made the strongest cement; but he had determined many other proportions which set immediately under water. With cement made according to the above proportions, thirty-one bricks had been set out from a wall, one brick being added every day, omitting the Sundays.

He had cemented bricks together, and he found in every case, that the bricks gave way and not the cement. He estimated the breaking force at the joints, at about 5000 lbs. on the 36 square inches, the surface of the brick. On comparing the strength of this cement with the chalk mortar, which had united some bricks, more than thirty years, he was led to consider the adhesive power of his artificial cement, forty days' old, as at least twenty times greater than that of the mortar.

January 31, 1837.

WILLIAM CUBITT, V.P., in the Chair.

"Description and Drawing of an Apparatus designed by Mr. Mitchell for Boring Wells." By Mr. Mitchell, Jun., of Sheerness.

Boring
Apparatus.

This apparatus consists of a frame, similar to that of a pile engine, in which the rods are suspended; on one of the rods is a wheel fixed on a square spindle (through which the rod can slide), and turned by means of a pinion and crank; the axis of this pinion serves also to draw the rods, since they may be drawn up by a single rope, or by a tackle suspended to the top of the frame, the rope of the block passing round the winch. The auger is regulated in the cut by a screw and nut; thus the rods are always kept from bending in the hole, and the bore from getting out of the perpendicular. This apparatus is found peculiarly convenient in chalk, and when stones are met with; since in most cases, if the auger be sufficiently hard, the stones flash off in small chips similar to gun flints.

"A Method of breaking Ice, by forcing it upwards instead of downwards; practised on the Herefordshire and Gloucestershire Canal, in the Winters of 1834-35 and 1836." By Stephen Ballard, Assoc. Inst. C.E.

Ice Boats.

Mr. Ballard places strong planks, covered on their upper side with sheet iron, in the front of a boat, so as to form an inclined plane

pointing downwards, the lower end projecting under the ice. The boat, drawn by a horse, is steered by a person walking on the shore, with a long shaft attached to a pole projecting over the stern. It is believed that one boat, a horse, and a boy, would thus break much more ice than three boats worked in the usual manner.

Mr. H. H. Price called the attention of the Institution to the importance of ascertaining, what were really the constituent elements of Artificial Hydraulic Mortars and Cements; several memoirs had been read before the Institute of France on the subject; but they exhibited great discrepancies, as to the principles of the formation of those cements. It was of the greatest importance to the engineer, to know from the materials at hand, how to make a cheap average hydraulic mortar.

Colonel Pasley remarked, that he considered Smeaton's Researches* as the only ones of value; the French philosophers had followed out many of his suggestions in great detail. Two systems appeared to have been pursued in France, the one, in which the substances were burnt previously to their being mixed, the other, in which they were mixed in a state of minute division previous to their being burnt. The Aberthaw limestone used by Smeaton, consisted of carbonate of lime and clay; 1 part of the lime from this stone, and 2 parts of sand, made a cement which set very hard in time; but the joints required to be protected at first by Sheppey, or some similar cement.

Mr. Lowe was of opinion, that very much must be attributed to the presence of silica; this evidently played a most important part. Limes had exceedingly different qualities; two makers using the same quarry would produce very different limes; if lime was flare-burnt, that is, burnt at a white heat, all the carbonic acid was driven off suddenly; the properties of lime burnt at a slow heat would differ much from the properties of the preceding. The mechanical mixing was also of the greatest importance; the Barrow lime was a natural hydraulic lime, but it must be well beaten with water and silica, or sand.

Mr. Blunt, (America,) gave, at the request of the Chairman, an account of the system of signals, which were employed in the geometrical operations now carrying on in America.

* Vide Smeaton's *Edystone Lighthouse*, Arts. 148—206.