THE CASTLE OF OSTIA.

[From a Sketch by Mr. Ripingille in 1844.]

Mr. F. GILES had listened with much interest to the excellent paper which had been read ; it was full of instructive, practical facts. He had been forcibly struck with the similarity of the results described, to the effects which were daily under the observation of engineers, in the harbours of the south coast of England. Rye, Dover, and Shoreham, might be quoted as examples. Of the ancient harbour of Rye, scarcely any traces remained. Mr. Giles was sent to Dover by the late Mr. Rennie, during the last year of the Pitt administration, in 1805, with instructions to make a survey, for the purpose of forming an extensive harbour of refuge for the Channel fleet. The design was not proceeded with, but certain improvements were commenced, with the view of removing the mass of shingle on the bar, and preventing a further accumulation. Mr. Walker had since done much for the further improvement of the harbour, by extending the backwater, and affording greater power of scouring by sluices. There was still great room for improvement ; and, although there was at present rarely such an accumulation of shingle across the entrance, after a storm, as to close it up, which frequently occurred in former times ; yet it was evident, that wherever piers or other obstacles were projected directly from the shore, the shingle would accumulate against them, and turning the point, would be thrown, in the form of a bar, across the entrance. This had become so evident, that the attention of engineers was now directed to the formation of a harbour of refuge, which must, in his opinion, be detached from the shore, in order to permit the free run

of the shingle. Such a harbour, or even a good breakwater, behind which steamers could take shelter, would be extremely useful, particularly in case of war, as from the proximity to the French coast, Dover would require special protection.

There were several harbours where, in the course of his practice, Mr. Giles had seen these views exemplified. Bridport harbour consisted of two small piers and open timber jetties, through which the shingle was carried, and was deposited in the entrance. When he was called upon to devise methods of improvement, he directed the open jetties to be filled up with rubble work, and by establishing a system of scouring by sluices, the accumulation was carried away.

Shoreham harbour was much in the same state, and in spite of all that had been done, it still remained a bar harbour.

The harbour of Sunderland was liable to be choked up with sand, and but for the scour of the river Wear, it could with difficulty be kept open. It, however, was still a bar harbour, and neither in it, nor in any other of the ports that had been mentioned, could vessels be received at low water; in fact, only during the time the tide was up. It would always be observed, that upon coasts which were subject to the shifting of shingle, sand, or mud, any solid projection would inevitably cause effects analogous to those which had been mentioned; and to which might be added, the instance of the works of the harbour of Courtown, County Wexford, commenced by Mr. Nimmo, and continued by Mr. Giles.

Sir JOHN RENNIE, *President*, said, that the chief object he had in view, in bringing the history of the ancient port of Ostia before the Institution was, independently of the interest which attached to such extensive works, which had failed so entirely from natural causes, to direct the attention of the members to the important question of the effect of the action of tides, and of rivers, in the formation of deltas, shoals, and bars, at the entrances of harbours. Some instances had been given of a few of the English harbours, but the opposite coasts of France and Holland exhibited, in a more marked degree, the effects of this action, not only in the bars of the harbours, but in the formation of banks parallel with the shore. The ports of Dunkerque, Calais, Boulogne, and Havre, might be especially mentioned. In all of them, in spite of continued extension of the jetties, and constant attention to the works, the accumulation of matter at the entrance extended with the new works. Havre was, perhaps, the most extraordinary instance. The current, at the entrance, was at times so strong, that a powerful steam vessel, such as the 'Phoenix,' had found much difficulty in entering the harbour.

The formation of the Goodwin Sands was a subject of interesting
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observation. There could not be any doubt of these sands being formed by the action of the eddies of the tide and the river Thames ; an attentive study of the position, with respect to the headlands near, the currents of the river and the tidal waters, bearing in mind the direction of the prevailing winds, enabled a reasonable solution of the problem to be arrived at.

Dover harbour was a curious example of the effects of the motion of shingle, which was produced from the *débris* of the fallen chalk cliff, the flints of which formed the pebbles, and the chalk and earth composed the silt. In the time of Henry VIII., Dover bay was instanced as being very fine, and having very deep water. The prevailing winds caused the shingle and silt to be carried to and fro freely along the shore. As soon as an obstruction was offered by piers, the shingle, having no longer a free and unrestricted course, accumulated across the ends of the piers, forming an embankment enclosing one side of the lake, which was replenished at each tide, until it became so extensive as to burst through the bank, and scoured everything before it. Constant endeavours had been made, and in some instances successfully, to improve the harbour by extending the piers, but, as had been stated, very much yet remained to be done, to form a good harbour at Dover.

It should be remarked particularly in the paper, that one of the leading features in the works at Ostia, was the construction of the moles upon arches, below the line of the low-water mark, so that the moles afforded still water for the vessels, while the arches permitted the alluvial matter to be carried through by the current. The same system had been adopted at Pozzolana, in the mole called Caligula's Bridge, in which concrete was used for the building. Sir John Rennie was of opinion, that this system of construction might be very advantageously adopted in many situations, and he had frequently proposed it. At Carrickfergus he designed two solid breakwaters to keep off the run of the sea on the most exposed side, while from the shore at right angles to it, and pointing to the centre of the breakwater, an arched mole would have been built, beside which vessels would lie, at all times of tide ; the run of the shingle along the shore, would thus have been very slightly impeded.

The Italian harbours deserved very particularly the study of engineers. The port of Genoa had been badly designed, and was constantly embarrassed by the deposit in it. Ancona being situated on a promontory had less deposit. At Ravenna the harbour had been nearly destroyed. The port of Venice was almost entirely kept open by dredging by manual labour, assisted by the moderate rise of tide at particular seasons. In the Lagunes, the accumulation of alluvial

matter was immense. A canal was constructed entirely round the Lagunes, with locks and sluices, to admit the fresh water when clear, by which means a power for scouring was obtained, and the channel was kept open. Civita Vecchia was principally indebted to its position for being preserved from the alluvial deposit, which was felt so severely all along the coast.

Mr. THOROLD was struck with the apparent similarity between the harbour of Sandwich and that of ancient Ostia, both of which had failed from the same causes; whereas Ramsgate was, like Civita Vecchia, an instance of the advantage of a proper selection of a site for a harbour. The port of Dublin might be also instanced as another example of comparative failure; while that of Kingstown was altogether as successful, as he believed it was almost entirely free from sand. The system of scouring away accumulations of sand and silt from harbours, by means of large reservoirs, did not appear to be sufficiently resorted to. Mr. Thorold was of opinion, that in some cases, great advantage would result from the application of the steam engine and the flash wheel, for raising water into the scouring reservoirs. In the fens of Lincolnshire, and near Yarmouth, he had found that arrangement of machinery very economical for draining. It had been applied in the river cutting of the Yarmouth and Norwich Railway, after it had been partially filled by a storm. The cutting was about half-a-mile in length, 100 feet wide at the top, and 20 feet in width at the bottom, and was 10 feet in depth. It was completely drained in 36 hours, with an expenditure of only 5 tons of coals. A reservoir of those dimensions would be found a great assistance for scouring a harbour, when any extra accumulation had occurred.

June 3, 1845.

SIR JOHN RENNIE, President, in the Chair.

The following candidates were balloted for and duly elected:—

Frank Forster, Thomas Longridge Gooch, and William Lewin, as Members; William Prime Marshall, William Lawford, George Lawford, and William Barber Buddicom, as Associates.

No. 713. "On the Corrosion of Metals." By R. Adie,
Liverpool.

This communication is intended to give an experimental proof of the fact, that water saturated with common salt, preserves to a great extent, the surface of the oxidizable metals from corrosion by the joint action of air and water. From some trials upon metals placed beside water in closed glass tubes, it will be seen, that water, or water containing a saline solution, does not act as a corroding agent, without