

# Jettying and Floor-Framing in Medieval Essex

By CECIL A. HEWETT

IN an earlier volume of this *Journal*<sup>1</sup> I attempted to outline a provisional course of development for scarf-joints and elsewhere<sup>2</sup> I have tried to indicate that certain carpenters' joints were in use only during limited periods of history. It also seemed probable, in the light of the arguments in these two articles, that the introduction of certain specific carpenters' joints would admit of fairly close dating, since sustained field investigations show that some techniques occur only in relatively recent centuries while others—such as the notched-lap technique—were obviously confined, as Deneux found in northern France, to a very few early centuries.

Deneux<sup>3</sup> contended that advances in structural method could not be made until commensurate advances in the mechanical efficiencies of carpenters' joints had been achieved, a point which J. T. Smith endorses.<sup>4</sup> In studying timber belfries and medieval barns, only such tentative courses of development as that suggested for the scarf-joints<sup>5</sup> used in barns could be attempted, while the belfries give clear evidence only of the changes in corner-jointing. Timber-framed houses, however, appear to give quite precise evidence, in the construction of first floors, for the development of the mortise-and-tenon joint. The function of any floor is to support weight, for which purpose the joints used in its construction must be very finely calculated, if the result is to be successful and enduring. I hope to show in this paper that much critical analysis of joints for this purpose, and deliberation as to which was the most efficient, was carried out between the close of the 13th and the opening of the 18th century.

I begin by describing the timber buildings which incorporate the joints in question, in what seems to be their chronological order, with particular reference to their floor-joists and I conclude by making tentative suggestions about the date of inception of each joint and the duration of its use by practising carpenters in Essex. The relevance of such 'linear' successions of carpenters' joints to the dating of timber buildings generally will it is hoped be appreciated, since many interesting vernacular buildings lack any stylistic or aesthetic peculiarities to help in dating them.

Carpenters' joints, made for whatever purpose, have at all times sought to attain a high degree of mechanical efficiency and, where a succession of forms of

<sup>1</sup> 'Structural carpentry in medieval Essex', *Med. Archaeol.*, vi-vii (1962-3), 240 ff. (especially pp. 253-260).

<sup>2</sup> 'The timber belfries of Essex: their significance in the development of English carpentry', *Archaeol. J.*, cxix (1962), 225 ff.

<sup>3</sup> Henry Deneux, *L'Evolution des charpentes du xi<sup>e</sup> au xviii<sup>e</sup> siècle* (Centre de Recherches sur les Monuments Historiques, 1927).

<sup>4</sup> J. T. Smith, 'Medieval roofs: a classification', *Archaeol. J.*, cxv (1960), 118.

<sup>5</sup> *Op. cit.* in note 1, pp. 253-260.

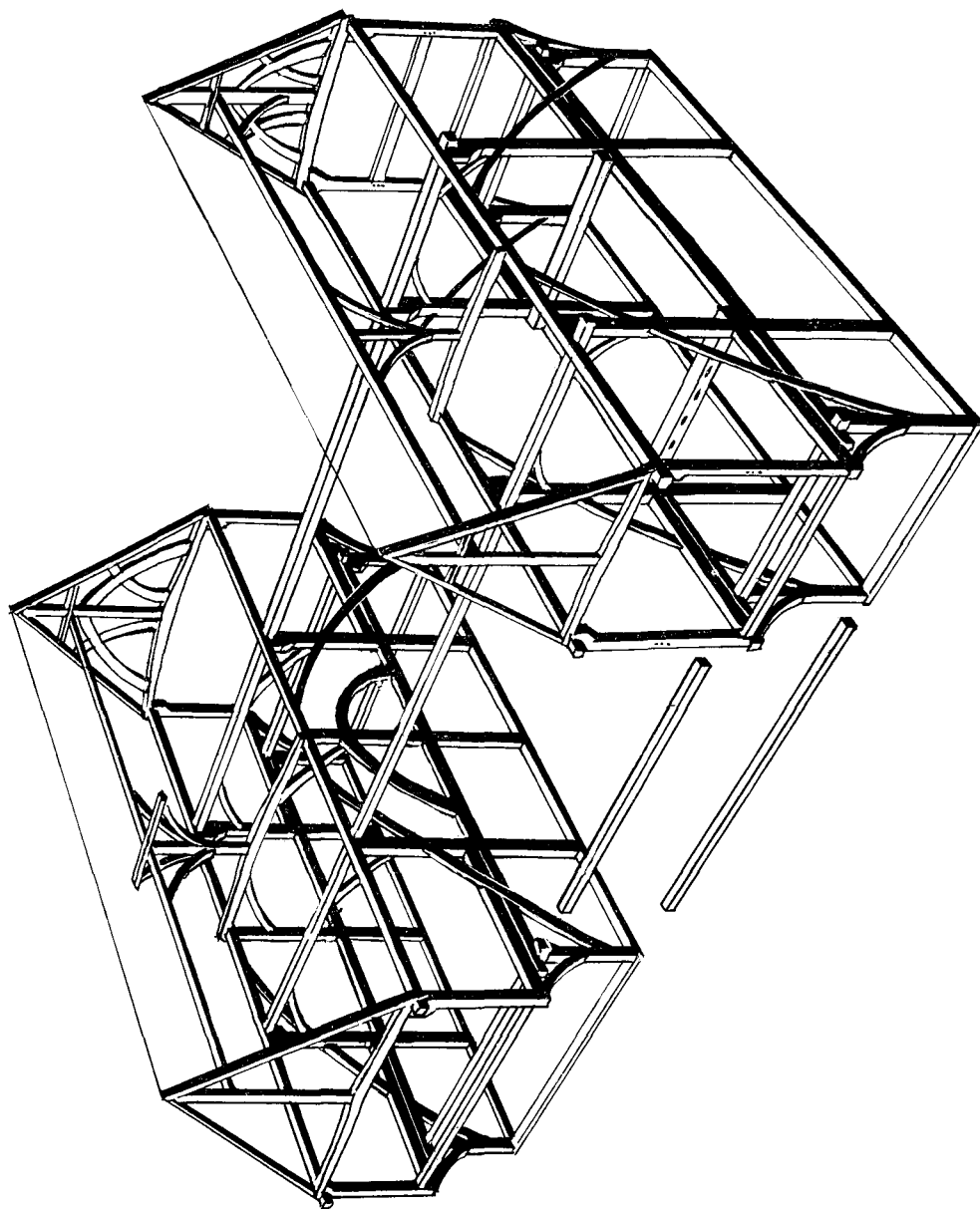


FIG. 31

PRIORY PLACE, LITTLE DUNMOW, ESSEX (p. 91)

Frame of building as exposed during summer, 1964. The 'floating' top-plates are hypothetical.

the same joint serve the same purpose, that form which is most archaic, and in consequence mechanically the least efficient, must be assumed to be earlier than the most refined and efficient form. The history of timber building is, therefore, totally inseparable from the history of technology itself.<sup>6</sup>

PRIORY PLACE, LITTLE DUNMOW, ESSEX (FIGS. 31-35)

This house stands about 100 yds. W. of the surviving part of Little Dunmow Priory—the chancel or lady chapel which since the Dissolution has served as the parish church. The priory itself was of Augustinian Canons and was founded by Geoffrey Baynard in 1106. The whole plan of the priory has been ascertained by excavation, and, since it extended westwards from the surviving portion the house now known as Priory Place must have stood so close to the priory on its W. side as to render any origin for it, other than a monastic one, unlikely. As a result of an extensive rebuilding, probably during the late 15th or early 16th century, the structure looked like a medieval H-plan hall-house—a misleading appearance, for when the house was stripped down to frame during its recent restoration it was possible to prove, to a large extent, what its initial design was.

Originally it had been an aisled hall of plain rectangular ground-plan and possessing four jettied gables, two at either end. Whether these jetties constituted the ends of cross-wings seems debatable, but I shall call them cross-wings rather than end-bays. Much of the structural evidence to which I shall refer is now, I regret, hidden from view by the recent restoration. FIG. 31 shows all that could, with certainty, be deduced from the skeleton before it was re-covered. In this drawing the hall top-plates are shown entire, since they have survived entire, although part of the eastern one had been replaced, as was shown by the change in scarfing method that occurred between the middle of the 14th and the last quarter of the 15th century.<sup>7</sup> The aisle top-plates are shown 'floating' since they no longer exist and their former existence had to be proved by reference to the orientation of their lap-joints, as will be described. A close study of this drawing will make it quite clear that, at several very important points, the order and method of assembling the frame is unlike any other published examples of frame-details of similar hall-houses. The solar wing had a crown-post with a very short octagonal base and four braces, while the service wing had a crown-post with only two braces of almost straight timber, square in cross-section and of steep angularity.

Most of the roof-timbers show a coat of red ochre and, wherever they are pegged, the pegs reveal a rare peculiarity, in that each is cut at its back end into a head resembling that of a modern wire-nail, which is very expertly decorated with a gouge. The only other example I know of this treatment for wooden pegs is published by Deneux<sup>8</sup> from the roof of the S. arm of the transept of the Abbaye

<sup>6</sup> In houses with jettied long walls at their sides floors are invariably framed transversely and as a result the common-joists have to be in two lengths, both of which are tenoned into a longitudinal, or axial, bridging-joist. Here confusion of terminology arises, since these axial joists are carried by transverse joists at the bay intervals, and, clearly, transverse and axial joists cannot both be termed bridging-joists, since they are not identical. In this article, therefore, the transverse bridging-joist will be qualified by the term 'binder', which function it necessarily performs, also; while the axially-aligned bridging-joists will be termed 'sheer', as in millwrights' terminology, precisely to denote that they are so aligned.

<sup>7</sup> *Op. cit.* in note 1, p. 256.

<sup>8</sup> *Op. cit.* in note 3.

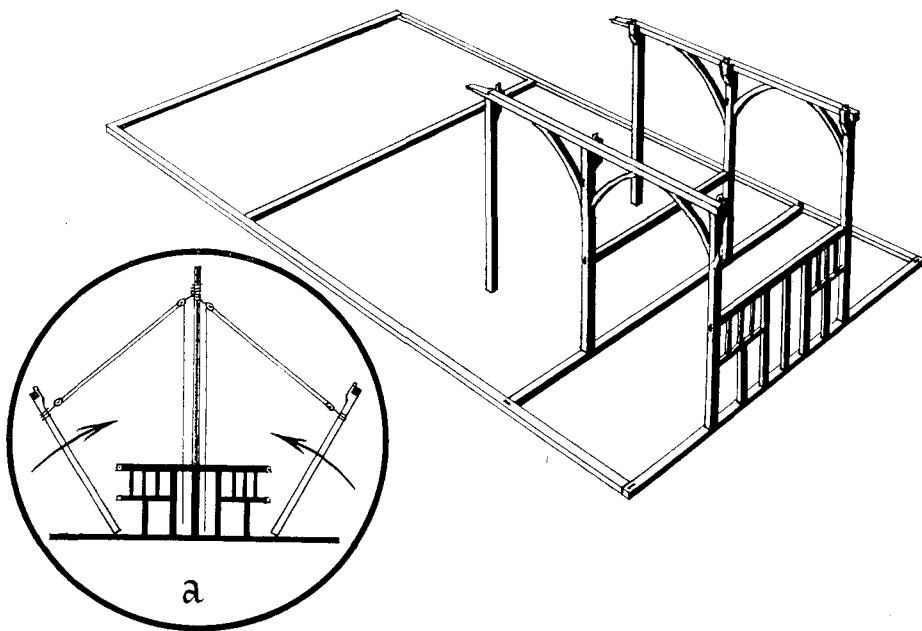


FIG. 32

PRIORY PLACE, LITTLE DUNMOW, ESSEX (p. 93)

Order of erection, stage one. Rearing the two halves of N. 'arcades' which were stabilized by N. end wall and side-girt to next bay. *a* shows method of rearing.

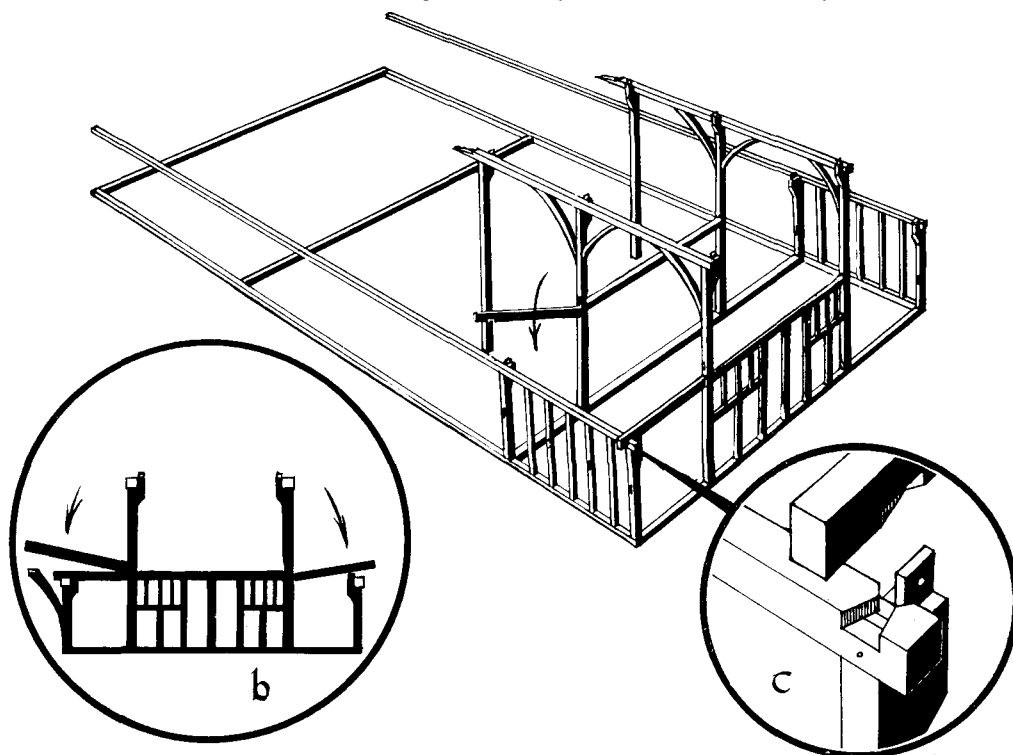


FIG. 33

PRIORY PLACE, LITTLE DUNMOW, ESSEX (p. 93)

Order of erection, stage two. Erection of aisle walls, which were then tied (*b*) by extension of side-girts. *c*, lap-dovetail joint with entrant shoulders.

Noirlac, which Deneux dates 1150–1160. The carved ‘nail-heads’ at Priory Place are much more elaborate than the French specimens, but both are monastic and it seems reasonable to assume that two so similar pieces of carpentry-practice might be tolerably close in date. With reference to what is said in the recent paper by Fletcher and Spokes<sup>9</sup> upon the development of crown-post roofs, I can see no objection to the examples at Priory Place being ascribed to the second half of the 13th century.

The peculiarities of assembly and jointing that were visible in this house can be best explained by describing its original order of erection. FIG. 32 shows the first stage, the rearing of six principal-posts, complete with their top-plates and braces, as ‘arcades’. This was done at the N. end of the building, since they could be immediately stabilized by the two seeming straining-beams shown in the drawing, which are, in fact, the side-girts of the service wing, here shown with its studding complete at the N. end, as would have been unavoidable in the logical course of erection. The inset *a* shows the probable method of rearing such ‘arcades’ in either halls or barns—a method too obviously expedient to have escaped use during those centuries in which the wedge and the pulley provided the greatest mechanical advantages.

FIG. 33 shows that the outshot or aisle walls of the building must have been erected, surrounding the hall-arcades, as soon as the latter were in position. The tiebeams for the aisles, at the ends, as in the service end shown, were laid on top of the eaves-plates, the same tiebeams forming a continuation of the side-girts of the wings. The tiebeams here, as elsewhere in this house, employ the lap-dovetail with entrant shoulders<sup>10</sup> and, as shown in inset *c*, these are so orientated that they tie only the eaves-plates, and prove thereby the existence of former aisles to the hall. Alternatively, had the hall been without aisles (two examples of aisleless halls are strongly suspected in Essex) and had the solar and service structures been cross-wings, the top-plates, at the eaves, would have tied the side-girts together, thus ensuring that the width remained constant beneath the weight of the superstructure.

Inset *b* shows the sectional aspect of this last process, in which the aisles were tied by laying the wing’s side-girts over them. The unique manner in which the side-girts were ‘doubled’ is also shown, and it was by means of this ‘doubling’ that the projection of the jetty was achieved, and, perhaps more important, the bressummers of the jettied first floors raised to the height necessary to accommodate the truly archaic floor-framing employed.

FIG. 34 shows the hall-arcades complete, with those parts of the aisle walls standing which were preserved for inspection, with the ‘doubled’ side-girts forming the jetties. Both these timbers were trenched, as may still be seen, for the passing-braces, of which large parts survive *in situ*.

The next stage of erection is shown in FIG. 35 illustrating the northern, or service, wing, which was more advanced in construction, and laying emphasis

<sup>9</sup> J. M. Fletcher and P. S. Spokes, ‘The origin and development of crown-post roofs’, *Med. Archaeol.*, VIII (1964), 172, table v.

<sup>10</sup> *Op. cit.* in note 1, p. 264, fig. 86, *b*; *op. cit.* in note 2, pp. 234–5.

upon the floor-framing. The next important step so far as the entire building was concerned, was the placing of the hall tiebeams immediately over the principal-posts. These used entrant-shouldered lap-dovetails. One (the southern) is shown in black, to emphasize the point that all four, two in each wing, were scarfed with stop-splayed scarfs<sup>11</sup> over the 'arcade-plates' of the hall, thereby constituting a 'normal-assembly'<sup>12</sup> at these points. It must be emphasized that

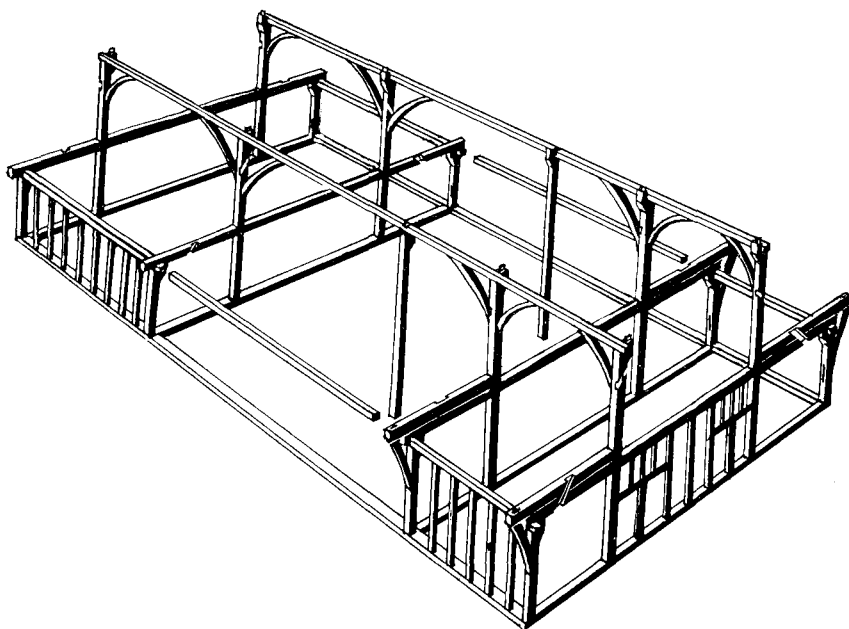


FIG. 34

PRIORY PLACE, LITTLE DUNMOW, ESSEX (p. 93)

Order of erection, stage three. 'Arcades' and aisle walls are erect and tied, transversely. The structure is very closely related to a barn designed along a single axis.

the alignment of the dovetails here proves that the tying of the width of the hall was the carpenter's sole concern—the width of the wings was tied only by the gable tiebeams and central tiebeam.

The framing of the two first floors, one in either wing, is of particular interest, and, as is shown in FIG. 35, the transverse joists between the four principal-posts are merely 'lodged' on top of the side-girts. They are not in any way jointed into the building, but merely rest in place. The massive joists in the angles of the posts and the side-girts are, effectually, bridging-joists; and into them the five common-joists are tenoned for the jetties. The joint used for this is the one that is fundamental for this purpose—the central tenon and mortise (inset *d*). This method was not, of course, mechanically efficient, since only two-thirds of the

<sup>11</sup> *Op. cit.* in note 1, p. 254, fig. 82, *a*.

<sup>12</sup> *Op. cit.* in note 1, p. 262.

common-joists' depths are involved in supporting the weight of the floor. Furthermore, it is the depth of the tenon alone which really sustains the floor, and this is analogous to a chain with a weak link, since the tenon is so much weaker than the joist.

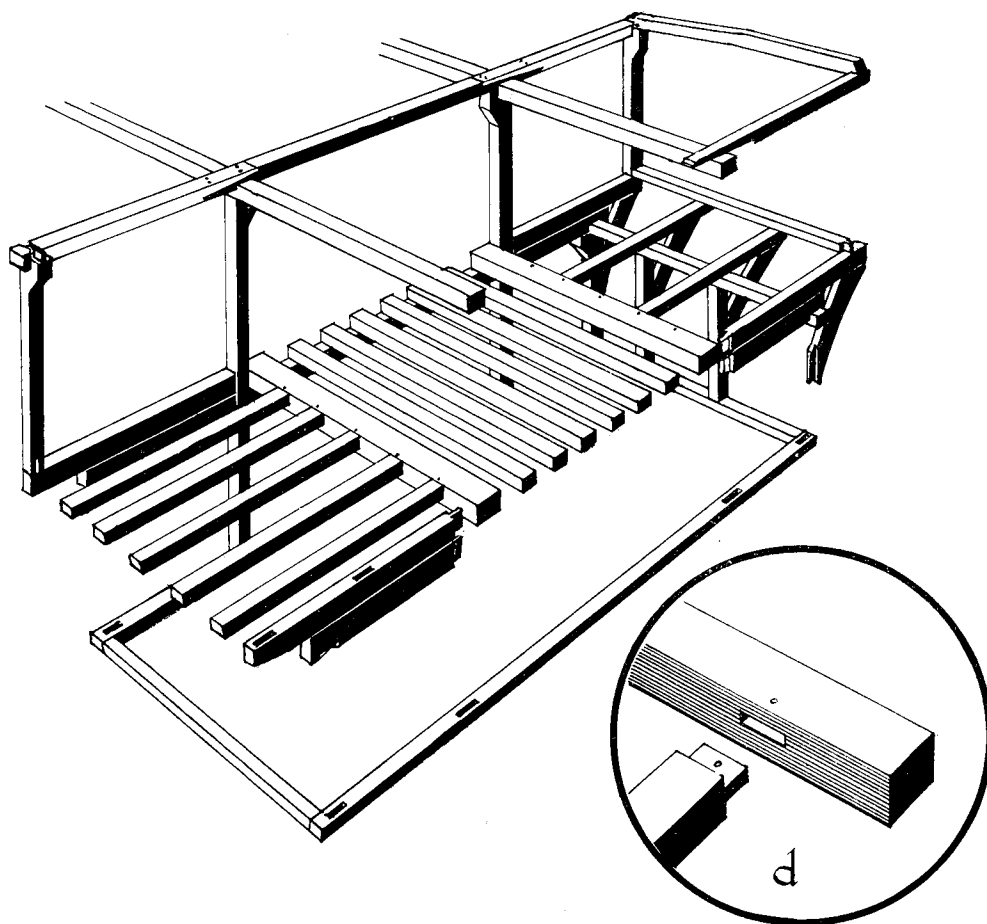


FIG. 35

PRIORY PLACE, LITTLE DUNMOW, ESSEX (pp. 93 ff.)

Order of erection, stage four. Completion of service wing as high as top-plates, showing width tied by continuation of 'arcade-plates' of hall, and archaic framing of floor with plain mortise-and-tenon (*d*).

The ground-floor end walls of these wings had widely-spaced studs with curved braces springing from alternate ones to support the jettying common-joists (FIG. 35). Thus all four jetties were provided with a close series of arched braces, and doubled, massive, timbers at either side; all of which prodigal use of timber provided but a minimal projection in the resultant jetty. It is reasonable to regard this construction as archetypal, if the late 13th-century ascription is tenable, and, if this were so, it would endorse the view, widely held, that of all forms of jetties, end-jetties must have been achieved first.

## LADYLANDS, GOOD EASTER, ESSEX (FIG. 36)

This house stands well away from the village and is evidently a solar wing. It formerly stood athwart an earlier ground-floor hall, which seems to have

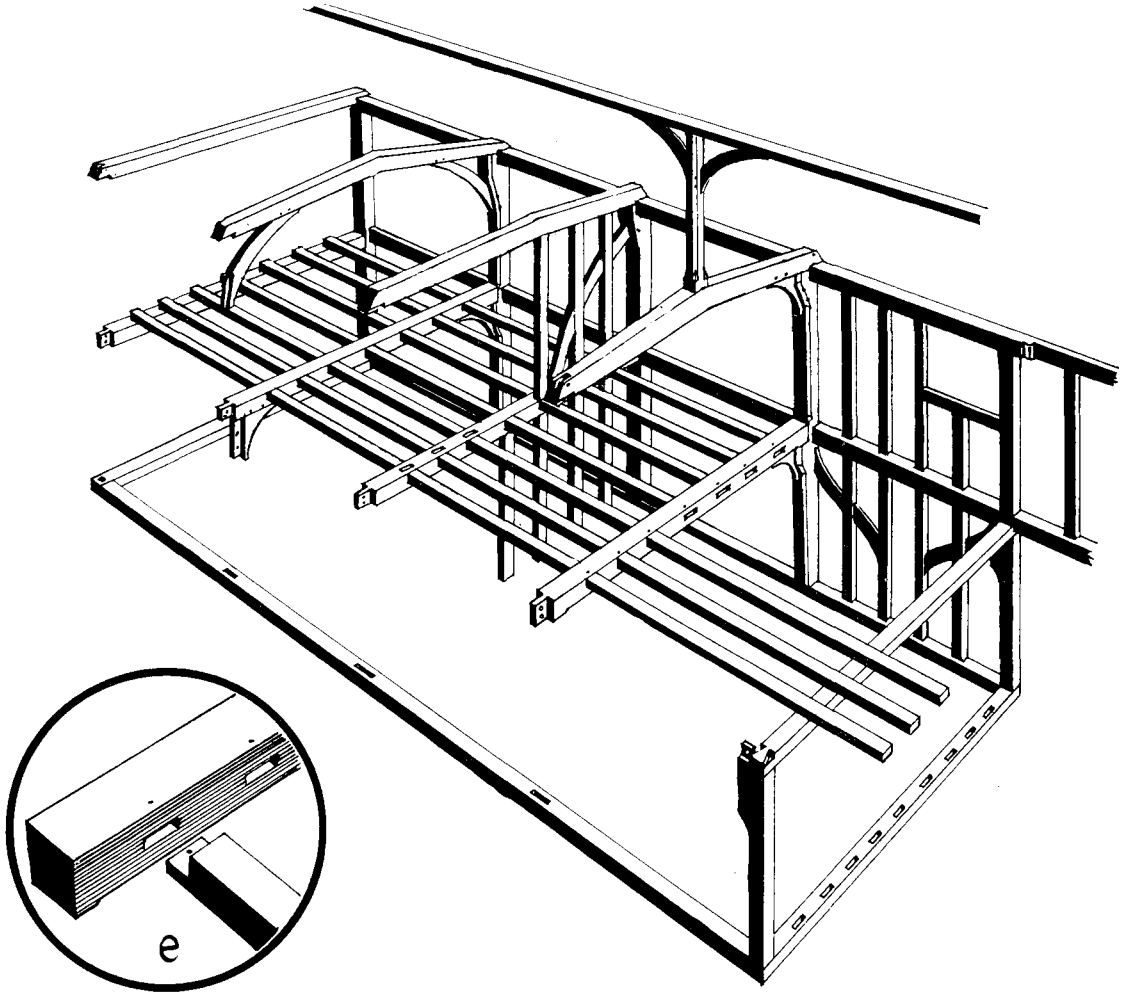


FIG. 36

LADYLANDS, GOOD EASTER, ESSEX (p. 96 f.)

Framing of first floor, with bare-faced soffit-tenon (*e*) which fitted the common-joists into the binders. The jettied end wall is tied by an upward-facing lap-dovetail cut on the end-girt.

been removed during the last quarter of the 18th century, when the solar wing was ceiled and two bays framed in elm were added to the S. end. As built, the wing was of four bays with hipped roof to the north and a jettied first floor at the S. end, which had been incorporated in the additional 18th-century bays. The central frame of the wing had at all times been a partition, the crown-post in it being of plain square section, while the other two were octagonal in section with

broach-stops to their facets at the bases. The story-posts had jowls both for the first-floor bridging-joists and for the tiebeams and top-plates at their heads. The knees, and arched braces fitted in most of the transverse frame angles are of the type which have their shoulders housed in the posts, a refinement of joinery later discarded.

The first floor (FIG. 36) was framed in the logical manner for houses of relatively narrow span, the common-joists being fitted between transverse bridging-joists, or binders, and running the length of the building. The joint used where the common-joists entered the bridging-joists is shown in inset *e*. It is clearly an attempt to place the tenon in a position in relation to the cross-section of the timber which would render the joist mechanically efficient. It can also be seen that where the side-girts pass over the head of the end wall, beneath the end-jetty, the lap-dovetail joint is used, and is so aligned as to tie the width of the overhanging superstructure. All timbers at Ladylands are very finely finished and chamfered, and the building probably belongs to the first third of the 15th century.

PAYCOCKE'S HOUSE, EAST STREET, COGGESHALL, ESSEX (FIGS. 37-40)

This splendid building is variously and profusely documented, but nothing has been published concerning the structure as a structure; yet when it is so considered many of its problems may be readily solved. It seems certain that we may regard the main building, attributable to Paycocke himself, as having been completed by 1505, when Paycocke died. This makes several constructional devices used in the carcase of great interest, since they appear to be very early examples of their kinds. The two wings at the rear, which run south toward the river, have for many years been regarded as later additions to Paycocke's building. In fact they are a complex of four buildings, all of which pre-date the most important structure, and their dates of erection must span several centuries before 1500. This will be explained by describing them in what seems to be their logical sequence of erection. The technological evidence afforded by this complex may then be checked against the other examples so as to elicit a chronology for the developments.

On the sketch-plan (FIG. 37) the oldest building that now survives on the site is marked *f*, a bresummer house, now of two bays only, which has long been regarded with caution, as of uncertain date. This house is illustrated in FIG. 38, which shows the early peculiarity of rafter interstices calculated in such manner as brings them into no relationship with the

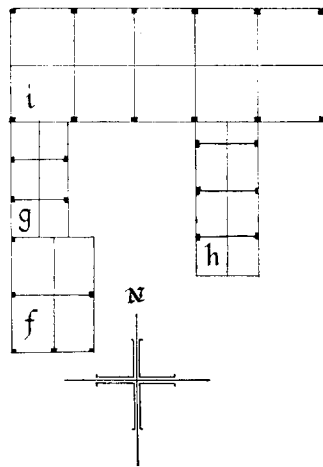


FIG. 37

PAYCOCKE'S HOUSE, EAST STREET, COGGESHALL, ESSEX (pp. 97 ff.)

Sketch-plan of complex showing the four component buildings, lettered *f-i* in order of their erection.

tiebeams. The roof, therefore, has no principal rafters; all are common rafters. The tiebeam is lap-dovetailed over the top-plates and is mortised, apparently, for a crown-post which has not survived. On the upper face of the same tiebeam are mortises which may at some date have received the feet of queen-posts. Since this

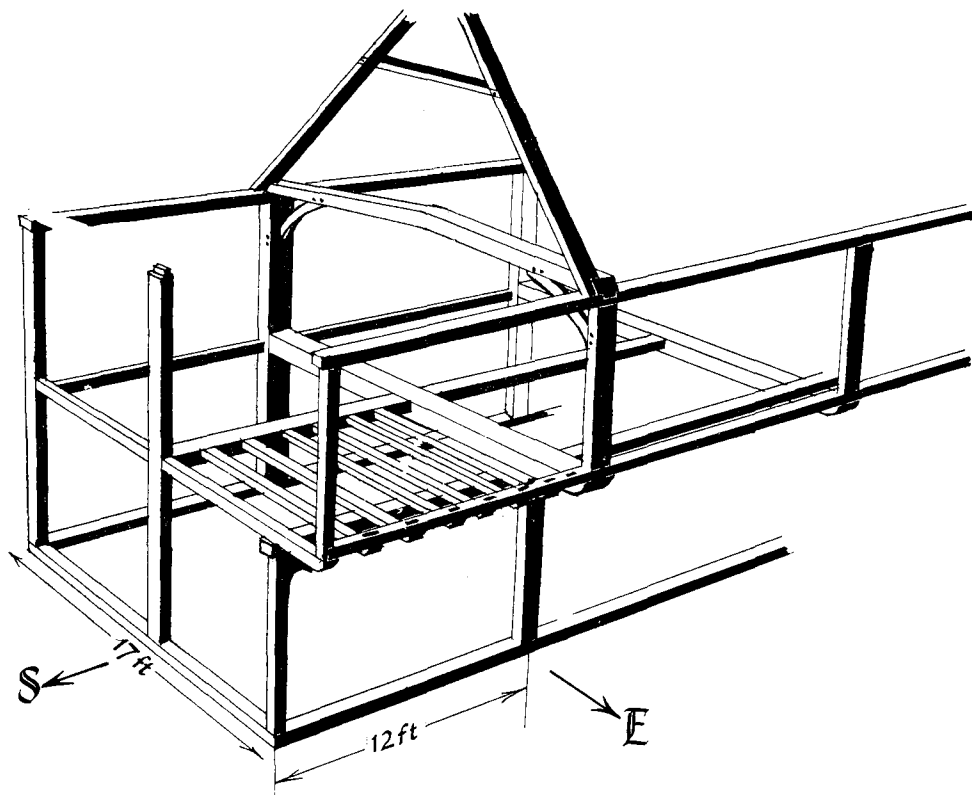


FIG. 38

PAYCOCKE'S HOUSE, EAST STREET, COGGESHALL, ESSEX (p. 97 f.)

Earliest building (FIG. 37, *f*), originally a two-bay house with a jettied E. side wall. The posts were not jowled and the rafters were all common, as in the earliest single-framed roofs.

house is bresssummered, the bridging-joist carries a longitudinal, or sheer-joist, into which the common-joists are fitted, with bare-faced tenons, off their soffits (see FIG. 39, *a*). The principal-posts have no jowls.

To the north of this structure and forming with it a continuous wing adjoining the back wall of Paycocke's House proper, is a second building (FIG. 37, at *g*), now of three bays, the first floor of which is framed upon transverse bridging-joists (binders) into which the axial common-joists are again fitted with bare-faced tenons off their soffits. Every rafter, both common or principal, in this roof is trenched for the collar-beams, apparently of a crown-post roof which was removed, probably during the 17th century, when side-purlins were fitted between collar-beams spaced at bay intervals.

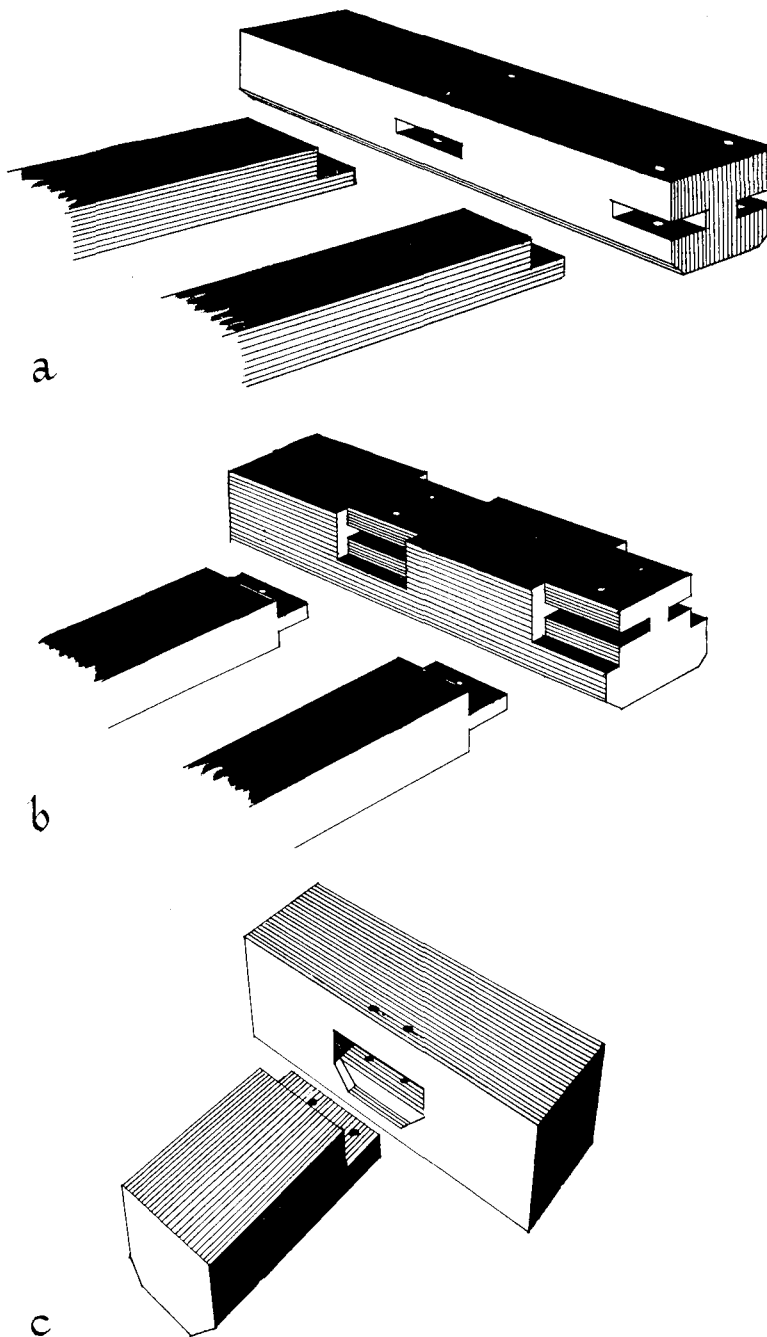


FIG. 39

PAYCOCKE'S HOUSE, EAST STREET, COGGESHALL, ESSEX (pp. 98, 100)  
 (a), bare-faced soffit-tenon joint as used in earliest building (FIG. 37, f). b, central  
 tenon with fully-housed shoulders, used for jointing common-joists to bridging-  
 joists in third component building (FIG. 37, h). c, central tenon with housed soffit-  
 shoulders and top-face cut back to profile, used for jointing most floor-joists.

East of this wing stands what appears to be another (FIG. 37, at *h*), also extending south from the rear wall of Paycocke's House. It is now of four bays and has carried two jetties at its S. end. It seems to belong to the second half of the 15th century. The six story-posts are jowled twice, once for the first-floor bridging-joists and secondly for the top-plates and tiebeams, which probably carried a crown-post roof. The common-joists of the first floor are longitudinally laid and are fitted into the bridging-joists by the joint shown in FIG. 39, *b*. This is clearly an advance in mechanical efficiency upon the bare-faced soffit-tenons used in the older wing, and it could not have come into equally general use until at the very least a century later. The head of the ground-floor wall beneath the jetty carries upward-facing lap-dovetails designed to tie the width of the superstructure, a feature which, together with the first-floor tiebeam above it, constitutes 'reversed-assembly', both ties lying under their respective axial timbers. Late in the 19th or early in the 20th century this house was ceiled above the first floor and a gambrel roof built over it.

The latest, and most important building on this site is, of course, Paycocke's House itself (FIG. 37, at *i*). This is of five bays, having six continuous story-posts in the rear wall. The bays vary in length (see FIG. 40) and the roof is calculated as an independent structure, since the principal-rafter couples are equidistant regardless of the varying bays beneath. The central partition shown inside the roof is evidently original and may indicate that the attics were used for warehouse storage of either cloth or staple. This partition incorporates a tiebeam, laid over the eaves-plates in the 'normal' manner which, with the two placed one at each gable-truss, comprise three transverse ties for the roof placed at intervals of about 25 ft.; this arrangement seems to bear no relation to the positions of the four principal-rafter couples with their collar-beams and wind-braced through-purlins.

The floors, both first and attic, or second floor, are framed upon transverse bridging-joists which carry the jettied front wall. Where these joists pass over the head-timber of the walls beneath they occupy twin stop-housings, cut into the top-face arrises. The joints used in fitting the various joists into each other are central tenons, with housed soffit-shoulders, and the upper shoulders cut back. All the exuberant roll and hollow mouldings on these joists are stopped, sometimes elaborately, and the need for scribing techniques is thereby avoided. A joint by which a sheer-joist is fitted into a transverse bridging-joist is illustrated in FIG. 39, *c*.

#### 'THE BELL', INGATESTONE, ESSEX (FIG. 41)

Today a public-house, this building evidently incorporates at least two earlier structures, both bresssummered. The site was occupied by a private house, or houses, in Elizabethan times, called Walkers, Chapmans and Beamishe. About 1556 a survey listed (*a*) a tenement 23 ft.  $\times$  16 ft.  $\times$  9 ft., tiled; (*b*) another, 36 ft.  $\times$  18 ft.  $\times$  16 ft., tiled; (*c*) a third, 36 ft.  $\times$  18 ft.  $\times$  11 ft., tiled. A John Walker map, dated 1601, shows the buildings.<sup>13</sup> It is reasonable to assume that

<sup>13</sup> I am indebted to Mr. K. C. Newton of the Essex Record Office for this documentary information.

the two-storied central house now forms the S. half of 'The Bell', and that the two-storied, dragon-beamed additional bays were added to the north during the 17th century.

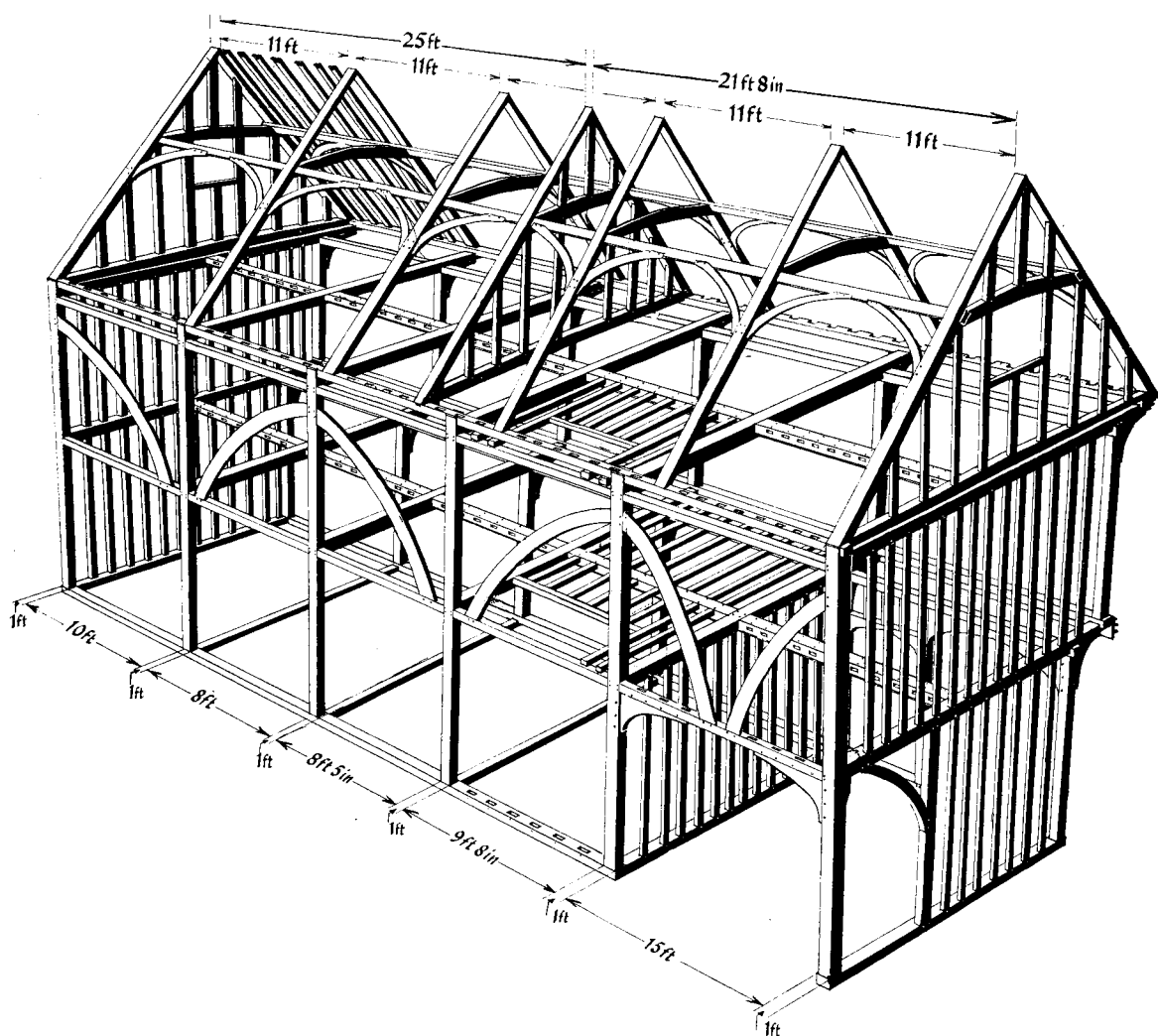


FIG. 40

PAYCOCKE'S HOUSE, EAST STREET, COGGESHALL, ESSEX (p. 100)

Frame of house proper (FIG. 37, *i*), *c.* 1500, showing its many peculiarities, including symmetrically divided roof-frame placed over asymmetrical bays.

The first-floor joists in the two S. bays, which we may assume represent the central building cited in the survey of *c.* 1556, are very well moulded (see sections and profiles, FIG. 41, at *j*). The fitting of all the joists, common and bridging, is effected by central tenons with their shoulders cut back to profile, but, where

the sheer-joist meets and appears to cross the transverse bridging-joist, the two identical and elaborate profiles meet at right angles, and the sheer timber is scribed to the profile of the moulding. This is not an efficient joint for the purpose and it has been reinforced at some time with bolts through the scribing. FIG. 41,

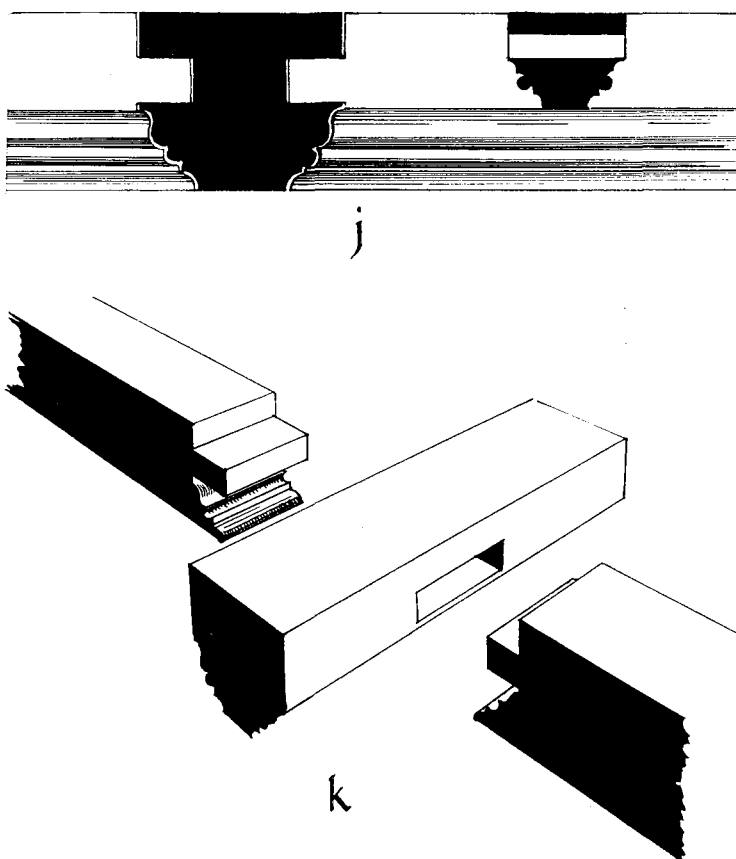


FIG. 41

'THE BELL', HIGH STREET, INGATESTONE, ESSEX (p. 101 f.)

Floor-framing principle, showing a central tenon with scribed soffit-shoulder, believed to date, here, from before *c.* 1556. At *j* is a section cut through the transverse bridging-joist and at *k* a simplified perspective view of this joint to explain nature of scribing.

at *k*, shows the exact method used, by representing the sheer-joist as of plain rectangular section, for the sake of clarity. It may safely be assumed, therefore, that the practice of scribing joints of this type was known before *c.* 1556.

52-54 CHURCH STREET, COGGESHALL, ESSEX (FIG. 42)

This is a bressummer house, of an uncertain number of bays. The fascia bears various monograms, together with the date ANO. DNI. 1565. The bridging-

joists are moulded to the profile shown in FIG. 42, at *n*, which also illustrates the joint used to fit the common-joists into the sheer bridging-joist. This is the bare-faced soffit-tenon, with diminishing haunch—probably the most efficient joint

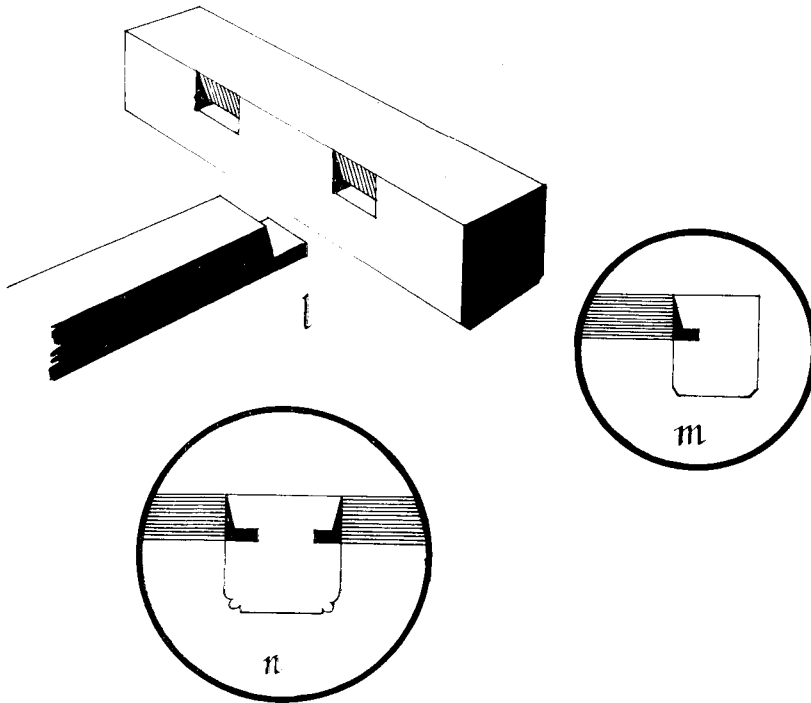


FIG. 42

HOUCHIN'S FARM, FEERING, and 52-54 CHURCH STREET,  
COGGESHALL, ESSEX (p. 103)

*l*, with section at *m*, bare-faced soffit-tenon joint, with diminishing haunch, used to fit joists into bridging-joist at Houchin's (c. 1412). *n* (in section), same joint in deep-sectioned joists in 52-54 Church Street, Coggeshall, of 1565.

for the purpose, yet here securely dated as early as 1565. The common-joists in this house are essentially of the 'deep' section, measuring  $4\frac{1}{4}$  in. deep by  $3\frac{1}{4}$  in. wide, a realistic section considering their function, and one which breaks with all medieval tradition.

FIG. 42, at *l* and *m*, shows examples of the same joint used for the same purpose, but employing the flat-sectioned joists advocated by medieval structural thought. In clear contrast these last joists measure 5 in. deep by  $6\frac{1}{4}$  in. wide, and occur in the building adjoining Houchin's Farm, which may be reconciled with 'Howhanny's' or 'Howchonys' of c. 1412.<sup>14</sup> This is an example of the most efficient joint applied to the least efficient cross-section!

<sup>14</sup> P. H. Reaney, *Place-Names of Essex* (English Place-Name Soc., XII, 1935), p. 390.

## HOUCHIN'S FARM, FEERING, ESSEX (PL. III; FIGS. 42-43)

Houchin's is a rare example of the house with warehousing spaces built into it as an initial feature of the design. It dates from *c.* 1600 and has two dragon-beamed corners (PL. III), in the framing of which the mitred-bridle joint is used.<sup>15</sup> The house has been previously described in print,<sup>16</sup> and I shall here mention only those technical details in it which are relevant to my argument.

The framing of the ground floor can be inspected from the cellar, and the principal joint is that which fits the sheer- or longitudinal bridging-joint into the transverse bridging-joint (FIG. 43, at *o*, with section at *p*). This is a haunched tenon and, as the inset shows, it involves fully three-quarters of the depth of the sheer-joint in load-carrying. The illustration also shows that the common-joists of the ground floor are fitted into surface trenches as laps, and have their soffit-shoulders housed in the edges of the sheer-joint.

The southern of the two sheer-joists, whilst it has common-joists fitted by the same method, shows an older, or more finely-worked series of joints for the same purpose which are now empty, and which may be seen below the existing common-joists. This older series is the one which most obviously relates to the principal-joint, previously described, and the date of the floor in its present form seems uncertain. The southern sheer-joint is proved to be suspect. Firstly, it has no joint into the transverse dormaunt of the floor, but is carried in an iron strap with its end merely abutting the dormaunt; secondly, the chamfers on the dormaunt are nicely stopped on either side of the principal-joint (FIG. 43, at *o*), and run right past the joint of the second sheer-joint. It seems likely that all of these floor-timbers are contemporary. The problem is further discussed below (p. 110).

## 59 EAST BAY, COLCHESTER, ESSEX (FIG. 44)

This bressummer house, of five bays, four of which are now a ruin, reaching to the first floor only, is illustrated in FIG. 44 which, with its numerous insets, shows all the important joints and methods of assembly. The ruin stands almost opposite a large building of very similar character externally, which bears a pargetted cartouche with the initials R.W.A. and the date 1692. This is very sobering evidence that in all probability bressummer houses of some size and pretensions were erected in East Anglian towns as late as the last quarter of the 17th century, for the ruined structure of 59 East Bay is, I suspect, quite possibly as late as the pargetted date-mark opposite.

The most important feature of the end-jointing of the common-joists is the difference between those in the bay marked *s* and the majority. In most instances the joists have central tenons, with their soffit-shoulders housed in the bridging-joists, while the bay marked *s* seems to have had joists with central tenons only. Doubtless some reason could be found for this were the structure complete enough to show which floors might have been expected to bear the greatest weight. It is again noticeable that the head-timber of the ground-floor wall,

<sup>15</sup> *Op. cit.* in note 2, p. 235, fig. 3, *c.*

<sup>16</sup> In *Essex Countryside*, XIII, no. 101 (June 1965), 502-3.

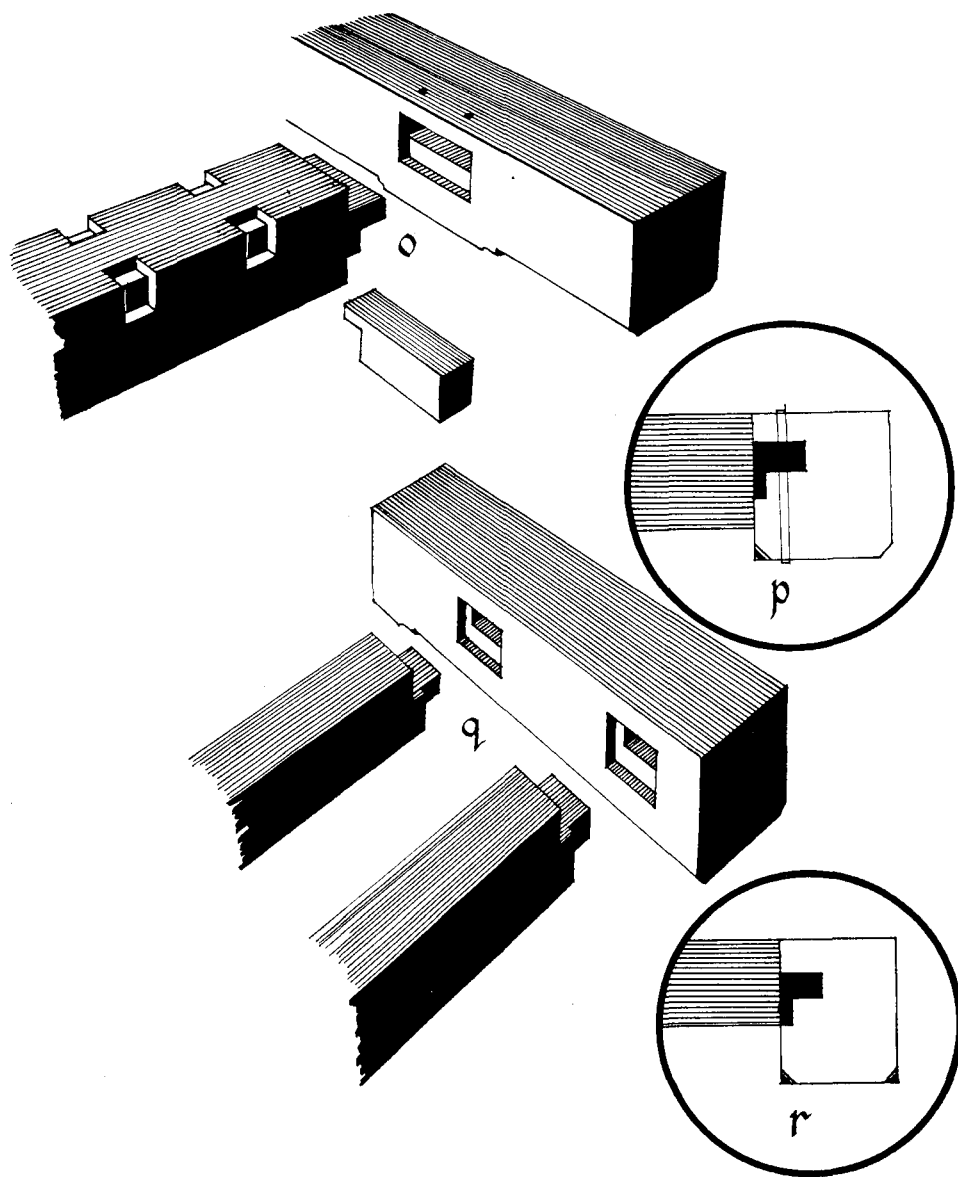


FIG. 43

HOUCHIN'S FARM, FEERING, ESSEX (pp. 104, 110)

Joints used in frame of ground floor. The principal floor-joint (*o*, with section at *p*), which combines transverse bridging-joint and longitudinal sheer-joint, is a soffit-haunched tenon, involving three-quarters of the depth of the sheer-joint in load-carrying. The face and edge housings on the sheer accommodate the common-joints, evidently inserted from above after the sheer was in place. The other perspective and inset (*q* and *r*), showing joints used before *c.* 1600 for the same purpose, are taken from a reused sheer-joint in same cellar.

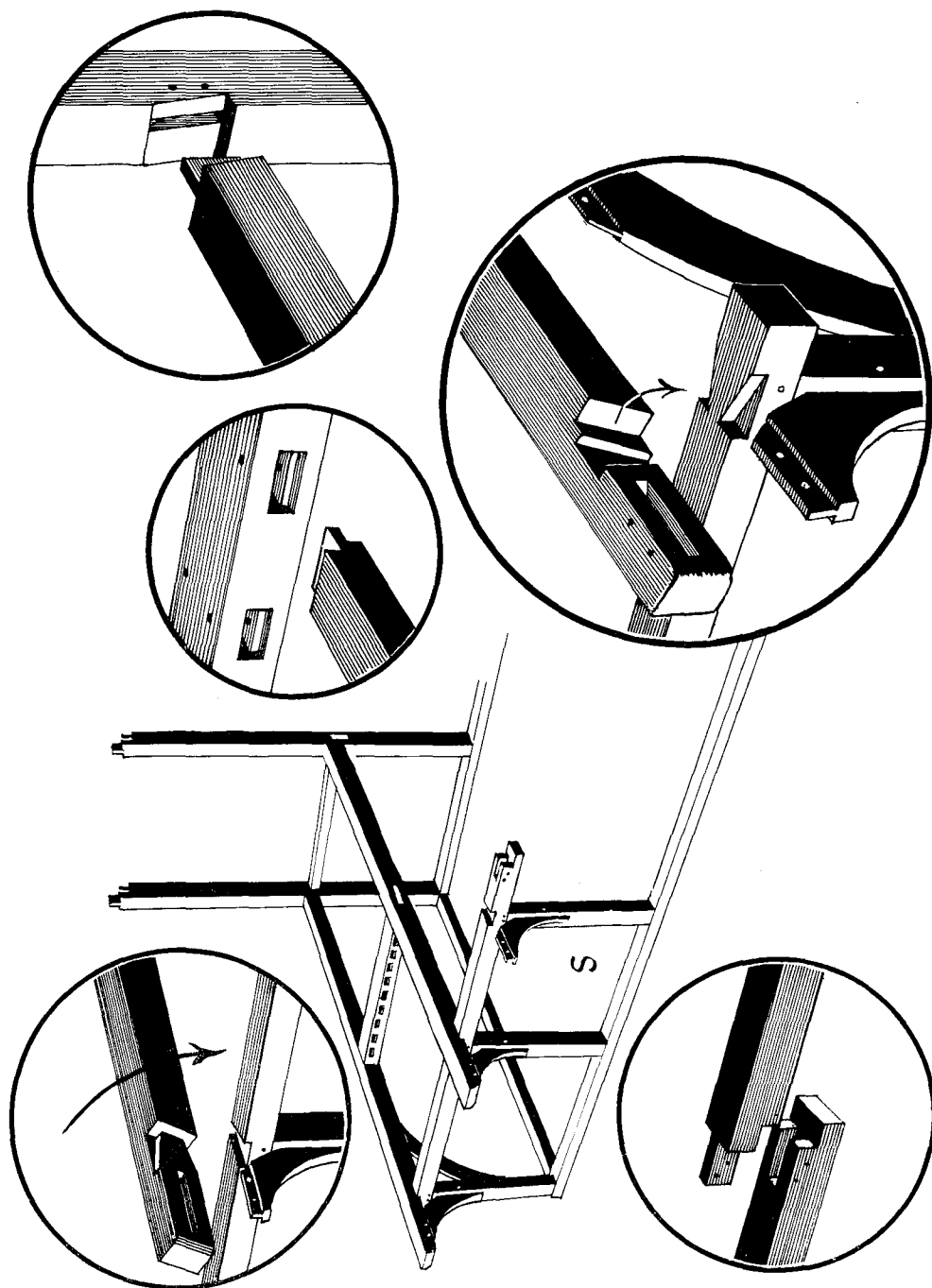


FIG. 44

59 EAST BAY, COLCHESTER, ESSEX (pp. 104, 107)  
 'Exploded' view of building showing all important joints and methods of assembly; the end-jointing of the common-joists in bay marked *s* differs from that in the other bays. This house may date anywhere between *c.* 1590 and 1680, since the use of lap-dovetails along bressummers is not yet datable.

under the jetty, is tied by lap-dovetails so aligned as to maintain the width of that story constant, while at the two ends the lap-dovetails are so aligned as to maintain the length of the structure constant, beneath its bressummer.

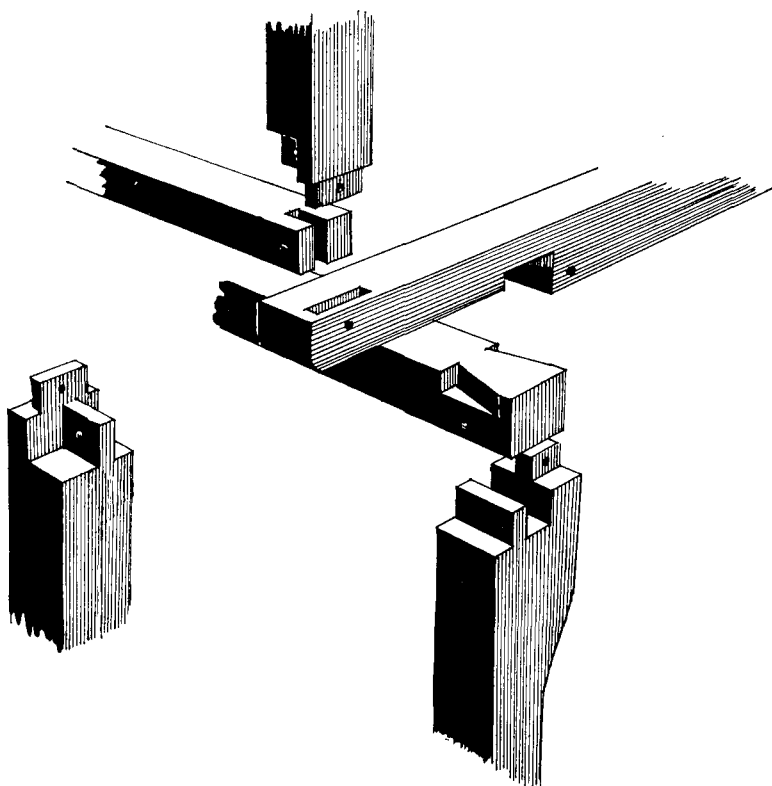


FIG. 45

14 STONEHAM STREET, COGGESHALL, ESSEX (p. 107)

'Exploded' view of corner of first-floor end-jetty, showing typical 15th-century type of assembly with lap-dovetails to tie width beneath superstructure. This example has now been underpinned.

14 STONEHAM STREET, COGGESHALL, ESSEX (FIG. 45)

One corner of the first-floor end-jetty of this building is shown in FIG. 45, with a method of assembly and jointing for end-jetties which is clearly in direct linear succession to the archaic form used, exploratorily, at Priory Place. It appears that the stop-housed method so frequently applied to long jetties on side walls, as at Paycocke's House, 'The Bell', and 52-54 Church Street, Coggeshall, would rarely or never have been applied to end-jettying, in which it was necessary to tie the width of the first floor beneath the superstructure.

## CONCLUSIONS, AND A TENTATIVE CHRONOLOGY FOR FLOOR-JOINTS

It appears in the light of the above evidence that a course of development for jetty construction may be traced, without bringing in further examples, which doubtless exist; and also that a very wide variety of mortises and tenons, with or without haunches or similar refinements, were used for fitting floor-joists between *c.* 1250 and *c.* 1600. It is equally evident that the mechanical efficiencies of the various methods differ widely, and that the most primitive methods of both jointing and assembly are attributable, in the light of all other evidence and on grounds of aesthetic style, to the earliest structures, while those examples that are most efficient mechanically are, fortunately, found in relatively recent structures, the dates of which are fixed by inscriptions.

We can, therefore, assume, to start with, that carpenters' joints have always, and for all purposes, sought to attain the maximum mechanical efficiency possible in timber-work. We must also assume, since we have noted a wide variety of joints for each purpose all of varying degrees of efficiency, that these have been evolved in a logical sequence aiming at ever-increasing mechanical efficiency; and it is most probable that the original invention of each successive refinement of joint followed, chronologically, the closest less perfect form. Theoretically, therefore, we could arrange all the floor-joist joints in order of mechanical efficiency, with the least efficient at the beginning, and then with the aid of the few known dates of use we could compile a table which would help to date buildings whose chronology is otherwise obscure.

There is, as always, one factor which is imponderable: the human element of preference which can be purely personal and even directly irrational. Did carpenters trained in archaic methods use those methods, always, throughout their working lives? Indeed did archaic usage persist even after their deaths by virtue of loyal apprentices adhering rigidly to their past training? As J. T. Smith points out,<sup>17</sup> the means for the dissemination of new ideas regarding the mechanical efficiencies of joints in carpentry are difficult to apprehend. The master, apprentice or teacher-pupil relationship will not explain those advances made in carpentry, since this would produce a single, linear course of development; and, were every apprentice to assimilate only those facts taught by his master, the inclusion of new concepts would have been precluded. It seems, therefore, most logical that master carpenters were of sufficiently lively mind to refine and develop their own techniques throughout their working lives, and they would, therefore, have trained their apprentices in a craft which was alive and expanding while it was being taught. If so, new ideas and refinements with regard, for example, to the mortise-and-tenon joint would have spread as rapidly as the means of communication and the distances travelled by the carpenters allowed. That a few, relatively unimportant, village carpenters continued to use techniques learned during their training is allowable, but such men would have been respon-

<sup>17</sup> In 'Cruck construction: a survey of the problems', *Med. Archaeol.*, VIII (1964), 126: 'The first consideration is that carpentry was a craft technique, a technique, that is to say, which was handed down from master to apprentice by demonstration, without formal instruction.'

sible only for purely vernacular buildings and would never, probably, be required to work outside their native parishes. This would allow certain obsolete forms of jointing to persist in limited rural areas for about sixty years, since it is most unlikely that beyond that period their pupils would persist, despite superior wisdom, in the archaic methods of their masters.

The development of floor-framing begins, in the examples given above, with the first floors in the wings at Priory Place. This is a very large building, extremely finely wrought and obviously expensive to the point of luxury; its monastic origin supports these facts but only a very early date may be reconciled with the primitive use of timber found in these floors. The problems presented by providing a wholly timber-framed building with a first floor could not have been posed earlier than the requirements of siege belfries dictated, and Priory Place may well be close in date to their origin. Numerous floors in both England and Europe had been built into masonry towers long before, but the problems of timber-framing are entirely different since, ideally, every member of a frame is jointed to its neighbours. The Priory Place floors follow, however, the mason's technique in that they are 'lodged' or merely rest in place and could be lifted without any mechanical or physical objection. Where jointing occurs, between the axial common-joists of the jetties and the transverse bridging-joists, central tenons only are used. This is the least efficient method among those described, since the strength of the joists is reduced to that of the tenons, which are slender.

One other example of central tenons for similar axially-aligned joists in an end-jetty has been recorded at 'Maggotts', a house of hall-type recorded by John Walker, the surveyor, in 1601. Many other features of this house are similarly archaic and its date is, as a result, called seriously into question. How long in a village like Fryerning would such techniques have persisted, after the general improvement of flooring had taken place elsewhere? A possible date for this building might be *c.* 1350–1400, if theory is at all reliable; there is no evidence in the structure to conflict seriously with such an early ascription.

The next step toward efficiency at this juncture—joists into bridging-joists—appears common to Ladylands, Good Easter, and the two earliest buildings (FIG. 37, at *f*, *g*) of the Paycocke's House complex: this is the use of bare-faced soffit-tenons. That this is a virtual stride towards efficiency is evident, since the tenon is at the base of the joist, so that its full depth of timber is involved in supporting the floor, although the mean strength of the joist is still reduced to that of the slender tenon. The date of these examples is not firmly fixed, but, when all other features of the buildings concerned are considered, the late 14th century would seem to be reasonable. This would postulate that the next development occurred towards the end of the 14th or the beginning of the 15th century. We find that development in the third building (FIG. 37, at *h*) at Paycocke's House. This (FIG. 39, *a*) reverts to the use of the central tenon, with both its shoulders housed in the bridging-joist. The building would seem to date from *c.* 1460. Whilst this is an efficient joint for the purpose, the bridging-joist is weakened at its upper face, which is crucial if the maximum load-bearing capacity is to be attained.

The final form of this joint was evidently in use, in Coggeshall, which was both prosperous and well supplied with carpenters, by the year 1565 (52-54 Church Street, p. 102 f.), but two developments had preceded this. As stated (p. 109) the upper and lower faces of a load-bearing timber are essential to its function, and these must not be reduced in width, as happened in the previous example. The sheer-joists in Paycocke's House, which were made by *c.* 1505 (FIG. 40) are in logical succession, since the upper shoulder is cut back to profile, while the soffit-shoulders are housed, so that the top-face of the primary load-bearing beam remains full-width. The scribed joint with central tenon at 'The Bell', Ingatestone, is a relatively archaic form, and one which the documentary evidence suggests must date before *c.* 1556. It is, structurally, as weak as the examples at Priory Place and 'Maggotts', although highly refined, and enriched by moulding and scribed shoulders. Here, again, an earlier date than is usually proposed is indicated by the use of such a joint.

The penultimate form of this joint occurs in the building adjoining Houchin's Farm, which is reconcilable with 'Howchonys' of *c.* 1412 (cf. p. 103). This is the *most* efficient form of the joint, worked upon timber of the *least* efficient cross-section—the 'flat' section favoured by the medieval and sub-medieval carpenters. That it should precede by a century and a half the final form (FIG. 42, at *n*), which is dated 1565 (cf. p. 102 f.), is logical, since the remaining improvement is there made—cutting the efficient joint upon timber of equally efficient cross section. This is then the ubiquitous joint for the purpose, used continuously thereafter as long as timber joists were fitted into timber bridging-joists. At Little Dunmow a fine date-inscribed example of 1663 is known; and even after 1900 examples occur in soft-wood flooring.

FIG. 43, at *o* and *p*, shows two highly efficient joints used in the framing of the ground floor at Houchin's Farm, which it is believed dates from *c.* 1600. In this example only three-quarters of the depth of the secondary beam is involved in load-bearing, while the square haunch beneath the tenon is effective only if continuous with the soffit-face of the timber. The use, at *o*, of open laps with housed ends for the common-joists in this floor is interesting and was doubtless devised to enable the joists to be fitted from above, after the sheer-joists were laid. These examples are reasonable, if ascribed to *c.* 1600, but tend to indicate that once such an aspect of a craft has reached perfection it must, almost inevitably, decline if inventive genius is to find any outlet. The alternative joints in FIG. 43, at *q* and *r*, are to be seen in a reused timber now serving as a sheer-joist parallel to the one at *o* in the illustration. That it was second-hand timber cannot be questioned, but there is no evidence, other than the form of the joints, to indicate how old it was when it was used for the second time. The joints resemble those noted at 59 East Bay, Colchester, which are akin to those in Paycocke's House of *c.* 1500. All are central tenons, with housed soffit-shoulders and with their upper faces cut back to profile, while those on the reused Houchin's timber have their widths diminished also. That these forms should have survived in use until *c.* 1600 is reasonable, but for how long thereafter is open to question, in the absence of other dated specimens.

Many other forms of mortises and tenons are to be found in timber building, but these are, for clarity, excluded from this argument; most of them do not, in any event, affect the evolution of basic floor-framing. That floor-framing and jettying are inseparable is evident, since the jetty cannot have arrived until first floors were accepted into general domestic use, possibly during the second half of the 13th century. The example given for such archaic framing is Priory Place, Little Dunmow, which I have suggested (p. 93) dates from the second half of the 13th century. In this case, which is as primitive as any yet recorded, the width of the hall is tied while the width of the jettied wings is left to chance, so that it is miraculous that they should have survived until now. It must have been realized long before *c.* 1400 that the width of the ground-floor structure which supported the jettied superstructure was the important factor, and jetties became tied in this direction by inverted lap-dovetails as shown in the drawing of Ladylands (FIG. 44), which it is believed belongs to the first third of the 15th century. It seems clear that the final form of this construction in end-jetties is the one shown in FIG. 45, but when did jetties other than end-projections become fashionable?

That end-jetties were first developed will withstand a reasonable analysis, since in buildings of very narrow span, as shown by Priory Place, the floors would be laid on transverse joists which, in time, would support axial joists once an end-projection were required. Buildings of later date and wider span, such as Ladylands, used their heavy bridging-joists transversely also, but only at bay intervals, the common-joists being laid axially, and still lending themselves to an end-jetty. Logically, it would seem that the long jettied side wall next appeared, not long after the development of end-jetties was consolidated. There is an early example in the oldest building at Paycocke's House (see FIG. 37, at *f*), which must be substantially earlier than 1400, since, although it incorporates the same joist-joint as Ladylands of the early 15th century, has a single-framed roof of much greater age. Unfortunately, the building has been 'restored'—in fact, mutilated—at this point on both transverse joists and it cannot be guessed what type of joint was there used.

The next instance of long-wall jettying among the examples here cited is Paycocke's House itself, where the two stop-housings are used in all twelve cases, the only tying function they perform being that of maintaining the ground-floor wall vertical and parallel to the rear story-posts. The same method is used in the bressummer of 52–54 Church Street, Coggeshall (p. 102 *f.*), and in another bressummer in East Street, Coggeshall, dated 1585. Farther afield, in High Street, Ingatestone, stands a building which dates from *c.* 1560, as can be proved by reference to the Walker maps of 1556 and 1601 (see below) and by an entry in the Ingatestone Court Rolls<sup>18</sup> concerning some alterations to the building in 1575. This house, known during the late 16th century as 'Makrons', employs lap-dovetails where the transverse bridging-joists pass over the head of the ground-floor wall, at the front. It is of three bays, and as a result the two central bridging-joists have dovetails so aligned as to tie the width of the ground floor, while the

<sup>18</sup> Information kindly supplied by Mr. A. C. Edwards, Essex Record Office, Chelmsford.

two at the ends have their dovetails aligned for tying the *length* of the ground-floor wall. This was a new building in *c.* 1560, since the Walker map of 1556 shows clearly a single-story building on the site in that year. It may be, therefore, that lap-dovetails were introduced for this purpose on side-wall jetties during the 16th century: alternatively we must envisage two schools of thought which were contemporary. 59 East Bay, Colchester, shows the same use of lap-dovetails along the bressummer, but this cannot be dated, on sight, closer than between *c.* 1560 and *c.* 1680. It therefore seems, provisionally, that twin stop-housings on wall-heads beneath bressummers ceased to be used *c.* 1590, and that variously orientated lap-dovetails were introduced for the same purpose shortly before the building of 'Makrons' in High Street, Ingatestone, *c.* 1560.

The introduction of simultaneously jettied end and side walls, which necessitates the use of the dragon-beam and radiating joists, would, most probably, have occurred during the closing years of the 13th or the first quarter of the 14th century.<sup>19</sup> It seems unlikely that this form, which is the most elaborate, should have been used before knowledge had been consolidated about the joints necessary for end- and side-wall jettying, which would have been invented, most probably, in that order. These tentative propositions are, admittedly, based upon field-work, which must always be incomplete. That analysis of the joints in firmly-dated timber buildings would radically modify this provisional theory is obvious. Such analysis is clearly desirable, and it is to be hoped that it would eventually provide truly valuable criteria for dating stylistically obscure vernacular buildings.

<sup>19</sup> Margaret Wood, *The English Medieval House* (London, 1965), p. 220, fig. 67.