the most important barns and other structures will first be necessary, in order that those differences which may indicate the existence of numerous distinct traditions, occasionally running parallel in time, may be established. This will be done in some detail in respect of those buildings which have been surveyed, while other structures that are relevant to the purpose, but are not yet surveyed, will be described in a more general manner. Following the descriptions the scarf-joints used in the buildings will be compared, and an attempt made to trace the possible course of development of those joints together with a statement, provisionally, of the order in which their root-forms seem to have appeared in Essex carpentry. The possibility of classifying the buildings into distinct carpentering traditions, or schools, will also be discussed. A glossary defining technical terms will be found on pp. 267 ff.

THE BARLEY AND WHEAT BARNS: CRESSING TEMPLE

Of Cressing Morant (1768, p. 113) says: 'It was anciently possess'd with Witham by Earl Harold, and others, down to the time of K. Stephen; who, about 1150, granted the whole maner of Cressynge with the advowson of the church of the same maner, to the Virgin Mary, and the Brothers of the Knighthood of Solomon's Temple at Jerusalem. Hence it came to be called Cressynge-Temple, as belonging to the Knights-Templars: Who, in 1185, are recorded to have had 5 hides of land in Witham and Kirsing, of the gift of K. Stephen, one part of which was in demesne, and the other lett to divers tenents; whereof Adam de Kirsing held two virgates at 25s. This was one of the Knights-Templars Cells, styled a Commandery, or Preceptory, dependent upon their capital House, the Temple, in London.'

³ P. Morant, *History and Antiquities of Essex* (London, 1768), p. 567.

The Templars were suppressed in 1311. It is, most probably, to the Templars that any early and intensive agricultural development of the manor must be attributed, and the two enormous and structurally unique barns remaining there are apparently Templars' barns since, by their joints, they belong to the late twelfth and late thirteenth centuries.

The barley-barn. This is the older of the two and to judge from the surface condition of its timbers it must be very much older than the other. It is built upon six transverse frames, any pair of which indicate the corners of a bay containing about 500 sq. ft., exclusive of the aisles or outshots. The two central frames standing on either side of the threshing-floor are unusually massive, and possess both tie- and straining-beams (PL. XXIII, A-B). The roof-ends are hipped with louvred gablets in their apexes, which leaves all twelve principal-posts free-standing. The braces fitted to the posts' backs, inside the outshot-frames, connect the post-plates to the outshot-tiebeams, thereby connecting two horizontal timbers.

The braces above the outshot-tiebeams are fitted to the posts' backs, and therefore are of the more normal type, connecting one horizontal timber to another vertical timber—a triangulation designed to ensure the stability of the angle created by post and beam—and must be part of an extensive and early rebuilding. In the square spaces bounded by these outshot-frames there is evidence, in a number of long-disused joint-matrices, for a much more elaborate frame-design than now exists. The order of assembly of the three principal frame timbers is here, as at the mainspan-height, what may be termed 'normal', i.e. the tiebeams are the last timbers placed in position and are laid over the top-plates. The barn has principal-rafters that are jointed into the upper surfaces of the tiebeams. These were, originally, and in all cases, braced by very long parallel scissors which crossed above the collar-beams, and were housed at their lower ends in squint-trenches cut right across the posts' sides. (One of these remains in position.) This indicates that the scissors were at the time of the first building 'through' or 'passing-braces', which had their 'starts' lower down in the structure, probably upon the outshot-wallposts of the first building-period of this barn. The existing outshot-wallposts are part of a rebuilding, as are the crown-posts and collar-purlins which have been inserted, probably as early as the beginning of the fourteenth century.

The end-joints used for all those timbers placed transverse to the barn are open laps, all of which are notched to prevent their withdrawal (PL. XXIII, A). The timbers placed longitudinally appear to be tenoned at their end-joints. The collar-beams are third-lapped into the rafters and the hip-rafters are of lozenge section, so placed that the jack-rafters' upper ends may be bird's-mouthed over their two lateral arrises. There is a central midstrey, some of the timbers of which show notched lap-joints and may, for that reason, be original. The roof of this midstrey enters the barn completely framed, but unclad upon those rafters that are inside the mainspan-roof (FIG. 77). This midstrey-roof is collar-tied, and barefaced lap-dovetails are used for the purpose upon the collars' ends, one collar being provided for every fourth rafter-couple.

Two scarf-joints may be seen in this barn, each of them being clearly attributable to different building-periods. The scarf showing on the post top-plate is clearly the one relating to the initial specification. It is a simple halved scarf (FIG. 84, *c*), being in length little greater than the edge-depth of the jointed timbers;

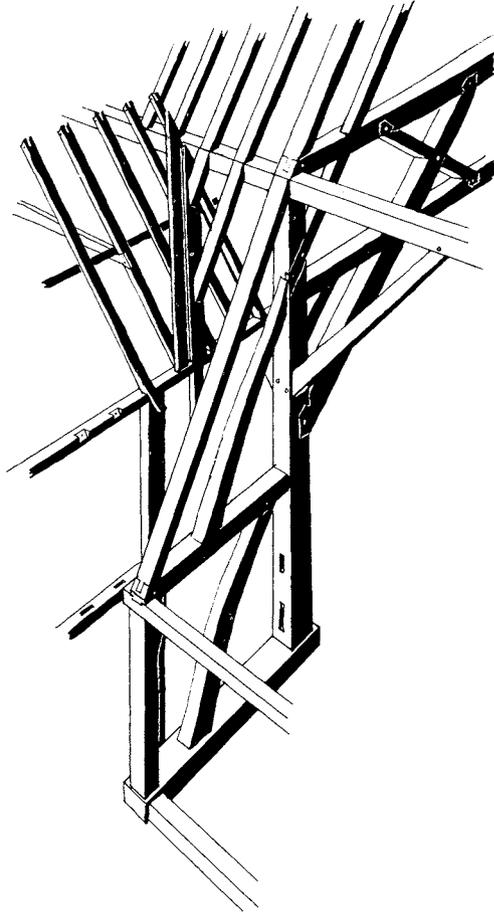


FIG. 77

CRESSING TEMPLE, ESSEX

Framing of roof-valley of barley-barn (p. 242)

Bracing shown in outshot is part of 14th-century rebuilding

it must be admitted primitive and able to resist little or no flexing strain, serving only as a 'registration' point. The other can be seen at regular intervals along the outshot top-plates and is of the halved-and-bridled type (FIG. 82, *c*).

The wheat-barn. This is the more recent of the two barns at Cressing. As in the barley-barn, practically all of its timbers are straight, a feature of great rarity in Essex timber-building. The barn has six transverse frames, the principal-posts of

which indicate the corners of bays each containing about 440 sq. ft., exclusive of their aisles or outshots. The majority of end-joints in this barn are tenoned, open laps and squint-housings being used only for the long-scantling braces of the roof and for the collar-frames. Both outshot- and mainspan-tiebeams are 'normally' assembled; that is, they pass over their respective top-plates and are jointed with the entrant-shouldered lap-dovetail (FIG. 86, *b*). The braces to the posts' backs inside the outshot-frames connect two horizontal timbers—the post-plate and outshot-tiebeam (PL. XXIII, C-D). Another important feature in these outshot-frames is the use of long 'through' or 'passing-braces'. These start from the outshot-wall-posts and rise parallel to the principal-rafters, passing through a squint-trench cut into the outshot-tiebeams and ending in a squint stop-housing in the sides of the principal-posts. This 'stop' is very narrow and on its further side the housing is repeated, having the opposite direction of entry, and from it rises a second length of the same brace that forms a parallel scissor-brace to the principal-rafter, and ends housed in its opposite rafter above the collar-beam. The second lengths of these braces thus pass both mainspan-tiebeam, collar-beam and opposite rafter (PL. XXIII, C-D). The two component lengths, therefore, of the 'passing-braces' connect, in the lower part, two vertical timbers and, in the upper part, one vertical and one inclined timber. At the end-frames of the barn, which stand freely inside the hip and gable roof, the 'passing-braces' are of a single length of timber which is trenched right across the principal-posts and stops on the sides of the mainspan-tiebeams, thereby connecting, so far as the end-joints show, a vertical timber with a horizontal timber and passing one of each.

The roof of this barn is a side-purlin design with wind-braces. The through-purlins are trapped by vertical struts in such a manner that they support the common-rafters upon their upper external arrises. The collar-beams and their vertical struts are lap-jointed, and, at the intervals of each half-bay, is fitted a similar collar-and-strut assembly, with braces halved-in below the collars. The purlins are scarfed only over one of these numerous collars, and the through-splayed scarf is used for their jointing, pegged vertically four times. The scarf to the post top-plates is most remarkable, and is, like that to the purlins, designed to break only over a post-head. It is halved in the vertical plane and closely resembles the type of the joint that was to become ubiquitous in East Anglia after medieval times (PL. XXVI, B). The eaves-level, or outshot top-plate, shows at the NE. corner of the barn (which is the oldest, and appears to be an original, portion of the exterior walls) a splayed-and-tabled scarf. This scarf is, in the light of its occurrence on the top-plates of the old deanery at Salisbury and on the same members of Southchurch hall in Essex (to name but two contemporary examples), reasonably attributable to the middle two quarters of the thirteenth century. Of that probability more will be said under the heading of scarf-joints and their development.

There is a central midstrey whose roof-valleys are framed into a valley-rafter that is pitched exactly upon the line of intersection of the two planes of roofing—midstrey and mainspan of barn. The hip-rafters are of pentagonal section and have the jack-rafters' ends lapped over their two inclined upper surfaces. The

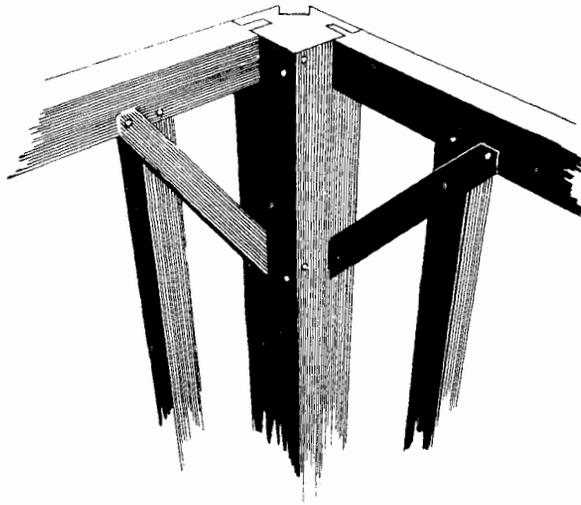


FIG. 78

CRESSING TEMPLE, ESSEX

Original method of framing corners preserved at NE. end of wheat-barn (p. 246)

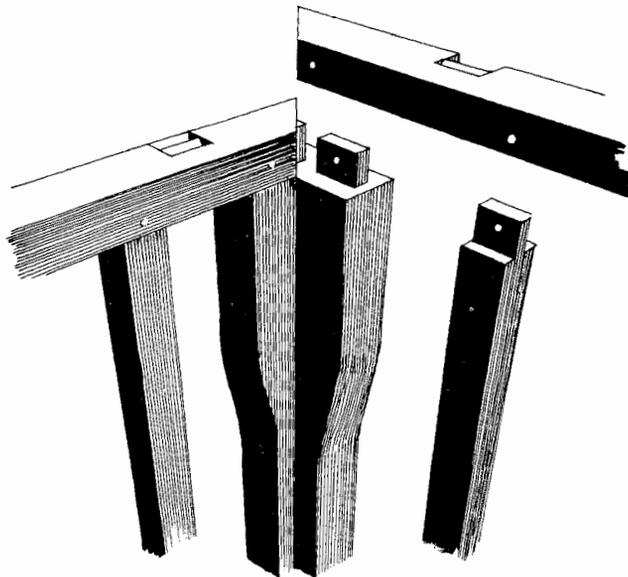


FIG. 79

CRESSING TEMPLE, ESSEX

Alternative method of framing corners used at SW. end of wheat-barn (p. 246)

corners of the external walls of this barn are framed in two totally different methods, between which, so far as the history of carpentry is concerned, there is possibly a gap of centuries. The older of these two methods survives at the eastern corners of the barn where the wall is original (FIG. 78). The opposite end employs the method shown in FIG. 79, which incorporates the mitre and two-way jowl and is unique in my experience.

THE BARN, PRIOR'S HALL, WIDDINGTON

Morant (1768, p. 567) writes: 'The Maner of Priors-Hall belonged, at the time of the Survey, to the Monastery of St. Valery in Picardy, on which account it received the name of Priors-hall: and is also called Stonehouse, because built of stone . . . This estate, as belonging to a Priory alien, was seized by K. Edward III during his wars with France; and of him, or K. Richard II, obtained by William of Wickham, Bishop of Winchester, for New College in Oxford of his foundation.'

The barn here is a very long one possessing seven free-standing frames and two half-hipped end-frames, which divide it into eight bays of *c.* 315 sq. ft. each, a division which prevents the two midstreys from being placed symmetrically. One midstrey and its threshing-floor cross the bay which is third from the eastern end while the other midstrey and floor cross the seventh bay from the same end. The principal-posts have jowls of a simple profile, their tenons being placed noticeably off-centre. The braces fitted to the posts' backs are placed above the outshot-tiebeams and connect a horizontal to a vertical timber without passing any intervening timbers. The framing is interesting in that the order of assembly is, at the eaves, 'reversed'; that is, the outshot-tiebeams pass under their top-plates (PL. XXIV, A; FIG. 86, *a*). By this means the use of lap-joints that can resist withdrawal, such as lap-dovetails and notched laps, is entirely avoided. The order of assembly at the principal-posts' heads is 'normal', i.e. the mainspan-tiebeams pass over the top-plates, which appear to be rebated to such a depth as would allow the existence of a lap-dovetail or similarly unwithdrawable joint, although the joint actually used has not yet been ascertained. A feature of 'reversed' assembly, as a timber building-method, is that the tiebeams have to project well outside the building in order that the outer cheek of the trench may resist splitting-off under the thrust of the outshot-roof, which is of great weight and derives no support from its junction with the mainspan-roof. A shipwright's hanging-knee is fitted between wallpost and outshot-tiebeam at Widdington. Hanging-knees are also used upon two other occasions, in the midstreys, but are otherwise of extremely rare incidence in Essex medieval barns.

Above the mainspan-tiebeams all the roof-timbers are of a single cross-section; the roof is crown-post and collar-purlin and has no principal-rafters. Occasionally the rafter-couples coincide with the tiebeams, when they are lapped into the sides of the beams' ends, to varying, and evidently arbitrary, depths. It is also noticeable that the outshot- and mainspan-flights of rafter do not align except at the half-bay intervals, where, in the outshot-flight, a heavy rafter is pitched to carry the outshot-purlins. The midstreys' valleys are framed into a valley-rafter (FIG. 80) pitched

upon the line of intersection. The midstrey-gables overhang the great doors and still carry the remains of ancient, cusped, verge-boards. The external walls are of studwork with wind-braces. Diagonally-barred wind-eyes have survived in both north and south walls. The barn was originally finished with wattle-and-daub and was built upon footings of random flint-rubble.

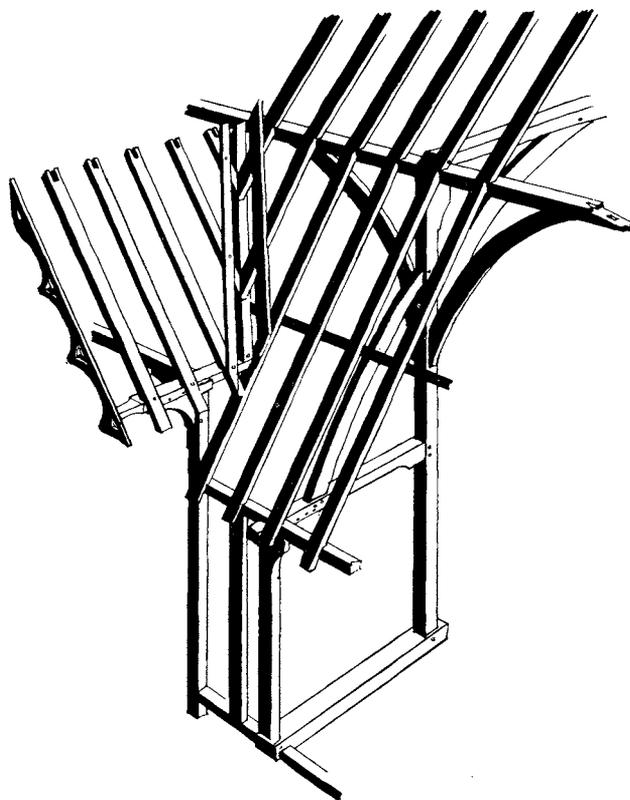


FIG. 80

PRIOR'S HALL BARN, WIDDINGTON, ESSEX

Method of valley-framing (p. 246 f.). Both flights of rafters stop at the valley-rafter

THE MONKS' BARN, NETTESWELLBURY

This barn abuts the existing wall of the churchyard. A short distance to the north are the remains of fishponds of the monastic type. Morant (1768, p. 490) states that Netteswellbury is not mentioned in the Domesday Survey and is unable to account for its omission. He also says (1768, p. 490) that the estate had always been possessed by the abbey of Waltham, and evidence to that effect exists upon the south wall of the church, which is dedicated to St. Andrew, in the form of a terracotta panel modelled with the arms of abbot Rose of Waltham, who ruled that abbey from 1497 to 1500.

This magnificent barn is of seven bays, each containing *c.* 320 sq. ft. exclusive of their outshots. It is without doubt of monastic origin. There are six transverse frames and there was until recently a central midstrey, which was demolished in the name of 'preservation'. The barn has half-hipped ends. The order of assembly is at all points 'normal' and appears to incorporate lap-dovetails for both outshot- and mainspan-tiebeams. All principal timbers are jowled, some of them at both ends, such as the horizontal end-girts. The bracing of the transverse frames is effected with unusually heavy curved timbers (PL. XXIV, C-D) which connect two horizontal members, the posts' plates and the mainspan-tiebeams. These pass both posts and outshot-tiebeams at their conjunctions. The roof-frame is of the through-purlin category, the principal-rafters being wind-braced each way to the purlins (PL. XXIV, D).

The external walls are remarkable in that they combine vertical boarding with close-set studs. None of the vertical boards has survived, but the three horizontal rails to which they were fixed are in position, these being mortised through all studs and wallposts of the external walls. It may be clearly seen that the boards were fixed to these rails with five lozenge-sectioned pegs, in the light of which it is interesting to note that the peg-tiles were also fixed with pegs of lozenge-section, which is, in tiles, uncommon. The end walls are framed without studs, and have two end-girts tenoned into a central post, into which are tenoned two further vertical posts of the same weight as the central one. The rails for the vertical boarding are passed through mortises in all the vertical timbers, and enter 'blind' mortises in the principal-rafters of the outshots (PL. XXIV, C). The outshot-roofs have one purlin each, which is mortised in-line (without joggling) through the principal outshot-rafters and is placed at the interval of their upper third of length.

THE BARN, UPMINSTER HALL, UPMINSTER

According to Morant (1768, p. 108) the manor of Upminster hall 'was one of seventeen, given by Earl Harold to the Abbey founded by him at Waltham, and thence named Waltham-Hall. K. Edward the Confessor confirmed it to that house, as did also K. Henry II, K. Richard I and K. Henry III. And in the *Cartae antiquae* it is called 104 acres. That Abbey was possessed of it at the time of the general Survey.' It is possible that the abbey was responsible for the building of this vast barn, the existence of which is otherwise very difficult to explain. It is, so far as I know, the only barn of the first magnitude in Essex that was built entirely without studs. The structure is of great length and contains eight transverse frames and two half-hipped end-frames; it has one midstrey that crosses the fifth bay from the E. end. It thus has nine bays, each of *c.* 300 sq. ft. exclusive of their outshots. The enormous roof of this area has, apparently, always been covered with reed thatch until, in recent years, the northern slope was re-covered with corrugated asbestos. The barn is shortly due to be demolished, being now the property of an Urban District Council.

The principal-posts are jowled and the order of assembly is, at the eaves, 'reversed', in contrast to the 'normal' assembly used for the mainspan-tiebeams.

The backs of the principal-posts are braced, their braces starting from the post-plates, passing through squint-trenches in the outshot-tiebeams and tonguing into the posts above those tiebeams, thereby connecting a horizontal timber to a vertical one. The roof is of crown-post and collar-purlin type. It is all of one scantling above the tiebeams and is without principal-rafters. The unique feature of this barn is its exterior walling. In the length of each bay of the structure there are only two posts between the transverse frames, and the horizontal rails to which the vertical boards were fixed are mortised through all the vertical wall-timbers (PL. XXV, B-C). Many of the vertical weather-boards survive, mainly upon the barn's north-eastern corner. The end-frames are built of massive timbers none of which is a stud in any sense, and the rails for the boarding are mortised through all timbers, including the outshot principal-rafters (PL. XXV, A). The scarf-joint used for the top-plates is the halved-and-bridled type shown in FIG. 82, c, and discussed later under the heading of scarf-joints.

BARNS NOT SURVEYED

Two barns of the greatest possible importance stand at the hall, Belchamp St. Paul's, close to the northern border of the county. Of this manor Morant (1768, p. 328) says: 'Belchamp St. Paul's is so named, because it is part of the possessions of the Cathedral Church of St. Paul's in London; to which it was given by the Saxon King Athelstan, grandson to good King Alfred; who dyed in 941. It belonged to St. Paul's, at the time of the general survey, and in the reign of King Henry I was rated to the King for five hides.' Precise measurements of two barns are given in respect of this manor in *The Domesday of St. Paul's* (ed. Archdeacon H. Hale, Camden Society, 1886). The leases in which the specifications are given must, it is considered, date before 1181. As these barns exist today there does not, at first inspection, appear to be much hope of reconciling the longer of the two with either of those specified in the leases, but the smaller, which has been much repaired and altered in length, may well contain two transverse frames of one of the barns specified in the twelfth-century lease.

The incalculable importance of the barns is, however, entirely independent of any grounds which may or may not exist for ascribing certain frames of their structures to the twelfth century with the aid of documentary evidence. The smaller was built entirely without recourse to any forms of joint either secret or lapped, which had any ability to resist withdrawal in any direction; furthermore, its assembly is entirely what I have termed 'reversed' at both outshot- and mainspan-levels. As has been stated, it is always necessary in the examples of 'reversed' assembly seen by me for the outer cheek of the tiebeam's trench to project well outside the structure, it being protected when this occurs at the eaves-level by the overhang of the roof. This fact seems to offer an absolute objection to the assembly being 'reversed' at the point of the mainspan-tiebeams, and it is, therefore, most interesting to note the manner in which this is achieved at Belchamp hall. The pitch of the mainspan-rafters, all of which are common, is steeper than that of

those in the outshot-flight, which are sprocketed on to the feet of the upper couples. This permits the ends of the mainspan-tiebeams to project sufficiently far beyond the post top-plates to avoid failure, by riving, of the outer cheek of the trench, which would result in total failure, by collapse, of such a roof (FIG. 85, *c*).

Those transverse frames of this barn which appear to be part of its initial design have no jowls to their timbers, while the posts that are replacements, although very ancient ones, have jowls of cyma-recta profile which, in Essex, is a rarity. It is also of far-reaching importance that the oldest mainspan-tiebeams which pass under the post top-plates, in view of their 'reversed'-assembly order, show no signs of joints for the feet of crown-posts. The other barn at Belchamp hall is equally interesting inasmuch as it contains no unwithdrawable joints, save a few notched laps, possibly belonging to an early thirteenth-century rebuilding. The order of assembly is 'reversed' at the eaves-level, or outshot top-plates, whilst at the height of the mainspan-tiebeams two different devices are used. The end-frames, which carry half-hipped roofs, have double, or 'clasping' tiebeams, both of which are trenched for the upper and lower top-plate faces. The intervening transverse frames have their tiebeams assembled in the 'normal' manner at the mainspan-height, and appear to employ a lap-dovetail upon the beams, which are single. This is not, however, the case. On close inspection it may be seen that these tiebeams lie in trenches cut across the top-plates' upper faces, and that the trenches are, at the inside edges of the top-plates, fully the width of the tiebeams; furthermore, the ends of the tiebeams are rebated, the soffits of those rebates declining in such a manner as would offer a slight resistance to withdrawal. Once again the principal-posts of this barn are without jowls, and there is no evidence for the roof ever having been of the crown-post—or scissor-braced—variety. The scarf-joint used for the various lengths of post top-plate is of the stop-splayed variety. It is very long and wasteful of timber and lacks any approach to tabling or alternative refinements (FIG. 82, *a*). The outshot top-plates have the through-splayed scarf, placed always directly over a vertical support; and the plates themselves (ground-sills) have a primitive scarf formed by halving both pieces (FIG. 84, *c*) and transfixing their halved parts with the foot-tenon of a wallpost. Two frames of this barn are 'new' (in relation, that is, to the greater part of the building) and these two frames rely very much on the notched lap-joints noted in the Cressing barley-barn.

A barn that is closely allied to the one just described stands at Mallbrooks farm, Mountnessing. The future of this structure cannot be assured, since it may be in the way of progressive farming in the near future. I have no doubt that this was not built as a barn, but it has obviously served in that capacity for several centuries, and may, therefore, be discussed without any special regard to its original purpose. Until some partial demolition recently took place, the structure contained the jambs of a door-case designed to carry a traceried head-timber. It still contains in its northern end-wall two wind-eyes, which are mortised for diagonal bars and were originally equipped with sliding shutters. These facts are interesting in themselves but tend to lose something in importance when the central transverse frame of the building is examined. This frame (PL. XXIV, *B*) is represen-

tative of a great number of roof-frames existing in Essex and covering church porches, residential halls, church naves (FIG. 81) and farm buildings.

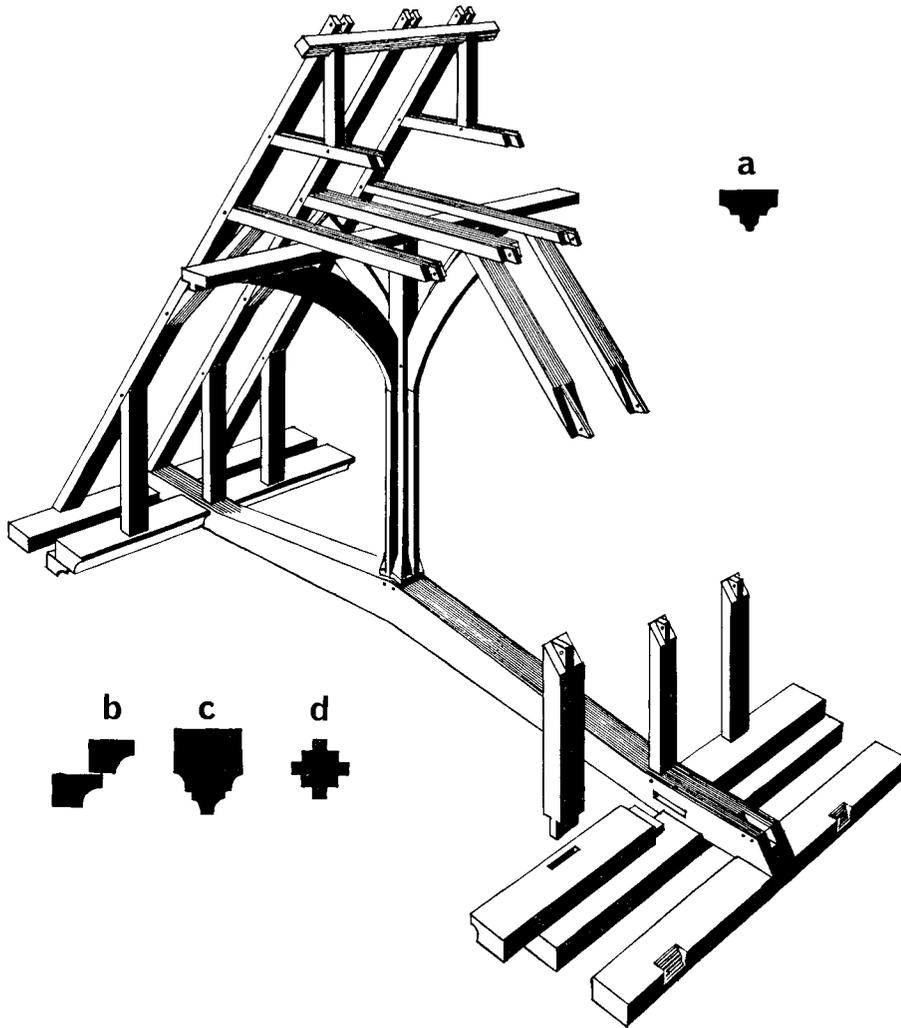


FIG. 81

DODDINGHURST CHURCH, ESSEX

Framing of nave roof. Inset, cross-sections of *a*, collar-purlin, *b*, top-plates and *c*, transverse beam; *d*, cross-quadrant section of crown-post (pp. 251 f., 265)

What is true of this example is equally true of all those noted in other buildings. All the principal timbers are richly moulded, the moulding used being the scotia, return and scotia, which was a predominant moulding in masonry during the Early English period. This cross-section is found in the principal-posts,

transverse beams (FIG. 81, *c*) and collar-purlins (FIG. 81, *a*), and the two top-plates that were invariably fitted form the same profile when together, as shown in FIG. 81, *b*. The cross-section of the crown-posts in these cases is that known to heraldry as cross-quadrant, illustrated in FIG. 81, *d*. Buildings of this category or school which are wholly timber-framed, as is the barn or hall under discussion, also have side-girts. The braces fitted at the heads of the crown-posts are always four in number, and are jointed into the collar-braces and collar-purlins with barefaced tongues. These details are remarkable in themselves but the end-joints of the transverse beams are more remarkable in that they are incapable of tying the top-plates. These joints are simply rebates, and do not even possess the declining soffits noted in the Belchamp hall barn. A few are not even rebated. These beams, therefore, can only be called straining-beams when they are seen to be rebated, and transoms when their soffits run straight over the top-plates—or wall-plates where masonry walls are roofed. This shows that some crown-post roof-frames were designed to exert only inward pressure upon their plates, and, since many of them have survived until the twentieth century, it cannot be denied that they have, in fact, exerted only that pressure.

Two other barns examined, but not yet surveyed, between them and in conjunction with an early bell-tower, exhibit a system of joinery that is as remarkable and difficult to explain as any yet mentioned.

The larger of the two barns is at Walker's manor house at Farnham in the north-western corner of Essex. This barn has no roof-valleys. Instead of midstrey-roofs at right angles to the barn roof the eaves-line of aisles or outshots is 'over-thrown' with regard to the great doors of the threshing-floors. This feature is common to a large number of medieval barns in the county, and it may be closely related to the remarkable end-jointing method noted at Walker's barn, namely twin-tenons at all points, such as may be seen in PL. XXVI, A, which shows the jowled head of a principal-post. Other examples of this practice are known in addition to those mentioned. What is as yet mysterious concerning such assemblies (which are of course 'normal') is the precise way the tiebeams were jointed on to the top-plates. It is probably significant that the roof of the barn at Walker's manor house is not a crown-post design, but one of the early side-purlin types with wind-braces.

The bell-tower of Laindon church is of a design that may be unique, and appears to date from the early fourteenth century. It is a double tower, one standing freely within the other. The inner one, which is entirely twin-tenoned, carries the bell-frames and transmits their weight directly to the plates, which serve for both structures.

The third example of work of this type is the barn at Ladylands in Good Easter (PL. XXV, D), which has several remarkable features. The important one in the present context is the tying of the end corner-posts at a point below the eaves with horizontal beams jointed into the posts' jowls by twin-tenons, which may be seen in the right-hand elevation. This barn is unusual in other respects, the most important of which, perhaps, is the absence of outshots. The method of end-framing is very rare—I have not so far seen it in any other building—and it

is in this barn combined with 'normal' assembly for the tiebeams between the end-frames.

Finally, at Navestock hall there is a granary which seems to represent the last method evolved in the county for the cladding of exterior walls with timbers placed vertically, the only position in which timber is able to avert the entry of water into its fibres, and in which water, once in the fibres, will quickly drain out. This structure bears a top-plate inscription to the effect that it was rebuilt in 1732. Since it has evidently never been rebuilt, this presumably indicates removal, and subsequent reassembly. It has a crown-post roof and walls of heavy and close-set studwork. The sides of each stud are grooved and into those grooves tongued panels of thick oak were slid before the top-plates were fitted on.

A POSSIBLE COURSE OF DEVELOPMENT FOR SCARFS

If the buildings described are reviewed in what appears to be their chronological order and with particular attention to the scarf-joints which they incorporate—these have merely been defined hitherto—two purposes may be served. First, the belief that the scarf-joint was collectively developed by various schools of thought or carpentry may be substantiated or shown to be invalid; second, the degree of probability for the apparent sequence of the erection-dates of these buildings may be enhanced.

The two buildings which evidently have the strongest claims to seniority are the barns at Belchamp hall, since, irrespective of any possible connexion between them and the barns specified in the leases of *c.* 1181, both are entirely without dovetails. This isolates them, literally and completely, from any of the others and it seems, therefore, that these two must be the earliest, since both their joinery and their structural concept are the rarest.

In brief, the older of the two has 'reversed' assembly for both outshot- and mainspan-tiebeams, whilst the other has 'reversed' assembly at the eaves with 'normal' assembly, that is dovetailless, at the height of the mainspan-tiebeams, the end-frames having double 'clasping' tiebeams. It is apparent that this carpentry is of the most ancient origin, since no attempt is made to use joints capable of resisting withdrawal, the earliest forms of which were probably the notched laps, such as were widely used during the eleventh and twelfth centuries in France.⁴ The scarf-joint used for the top-plates of both these barns is the stop-splayed scarf (FIG. 82, *a*) and the examples of it examined are very many times greater in length than the edge-depth of the two timbers so jointed. This is a scarf-type that is incapable of offering any substantial resistance to flexing of the timber at the point of jointing, so that it is remarkable that it was not placed over the heads of vertical timbers, as frequently happens with superior scarfs in later work. The ground-plates of these barns seem to be halved together (FIG. 84, *c*) and usually transfixed by tenons at the halved points, and neither of these methods show any attempt to make the joint as strong and closely integrated as in principle it can be. These joints, together with the general structural methods of the barns, suggest

⁴ H. Deneux, *op. cit.* in note 2, p. 85.

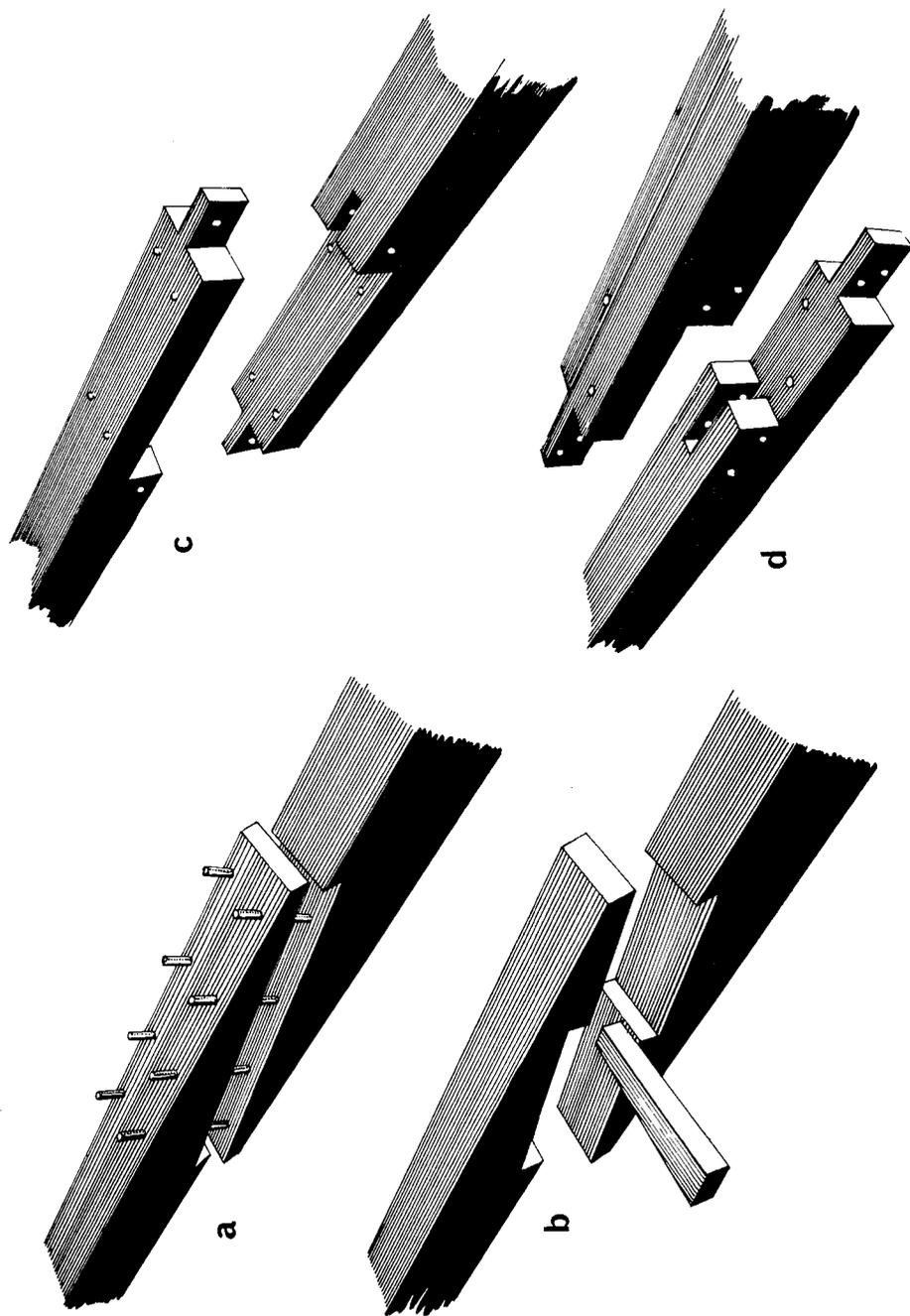


FIG. 82

SCARF-JOINTS IN ESSEX TIMBER-FRAMED BUILDINGS (pp. 250, 253 ff.)

a, stop-splayed, of top-plates in Belchamp hall barns; *b*, splayed-and-tabled, at eaves-level of NE. end of Crossing Temple wheat-barn; *c*, halved-and-bridled, of top-plates in Upminster hall barn; *d*, variation of halved-and-bridled, of top-plates in Brett's hall barn, Tending

that they are either the oldest buildings among the limited number described, or the work of adherents of a school of carpentry which perpetuated into a later period earlier structural methods and jointing devices.

The buildings that seem to be next in chronological sequence are the two barns at Cressing Temple. These are separated in time by a considerable period of uncertain duration, but, to proceed by analogy, the younger of the two—the wheat-barn (which has never been restored)—incorporates examples of what was in all probability the next step in the development of the scarf from the form noted at Belchamp. This is the splayed-and-tabled scarf (FIG. 82, *b*), designed to integrate itself more closely and immovably when the transverse wedge is driven home between the tablings of the joint. This scarf is rare in Essex, and its incidence is but little more frequent than the stop-splayed-and-untabled scarf previously described. Further evidence about the date when this joint was widely employed exists in the old deanery at Salisbury, where it is used to join the top-plates. This building has been ascribed to *c.* 1265 by the Royal Commission on Historical Monuments. The same joint is also used on the top-plates of Southchurch hall in Essex which we may ascribe on many grounds to the thirteenth century.

These facts firmly endorse a thirteenth-century ascription for the wheat-barn: I suggest *c.* 1275. It will, of course, be accepted that the stop-splayed-and-tabled scarf (FIG. 82, *b*) is the logical development of the stop-splayed scarf (FIG. 82, *a*) and that it is possibly the only practicable refinement of the splayed principal so far as timber scarfing is concerned. The tabled scarf occurs only on the outshot top-plates, however, and the two joints used for the post top-plates and the side-purlins are most interesting. The side-purlins are designed to be jointed only over collar-beams, and at these points they are through-splayed and transfixed with four pegs. This is a more defensible use of that scarf-type than are the Belchamp examples, since these purlins and their actual joints are 'trapped' (PL. XXIII, *c*) and the scarfs are thereby relieved of any stress. The scarf used for the post top-plates (PL. XXVI, *B*) is remarkable in that it resembles closely the scarf which was destined to become the ubiquitous one after the close of the medieval period. This joint is quite unrelated to the splayed varieties of the scarf in the same barn, and is placed always over a post-head; in fact, as is evident from PL. XXVI, *B*, it could not be otherwise placed. With the wheat-barn at Cressing the use of splayed scarfs ceases so far as the buildings here described are concerned, and I have seen only one other example of the joint where it is used to resist extension in the Fryerning post-mill of *c.* 1705. It is possible therefore, as has been suggested, that these scarfs were peculiar to the eleventh, twelfth and thirteenth centuries.

The barley-barn at Cressing helps us little with this issue, since it has been extensively rebuilt, many centuries ago. The only visible example of a scarf-joint which is original in this barn is on the north-western length of post top-plate and that is simply halved, longitudinally, and pegged through in the same way as are the ground-plates at Belchamp (FIG. 84, *c*). This seems an impossibly primitive joint for a structure of vast size and of such longevity, but it is a fact and will admit of no argument. Considered in relation to the predominance of notched lap-joints used in the barn, joints which are to be seen in places where one would

normally expect to see mortises and tenons, it may help to determine, one day, the time when the splayed scarfs came into general use. With regard to the last-mentioned preference on the part of the Cressing carpenter, Deneux⁵ found the use of such joints in the area he studied between Dunkirk and the Loire to be confined between *c.* 1000 and 1260, the last date being final. The foregoing evidence suggests that the barley-barn was built by the Templars between 1150 and 1200, the restoration probably dating from the fourteenth century in view of the scarf-joints used for the work and the jowled outshot-wallposts which were then fitted. It is probable in the light of the evidence considered so far that the splayed scarf, with all its variations, came into use sometime before the building of the Belchamp hall barns (possibly in the early twelfth century) and was on the way out about the date of building of the wheat-barn at Cressing, which appears to be *c.* 1275 at the very latest, since it retains a few notched lap-joints although it consists primarily of tenoned work.

The scarf noted on the wheat-barn's post top-plates did not come into general use in Essex until some centuries had elapsed, and the next type in historical succession appears to be the halved-and-bridled scarf, which we may assume began to be widely used about the year 1300. Of this category of scarf the buildings here described show many variations. The Upminster hall examples have halvings of great length which are pegged four times in the vertical plane, and once, laterally, through each bridle (FIG. 82, *c*). The examples of the same scarf to be seen in the barn at Brett's hall near Tendring (FIG. 82, *d*) are a direct variation in that the halvings are shorter and the bridles longer. The pegging of the Tendring scarfs is quite different, since the pegs are placed always along the diagonals of the areas impaled (FIG. 82, *d*). These two variations of the principle cannot, at present, be placed in chronological order, but they are clearly forms of the same joint with different mechanical efficiencies. It is most probable that the Brett's examples, in view of their shorter length in relation to edge-depth, are the later of the two.

This type of the end-to-end joint was invariable in Essex throughout the medieval period, and it was evidently, as would be expected, very much developed by the craftsmen of the monastic orders during their extensive agricultural undertakings. Two further examples of this joint showing much higher degrees of elaboration and refinement than the two already described are in the monastic barns at Widdington and Nettesswellbury. The Widdington specimens are probably the earliest of these two variations, and whilst they are halved-and-bridled they are very much altered, mechanically, since none of the surfaces form parallels. As may be seen in FIG. 83, *a*, the halvings are inclined and the bridles are diminished, on plan, while the whole joint is transfixed vertically by a tapered cotter. No pegs are used other than the two impaling the bridles laterally. This excellent joint is placed over a post-head sometimes, but does not demand any such placing, and may also be seen on unsupported lengths of top-plate.

The second of the two monastic variants is that used in the monks' barn at Nettesswellbury (FIG. 83, *b*). This joint is used for the post top-plates, where it is,

⁵ *Op. cit.* in note 2, p. 85.

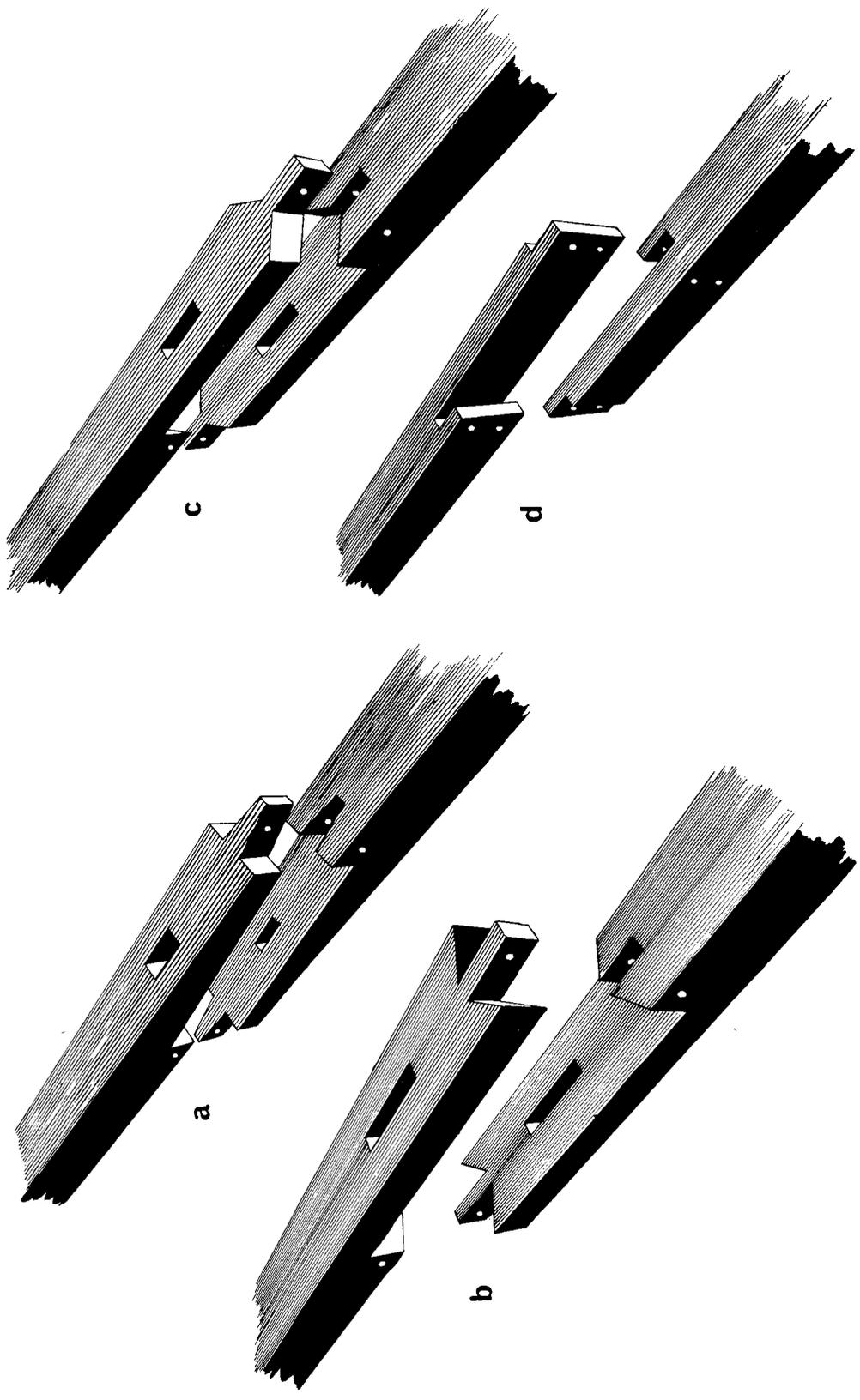


FIG. 83

SCARF-JOINTS IN ESSEX TIMBER-FRAMED BUILDINGS (pp. 256, 258)
a, halved-and-bridled, of top-plates in Prior's hall barn, Widdington; *b*, halved-and-bridled, of post top-plates in monks' barn, Netteswellbury;
c, modified form, of outshot top-plates in monks' barn, Netteswellbury; *d*, lipped-and-halved which became invariable after 17th century

occasionally, placed over a post-head and impaled by the head-tenon of the post, the mortise for which is illustrated. The alternative form in the same barn (FIG. 83, *c*) is used for the outshot top-plates, in which position it is also placed, when convenient, over a wallpost and transfixed by its head-tenon through the halvings.

There are, then, among the few buildings described, five variations of the halved-and-bridled scarf, two being found in the Netteswellbury barn. That the Widdington and Netteswellbury scarfs must be later than the Upminster and Tendring examples is obvious, since they are clearly derived from the plain root-form of the scarf seen in those two buildings. This affords some indication of the relative dates of the barns, which cannot otherwise be dated. Top-plate scarfing seems to have become relatively standardized sometime during the seventeenth century, so far as Essex is concerned. The type of scarf which then became invariable (FIG. 83, *d*) had its halvings sawn in the vertical plane. This scarf is curiously similar to the joint noted in the Cressing wheat-barn, from which it may have been derived.

In the light of these few observations it is possible to deduce, provisionally, the course of development of scarf-joints in Essex. That through-splayed scarfs are the earliest is apparent, although a possibility exists (barley-barn top-plates) that short horizontally-halved scarfs were used during the same period, and it is possible that use of these joints continued without a break from the period of the Glastonbury lake-village, where many examples of the joint were found 'folded' through mortises. We should expect that this type of scarf was improved while it was in predominant use for end-to-end jointing, and this improvement would have been possible only by the introduction of 'stopping', 'tabling' and the transverse wedge, which we have in fact noted in examples probably dating from the thirteenth century.

The date for the inception of splayed-and-tabled scarfs, so far as general carpenter's practice is concerned, would probably lie between the dates of the Cressing wheat-barn and the Belchamp hall barns, a period of unknown duration. The most recent example of the use of the tabled-and-wedged splayed scarf known to me may be seen upon the cross-trees of Fryerning post-mill in Essex of *c.* 1725. Here the joint is used specifically to resist extension of the resultant long-timbers. This late example in no wise invalidates the suggested change, in general practice, from splayed to halved scarfs. The joint had previously been used for top-plate jointing, which was never subjected to longitudinal tension, while it was evidently used during the eighteenth century in more directly appropriate capacities, since, as da Vinci had been aware at a time between these two usages of the type, it was peculiarly adapted for resisting extension.

When the halved-and-bridled scarfs appeared cannot at present be determined with any accuracy, but the form noted at Upminster may be the earliest, or archetype. The modification noted at Brett's hall will probably be found to be later, since it is the shorter joint in relation to its edge-depth, and therefore is least wasteful of timber and more efficient mechanically. The three monastic elaborations cannot be securely placed in chronological relationship to the other examples, but it seems highly probable that they follow after those forms of the

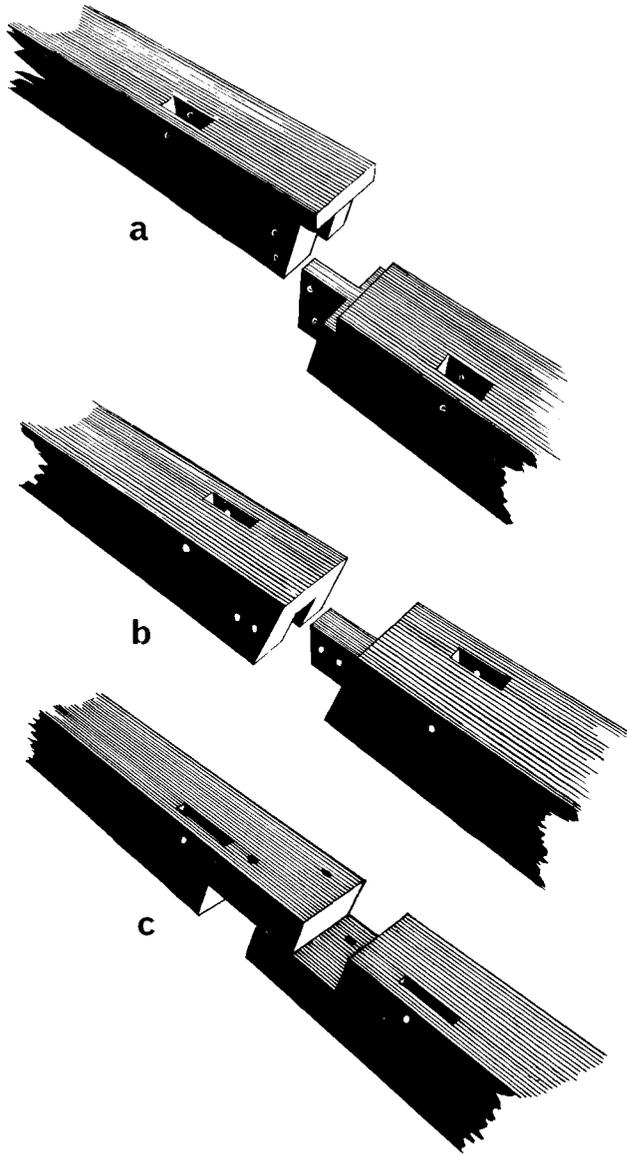


FIG. 84

SCARF-JOINTS IN ESSEX TIMBER-FRAMED BUILDINGS (pp. 250, 253, 255, 260)

a, invariable scarf-joint used for ground-sills; *b*, form used for ground-sills in monks' barn, Netteswellbury; *c*, halved, for ground-sills in Belchamp hall barns and for top-plates in Cressing Temple barley-barn

joint possessing square shoulders, while it is evident that both joints must be considerably earlier than the Dissolution.

These observations concern only the end-to-end joints necessary for the top-plates of barns, but other categories of scarfs have always been essential for timber building, the most important of which is that invariably used for ground-plates or sills (FIG. 84, *a*). This joint was used, apparently, throughout the middle ages in Essex, and continued in use thereafter until the last big timber-framed barns of the early nineteenth century. This continuance must indicate a high degree of efficiency for the purpose, which was to maintain longitudinal alignment between the two lengths of timber, whose sole tendency would normally have been to subside under the structure's weight independently of each other. Wherever the scarf shown in FIG. 84, *a*, was used, neither length was able to subside without the other. The preceding scarf for ground-plates seems to have been the short halved-scarf at Belchamp hall, which must have been highly inadequate since one timber could obviously subside without affecting the other (FIG. 84, *c*). At Netteswellbury barn a third scarf may be seen (FIG. 84, *b*) without the transverse lip, and although probably later than the other it was less efficient and may denote an irrational preference on the builder's part.

SOME EVIDENCE FOR DISPARATE SCHOOLS

It is not easy to determine what degree of difference in method is sufficient to warrant the ascription of certain works to definite schools of carpentry. J. T. Smith⁶ has suggested that the use of roof-timbers all of the same scantling indicates one such school. From the evidence here assessed, however, the principle of uniform scantling above the tiebeams seems to be common to several differing methods of timber-framing, and we may probably, therefore, have to subdivide schools or, alternatively, postulate the existence of numerous schools within overall categories. A review of this evidence, laying particular stress on orders of assembly in relationship to the joint-forms by which they were in all probability necessitated, and also the apparent chronological succession of the buildings involved, may help to clarify the matter.

The unique, and obviously most important, structural method among those described is the dovetailless and totally-'reversed' assembly of the older barn at Belchamp St. Paul's. That this barn is representative of timber-framing methods that were long predominant is highly probable, and initially this must have been so because the joints necessary for any variation in the order of assembly were unknown to the carpenters concerned. The general significance of this method of assembly may be seen in FIG. 85, *c*. It is immediately apparent that this is an advance, and the only possible advance without the use of different timber-joints, from the method shown in FIG. 85, *b*, that occurs in the other barn at Belchamp hall. The existence of these two methods postulates the previous existence of that shown in FIG. 85, *a*, which, although I know of no examples of it, must certainly have been employed and may well survive in some building which I have not

⁶ 'Medieval roofs: a classification', *Archaeol. J.*, cxv (1960), 116.

seen. It is reasonable to assume that these assembly orders were necessitated by the carpenter's ignorance of joints able to resist withdrawal, the earliest of which appear to have been the notched lap-joints which, in certain areas of France, must have preceded the use, if not the knowledge, of lap-dovetails. The examples

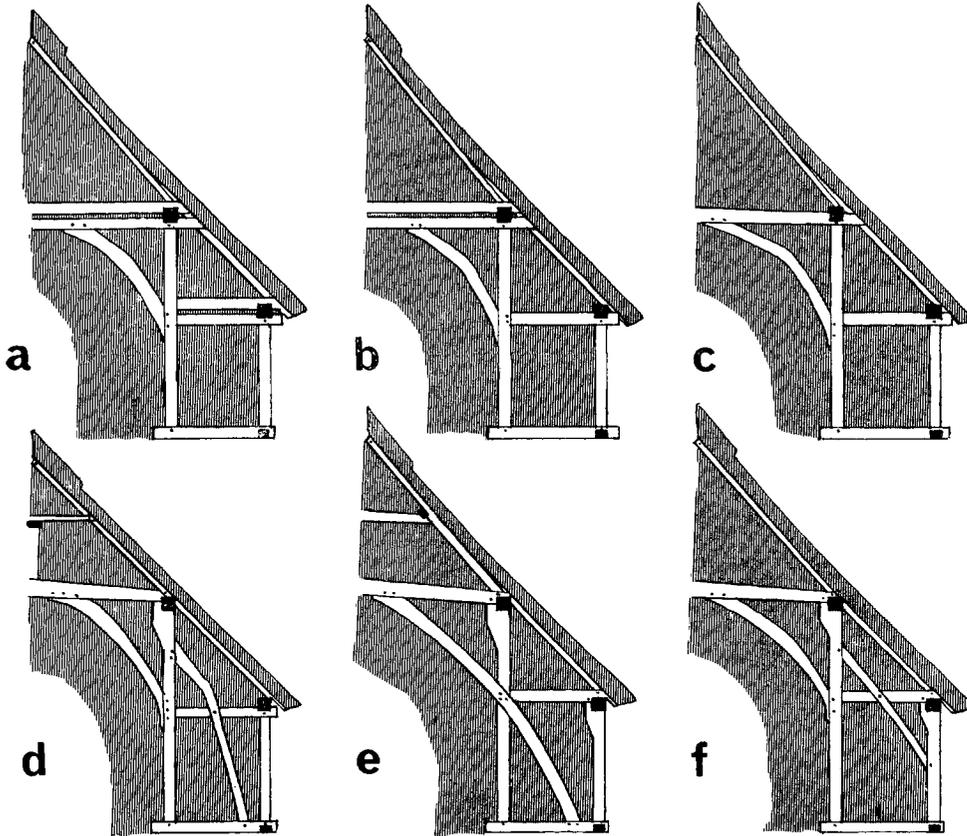


FIG. 85

TIMBER-FRAMING METHODS IN ESSEX BUILDINGS (pp. 250, 260 ff., 265)

a, hypothetical cross-section of aisled barn with clasping tiebeams at two levels; *b*, clasping tiebeams and 'reversed' assembly, later barn, Belchamp hall; *c*, totally-'reversed' assembly, earlier barn, Belchamp hall; *d*, partially-'reversed' assembly, with higher tiebeam in 'normal' position, Upminster hall barn; *e*, entirely-'normal' assembly of most aisled barns with all tiebeams uppermost; the 'passing-brace' connects two horizontal timbers; *f*, entirely-'normal' assembly with aisle; the 'passing-brace' connects two vertical timbers.

in FIG. 85, *a-c* are in no way problematical, although FIG. 85, *a* is admittedly hypothetical. The significance is probably that those changes in constructional order were possible, in that sequence, without the inclusion of any novel jointing concept. Only the 'trench' was necessary.

The next example (FIG. 85, *d*), based on the Upminster barn, is, in contrast, highly problematical. A new joint-form is introduced in most instances of this

structural method, but there is no evidence why that new joint, with its resultant new order of assembly, was tried at the juncture of the mainspan-roof, and never at the eaves-level. 'Reversed' assembly at the eaves-line, which is at the outshot-tiebeams' ends, is common in the medieval barns of Essex, although hitherto unnoticed, and there are adequate grounds for assuming that it was used throughout that period, since one specimen incorporating the feature seems to be much later than any of those described. This is the very large barn of Claredown farm, near Clare on the Suffolk border, which has full lap-dovetails of very subtle angularity upon the fish-pieces which reinforce the conjunctions of the outshot-tiebeams and the posts' backs. This barn also exhibits the rare feature of wind-braced common-rafters in a crown-post roof. It is difficult to decide whether this survival of the preceding structural method, 'reversed' assembly combined with 'normal' assembly for the mainspan, constitutes a characteristic feature of the works of a school, or whether it was, in fact, typical of most works during an indeterminate period in which no clear preferences were established by the practising carpenters. The Cressing barns must be remembered in this context since both are assembled throughout in the 'normal', or contemporary, manner, though they are earlier than any other barns here described except those at Belchamp St. Paul's.

The most plausible explanation of the frequent incidence of 'reversed' outshot-assembly together with its probable place in historical succession, is as follows. It is indisputable that this anomalous method of 'reversed' outshot-assembly with 'normal' mainspan-assembly was ultimately discontinued in favour of completely 'normal' methods, and it is apparent that it was preceded by completely 'reversed' assemblies, since a specimen has survived. The partial 'reversal' was in use, therefore, during the period between the two fully consistent framing-methods. This succession is largely confirmed by the frequency of partially-'reversed' medieval barns; the extreme rarity of totally-'reversed' barns which, when found, cannot be dated by any criteria generally known; and the superabundance of entirely-'normal' structures that are readily datable by various and generally accepted methods. It is therefore suggested, quite strongly, that the outshot-'reversal' was a survival-feature of the preceding order of framing in timber, and does not indicate the existence of a school which advocated both 'normal' and 'reversed' structural method. We may accept the appearance at Cressing Temple of entirely-'normal' assembly order during this indeterminate period, since these two monumental barns probably embody principles much in advance of their times.

If this matter is pursued purely by following changes in the order of assembly of frame-members, the next group is very large indeed, since it comprises the vast majority of all timber-framed buildings which have survived. Since these buildings are assembled in the contemporary manner I have called them 'normally' assembled. Every tiebeam is laid *over* the top-plates, either outshot or mainspan, in barns which retain the early feature of aisles, and aisled halls. The majority are jointed with forms of lap-joint which are capable of resisting withdrawal in any direction other than that in which their two components are assembled. This joint is normally the lap-dovetail, which seems to appear in Essex about the beginning of the fourteenth century.

Practically all surviving timber buildings are included in this last group, and work pertaining to several disparate schools—or traditions—of carpentry is to be found among them. We are thus obliged to confirm that the two preceding orders of assembly cannot denote preferences peculiar to schools of structural thought. And it is highly probable that many schools which are necessarily unknown, because works of such antiquity have not survived, must have used both ‘clasping’, ‘reversed’ and partially-‘reversed’ orders of assembly, simply because alternative methods were then impossible within the range of timber joints available. This is logical, since, as Deneux contended, progress in roof-framing could not be made until the necessary joint-types were known and had attained such mechanical efficiency as warranted advances in structural thought.

Since we have now arrived at the category of timber buildings which affords most examples for comparison, the ‘normally’-assembled majority, it is possible to begin to decide which disparities are sufficient to indicate sub-divisions, or schools. There seems to be sufficient evidence among the buildings here described to suggest that two major schools of carpentry existed during the late medieval period, both of which endured at least two centuries. They are distinguished by their preferences for either the full lap-dovetail or the barefaced lap-dovetail. Within the first of these it may not be permissible to include such varieties of that joint as the entrant-shouldered lap-dovetail, and the X-shaped lap-joint, resembling a contemporary ‘dovetail-key’, and those two forms may warrant further sub-division of the school. The earliest example known to me of the entrant-shouldered lap-dovetail is used for the outshot-tiebeams of the Crossing wheat-barn (FIG. 86, *b*, and inset). It is probable that this barn dates between *c.* 1260 and *c.* 1300, and it is interesting to note that exactly the same joint was used for the many tiebeams of the belfry at St. Lawrence’s church, Blackmore, in *c.* 1480.

The possibility that this dual occurrence of a joint is fortuitous must be dispelled when we consider the analogous case of the barefaced dovetail’s incidence, for examples of that joint exist which seem equally distant from each other in time. The earliest example is probably the lap-jointing, by barefaced dovetails (FIG. 86, *c*), of the granary tiebeams at Prior’s hall, Widdington. This granary is difficult to date, but it is reasonable to assume that it forms part of a single range of buildings, along with the stone-founded barn and the largely stone-built house, all possibly thirteenth-century. Similar barefaced dovetails are used for the mainspan-tiebeams of the barn at Thurrocks in Clavering, which is, again, undatable, but is certainly medieval. Finally, the barefaced dovetail is the only one used for the many tiebeams of the belfry of *c.* 1450 of the church of St. Margaret at Margaretting, which stands within three miles of the Blackmore belfry and seems to date from the same half-century.

The curious lap-joint used for the turret tiebeams of the belfry at West Hanningfield⁷ may also have been in use for a considerable period. It has also been recorded at Rufford Old Hall in Lancashire of the late fourteenth century, which indicates a wide distribution in England some two centuries before Deneux

⁷ *Op. cit.* in note 1, pp. 39, 45, fig. 14.

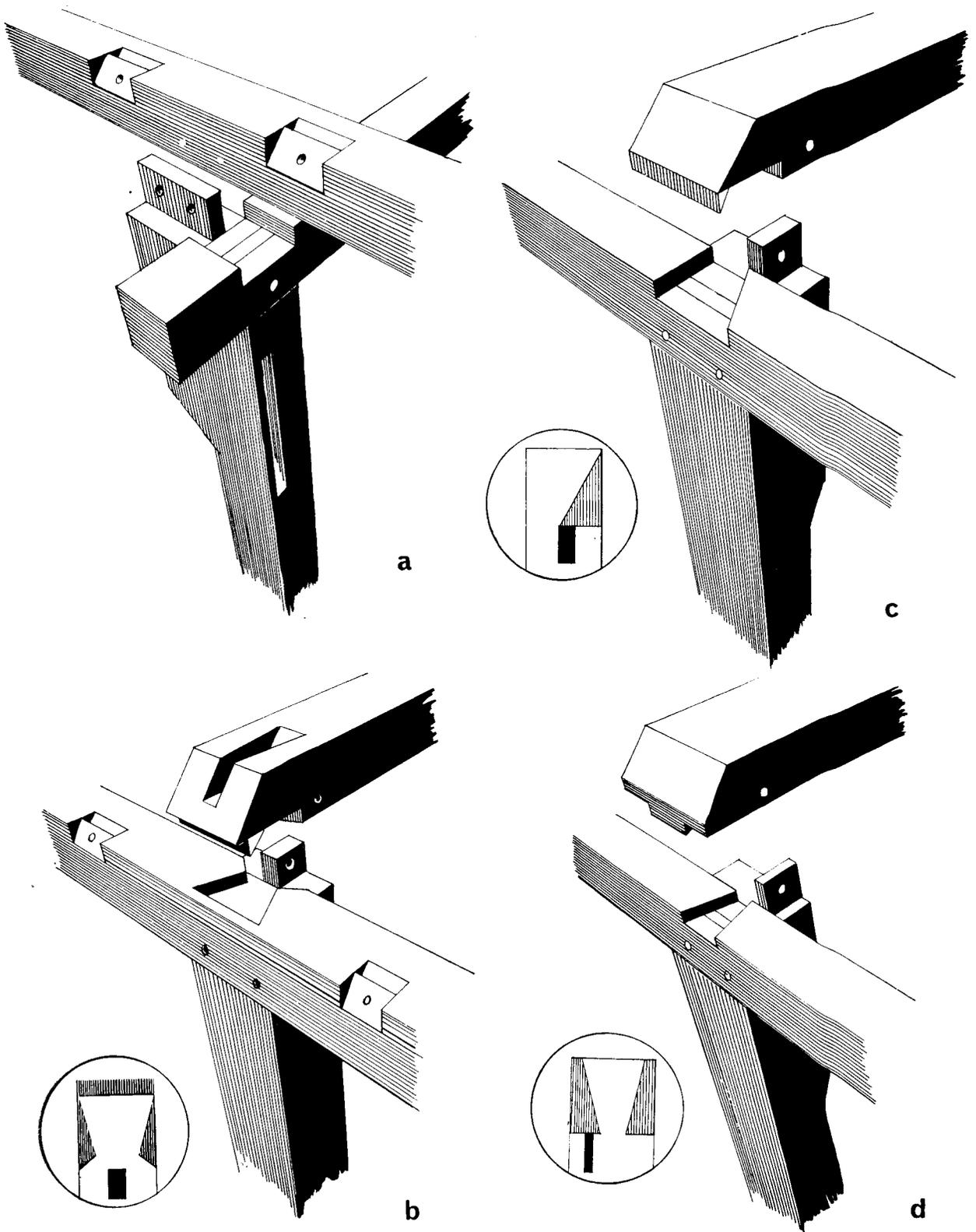


FIG. 86
 For explanation see p. 270

records it in France. It is possible that this joint had such a following among carpenters as might warrant considering its use peculiar to a school.

To those three dovetail-forms must, of course, be added that of the true dovetail as currently understood (FIG. 86, *d*, and inset). If this could be shown to have been introduced at about the same time as the others it would constitute a fourth division. The earliest examples of the true dovetail are those on the turret tiebeams at Stock Harvard belfry, and the tiebeams of Southchurch hall. The latter are probably of the last quarter of the thirteenth century while the Stock belfry dates from *c.* 1360, which seems to indicate, since the joint was in uninterrupted use until the nineteenth century, that the variations we have mentioned had entirely independent histories; that is, that they were not involved in any evolutionary sequence of dovetails.

An alternative to all these methods of tiebeam-seating exists in Essex, within the overall category of 'normally'-assembled timber-frames. This has been described in connexion with the barn at Mallbrooks farm, Mountnessing (p. 250), and clearly occurs in a very wide range of buildings of both secular and ecclesiastical types. The salient feature of this school's roof-framing method is its use of non-tying tiebeams together with ashlar-pieces that tenon into an interior top-plate, which is carried by the tiebeams. Examples of this roof-type have the crown-post of cross-quadrate section (FIG. 81, *d*). This illustration is based on the nave-roof of Doddinghurst church, built on masonry of *c.* 1225.

Another structural peculiarity noted in the examples here described is the use during the medieval period, in Essex, of long-scantling braces which, it is suggested, may be defined as 'passing-braces' in view of their passing-, or crossing-joints. These may be seen in four different capacities and there is an occasional combination, in the same structure, of two of these types. The first is that noted in the Cressing barns, and also in the monks' barn at Netteswellbury, in each of which the braces' ends join a horizontal timber to another horizontal one, these two being the post-plate and the outshot-tiebeam (FIG. 85, *e*). It appears, furthermore, that this peculiarity does not occur in combination with 'reversed' assembly at the eaves. It has been stated that this tradition of bracing horizontal to horizontal, without triangulating any two members, was known in north-east Germany, indicating a common origin for the principle in both England and Germany, which origin would necessarily be earlier than the Norman conquest of England.

The second capacity in which 'passing-braces' have been noted is to be seen in the barns at Thurrocks, Clavering, and at Walker's manor house, Farnham, in both of which the braces' ends connect two vertical timbers (FIG. 85, *f*). Here it is again noticeable that the order of assembly is nowhere 'reversed'. As already stated, the Thurrocks barn is of the barefaced-dovetail school, while the Walker's manor barn is of entirely twin-tenoned jointing. The question of ascribing these framing and jointing methods to disparate schools is much complicated by these two examples, since their end-jointing is entirely different, although their 'passing-braces' perform the same functions of connecting vertical timbers.

The combination of 'passing-braces' of both these categories in the same structure may be seen in the barns at Cressing Temple and in the belfry at

Navestock church. In both these instances the braces which start lowest in the structure connect two horizontal timbers, and those starting farther above ground-level connect two vertical timbers, or one that is vertical to another which is inclined. The significance of these variations in bracing theory is not known, but, since the first has been recorded in ancient Germany, it is obviously of more than local importance. It is probably important that no 'reversed' assemblies are seen in those structures incorporating these bracing theories, since 'reversed' assembly has also been recorded in north-east Germany.

Other barns, some of which have been described above, incorporate 'passing-braces' that are not in conformity with any of the categories yet mentioned. One of the most important of these is the vast barn at Upminster. The braces there connect the post-plates to the posts above the outshot-tiebeams (FIG. 85, *d*), thereby connecting a horizontal timber to a vertical timber, and passing a third horizontal one, the outshot-tiebeam. A fourth category is represented by the very large barns at Guttridge hall, near Weeley, and at Hassobury, in Farnham. In these two there are 'passing-braces' of great length which start from the outshot-wallposts and stop at the mainspan-tiebeams, forming parentheses to the mainspan arch-braces, and passing one vertical (principal-post) and one horizontal (outshot-tiebeam) timber. Both of these barns are 'normally' assembled. There are, then, in existence at least five quite different methods of bracing timber-frames to make them rigid. These would presumably bear some relationship to any schools that could ultimately be defined during the middle ages.

The occasional preference for twin-tenons at all such points as would normally be deemed to warrant only a single tenon may also denote the former existence of a school. The example described in this article is the barn at Walker's manor house in north Essex. Other examples are the belfry of St. Nicholas' church at Laindon, in south Essex, the barn at Ladylands in central Essex and, until its demolition recently, the barn at Crane's farm, Basildon, south Essex. It seems that twin-tenons are used at all points in these structures. The great-door jambs, for example, are twin-tenoned at both top and bottom ends in the Walker's barn. The belfry of St. Nicholas' church, Laindon, which appears to date from *c.* 1300, is a double structure from the ground-plates upward, the internal frame being for the support of the bells, while the external frame supports the turret and its lofty spire. The internal frame is completely twin-tenoned.

Finally, there is the protracted use of vertical weather (or external)-boarding. This would seem to bear some relationship to the 'stave' wall-structure which has been noted in Scandinavia and elsewhere in Europe, but which does not appear to be the product of a school.

Vertical cladding in the form of boards may be seen in innumerable structures, from the Upminster and Nettesswellbury barns right down to late eighteenth-century examples, which are abundant in south Essex. The boards may be applied to rails only and involve the use of the minimum quantities of timber, as at Upminster, or they may be applied to rails that are mortised through the usual frequency of close-set studs, as at Nettesswellbury. This may denote a distinction between two longstanding walling traditions, since the Upminster barn is of both

'normal' and 'reversed' assembly orders, while the Netteswellbury barn is 'normally' assembled throughout, and the bracing of the two structures is also entirely different.

Both types of this vertical cladding continued in use until the fifteenth century, since they may be seen in several belfries of that date. The belfries will not, however, sustain comparisons involving roofing, since they possess only lean-to roofs and their surmounting spires. Nevertheless, it can be seen in the turret at Doddinghurst that the boarding is hung from rails which pass through frequent wall-studs, while the Blackmore belfry appears to have rails only, like the Upminster barn.

The type of vertical cladding noted at the Navestock hall granary, which is very late medieval, could be a development of one or both of the preceding methods. If it were a development of one of these, it would logically be the Netteswellbury one, since studs are included in both. It could, however, indicate the existence of a third tradition of wooden walling.

GLOSSARY

- ABUTMENT**—This occurs most frequently in the mortise-and-tenon joint. The pieces remaining on either side of the mortise are called butment-cheeks; these are met by the tenon's shoulders.
- AISLE**—Currently the side passages in a church. Used also to denote the side areas in a medieval barn, which may also be termed outshots (see *s.v.*).
- ARRIS**—In squared timber, the meeting of one face and one edge.
- BAREFACED**—In joinery this implies the possession of only one shoulder, as 'barefaced tenon' or 'barefaced lap-dovetail' (cp. FIG. 86, *c*, inset).
- BAY**—The length, in a timber-framed building, between two transverse frames, generally one perch.
- BINDER**—In timber-framing a horizontal beam acting as a 'distance-piece' between upright members. Necessarily below tiebeam-level, as bridging-joists for a first floor, when athwart the building.
- BIRD'S MOUTH**—Any abutment resembling an open bird's mouth, i.e. diverging shoulders, in the case of tenons entering arrises.
- BRACE**—Normally, in timber-framing, braces triangulate the junction of two timbers and maintain the angle they form.
- CHEEK**—Term applied in joinery to the solid wood left, each side of a mortise, to receive the tenon's shoulders.
- CLADDING**—Clothing of a structure, as boards, tiles, etc.
- COLLAR-BEAM**—In a roof-frame, a horizontal timber between two rafters, placed about midway between their apexes and bases.
- COLLAR-PURLIN**—A timber running longitudinally through a roof-frame immediately beneath the collars and normally (in Essex) supported on crown-posts. The function these timbers were intended to perform is frequently uncertain (cp. FIG. 81).
- COLLAR-TIED**—Used of a roof-frame in which the collar-beam is specifically introduced to resist extension. In such cases there are no tiebeams.
- COMMON-RAFTERS**—Inclined roof-members which support the cladding, normally spaced at distances of one foot.
- CORNER-POST**—Post set at the junction of two walls and itself forming the termination of each, vertically, as, e.g., the posts standing in each corner of a square structure.
- COTTER**—A tapering wedge-shaped pin, key or block.

- CROSS-HALVING**—Joint effected by crossing two timbers at right angles and removing half the depth of each, the actual crossing seeming, thereby, to be of their common depth. The method produces a rigid angle of crossing, whilst weakening both timbers by half.
- CROSS-QUADRATE**—Heraldic blazon (cp. FIG. 81, *d*).
- CROWN-POST**—A vertical post standing centrally upon the top face of a tiebeam or transom (cp. FIG. 81). These support collar-purlins, and thereby collars.
- DOVETAIL-JOINT**—Formed by ‘pins’ whose shape in cross-section is that of a wedge, fitted between ‘tails’ that are shaped like extended dove’s tails. This results in a corner-joint of great rigidity which offers complete resistance to withdrawal, mechanically, in one direction. This joint may be ‘open’ or ‘secret’, ‘through’ or ‘stopped’, and can possess one, or more, ‘pins’.
- END-GIRTH/GIRT**—A horizontal timber in the frame of an end wall, placed midway between its top-plate and its plate, i.e. half-way up the wall. The purpose of these timbers is to render the studs more rigid by shortening them.
- END-JOINT**—A joint occurring at the termination of the principal timber involved (cp. FIG. 86, *a-d*). The bridle-joint is an example in which neither timber is ‘principal’.
- ENTRANT-SHOULDERED**—FIG. 86, *b*, and inset, shows a lap-dovetail-joint that has entrant shoulders; normal shoulders are square.
- GABLE**—The triangle formed by an end wall running up to the apex, or ridge, of two inclined slopes of a roof, which meet.
- GABLET**—Diminutive of a gable, formed by the lower part of a roof being hipped, the upper part being vertical.
- GREAT DOORS**—In a barn, the very large pair of doors placed at the entry to the threshing-floor. These are large enough to admit a loaded harvest-wagon.
- GROOVE**—In carpentry and joinery a ‘furrow’ of square section which runs, essentially, along the grain.
- GROUND-SILL**—Currently used to denote a ‘plate’. The horizontal timber laid along the footing or plinth into which all wall-timbers are jointed.
- HALF-HIPPED**—A roof-end which is hipped on the upper part alone, thus presenting a truncated gable.
- HALVED-AND-BRIDLED**—A scarf-joint (cp. FIG. 82, *c*).
- HANGING-KNEE**—Term and structural component derived from shipwrighting. A solid brace to an angle cut from the junction of tree-branch and trunk, resembling a bent knee. Described as ‘hanging’ when placed beneath a beam, ‘standard’ when above the beam, and ‘lodging’ when placed horizontally on either side of the beam.
- HIPPED**—A roof’s end which slopes, usually at the same angle to the vertical as do its sides.
- HIP-RAFTER**—A rafter pitched upon the meeting-line of the pitched end and pitched side of a hip-roof, so that it extends from apex to corner of such roofs.
- HOUSING**—End-joint effected by accommodating the timber’s end entirely in a ‘housing’ or socket of identical shape.
- JACK-RAFTER**—Short common-rafter which runs from eaves to hip-rafter in the corners of a hip-roof (cp. PL. XXIV, *c*).
- JAMB**—The side-piece, or post, of a doorway.
- JOWL**—End of a timber, thickened to afford a greater cross-sectional area for jointing and, thereby, maximum rigidity for the joint.
- LAP-DOVETAIL**—Joint in which the principal component is a ‘tail’ shaped like an extended dove’s tail, and not a ‘pin’ as is more usual. This ‘tail’ is fitted into a matrix of identical shape (cp. FIG. 86, *d*). The resulting lap-joint can only be taken apart in the same way as it is assembled.
- LAP-JOINT**—Form of joint, either terminative or crossing, in which part of one of the timbers overlaps part of the other, as distinct from entering the other.
- LIPPED-AND-HALVED**—Used to denote the scarf-joint type shown in FIG. 83, *d*.

- LONG-SCANTLING—Timber of cross-section no greater than about 9 in. by 7 in., which is available in great length. In England at present, elm.
- MIDSTREY—In a barn a substructure projecting from the 'nave' at right angles, sufficient to cover a loaded harvest-wagon which is not hauled on to the threshing-floor. OE *midd*, *middel*; some connexion with the centre of the barn.
- MITRE—Abutment in joinery formed by cutting the bisection of an angle formed by two timbers to be joined.
- MORTISE—A cavity 'chopped' into a timber, essentially rectangular on plan.
- NOTCH—A nick, an indentation. Produced by two cuts upon a face, edge or arris of a timber which converge.
- NOTCHED LAP—Lap from which a notch is removed, which prevents its being withdrawn from its housing.
- OUTSHOT—Area of a building which is additional to the 'bay', determined by the placing of any four posts. This may be either at an end or on one side; in barns, on both sides. OE *gescot*, ON *skot*, part of a building shut off from rest. Icelandic *af-hus*, a side apartment. Norwegian *skut*, or *utskut*.
- OUTSHOT-FLIGHT—The length of rafters used to cover an outshot, or barn aisle.
- OUTSHOT-PURLIN—Purlin fitted to under side of outshot-rafters (cp. PL. XXIV, A). This may have been the first point in roofing where true purlins were introduced.
- OUTSHOT-ROOF—Essentially a lean-to roof, which, in a barn, leans against the main structure.
- OUTSHOT-TIEBEAM—Tiebeam necessary to tie the eaves of an outshot-roof to the structure upon which it leans.
- OUTSHOT-WALLPOSTS—Posts of a transverse frame in barns that have outshots or aisles, which stand in the exterior wall at 'bay' intervals.
- OVERTHROWN—Crested, implying an arching of a horizontal line.
- PARALLEL SCISSORS—Scissor-braces set parallel to those rafters they brace (cp. PL. XXIII, D).
- PASSING-BRACE—A brace which, by the use of 'crossing' or 'passing' joints, is able to brace several consecutive timbers.
- PITCH—The angularity of the slopes of ridged roofs.
- PLATES—Horizontal timbers set on the footings and carrying the wall-frames, or on which the principal-posts are erected. The width always exceeds the depth of these timbers.
- POST-HEAD TENON—Tenon (or tenons) cut at the upper end of a post.
- POST-PLATE—Timber upon which a principal-post is erected. In barns these plates run in from the walls at right angles.
- POST TOP-PLATE—Longitudinal timber placed on the heads of the principal-posts.
- PRINCIPAL-POST—In barns, free-standing massive posts supporting the mainspan-roof at 'bay' intervals.
- PRINCIPAL-RAFTER—Rafters at 'bay', or transverse-frame, intervals. These are of heavier section than are common-rafters and are frequently associated with side-purlins, which they support. They stand on the tiebeams' upper faces, at their ends.
- REBATE—To reduce the thickness of timber either transversely or longitudinally. This is always effected along an edge.
- RETURN—An angle.
- RIDGE—Horizontal line of intersection of the two inclined slopes of a ridged roof.
- RIVE—To split. ON *rifa*.
- SCARF-JOINT—Category of joint devised to join lengths of timber end to end.
- SIDE-GIRTH/GIRT—Horizontal timber in a wall-frame set midway between plate and top-plate. By shortening the unsupported lengths of stud this renders the wall more rigid.
- SIDE-PURLIN—Longitudinal, horizontal timber placed under the common-rafters. These maintain the slopes of the roof in a single plane.

- SOFFIT**—Under side.
- SPLAYED SCARF**—Scarf incorporating slope, bevel, or taper (cp. FIG. 82, *b*).
- SPLAYED-AND-TABLED SCARF**—Cp. FIG. 82, *b*.
- SPROCKETING**—Laying timbers of greater angularity to the vertical on top of rafters' feet as 'eaves-catches', or laying rafters of outshot-flight on to those of mainspan-roof.
- SQUINT**—Oblique. In carpentry any angle other than one of 90°.
- STRAINING-BEAM**—Timber to maintain the distance between two other timbers constant.
- STUD**—The vertical, common, or general timbers in a framed wall. OE *studu*, a post.
- TABLE/TABLING**—A raised portion, rectangular on plan (cp. FIG. 82, *b*).
- TENON**—A projection of rectangular section on the end of a timber to be fitted into a mortise. May be 'double', 'twin', 'haunched', or any combination of these three kinds.
- THRESHING-FLOOR**—Floors laid across barns, invariably having a hardened surface, not uncommonly packed chalk, on which the grain was threshed with a flail.
- THROUGH**—Any mortise, trench, housing, groove, dovetail, etc., which completely traverses the length, breadth, width, or thickness of the timber on which it is worked.
- THROUGH-PURLIN**—A side-purlin which is continuous and passes the transverse frames of the roof. It is broken only by the necessary scarf-joints.
- TIEBEAM**—Horizontal beam uniting the principal-rafters' feet, or, in the absence of principal-rafters, tying the top-plates, on which the common-rafters stand, together. This prevents the rafters' feet from pushing the top-plates apart.
- TONGUE**—In joinery any tenon greatly extended in one respect. Precisely: the corollary to 'groove'.
- TOP-PLATE**—Horizontal timber laid along the top of a timber-framed wall, upon which the rafters rest at their lower ends.
- TRANSOM**—A cross-beam. Shipwrights' term, primarily denoting beams crossing the stern-post.
- TRENCH**—To remove the wood between two saw-cuts, thereby producing a groove across the grain.
- TWIN-TENONS**—Two identical tenons cut upon the same timber's end, essentially side by side. These are called 'double tenons' if cut end to end.
- VALLEY-RAFTER**—A heavy rafter pitched on the line of intersection of two inclined planes of roofing (cp. FIG. 80).
- VERGE-BOARD**—Boards placed as fascias to end-couples of rafters, frequently cusped and decorated, also known as 'barge-boards'.
- WALL-PLATE**—Timber or timbers running along the top of a masonry or brick wall to receive the roof-frame members, generally (cp. FIG. 81).
- WIND-BRACE**—A brace fitted into a frame-angle, either roof- or wall-frame, to strengthen the building against wind-pressure upon its outer surfaces.
- WIND-EYE**—Opening in a wall for ventilation. Always necessary in barns so that the vast quantity of stored grain may retain its qualities.

EXPLANATION OF FIG. 86

TIMBER-FRAMING METHODS IN ESSEX BUILDINGS (pp. 246, 263, 265)

- a*, 'reversed' assembly at eaves with tiebeam passing under top-plate, Prior's hall barn, Widdington; *b*, 'normal' assembly with entrant-shouldered dovetail, based on wheat-barn, Cressing Temple; *c*, 'normal' assembly with barefaced dovetail, based on barn at Thurrocks, Clavering; *d*, 'normal' assembly with true lap-dovetail, based on belfry in Stock Harvard church

APPENDIX

NOTE ON TWO RADIOCARBON DATES FOR TIMBERS FROM THE CRESSING BARLEY-BARN

Two samples of oak cut from the Cressing barley-barn, by the kind consent of its owner Mr. F. J. Cullen, were analysed by Professor G. J. Fergusson of the University of California, U.S.A., in June 1963 and October 1963 respectively. The first sample was cut from the post-plate situated NE. of the threshing-floor and gave a radiocarbon age of 240 ± 60 years. This date presumably indicates the time of the rebuilding of the barn's exterior walls, when the majority of the post-plates in the eastern series were evidently renewed.

The second sample was cut from the principal-post standing in the SW. corner of the barn and gave a radiocarbon age of 940 ± 70 years. This suggests a date in the eleventh century, centring on 1023, for the felling of the oaks used in its original building. It is perhaps surprising that this date is earlier than the gift of the estate by King Stephen to the Templars, but there is no obvious reason why the barn should not have been built whilst the estate was in the possession of the Crown.