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## Lighthouse on the New South Shoal, Nantucket, U. S. \* THE SCREW PILE—THE PNEUMATIC PILE.

No work of a solid character placed on a submerged sand at so exposed a point as New South Shoal, were it possible to found one, could long withstand the power of the ocean. That it would not be overthrown by the direct blow of the waves, the successful resistance of the works just named (Eddystone, Bell Rock, Skerryvore Lighthouses), at points where the inclination of the bottom and the depth of water are calculated to give greater force to the waves, prove beyond all reasonable doubt; but that its destruction would nevertheless be inevitable, from the rapid and ceaseless process of the wasting of the sands of the shoal, caused by the recoil of the sea, from the mass, is no less certain. To provide a base of sufficient size and strength to sustain the necessary superstructure, that shall at the same time offer no very sensible obstruction to the free passage of the currents and the waves, is the great desideratum in founding works on submerged soils exposed to the batter of the ocean. This desideratum the last few years has supplied in the screw-pile of Mr. Alexander Mitchell, of Belfast, and in the pneumatic pile of the late Dr. Lawrence Holker Potts, of London. The next inquiry in order is, whether either of these modes is applicable to the site of New South Shoal. After much reflection, aided in no small degree by the experience acquired in the erection of the light-house on the Brandywine, I am of opinion that the first, being the method of screw-piles, cannot be employed to found a work at that point: and for these reasons:

1. That the screws could not be made to penetrate the shoal to the required depth, by any means applied from a floating body, moored in the tide and sea-way at the point in question.

2. That it is not possible to erect a temporary fixed structure during the working season at so exposed a point, at least in time to be available for driving the screw-piles; and,

3. That if it were possible to raise such a structure in time, it is doubted whether any power applied from it could insert the piles to a necessary depth, into a sand so hard and compact.

The screw-pile has been successfully applied in forming foundations of light-houses on the Maplin Sands, mouth of the Thames; on the North Wharf Sands, mouth of the Wyre; on the shoal ground of Holywood, Belfast bay; and, in this country, on Brandywine shoal, mouth of Delaware bay. The attempt to erect a light house on the north end of the Fish Bank, in St. George's channel, by means of these piles, failed, from no defect in the principle claimed for these useful appliances in forming submarine foundations, but principally, as it is understood, from the coming up of a heavy gale from the south-east before the piles were properly braced and the diagonal stays attached. The design to raise a beacon of screw-piles on the eastern end of the Tongue Bank also proved abortive; but, as the case of the structure on the Kish Bank, from no inherent defect in the piles themselves. This beacon

was composed of five six-inch piles, and raised in position by the Trinity House. Shortly after it was put up, it was discovered that an accident had happened to it, and, on examination, it was ascertained that three of the piles were broken off short, and the other two bent. The stump of the broken piles, and the lower parts of the bent piles, were found perfectly upright, and the sand around them undisturbed; shewing the structure failed from no fault of the *hold* they had taken of the ground. Their condition indeed affords the best evidence of the capacity of the screw pile on this point, as it appears the force that was sufficient to break off three and bend two wrought-iron piles of the size stated, was, at the same time unequal to the task either of uprooting them or even changing their position in the bottom. As the force of the waves, acting on such small surfaces as these piles presented, was entirely inadequate to produce the effects described, the destruction of the beacon was sought for in other causes. The conclusion arrived at, at the time, and no doubt the correct one, was, that a vessel had passed over it; a conclusion in a measure confirmed by finding the copper of a vessel attached to the top of one of the bent piles. It may be remarked here, incidentally, that accidents from this cause form the only real objection, save the destructible character of the material, either to the screw-pile or the pneumatic-pile, and only then of works founded in navigable depths.

The pneumatic-pile of Dr. Potts is of more recent origin than the screw-pile, or, at least has not been so long known to the public. It has not yet, it is believed, been successfully applied in founding works, such as light-houses, beacons, harbours, &c., exposed to the sweep of the ocean. That it is practically applicable for the purpose there is every reason to believe. The favourable opinion of those well known in engineering and construction in Great Britain, communicated in the report on the ice-harbours of the Delaware, dated the 28th December last, may be received as conclusive, particularly as it is supported by cases of application already made in other, and in some respects kindred works, on this point. To this testimony and to these cases the bureau is again referred for all the information in possession of this office upon the subject. Of the latter it is deemed sufficient for the present occasion to recount merely the following instances in which these piles have been used, to show that their size, both length and diameter considered, would seem only limited in their application to the power under the circumstances to handle them. Besides being employed, among other instances, in the founding of the piers of a viaduct in Anglesey over an arm of the sea, the bed of which is of running sand and gravel of great depth; in an experiment on Grain Spit to test the powers of the piles to sustain great weights; in the sinking of a pile of large dimensions in a quicksand in Cornwall; in the construction of a bridge over the Thames at Datchet; and in the foundation of part of a large viaduct on the Holyhead line of railway, a pile of this description, 3 feet in diameter, has been sunk in the Goodwin Sands to the depth of 77 feet, to the chalk formation; and others of the enormous size of 10 feet diameter as cofferdams, in the construction of the Midland Great Western Railway bridge over the Shannon. To this list may be added the new bridge over the Thames from Putney to Fulham, in which the piers will be formed of four cast-iron cylinders 8 feet in diameter, carried to such a depth as not to interfere with the dredging of the river. It is proper to remark here, that other applications of both the screw-pile and pneumatic-pile either in constructions or in experiments, may have been made and noticed in the publications of the day, par-

\* Abstract of a report to the Senate of the U. S. communicating, in compliance with a resolution of the Senate, a Report &c. from Major Hartman Bache, in reference to the construction of a Lighthouse or Beacon on the New South Shoal of Nantucket.