Mr. BATEMAN said, it appeared to him that the most remarkable part of this work, was the manner in which the traffic of the line was maintained during the time the iron girders were being constructed and substituted for the wooden arches. He did not think the Paper described with sufficient clearness how that was accomplished ; how in fact two iron girders could be made to take the place of four wooden arches, whilst the trains were running.

Mr. FAIRBAIRN said, his object in bringing forward the Paper was to show the way in which iron girders had been substituted for wooden arches, without obstruction to the traffic, or danger to the public, during this difficult and critical operation. The Dinting and the Mottram viaducts had been erected about twenty years, and had undergone repeated repairs. When he examined the Mottram viaduct, one of the arches was so much decayed, as to cause the timbers to rise and fall from 3 inches to 4 inches during the passage of the trains ; and in his opinion it was in so precarious a state, that it would have tumbled down within eighteen months, or two years. In fact, the passengers became so alarmed, that it was seriously proposed to run an omnibus to a distant station, in order to avoid crossing over the viaducts. It was necessary that the main girders should be constructed, be fixed in their places, and be made continuous, before the removal of any portion of the old wooden arches ; and as it was found that there was not sufficient room to effect the reconstruction between the arches without danger, it was decided to build the girders on the top, at the same level as the rails. During the progress of the works the old timber arches were strengthened by the introduction of tie-rods and bolts. The traffic both ways was conducted first on one line of rails, while the girders were being erected for the other, and on their completion, it was transferred entirely to the second line of rails. This was effected without the slightest stoppage or interruption of any kind, during the whole process of reconstruction. The girders were originally constructed completely at the works, and were then taken to pieces in sections, reconstructed as separate girders, and when in place, were riveted together, so as to make them continuous from abutment to abutment. They were fixed on the central piers, and there were rollers on the abutments at each end to allow for expansion and contraction. The extent of expansion from the freezing point to summer heat, was about $\frac{3}{4}$ of an inch ; and as the movement was in both directions, from the centre to the extremities, it was not considerable. In the Britannia bridge the possible movement would be about $2\frac{1}{2}$ inches. Cutting out some of the cross braces to get the girders down was a delicate operation, owing to the want of lateral braces, the old ones being totally inoperative. It was feared that the new bridge might be ugly ; but on the contrary, it had a very light and symmetrical appearance,

even more so than ordinary arches, and was not without harmony in its general outline. The apparatus employed for raising and lowering the tubes was simple and effective in every respect. The diameter of the screws was $4\frac{1}{2}$ inches, and the weight of the girder was 40 tons at each end. The pitch of the screw was about $\frac{3}{4}$ of an inch. In his opinion there was no economy in the erection of timber bridges in this country, when iron bridges could be built at so moderate a cost. The expense of the iron work in these viaducts did not exceed £20 or £22 per ton, including erection, and the cost was not increased by the peculiarities of the situation, or the circumstances under which the girders were erected. It was true that a certain deterioration was constantly going on in iron structures, particularly wrought iron, which oxidised more rapidly than cast iron; but with care and attention, a riveted plate, or lattice bridge of wrought iron, if occasionally painted and looked after to prevent oxidation, should last not only a hundred years, but for five hundred years.

Mr. HAWKSHAW, President, said the personal explanations which Mr. Fairbairn had given, in reply to questions from the Members, would he was convinced render this interesting work more fully appreciated. Every one must have been struck with the ingenuity which had been displayed, and the care which had been evinced, throughout the successful operation.