therefore, the flexures of the compression-members will be. The flexures of these members are desired to be as small as possible, because they have great moments of inertia or are very stiff, and hence would receive great strains. And since these members must be safe against crippling, flexures would be more dangerous to them than to tensional members. The narrowness of ties, however, has a certain limit below which their own secondary strains again increase.

The practice of using eye-bars is advantageous as regards reduction of secondary strains, also because at the joints eye-bars are stronger against flexure than in their shanks, and much more so than broad, thin riveted ties. Eye-bars are attached in their gravity-lines, whilst this is not the case with the angles serving as diagonals of lattice-bridges.

It is good practice to build the end-posts and compression chords of trusses as continuous unhinged members, for otherwise the pins will receive not inconsiderable torsional moments causing additional strains, and because nothing is gained by hinging those members together. The pins, when the bridge is once freed from the false-works, do not admit of rotation, because the secondary moments in a properly designed structure are not strong enough to overcome friction.

The secondary strains of pin-jointed structures arise only from movable loads.

Also, a part of the secondary strains of riveted structures may be assumed to have vanished by the settling of the structures during the removal of the false-works or under the test-loads. But if the rivets are very numerous and are well driven at the joints of such structures, the head friction may be sufficient to keep the joints rigid.

The author calculated the secondary strains of a 100-foot Whipple truss, 20 feet deep, with panels 20 feet long. The maximum secondary strain was 8 per cent. of the admissible pressure of the top-chords near the centre. These members could easily have been reinforced by using sufficiently long and strong joint-plates. The secondary strains of the eye-bars were quite insignificant.

The secondary strains of riveted structures were calculated to be much greater. For triangular girders 32 to 100 per cent., for quadrangular 10 to 24 per cent. in the top-chords were found.

Of a triangular, all pin-jointed girder, of which the tensile members are built of broad flats with eyes riveted thereto, secondary strains up to 66 and even 172 per cent. were calculated at some points. This bridge of 118 feet span consists of 9 panels, it is 12.5 feet deep, and was built in South Germany."

"On the contrary, deep, long-panel, pin-jointed structures with eye-bars as tensional members are almost entirely free from secondary strains. They are the best and the most economical structures, provided that the principle of central intersection of gravity-lines is not only applied to the main girders, but also to the lateral and transverse bracing, and to the attachment of the floor. Without this condition being fulfilled, or, at least, duly considered, they lack more or less the lateral stiffness required."

I have quoted nearly all Chapter V., as the subject of secondary strains