similar substances are in contact, as when a gate of one kind of wood is fastened with pins of another wood, some action tending to loosen the pins prematurely takes place betwixt them.

“On Tubing the Boilers of Locomotive Engines.” By George Buck, M. Inst. C. E.

Tubing for
Boilers.

In this communication, the author has attempted to determine the diameter of the tubes of the boiler of a locomotive engine, so that the effect in the generation of steam may be a maximum. The following are the conditions upon which the problem is solved: That the evaporating effect of the hot air, in passing through the tubes, is in proportion to the extent of surface in contact with the hot air, and as the time of contact conjointly. The following are the results of the investigation: The distance between the centres of two adjacent tubes should be equal to four times the interval between their internal surfaces—the diameter of each tube should be equal to three times the same interval—that the tubes should be as near each other as possible.

In illustration, Mr. Buck has drawn two sets of tubes of the locomotive boiler as generally employed, and one as they would be arranged according to the results of this investigation. On comparing the products of the aggregate periphery, and the aggregate area of the tubes, it appears that the boiler tubed according to the above theoretic proportion is from 23 to 26 per cent. superior to the others.

“On the State of the Suspension Bridge at Montrose, after the Hurricane of the 11th of Oct. 1838, with Remarks on the Construction of that and other Suspension Bridges, in reference to the Action of violent Gales.” By C. W. Pasley, Col. R. Engineers; Hon. M. Inst. C. E.

Suspension
Bridges.

By the hurricane of the 11th of Oct. 1838, one-third part of the roadway of the bridge at Montrose, with a very small exception, was carried away. The suspension rods on the west side were either broken or very much bent, but the chains, four in number, and extending in two parallel lines of two tiers each, appeared perfect. The distance between the piers is about 410 feet; and the chains had been strengthened by additional bars, or plates, since the bridge was erected. The statements of Mr. Provis, and the author's own ob-

servations, led him to the opinion that the motions which a bridge experiences are not lateral, but longitudinal. The Hammersmith suspension bridge does not appear to be subject to those longitudinal motions even in a most violent gale, and Col. Pasley considers this is amply accounted for by the longitudinal trussing which is there adopted. The idea that these longitudinal motions, and the injuries to the roadways of suspension bridges, are owing to the violent action of the wind from below, is confirmed by what Col. Pasley witnessed in Nov. 1836, at the Chatham dock-yard. One side of the roof of a shed for ship-building was raised up and down repeatedly, till at last a large portion of it, about 40 by 50 feet, was floated up like a sheet of paper, and carried to a distance of 50 yards. Such being the violence of the wind, we may readily conceive that the continual extension and compression to which the suspending rods must be subject by the rise and fall of the roadway, will in time break or bend them. This rise and fall of the roadway is prevented in the Hammersmith bridge by four lines of strong trussing along the whole length of the roadway, firmly connected to the bearers below; no similar trussing exists in the Menai, the Montrose, or any other suspension bridges which Col. Pasley has seen, or in the Brighton pier. The damage done to the latter, in Nov. 1836, is attributed, by Lieut.-Col. Reid, who witnessed it, to the action of the wind on the under surface of the roadway, and not to the lightning. The rise and fall of the platform of the Menai bridge is confidently stated to be three feet in ordinary gales, so that unless some similar trussing be employed, it may reasonably be expected that this bridge will be seriously injured in some hurricane. The peculiar construction of the suspension rods in several pieces, with joints, is a source of security to this bridge which the others do not possess. The author conceives that no suspension bridge of 400 feet betwixt the piers can be considered secure without two, at least, inflexible lines of longitudinal trussing from pier to pier.

Feb. 5, 1839.

The PRESIDENT in the Chair.

The following were ballotted for and elected:—Alfred Burges and John Taylor, as Members; Joseph Baxendale, J. M. Parsons, J. Bennett, as Associates; and Charles Wood, M.P., as an Honorary Member.

At the preceding meeting, Mr. Cottam had mentioned an instance of Corrosion of iron inclosed in lead for 90 years, being taken out with the fin Substances