Correspondence.

Cement Tiles Once More.

To the Editor of the SCIENTIFIC AMERICAN:

In your article of March 3 I notice an article by C. E. Bartlett in regard to cement tile for farm drainage.

I have no doubt Mr. Bartlett is conscientious in his opinion but I am afraid he will carry an erroneous idea to some one interested in farm drainage.

The fact is: no water to speak of goes through the wall of the tile, but at the joint.

For proof take a soft tile, cement the bottom, fill with water and cover so that none of the water will be lost by evaporation. If the tile is an unusually soft one you will find at the end of twenty-four hours that the water has lowered about ½ inch.

In this section of the country the farmers are putting in *thousands* of tile every year, and the simple fact that the glazed tile are meeting a ready sale and giving universal satisfaction, against scarcely no sale for soft tile, is in itself proof of the error of Mr. Bartlett's statement. W. M. SNYDER.

Renwick, Iowa, March 7, 1906.

To Prevent Obnoxious Odors in the Subway.

To the Editor of the SCIENTIFIC AMERICAN:

I have read in your valuable paper, from time to time, various suggestions as to the best means of doing away with the obnoxious odors in the New York Subway, and having traveled in the Subway myself during the past summer, I therefore make these suggestions:

(1) I would have suspended from each truck a casing (made of some thin metal), same to inclose wheels, brake, shoes and boxes, and having of course an opening at the bottom for the wheels, said opening to be almost airtight, so as not to allow too great an inflow of the outside air while the aim pump is running.

(2) Have one car in each train fitted with an electric pump, also a tank (for the storage of foul air), connecting each casing to a running pipe under the car, same to empty into storage tank.

By having the wheels, brake shoes, and boxes incased, as above stated, the casing would catch any waste oil that might otherwise fall to the roadbed (and in time cause obnoxious odors); also the heat generated from the application of the air brakes, which as we know is very disagreeable.

(3) When the motorman applies the air brakes, the air pump could be automatically started and run as long as he may deem necessary in order that the foul air which has arisen during the application of the air brake and already in the casings, with any other odor that may have arisen from the oil, be forced into the storage tank.

(4) When the train has come out into the open air, or has arrived at the yards, a release valve in the storage tank could be opened, thus allowing the inclosed air to escape.

(5) Have the casings made similar to the present boxes, allowing for the injection of oil, also space for the cleaning out of the casings when necessary.

It seems to me that this would be a partial solution of the present annoyance. JOSEPH J. PARMENTER.

Chicago, February 27, 1906.

THE DIAMOND SHOALS LIGHTHOUSE.

Ever since American shipping amounted to anything the Diamond Shoals, extending for eighteen miles out into the Atlantic, off the point of Cape Hatteras, on the North Carolina coast, has been the worst menace to shipping known to mariners.

A properly placed beacon light at that point is an imperative necessity; for the lighthouse located on the outer bar is too far inward from the Diamond Shoals, while the lightship is too distant seaward, but is far enough out to insure sufficient depth for all vessels. In rough weather the light is not easily discernible. A permanent structure located at the edge of the outer shoal, and high enough to be seen in all kinds of weather, has become a necessity. An attempt was made not very long ago to build a lighthouse on this shoal, but was unsuccessful. For four or five years past Capt. Albert F. Eells, of Boston, Mass., has given the subject much study, and has recently been successful in persuading Congress to give him an opportunity to build a lighthouse at his own expense. Under the terms of the bill he is authorized to construct a substantial, sufficient lighthouse and fog signal of the most improved construction, together with auxiliary works.

The act specifies that Capt. Eells and his associates shall build the light station at their own cost, maintain the structure and operate the light in accordance with the regulations of the lighthouse board for one year, also at their own cost, after which it shall be placed under the control of the lighthouse board, who shall operate it for four years more at the cost of the United States. Eells and his associates shall then be entitled from the United States to the sum of $750,000, provided the structure is in a substantial and satisfactory condition.

In their report of 1888 the lighthouse board stated that the erection of a permanent lighthouse off Cape Hatteras would be an engineering task of great magnitude.

In 1902 O. L. Spaulding, acting Secretary of the Treasury, stated that the probable cost of erecting such a permanent light on Diamond Shoals according to the best plans then proposed would be $1,588,000.

The ship-owning and seafaring people throughout the country clearly realize the importance to their property and their lives of the work intrusted to Capt. Eells and his associates. The petition to Congress for the passage of the act contained the names of fifteen marine insurance companies, fifteen national banks doing the business of marine men, and 209 steamship lines and miscellaneous marine organizations.

Through the courtesy of Harriman Brothers, the engineers who have been intrusted with the designing and the erection of the lighthouse, we are enabled to present the following description of the proposed structure.

The foundation for the lighthouse will be a massive steel caisson in the form of a truncated cone with a cylindrical base. Upon this will be erected a tower comprising essentially a plate-steel cylinder with a slight batter from base to top, which tower will support a lantern at a height of 150 feet above sea level.

The foundation caisson will be 108 feet in diameter at the bottom, 80 feet high and 50 feet in diameter at the top. It will have a double shell of steel plates parallel to each other, spaced 6 feet apart and attached to twenty-four upright inclined plate girders, which will divide the space between the shells into twenty-four watertight compartments. It will have a double bottom, which is about 7 feet higher than the outer bottom edge of the caisson. The space between the two floors of the bottom, about 7 feet apart, is divided into twenty-four sections by twenty-four frames or trusses, extending radially from near the bottom of the twenty-four outer inclined girders, horizontally, to within 8 feet of the center of the caisson.

The central part of the caisson will be in the form of an open vertical shaft, 16 feet in diameter, extending from top to bottom, inclosed by steel plates riveted together and riveted to the steel girders, extending horizontally from this shaft to the inner edge of the twenty-four inclined girders mentioned. These horizontal girders, being about 13 feet one above the other, act as temporary floor beams that will divide the caisson into five large circular rooms.

The estimated weight of the entire structure, including the lighthouse and contents, is to be 27,000 tons. The displacement of water will be about 10,000 tons, which will leave an effective weight resting on the sands of the Diamond Shoals of about 17,000 tons, covering an effective area on the base of 8,960 square feet. This will give a pressure on the base from a vertical weight of 1.9 tons per square foot. The resultant pressure on the base from wind and wave is about 0.9 of a ton per square foot, added to the vertical weight of 1.9 tons per square foot, gives the maximum pressure on the leeward side of the caisson of 2.8 tons per square foot, while the pressure on the windward side of the base would be 1.9 tons per square foot, minus 0.9 ton wind and wave pressure. This would still leave a downward pressure on the windward side of the base of one ton per square foot, which gives this entire structure as here designed a stability never before submitted for the construction of such a lighthouse. The caisson is to be built at some shipyard and towed to its destination.

The central tube in the caisson, which extends from top to bottom, is made of curved rolled steel plates, attached to the ends of the horizontal floor girders and to the bracings, all of which when riveted together will form a vessel-like caisson of circular shape, built sufficiently strong to stand its sea voyage and the wind and wave pressure, after its final settlement into the sands of the Diamond Shoals.

All the inside horizontal girders are covered at the different elevations to make temporary floors and rooms in the caisson. It is proposed to place in these rooms, at the time of towing, the boiler, engines, pumps, derricks, dredging apparatus, concrete-mixing machinery, water, sand and cement, and the different materials necessary for sinking and filling, as well as supplies and equipment for the workmen.

A portion of the space between the two outer shells, and part of the bottom will be filled with concrete before leaving the shipyard, so that the caisson will draw about 21 feet of water.

After reaching its destination the caisson will be held in place by suitable anchors and cables. It will be scuttled by pumping water into the interior compartments until it rests on the sands in about 24 feet of water, leaving the top or deck about 56 feet above the surface of the ocean.

The lighthouse will be located some distance back from the outer edge of the shoals, so that it will be protected from the unbroken force of the ocean waves in time of storm. The shoals below the four-fathom contour extend over an area of about six miles by two miles, and the location selected, as shown by studies of the government maps made during the last fifty years, has suffered but slight alterations in depth.

After the caisson has been scuttled water ballast will be pumped into the twenty-four side compartments above the sea level. It is then proposed to sink the foundation caisson as quickly as possible, by a combined dredging and compressed air process, the dredging being done in and through the central well or shaft, and the caisson being sunk as far as practicable by open dredging through this well. This work will be preferably done in the spring of the year, as at that time the prevailing winds are from the shore, and therefore, the seas do not run so high.

After the caisson has been sunk as far as practicable by open dredging and the added weight of water and concrete, the lower air chambers will be filled with compressed air to force out the water. Laborers will enter these chambers and assist the hydraulic dredging machinery in excavating with powerful water jets, shovels and special tools to force the sand toward the central tube, whence it will be pumped upward and discharged through the outer shell.

While the dredging is being done the work will be be carried on as fast as possible in filling the different chambers with concrete. The material—cement, crushed stone, granite blocks, boulders, supplies, etc.—will be brought to the caisson in lighters, and hoisted aboard and stored in the different rooms to be used when required. A balance in weight will be preserved between the increasing weight of the structure and the increasing buoyancy of the surrounding water as the caisson sinks to its final depth. The caisson may thus be temporarily held at about the same level, to facilitate certain details of the excavation, or it may be made to sink more rapidly in the sand.

It has been estimated by a competent engineer, who has made an investigation of this location, that the sand is capable of supporting a weight as high as from eight to ten tons per square foot, but at no place, with this structure, will the pressure be greater than 3.6 tons, after deducting the amount of buoyancy or the pressure of the water displaced by the caisson.

As soon as the caisson has been sunk to its proper depth, about 26 feet below the surface of the sand, the bottom being about 50 feet below the surface of the water, the work of filling will begin. A rip-rap apron of oval shape, composed of irregular granite blocks or boulders, will be deposited on the surface of the sand entirely around the foundation, extending outward about 75 feet from the edge of the caisson in the direction of the greatest exposure.

After this caisson has been scuttled and sunk a few feet into the sand it is claimed that it will withstand any storm that may come up at that season of the year, and by the time it has reached its total depth of 26 feet in the sand and been partially filled with granite and cement and surrounded with rip-rap, it will withstand as great a storm as has ever been recorded off these shoals.

The entire shell of the caisson having been filled with concrete, and the central tube having been loaded with sand, except a space of about 12 feet deep, for a cistern that will hold 15,000 gallons of fresh water, and for rooms 14 feet high for storing the oil, water, and hoisting engine for the lighthouse, the foundation will be complete. The erection of the lighthouse or superstructure will thereupon begin. The lighthouse is of steel construction, and consists of an outside circular steel shell with an inner central steel tube, which contains a spiral stairway, chimneys, and ventilators, all of which are well braced by steel girders, frames, and partitions, and which has eight different floors besides the lantern gallery and watchroom. The outer shell of this structure is to be lined with a layer of concrete or plaster placed upon wire mesh or expanded metal, about 4 inches thick.

The first floor will be equipped with three lifeboats, with a crane for hoisting or lowering on the outside. The second floor will be divided into four rooms and will contain the fog-signaling apparatus and two oil engines. The third floor will contain the hoisting engine for operating the crane, and two large provision rooms and a bedroom. The fourth floor will have two bedrooms, a writing room and a bathroom. The fifth floor will have two bedrooms, a writing room, and a bathroom. One half of the sixth floor will be devoted to the dining room, and will have a well-equipped kitchen, pantry and refrigerator. The seventh floor will have a double sitting room and a laundry, and on this floor will be placed a tank that will hold 1,600 gallons of fresh water. The eighth floor will be properly equipped for the Lighthouse Service room. The ninth floor will contain the watch room and will have a gallery extending all the way around it, where those connected with the life-saving service as well as the light service may keep constant watch and records, during calm or storm. The floor above this will contain the light, for the installation of which the government has separately appropriated $30,000. The light will be of the first order and will be seen at a distance of 15 miles.