

(Paper No. 2097.)

**“The Semicircular Timber Roof-Truss Designed by the  
late Captain F. Fowke, R.E.”**

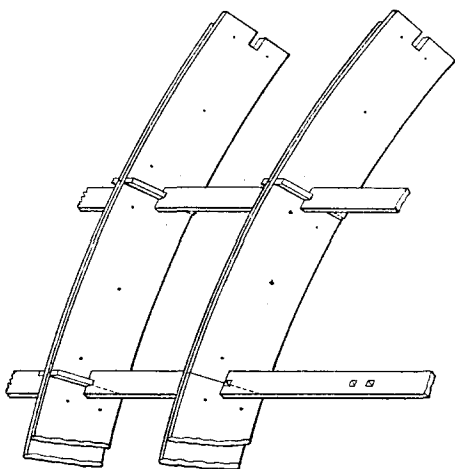
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THE composite roof-truss devised by the late Captain Fowke, and extensively employed in various buildings at South Kensington, was founded on the principle described by Philibert Delorme, in his work entitled “*Nouvelles Inventions pour bien bastir et à petits fraiz*,” published at Paris in 1561. In this book the writer draws attention to the method he had invented of making trusses composed of numerous pieces of wood framed together into a semicircular arched rib. Each truss was formed of two thicknesses of inch boarding sawn to the sweep, and put together in lengths of 4 feet, the lengths being so arranged as to break joint. Delorme's entire treatise is devoted to the description of the mode of constructing these trusses for roofs and floors, and he enumerates very quaintly the advantages of the invention, and the benefits to be anticipated from the adoption of the system, both in France and in other countries. It would appear from the context that Delorme employed this truss in his restoration of the Château de la Muette, at St. Germain-en-Laye, the central hall of which had a span of 10 toises (64 feet), and he states that the new roof had proved thoroughly sound and substantial. From the numerous woodcuts it would seem that the boards were pegged together, and that the ribs were placed 2 feet apart, being tied together by battens or purlins, 4 inches by 1 inch, passing through the centre of each, in mortise-holes at the junctions of the short lengths. Stout wedges, driven through the purlins on either side of the ribs, served to tie the work together. The accompanying illustration (see next page) shows the form of truss used for small spans. For larger spans, such as the roof of the Château de la Muette, Delorme designed a more complicated system of inter-ties, full details of which are given in his book.

Notwithstanding the obvious advantages of this mode of construction, in a country where large timber was becoming scarce, it does not appear that it was much practised, and the Author is

unable to trace any work of importance in which it was adopted until the construction of the roof of the Halle aux Blès, at Paris, in 1783. Previous to this, arched ribs of laminated timber, on the principle invented by Colonel Emy, had been employed in France with advantage for large spans. This latter system has attracted the attention of English engineers, having been successfully adopted by Mr. L. Cubitt for the roof of King's Cross Railway Station.

Tredgold, writing in 1820, in his "Elementary Principles of Carpentry," states, in Article 171, that "to make principal rafters in a continued series of pieces abutting end to end against one



DELORME'S SYSTEM.

another," would remedy the defects in roof-trusses arising from the shrinkage of timbers in large spans; and, in Fig. 55, he furnishes an illustration of the mode of constructing a principal of this kind. He also shows, in Fig. 57, how such a truss would be adapted to a span of 100 feet; but he indicates the parabola as the proper curve to be employed, and it is clear that he contemplated the use of much stouter timber than that proposed by Captain Fowke. The truss is shown to be composed of three thicknesses of sawn timber, each length breaking joint, bolted and tied together in the form of a parabola, with a rise of about one-eighth of its span.

Captain Fowke's truss was first employed in the construction of the drill-shed erected at South Kensington in 1858, for the First Middlesex Engineer Volunteers. This building was a marvel of

cheap construction, as the total cost for enclosing 90 feet by 40 feet was only about £100. The exterior was covered with felt; the skylights being formed of oiled calico. The ribs, which were 10 feet apart, were composed of three thicknesses of  $\frac{3}{4}$ -inch boarding; the rafters, placed at intervals of 2 feet from centre to centre, were 3 inches by 2 inches.

Shortly afterwards Captain Fowke employed the same principle for the "temporary" entrance to the Royal Horticultural Gardens (a building still in existence), and for the machinery annexes of the Exhibition of 1862, in which latter case three parallel lines of sheds, 50 feet in width, were erected side by side.

Recently the system introduced by Captain Fowke has been used on a very extensive scale for the buildings constructed at South Kensington, under the late General Scott, for the Fisheries Exhibition, and much attention has been directed to this very simple and economical truss. As the Author believes that the system has not been illustrated, he has prepared some details of the mode of construction (see Plate 5).<sup>1</sup> However carefully this kind of truss may be put together, it has a tendency to spread at the springing, to counteract which it is advisable to secure the feet of the rib to a firmly-fixed plate or sill, and, in setting out the upright sides of the structure, it is as well to make the total width at the eaves (for a span of 50 feet) 6 or 7 inches less than at the springing; by this means, when the truss is fixed in position and fully loaded, the haunches will give sufficiently to bring the sides upright.

Owing to the extremely small lateral rigidity of this form of truss, it is necessary to take strict precautions in rearing it into the vertical position, after nailing it together on the floor, as otherwise it may become greatly crippled. The Author has found it advisable to lash crossed scaffold-poles at back and front, and across the springing, in order to render it stiff enough to hoist. Care must likewise be taken to connect together the several trusses with purlins and wind-braces, as fast as they are raised, as, until the various ribs are securely attached together, they have not sufficient rigidity to resist a gust of wind. A length of several hundred feet of sheds was instantaneously demolished at South Kensington, owing to the neglect of these precautions.

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<sup>1</sup> It will be seen that Captain Fowke used 9-inch boarding, not sawn to the sweep, and in lengths of about 6 feet; by the occasional insertion of radiating braces, combined with double planks for the vertical framing of the sides and for the principal rafters, a manifest improvement on Delorme's principle is secured.

Where internal height is not a matter of importance, it is expedient to make the arch rather less than a semicircle; and the Author has found much difficulty with structures of this kind, in which the arch was stilted several feet above the springing, as in the example given, where the stiling is 6 feet. A notable advantage of this system of construction is that the building internally assumes a decorative appearance, and readily lends itself to decoration; it is also very much cheaper than a wood, or wood-and-iron, truss of the ordinary kind.

The communication is illustrated by one drawing and one sketch, from which Plate 5 and the cut have been engraved.

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TIMBER ARCHED ROOF-TRUSS.

PLATE. 5.

DESIGNED BY THE LATE CAPTAIN FOWKE.

DETAIL OF ARCHED RIB.

