

I.

THE ANCIENT ROOF OF GLASGOW CATHEDRAL: ITS CONDITION AND RESTORATION. BY W. T. OLDRIEVE, F.R.I.B.A., F.S.A. Scot.

Only two of our Scottish mediæval cathedrals have, with any part of their original roofs, survived the stress of time until this generation, that of St Magnus at Kirkwall, and that of St Mungo at Glasgow. It must therefore be a matter of interest to antiquaries when such a roof is laid bare, its condition exposed, its construction and subsequent treatment traced, and its original design restored. For this reason it was thought advisable to lay before this Society and to record in its *Proceedings* an account of what has been done within recent years in connection with the renewal of the roof of Glasgow Cathedral.

The work was carried out at the cost of the Treasury and under the direction of H.M. Office of Works, and was, as will presently be shown, absolutely necessary in order to prevent a total collapse of the building.

Many and various have been the definitions of the term "restoration" as applied to architectural works, and monstrous indeed have sometimes been the results. During the eighteenth and nineteenth centuries especially, what appalling errors of destruction and disfigurement were committed under this pretentious term! Whims of corrupted taste or of a passing fashion, of form were allowed licence, and in many cases original work of great merit was cut away or mutilated to make room for modern work so devoid of character that it seems incredible that the artistic standard of the day should have been so low that there was no general outcry against the vandalism.

Such a "restoration" was perpetrated when in the eighteenth century the original design of the roof of this Cathedral was deliberately obliterated by the simple process of hacking away the oak moulded ribs, carved work, and panel-boarding, in order to substitute a commonplace plaster ceiling. The original oak roof-work had doubtless fallen into decay, and to repair or renew it in such a way as to preserve intact the old design and character would perhaps have been both too costly and beyond the vision of those who were at that period responsible.

Before proceeding to give an account of the condition of the roof immediately before the restoration, it may perhaps be better to state a few historical facts bearing upon the subject.

The foundation of the See by St Kentigern, or Munghu, dates from the sixth century.

In July 1136, John, Bishop of Glasgow, in presence of King David the First, dedicated a new church to St Kentigern.

After destruction by fire the church was commenced to be rebuilt in or about 1190, in more magnificent style, by Bishop Joceline, Chancellor to King William the Lion, and was dedicated in 1197. It was added to and embellished from time to time by successive prelates, chiefly Bishops Bondington, Lauder, and Cameron.

An interesting statement bearing upon the subject of the timber supply is made in the *Origines Parochiales Scotiae*, viz. that Bishop Robert Wishart (1272-1316) obtained timber from Edward the First for making a steeple to the Cathedral, but "used it for constructing engines against that king's castles."¹ In 1277 the Church purchased the right from the Lord of Luss of sending their workmen freely to his lands to fell and prepare whatever timber in his woods they deemed expedient for the steeple and treasury of the Cathedral, until these were perfectly completed in woodwork.²

Bishop Robert Blackadder, transferred about 1484 from Aberdeen to Glasgow, constructed the Rood loft, the descending approaches to the crypts, and commenced the erection of the south transept, completing only the lower story or crypt which is known by his name.

In 1574 the Magistrates, Town Council, Deacons of Crafts, and other "honest men of the city" voluntarily resolved to impose a tax of £200 for the repair of the Cathedral because of the great decay into which it was falling through "takeing awaye of the leid, sclait and uther graith thair of in this trubulous tyme by-gane." The great care, pains, and charges incurred by the community for this object were acknowledged by Charles the First.³

The General Assembly in 1587-8 "ordained that an article should be given in to the King bearing regrate for the decay of certain Kirks which are ruinous, and without hastie repare are not able to be remedied, namely:—Glasgow, Dunfermling, Dumblain." The General Assembly suggested that "the lead fallen, or like to fall, may be employed to the sclating and repairing thereof."⁴

It has been suggested with good reason by Dr John Hill Burton that "the Cathedral of St Mungo owed its preservation to the wealth and liberality of the community of Glasgow, and that the other churches which rivalled or excelled it—Elgin, St Andrews, the Abbey Church of Arbroath, and others—fell to pieces through poverty."⁵

¹ *Origines Parochiales Scotiae*, vol. i. p. 2.

² Cosmo Innes' *Sketches of Early Scotch History*, p. 45.

³ *The Reformation in Scotland*, Dr Hay Fleming, p. 392.

⁴ *Booke of the Universall Kirk*, vol. ii. p. 706.

⁵ *History of Scotland*, vol. vi. p. 222.

In a minute of the Town Council, dated 13th June 1663, there is an entry as follows: "The same day appoynts the kay [quay] at the Broomilaw to be heightit twa stanes heigher nor it was ordained to be of befor, and ordains the Deane of Gild to try for moir oakin timber ather in the Hie Kirk or bak galrie for facing thereof."

In M'Ure's *Description of Glasgow*, published about 1736, the choir—then called the Inner or Easter Kirk—is referred to as "newly ceiled and painted in the roof and walls whitened"; while of the nave—the western part of which was then called the Outer or West Kirk—it is said, "The roof of this kirk is finely ceiled and painted." This appears to indicate about the date when the original design of the ancient roof was obliterated, the internal lining of oak removed, and the roof "newly ceiled" with plaster.

It is well known to students of the Cathedral that there are abundant evidences both at east and west ends and on the north side that large masses of the main walls have moved considerably through the "thrust" of the stone vaulting of the aisles and the timbers of the main roof. My attention, as architect at H.M. Office of Works, was drawn to this about 1905, when steps were taken to strengthen those parts urgently requiring it. It was clear from an examination of the masonry that a considerable amount of work had previously been done, probably in 1824, with the object of strengthening the upper parts of the main walls; but the old roof exercised a continual outward thrust, and exact measurements proved that this was so great as to constitute a very serious risk if the roof were allowed to continue to deteriorate by decay. From a general view, however, no casual observer would detect any deviation from a straight line in the roof or walls.

Measurements with the plumb line were taken at intervals, and it was found in 1909 that the maximum thrust was over the central north pillar of the nave, where, from the top of the capital of the main pillar to the wall-head, the wall-face was falling outward to the extent of $13\frac{5}{8}$ inches. In the choir the maximum thrust was on the south side near the second detached pillar from the east end, where the face of the wall was leaning outward at the top to the extent of $13\frac{1}{4}$ inches.

The views shown indicate better than any description which I can give what was discovered as regards the general state of the roof. Standing at one end of the gutter on either side of the nave or choir, and glancing along the parapet, what should be seen as a straight line is a very considerable curve (see fig. 1): indeed, to any one unaccustomed to ancient buildings the first impression is truly alarming, and suggests instability and danger which really do not exist if the process of the outward thrust is arrested.

Following upon the test by measurement, a detailed inspection of the roof timbers was made—first from the interior space above the collars of the trussed-rafters, and then from the outside by stripping

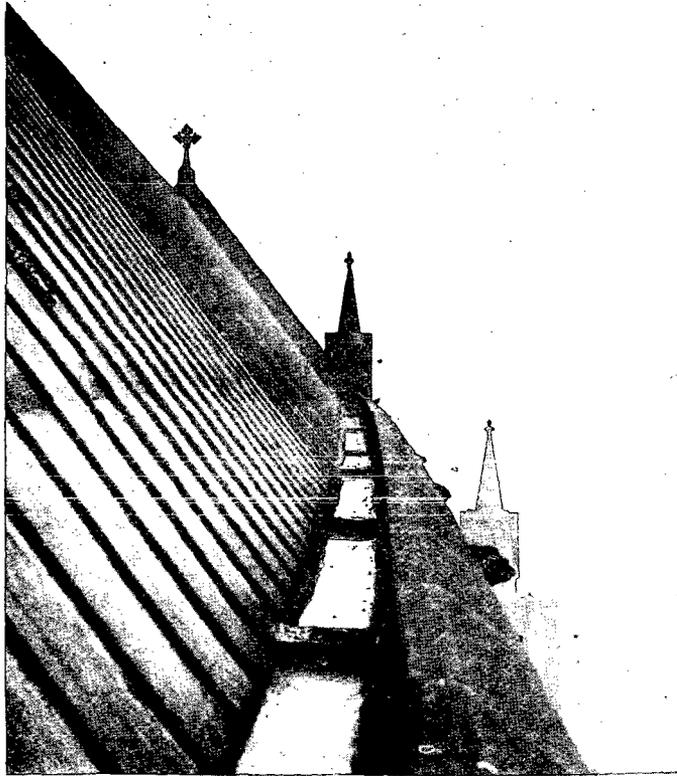


Fig. 1. North Gutter of Roof over Nave, looking west, showing "bulge" of wall caused by thrust of old roof timbers.

the lead and boarding near the feet of a number of the rafters and noting their condition, as in fig. 2. It was found that a large number of the rafters were badly decayed, and that the repairs carried out about 1735 and 1824 had not appreciably strengthened the roof trusses. In several cases the lower ends of the rafters had entirely disappeared,

and had no bearing whatever upon the wall-head, as shown in figs. 2 and 3.

A full report upon the condition of the roof was now submitted to the Board of H.M. Office of Works, with plans and estimate; and

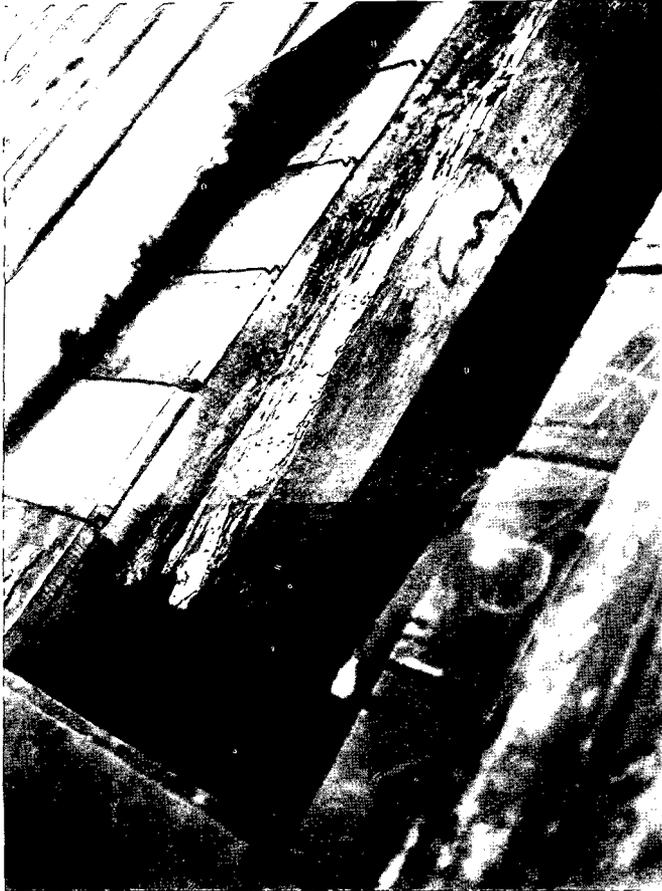


Fig. 2. Condition of an old Oak Rafter over Choir, as seen from the outside.

after a report by the Inspector of Ancient Monuments, and upon the urgency of the case being made known to the Lords of H.M. Treasury, funds were in due course provided for the necessary expenditure.

There is no evidence that stone vaulting was originally contemplated for roofing this Cathedral. If the proposed addition of stone vaulting, as shown over the nave in the set of drawings for a restoration in 1836,

had been carried out, the result would almost certainly have been the wreck of the building, as in the case of Holyrood Chapel Royal in 1768.

It is perhaps necessary here to trace very shortly the development of mediæval church timber roofs. Of Norman church timber roofs few remain. One over the chancel of Adel Church, Yorkshire, is referred to as apparently original in Brandon's *Analysis of Gothic Architecture*,

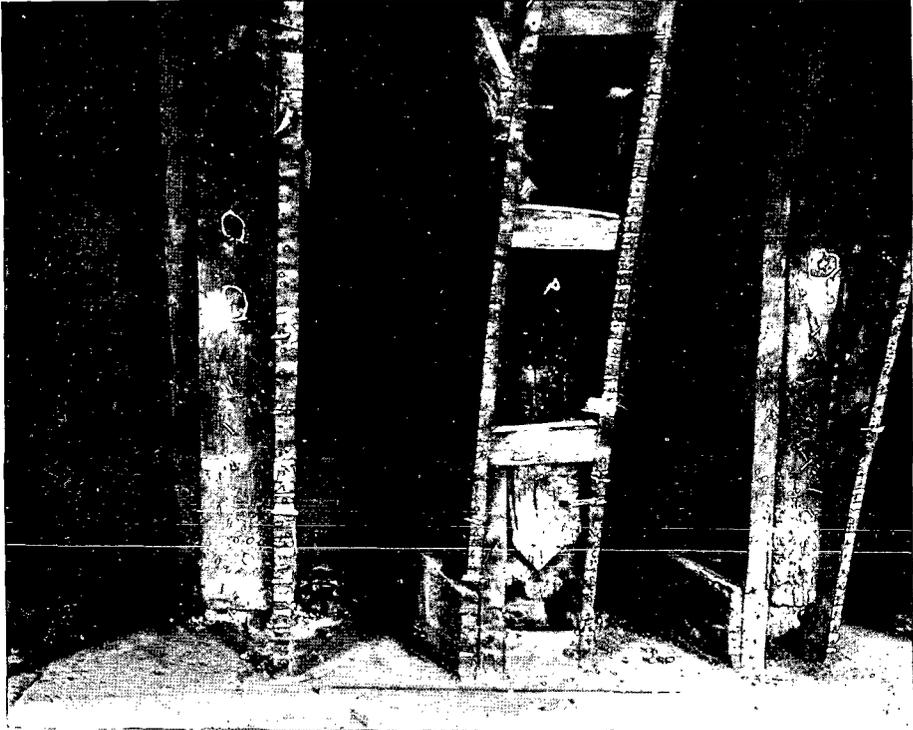


Fig. 3. Condition of old Rafters of Choir Roof, as seen from the inside, when stripped of plaster and lathing.

as also one over the nave of Whitwell Church, Rutland.¹ The best-preserved Norman roof is said by Mr Francis Bond to be that above the Bishop's Palace at Hereford, as also that the south transept at Winchester has the original eleventh-century roof.² These early roofs were of the "tie-beam" type, the tie-beam evidently being at that time intended to form a tie between the walls of the building, and not

¹ Brandon's *Analysis of Gothic Architecture*, vol. i. p. 91.

² *Gothic Architecture in England*, p. 572.

the tension member of the roof-truss as in modern carpentry. In this type the principal rafters pitch on to the tie-beam and are braced together with collars, while slanting struts stiffen the principal rafters by taking the weight on to the tie-beam as a cross-strain.

Gothic church roof design developed under four main types, *i.e.*:- (A) tie-beam, (B) trussed-rafter, (C) arch-braced, and (D) hammer-beam. Fig. 4 shows by a simple outline diagram the development of the timber roof. The tie-beam type (A) is indicated by (2), (3), and (4); the trussed-rafter type (B) by (5), (6), and (7); the arch-braced type (C) by (8); and the hammer-beam type (D) by (9). There were, however, no hard-and-fast divisions between the different types. Gothic builders had no compunction in mixing tie-beam and trussed-rafter types, tie-beam and arch-braced, tie-beam and hammer-beam, or hammer-beam and arch-braced.

Sandridge Church, Herts, affords an example of the transitional form of roof where the tie-beam has been retained at intervals, *i.e.* two ties in the length of the chancel, with about twelve rafters between each.

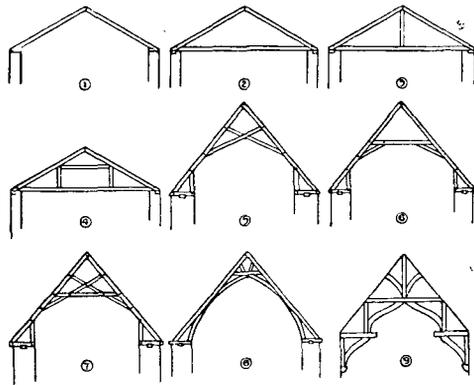


Fig. 4. Diagram to show development of the Timber Roof.

A similar example is that over the nave of Clymping Church.¹ Bloxam refers also to the roof of the chancel of Polebrook Church, Northamptonshire, which he says is apparently in this style. It is divided into three bays by moulded tie-beams with braces beneath, and each tie-beam supports a king post. The principals, which are massive, are cut in the form of a trefoil; the purlins, ridge-piece, and wall-plates are moulded; but the common rafters are plain.²

One great defect of the trussed-rafter type of construction, open or ceiled, was the absence of any longitudinal tie other than the wall-plate. A view, shown by fig. 5, of the old trussed-rafters of the nave, as exposed at Glasgow after removing the outside boarding, shows how the rafters have gradually moved over (about 12 inches at the apex) under pressure from the prevailing west wind. There can be little doubt, that but for the boarding and the resistance of the

¹ *Parish Churches*, Brandon, p. 75.
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² *Gothic Architecture*, Bloxam, p. 180.
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tower, the roof would have collapsed for want of a longitudinal tie along the ridge.

As Early English church-building developed, the simple trussed-rafter type of roof without tie-beams became the favourite style, and continued into the "Decorated" period. Brandon affirms¹ that the remaining examples of this type of roof are more numerous than

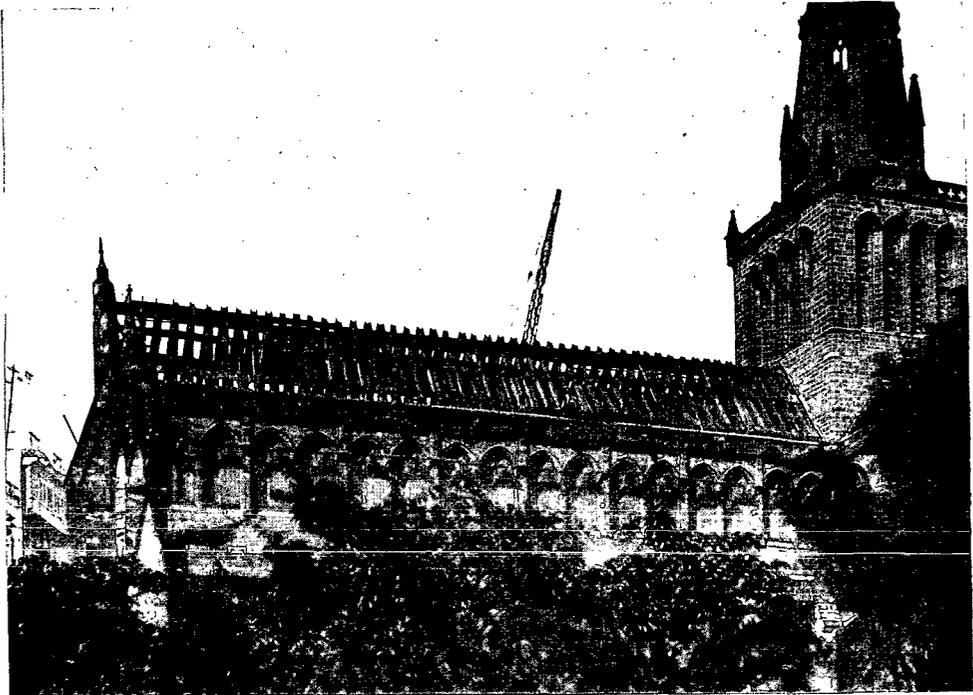


Fig. 5. Old Roof over Nave, showing the rafters leaning over to eastward.

any others, but that in most cases they have been lathed and plastered, though probably they were originally sometimes boarded.

Lympenhoe Church is a good example of the open trussed-rafter type of roof, and Wimbotsham provides an example of a somewhat similar type boarded and panelled by moulded ribs underneath.

No inscriptions or coats-of-arms have been found upon the old oak roof at Glasgow to furnish a clue to the exact date of its construction: there has been some misconception on the subject through a misstatement in 1736 by M'Ure. In Gordon's edition of M'Ure's *History of Glasgow*² it is stated that the coat-of-arms of Bishop Walter Wardlaw

¹ *Analysis of Gothic Architecture*, vol. i, p. 92.

² Vol. i, p. 60.

“is placed near the middle of the choir, on the right side of the high altar, where has been an altar for him. Over it on the roof of the area is his coat-of-arms finely illuminate.” The fact is, as anyone may see, that the shield with “arms” and the words “Walterno Cardinalis” are not on the roof of the choir at all, but upon the stone vaulting of the south aisle at the second bay eastward from the south transept.

When it was ascertained that the condition of the ancient timbers of the Glasgow roof was such that most of them could not possibly be safely retained, steps were taken to ascertain from a very careful examination of the remains of the old timbers every detail which would throw light upon the original work, and to endeavour to follow in the reconstruction of the new roof the guidance thus obtained.

ROOF OVER CHOIR.

We first dealt with the choir, constructing a temporary flat roof so that the church services should not be interrupted.

Upon the naked timbers being exposed by the removal of the plaster ceiling, diagrams, sketches, and photographs were prepared and fragments of detail which would help to elucidate the problem carefully noted, all peg-holes being marked and plotted in their correct positions. By these means certain disputed points were clearly settled. For instance, it was found that there could hardly have been tie-beams—as some at first thought probable—because the details of the old jointing at the foot of the rafters varied so much that this appeared impossible. The method of connecting the rafters and struts to the existing cross pieces upon the wall-head would have been out of the question for the purpose of a tie-beam. That originally there was internal boarding was also clearly proved, because fragments of the actual oak boarding and grooves were found upon some of the principal rafters. One fragment only was found to indicate at all clearly the character of the moulded principal rafters (see fig. 6), and this was, of course, carefully measured and drawn full size. From this fragment it was possible to construct the contour of the original mouldings.

The position of the peg-holes indicated, it was thought, where the carved bosses had been fixed at the junctions of the moulded ribs, and it became evident that the original division of the ceiling into panels had been followed when the plaster ceiling was substituted, although the character and spirit of the original work had been entirely lost.

The greatest surprise of all was to find that the original rafters

had been shaped so as to form a trefoil or cusped roof: the shape of the old rafters is shown in fig. 6. When we first examined the roof from the interior space near the ridge, it was only possible by the light of a lantern to look down between the outer boarding and the



Fig. 6. Showing trefoil, or cusped, form of Rafters of Choir Roof, with fragment of moulding at apex.

plaster ceiling, and in one or two instances to crawl down into a very limited space so far as one could reach. It had not occurred to anyone, so far as I am aware, that the uneven-shaped timbers were all carefully shaped in order to form the cusped design, which is a most unusual, if not unique, form for the trussed-rafter type of roof to take in a church of large dimensions.

The ancient roof timbers of the choir were found to be of the following dimensions:—Rafters, 8 × 8 inches; collars, $7\frac{1}{2} \times 7\frac{1}{2}$ inches; braces, $8 \times 7\frac{1}{2}$ inches; wall-plates, 8 × 8 inches; cross-plate, 8 × 8 inches. The span is



Fig. 7. Old Timbers of Nave Roof, as seen when stripped of plaster and lathing.

25 feet 2 inches at the east gable and 25 feet $3\frac{1}{2}$ inches at the west end. The maximum span where walls have bulged is 25 feet $11\frac{1}{2}$ inches.

ROOF OVER NAVE.

It was found on exposing the ancient timbers of the roof over the nave, as shown by fig. 7, that, unlike the choir roof, there was no

evidence whatever of there ever having been internal boarding. The timbers themselves were, as shown by fig. 8, of the same trussed-rafter type, but without the trefoil suggestion, while the length of the nave was divided into bays by massive bowtell-moulded lower edges to the



Fig. 8. View of the old Timbers at apex of Nave Roof.

principal rafters over the main wall-shafts, as seen by fig. 9. Evidently there had been tie-beams at these points.

The condition of the old rafters is indicated by fig. 10; and while separate members of the old trusses have been re-used wherever the old oak was found sound enough for this to be possible, only one comparatively complete truss could be used in the nave roof, and only one complete trussed-rafter of the roof of the triforia.

FUTURE STABILITY.

It was necessary in order to ensure the future stability of the edifice to reinforce the strength of the timber roof, especially in



Fig. 9. One of the principal Rafters of Nave Roof, showing remains of bowtell moulding.

respect of those parts where the construction was known to be defective, by hidden supplementary steel. This was achieved, firstly, by relieving the main walls of outward thrust, and, secondly, by providing longitudinal rigidity. So far as the choir is concerned these objects have been attained by setting steel trusses at intervals of about

12 feet between the rafters, sufficiently strong to resist the entire strain of dead load plus stress of wind and weather, and by means of steel joists as purlins to transmit the weight of the whole of the oak trussed-rafters to the steel trusses, so that there can be nothing but vertical pressure upon the walls. In the second place, longitudinal rigidity has been attained by means of these steel purlins riveted to the steel ribs and built into the walls of the tower and the east gable, also by

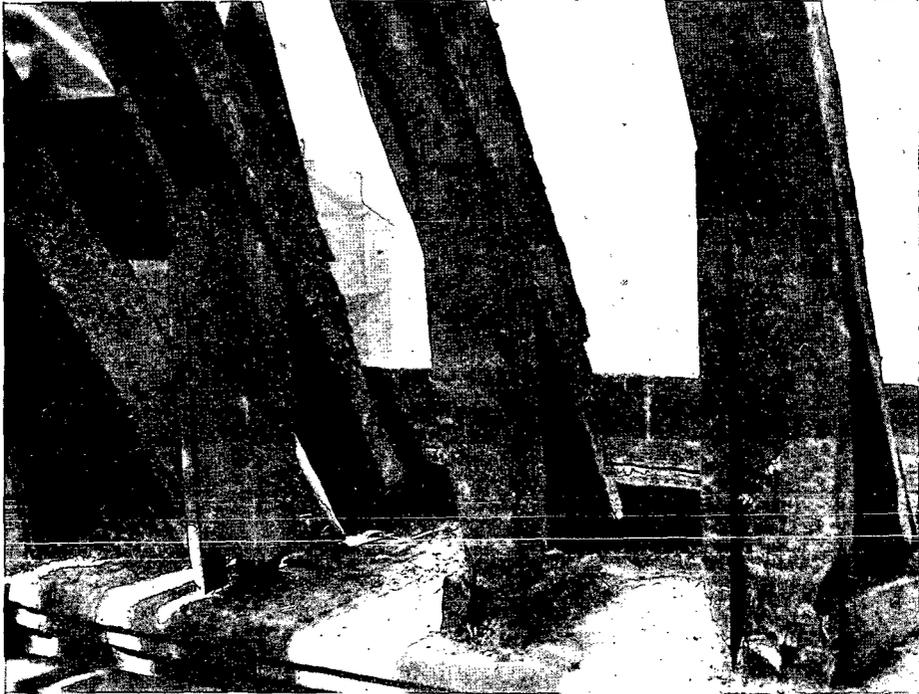


Fig. 10. Condition of old Rafters of Nave Roof at the wall-head.

continuous double steel wall-plates upon the wall-head. The steel reinforcement has in the nave also been adopted in such a way as to relieve the timbers of excessive strain both laterally and longitudinally: the tie-beams have steel fitch-plates 12 inches \times $\frac{1}{2}$ inch secured by adequate angle plates and bolts to steel angles 6 \times 6 inches, and resting on double steel wall-plates 3 inches \times 1 inch, such wall-plates forming, as in the choir, continuous longitudinal straps anchored at the ends to the tower and to the west gable. Other two similar steel bands 3 inches \times $\frac{1}{2}$ inch form a sufficient ridge tie to resist any possible strain longitudinally at the apex of the roof. Architecturally I should have preferred to omit the

tie-beams, but this could not have been done with permanent safety. On the other hand, I did not feel free to recommend an entire departure from the original type of roof in order to obtain what might be considered a better architectural result.

The weight of the roof throughout has been reduced considerably by the substitution of copper sheeting for lead or slate.

RE-USE OF THE ANCIENT OAK.

As much as possible of the old oak has throughout been re-used, not only because of its historical interest, but because of its beautiful mellow-brown colour. This, however, involved considerable extra expenditure in selecting and cutting out from the old timber suitable sound blocks, and in the increased labour in carving, the material having become through age extremely hard as compared with new oak.

INCIDENTAL "FINDS."

It is always interesting, when engaged upon works of this kind, to take note of what may throw light upon past history, especially when anything is found in parts usually inaccessible. It may therefore be worth while, in conclusion, to mention a few incidental "finds" which have come to light.

It is probably well known that until about seventy years ago the west end of the Cathedral had a consistory house at the south-west angle and a clock tower at the north-west angle. The former was demolished in 1846 and the latter two years later, the present rather tame west gable being then erected. When the old loose masonry at the west end of the north gutter of the nave roof was taken down to get proper anchorage for the ends of the steel wall-bands, four well-worn steps of a spiral turret stair were found in their original position which evidently led to the tower roof. These steps are now the only reminder of the vanished tower. They have been carefully pointed for preservation, and can be seen by the curious from the north gutter.

Another most interesting surprise was the discovery, while cleaning the interior stonework over the great east window, of a beautifully sculptured head of an angel or female—perhaps in mediæval days the terms were synonymous!—the face downward, and within a recess in the thickness of the wall, so that it could only be seen close at hand, by peering up at an acute angle with the wall face. It is impossible, as one contemplates this beautiful piece of work in such a position, to avoid questioning the object of the designer, whoever he may have



Fig. 11. Interior of Choir, looking west, and showing the oak roof restored.



Fig. 12. Interior of Nave, looking west, and showing the "open-timbered" oak roof restored.

been. A grotesque might have suggested some fanciful freak on the part of the carver, but there is nothing of the kind here. Was the sculptor a man after Ruskin's own heart, who put his best into his work for its own sake and for the sake of the house of God? Most certainly this piece of work was not done "to be seen of men," like so much that is done in the world. Is there a still deeper significance? Perhaps the designer wished to express his deep reverence for that which was to be celebrated at the altar far beneath the figure. May he not have had in mind Isaiah's vision of the seraphim covering their faces with their wings, or the vision of St John when he saw angels round about the throne who fell on their faces and worshipped God? We may not, in the present days of Protestant enlightenment, be able to agree with or enter fully into the deeper motive of these mediæval craftsmen, but we may still, I think, learn the lessons of thoroughness, faithfulness, and reverence, which come to us through these six centuries from that bowed head of the shadowed recess.

The appearance of the interior of the Cathedral after the completion of the new roofs is shown by fig. 11 of the choir, and by fig. 12 of the nave.