

# DESIGN

*Construction Surveyed :  
Structure Compared*

POULSEN

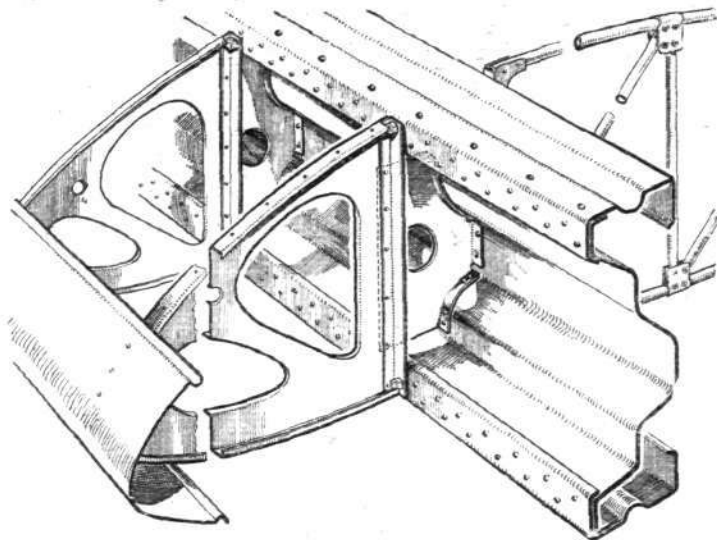
corrugated steel or duralumin, with the edges at the corners of the box riveted together. The corrugations were, of course, added in order to prevent the spar from collapsing by buckling or secondary failure long before the full compressive strength of the material had been developed.

Mention has been made of the early Short all-metal biplane. Other firms which were in the field from the very start were the Siddeley and Boulton and Paul concerns. The former produced the first all-metal military aeroplane, the Siskin single-seater fighter, and the latter had the remarkable foresight to standardise some 50 corrugated strip-steel sections, which could, by suitable combinations, be formed into wing spars of almost any dimensions likely to be used in any conceivable aeroplane. The idea behind this standardisation was that the rest of the firms in the aircraft industry would not need to spend time and money in developing their own sections, but could order their steel strip ready corrugated and in the required lengths from Boulton and Paul. In spite of its obvious merits, the idea was not taken up, and individual firms spent much time and money on learning how to roll or draw steel strip so that it left the machines straight and true. The early efforts had a distressing habit of tying themselves into knots after leaving the rolling mill or drawbench.

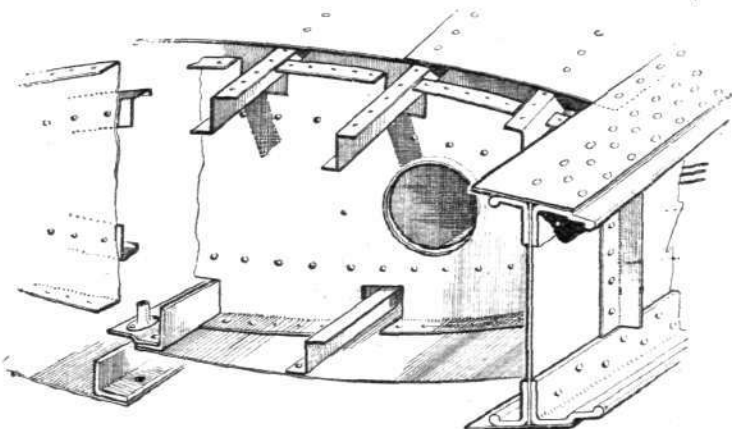
### Initial Difficulties

Another initial difficulty arose from the springiness of the steel strip used. The amount of "spring-back" varied with the composition of the steel, and with the dimensions of the strip. Ultimately all these troubles were overcome, but they took time and caused delays. However, there was no expansion panic in those days, and by leaving each firm to rake its own chestnuts out of the fire it seems likely that ultimately the *very* most efficient corrugated strip construction was evolved, so perhaps there was something to be said for the apparently wasteful methods adopted.

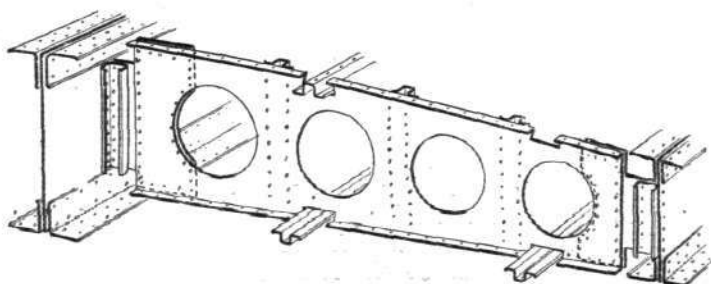
In the days of crinkled strip most firms used steel. This was due partly to the fact that from the designer's point of view it was the better material for most parts of the structure, but also partly to fear of corrosion of the aluminium alloys, the anodic protective treatment not having been put on the firm foundation which it occupies to-day.



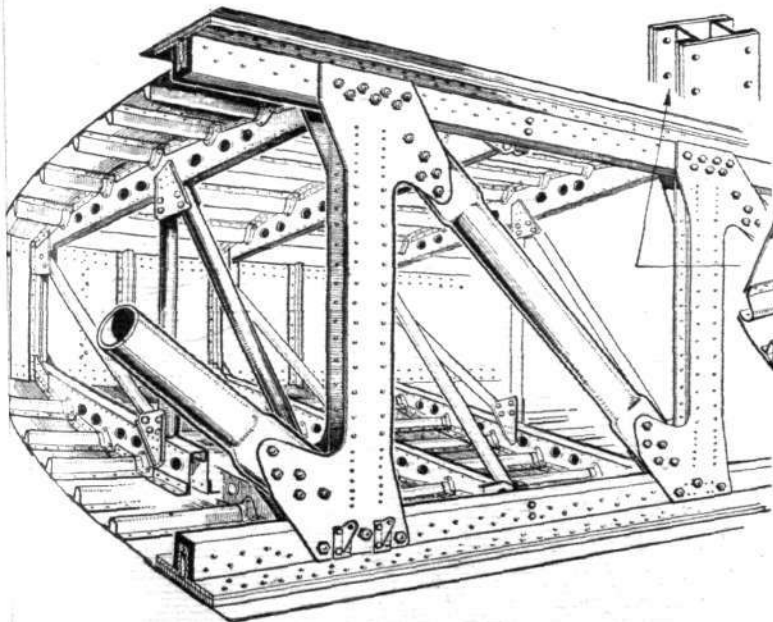
A somewhat unusual wing spar construction is used in the Supermarine Scapa biplane flying boat. The spar, known as a "Sigma" section, is built up of three corrugated strips



Extruded sections are used in the spar flanges of the Fairey Battle. The covering of the wing is of the stressed-skin type, stiffened by stringers of extruded Z-section, notched into the wing ribs.



The wing of the Bristol Blenheim is also of the two-spar type, and the skin-covering is stiffened by "hat"-section stringers.



Extruded sections are used in building up the spar flanges of the Handley Page Harrow. The spar webs are N-girders, and the leading edge is made as two separate units