rience, he left in each of the haunches three cylindrical openings, from face to face, and it is said that the intermediate spaces are filled up with charcoal. The bridge was finished in 1750. The arch measures 140 feet betwixt the abutments, and has a curved line of 35 feet. The width of the soffit is 15 feet 10 inches at the springing, and 14 feet 5 inches at the crown; the width of the roadway at the crown being 11 feet.

The preceding is accompanied with a beautiful drawing, exhibiting the elevation, plan, and section, of the bridge.

On some Operations in Blasting in the Jumna, and at Delhi.
By George Tremenheere, Lieut. Bengal Engineers, Assoc. Inst. C. E.

In this paper, the author gives an account of the charges of blasting powder, and the mode of tamping in blasting, under his direction during the years 1828 and 1829, for improving the navigation of the Jumna, and from the years 1831 to 1835, at the fortifications of Delhi. The jumpers were 6 feet long, and 2$\frac{1}{2}$ inches in diameter; the blasts 5 feet deep, and at a distance of 4 feet from each other. The rate of boring varied from 2$\frac{1}{2}$ to 5 feet per day's work for two men. A double-headed jumper was used, to render the hole completely circular for the reception of the canister, about 2$\frac{1}{2}$ feet in length and 2 inches in diameter, and filled two-thirds with powder and the rest with sand. The small tube reaching to the surface of the water contained quick-match, with a piece of slow-match at the extremity. The canister, well greased, was placed in the hole without any additional tamping. The method of removing the masses and the tools employed are described and explained by drawings.

At Delhi, the blasting was in dry rock, and economy of gunpowder being of more importance than economy of time, tamping was resorted to. For this a stiff red clay, slightly moistened, was employed, and the tamping bar was of wood, and the priming wire of copper. Any dampness which might exist in the bore was obviated by a tube of coarse paper, greased on the outside. Fine mealed powder was used as priming, and a piece of port-fire for ignition. If the firing did not succeed, a fresh priming hole was bored in the tamping; or the mine abandoned. In large irregular masses of rock, the depth of the bore, or the intervals between the blasts, will generally represent the line of least resistance, and the following results were obtained in the rock at Delhi, which is hard quartz.
The line of least resistance not exceeding one foot, a charge of 2 oz. is sufficient; the line not exceeding 4 feet, and the rock not being highly chrysonaline, 3 oz. per foot will be sufficient.

The charges will vary with the tenacity of the rock, but the following may be a general guide:—the line of least resistance being 1, 2, 3, 4, 5, 6 feet, the charge will be 4, 8, 14, 20, 26, 36 ounces.

On comparing the charges used at Delhi, where stiff clay was used as tamping, with those in the Jumna where sand was used, the following table is the result:—

<table>
<thead>
<tr>
<th>Line of least resistance</th>
<th>With clay tamping</th>
<th>With sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 feet</td>
<td>8 oz.</td>
<td>26.8 oz.</td>
</tr>
<tr>
<td>2½</td>
<td>10</td>
<td>33.5</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>40.2</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>53.6</td>
</tr>
</tbody>
</table>

The charges in the last column are to those in the second as 3 to 1, nearly; they are not, however, given as the least required, but are those actually used.

The author is of opinion, that notwithstanding the increased expenditure of gunpowder when sand is used as a substitute for tamping, the saving of time and labour is such as may, under some circumstances, counterbalance that disadvantage. This is stated to have occurred on the Jumna, where, owing to the rise of the river during the periodical rains, it was required to execute the greatest possible quantity of work with large bodies of men in a given time.

May 1, 1838.

JOSHUA FIELD, V. P., in the Chair.

Peter Rothwell was elected a Member; Sir George Cayley, Bart. and James G. Marshall were elected Associates.

On Huddart's Rope Manufacture. By George Drysdale Dempsey.

The above communication on the improvements in rope manufacture, introduced by the late Captain Huddart, contains a general account of the successive improvements introduced, and a description of the machinery invented by that celebrated man and erected at Limehouse.