as if the strain were applied over the line of centre of gravity, and then, finding the strain due to the angular motion, by the same process that would be used for obtaining the strain on that portion of a cantilever contiguous to where it was attached to a wall; using the total compressive force applied as the weight, and the distance of that pressure from the line of centre of gravity as the leverage. Then the strain on the outer fibre thus obtained, added to the former square-on pressure, would give the whole detrimental action upon the outer fibre of the material. Thus, as he had previously explained in reference to the Charing Cross Bridge, when a pressure of 475 tons was applied, square-on, to a piece of iron of 161.25 square inches sectional area, all the fibres would be strained uniformly up to 2.94 tons on the square inch; but by removing the line of pressure 3.6 inches away from the centre of gravity, the pressure on the outer fibres would be increased up to 6.86 tons on the square inch. Mr. Phipps added that, in cases where the arched rib proper was well connected with the roadway bearer above, by an efficient system of diagonal bracing, the centre of gravity of the whole section of the arched rib and roadway bearer together must be taken, as that around which the previously-named angular motion must be computed.

Mr. F. W. SHEILDS could not agree, that the object of the bracing in a girder bridge was merely to keep the top and bottom members asunder, and to enable them to do their work. In his opinion, the chief object of bracing in all parallel girders, was to carry the vertical weight of the bridge, with the extraneous load upon it, to the points of support at the piers; and that duty was just as important as, and quite distinct from, the work to be performed by the top and bottom flanges. The bracing ought to be specially designed for that duty, and in that view he thought the American bridges brought under their notice, even those of the simplest form, showed a want of scientific knowledge in their construction. Thus, if a girder bridge be supposed to consist of twelve bays, and the driving-wheels of a locomotive loaded with twelve tons rested over the third bay, that load would be transmitted to each pier, by the bracing, in the inverse proportion of the distance of the loaded point from the piers, being nine tons to the nearer, and three tons to the further pier. One of the diagrams exhibited was just in such a case, and he observed that at the third bay, there was no diagonal tie from the lower flange which could carry the load to the further pier. Consequently the girder would have to depend merely upon the rigidity of the top flange,