several in confinement to experiment with, and legend and psuedo history have played many merry pranks with them. Thus the old Romans called them ship stayers, and several of the classics contain references to them—fishes that fastened themselves to the war galleys and aided in their defeat by holding them back. It will be remembered that Pliny, among others, gravely informs us that Antony's ship at Actium was held by a remora, though several hundred sailors pulled at the oars. Then, too, we are told that Caligula's ship was held between Astura and Actium by a remora that was seen clinging to the rudder, pulling successfully against the oars of four hundred stalwart seamen.

The peculiar feature of the remora is the large sucker on the top of its head that is so conspicuous that an observer who had never seen one would select the belly as the dorsal surface. The fish appears to be tipped upside down; but as stated, the sucker is on the top of the head, and doubtless is a modification of the first dorsal fin, forming a perfect sucker which clings so tightly that I have lifted a bucket full of water by allowing the fish to attach itself to the bottom and lifting it by the tail. This sucker resembles a Venetian blind with its cleats, being made up of cartilaginous plates in a double series whose edges are sawlike or serrated. This disk is on the head and neck and often overhangs the mouth and always the eyes, calling to mind in a very superficial way some of the hornbills among birds.

The lower jaw generally projects beyond the upper. The fish is dark, or lead colored, sometimes striped, and presents a singular appearance as it swims about. I once saw a very large man-eater, possibly fifteen feet in length, swimming about my boat, in a deliberate fashion, and as attendants it had six or seven remoras and as many pilot fishes. The latter swam near its head, venturing only a few feet away, while the remoras roamed about in every direction, and when I threw pieces of crayfish into the water they rushed at it greedily but were not joined by the pilots.

There are several genera, as *Phtheirichthys*, *Echeneis*, *Remilegia*, *Remora*, and *Rhombochirus*. One of the most interesting remoras is *Phtheirichthys lineatus*, as it has two very pronounced white bands running laterally, which give the fish a very striking appearance. In specimens preserved in alcohol or formaldehyde the stripes fade out, but in several which I took from a large hammerhead shark off Avalon Bay, Santa Catalina, the stripes were pure white and the fish a very dark blue black, a most conspicuous object, long, and very slender. I find no record of the fish having been seen on the Pacific coast, Jordan giving its range in the Atlantic north to North Carolina and Pensacola. It is said to attach itself to barracudas in the Atlantic or Gulf of Mexico. I have never noticed this, although I have taken by grain and line many specimens of this large fish. The Bahaman barracuda, at least on the outer reef, is a "solitary." It lurks in certain places, remaining quiet and poised for long periods, and has a habit, also distasteful to the remora, of swallowing its food entire without crushing it.

The remora affects wanderers like the shark, swordfish, and animals which, in their savage rush at prey, crush and macerate it, so that particles escape into the open water, which can be secured.

In *Echeneis naucratis* the disk is long and has from twenty to twenty-eight laminæ. Its color is brown, with a dark belly, a dark stripe with a white edge extending along the side and through the eye. This appears to be a world-wide roamer, carried hither and yon by large sharks, and common on each side of the continent, and especially in southern seas. It is this remora of which the story is told that fishermen employ it in the Caribbean Sea to catch turtles. The remora is kept, so runs the story, in a pail; a ring is placed about its tail and to this a line. When the men sight a turtle the remora is slipped overboard and it is supposed darts at the turtle, seizes it, and holds on with such firmness and vigor that the animal can be hauled in. I lived on the Florida reef, winter and summer, several years and had a remarkable experience with the various fishes, and among other things I experimented with the remora; but the fish invariably refused to dart after the turtle, preferring to find shelter under the boat. One tossed at a shark was seized by the latter, that doubtless thought it a votive offering. Possibly something was wrong; our remoras may have been stale; they surely were not ship stayers, or turtle. I do not mean to insinuate that this tale is not possible, as so good an authority as Columbus refers to it, and in 1884 Mr. Frederick Holmwood, British consul at Zanzibar, described fishing with the remora in that latitude. The fishes, it is said, are kept in a well, and the ring is so firmly placed on the tail that it becomes imbedded in the flesh, so that a large turtle can be caught by them.

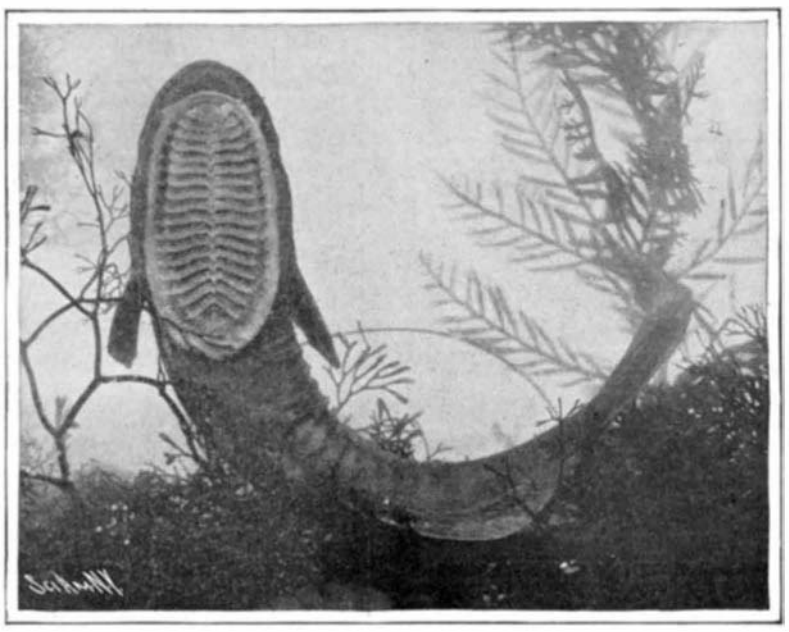
This remora is found as far north as Gloucester, and Monterey on the Pacific side, and is the common ship stayer of song and story. Two presumable species have been described; one with from twenty-two to twenty-six laminæ, and another with from twenty to twenty-one. A rare and little known remora is *Remilegia australis*, described by Bennett, and found clinging to a dolphin in tropical water seas. It is a rich brown color and easily distinguished from other remoras by the size of the sucking disk, which is very large and elongate, and has twenty-seven laminæ.

The genus *Remora* is well known, the species of that name being a dark fish about fifteen inches in length, with a large sucking disk, and found on the large sharks that are commonly caught at Santa Catalina in summer, especially the huge monsters that affect the grouper banks in the San Clemente channel. I saw four or five of these remoras on one large specimen and the same fish is taken on large sharks at Nantucket and Block Island in the summer, and occasionally found on the large swordfishes of the latter waters. It is also common on the Florida reef, and said to follow the big sailfish of Cuban waters.

The so-called white remora, *Remora albescens*, which is not white, rather a gray tint, has thirteen or fourteen laminæ in the sucking disk. It is found in the warm waters of the Pacific Ocean, and doubtless strays north in summer, when many large varieties of sharks go north.

A similar remora is included in the genus *Rhombochirus*, having been found on the swordfish Tetrapturus on the Atlantic coast ranging from the West Indies north to Cape Cod. A fossil remora is known, described by Cope as *Opisthomyzon*. It was in general appearance more normal, according to Storms, than the typical remoras of to-day. Its head was not so flat, the jaws were equal, the head was narrower, and the sucking disk much smaller than that of the remora of to-day. In all probability, the fish was more active, a better swimmer, and not so dependent upon other fishes as are the present forms. Very little, if anything, is known of the breeding habits of remoras. In Florida I kept them in dead coral inclosures in order to watch them, but could never find the young.

Few more interesting groups of fishes are known than the remoras, which have figured in legend and history, well known to a few, rarely if ever seen by the majority. The accompanying illustration is a photograph of the fish in the water, taken at Santa Catalina Island, California, under my direction by Charles Ironmonger. It shows the sucker and its partitions perfectly, and doubtless is the only photograph ever taken of the remora, as the fish is rarely caught except when sharks are brought in alive.



THE REMORA, SHOWING SUCKING DISK WITH SEVENTEEN LAMINÆ.

Taken from large shark at Santa Catalina Island, Cal.

THE GREAT SEA WALL AT GALVESTON.

BY W. S. HUDSON.

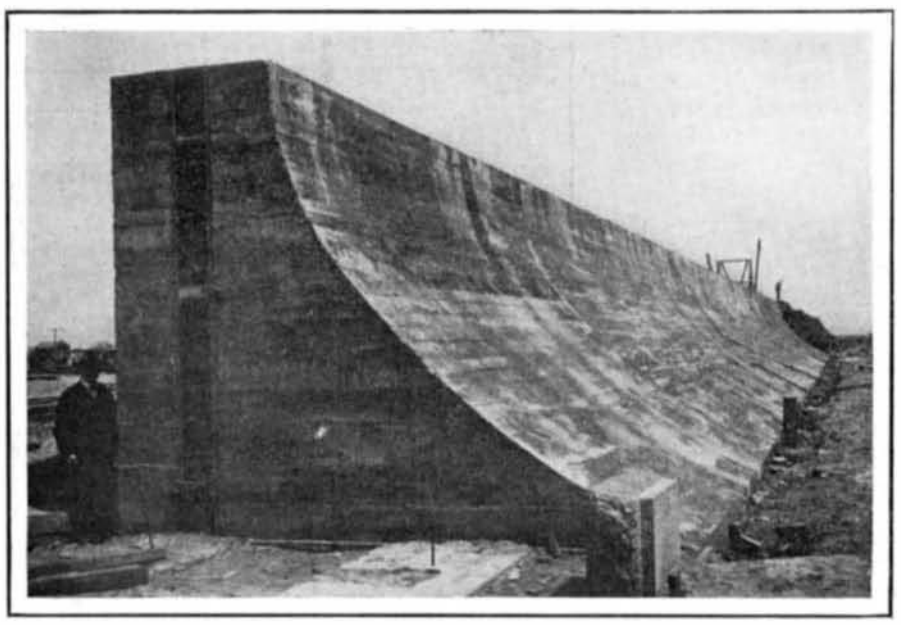
The completion of Galveston's great sea wall marks the first step toward making that city, the most important port on the Gulf coast, storm-proof for all time to come, and also marks the successful culmination of one of the most unique and gigantic engineering undertakings in recent years. The building of a solid concrete wall 4½ miles in length and seventeen feet high and the elevation of the city's grade to the level of the top of the wall is an achievement of which any city twice the size of Galveston might well be proud, and when the conditions under which this undertaking was begun are considered, the wonderful nerve of Galvestonians is more properly realized.

Although repeatedly warned to take some measure for the protection of the city from the occasional overflows of the Gulf, it remained for the great disaster of September 8, 1900, to bring the people of Galveston to a complete realization of the necessity for such protection. In the great storm of that date over 8,000 lives were wiped out of existence, more than $20,000,000 worth of property was destroyed, and faith in the stability of the rapidly-growing city so rudely shaken that five years have not entirely sufficed to restore public confidence. When the city had partly recovered from the overwhelming disaster the board of city commissioners passed a resolution calling for the appointment of a committee to select competent engineers to report upon the following:

1. The safest and most efficient way for protecting the city from overflows of the sea.

2. Plans and specifications and estimates of the cost

BUILT OF GRANITE AND CEMENT, THE GALVESTON SEA WALL IS 4½ MILES LONG AND WEIGHS 40,000 POUNDS TO THE FOOT.



THE GALVESTON WALL MEASURES 16 FEET AT THE BASE, IS 17 FEET HIGH AND 5 FEET ACROSS AT THE TOP.

of a breakwater, or sea wall, of sufficient strength and height to prevent the overflow of the city from the Gulf.

3. Plans and specifications and estimates of the cost for filling and grading the city, so as to protect it from overflow, and to secure sufficient elevation for drainage and sewerage.

The board of engineers selected for the purpose were Gen. Henry M. Robert, chief of engineers, U. S. A., retired; Mr. Alfred Noble, and Maj. H. C. Ripley, all engineers of national renown. In January, 1902, this board submitted plans calling for the construction of a solid concrete wall and the raising of the grade of the city to the level of the top of the wall. Under the plans submitted, which were unanimously adopted, the total estimated cost of the sea wall and grade-raising was $3,505,040. The wall was planned to extend 3½ miles around the Gulf side of the city, and the government later agreed to further extend the wall nearly a mile, at a cost of $591,046.25, making the total length about 4½ miles. The sea wall was to be constructed by the county, while the grade-raising was to be done by the city, with the exception of 100 feet along the sea wall right-of-way, to be carried out by the county. The county issued bonds sufficient to carry out the building of the sea wall, while the aid of the State was sought in the grade-raising. The city was authorized to issue bonds to the amount of $2,000,000 for grade-raising purposes, and the State legislature agreed to remit the taxes for eighteen years, the taxes to be paid as usual, but the share which formerly went to the State to be used as a sinking fund for the redemption of the bonds and to pay the interest.

Work on the sea wall was started in October, 1902, and the county's extension was completed in July, 1904. The government extension of one mile was finished this month. Some idea of the immensity of this undertaking may be obtained by considering the following figures: The wall is built of solid concrete made of Texas granite and Portland cement. It is 4½ miles long and weighs 40,000 pounds to the lineal foot. The wall is built upon a round piling foundation, the piles being 45 feet in length, and not less than 12 inches at the top and 17 inches at the base in diameter. The piles are driven in four rows at intervals of 4 feet from center to center. The wall proper measures 16 feet at the base, is 17 feet high, and 5 feet across the top. It is protected from undermining on the Gulf side by an apron of rip-rap 27 feet wide, as well as by a row of sheet piling extending the entire length of the wall, and driven down to a depth of twenty-four feet.

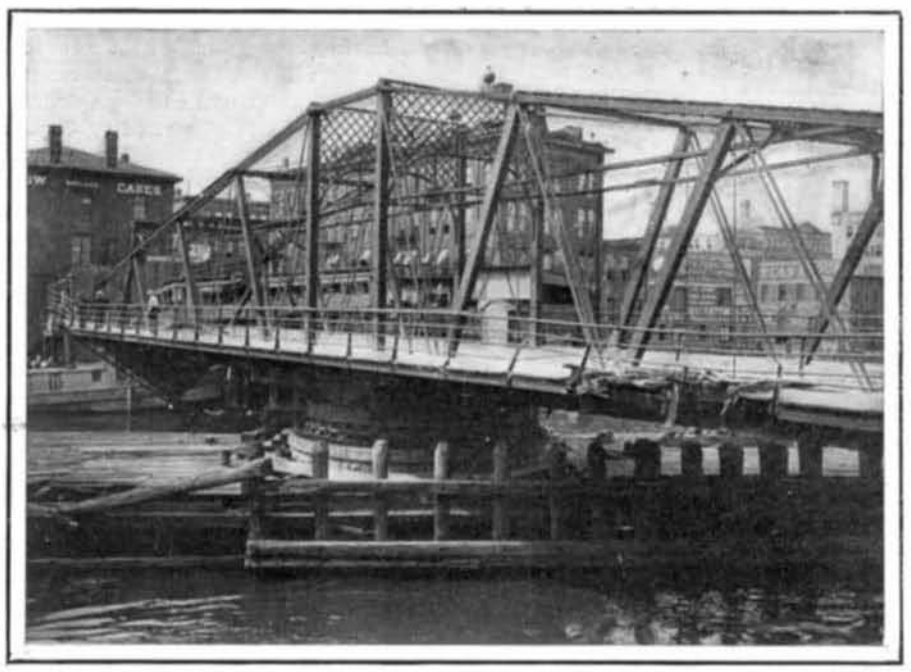
In the 3½-mile county extension were placed 13,300 carloads of material—5,200 carloads of crushed granite, 1,800 carloads of sand, 1,000 carloads of cement, 1,200 carloads round piles, 400 carloads sheet piling, 3,700 carloads of rip-rap, and 5 carloads of rim-filling rods.

Work on the grade-raising has been in progress fifteen months and the entire undertaking is expected to be completed early in 1907. The plan for filling in, while unique, is very satisfactory and its practicability has been fully shown. The initial move was the digging of a canal parallel to the sea wall and intersecting the avenues of the city. The material taken from the canal was used for filling in the sea wall right-of-way. The canal right-of-way was leased for a nominal sum and all the houses removed. With the building of the canal the material for filling in the city is being obtained from the bay and from between the government jetties by self-loading and discharging and self-propelling dredges. These steam from the excavating ground through the canal to pipe-line stations at points where the canal intersects the avenues. At these points the excavated material is forced through pipes running down the avenues, the sand remaining to fill up, the water running off through a discharging canal. In this manner very rapid progress is made. The harbor entrance is also deepened by the removal of the excavated material from between the jetties, which extend 5 miles out into the sea, and which were constructed by the government at a cost of $8,000,000.

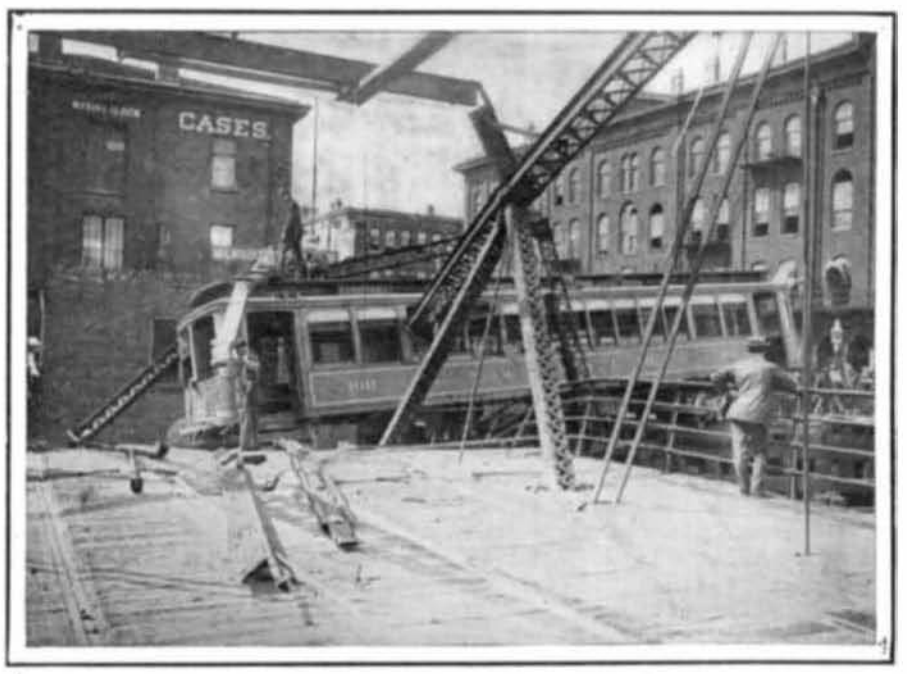
When the grade-raising is completed the dredges will back out of the canal, filling it up firmly as they go, and the houses removed therefrom will be restored.

The grade-raising necessitates the raising of 2,156 houses. The territory raised embraces private property as well as streets, sidewalks, and alleys, and there is no special tax or charge made against the private property for the filling placed thereon, although the expense of raising the houses is borne by individuals.

When the grade-raising is completed to the level of the top of the wall, the top of the embankment for about 50 feet from the sea wall will be protected by a pavement, and 40 feet further by soil and Bermuda grass. Thus a fine driveway will be the result, 50 feet in width, which, added to the available part of the top of the sea wall after an iron railing has been placed upon it will give a sidewalk 9 feet in width overlooking the Gulf of Mexico.

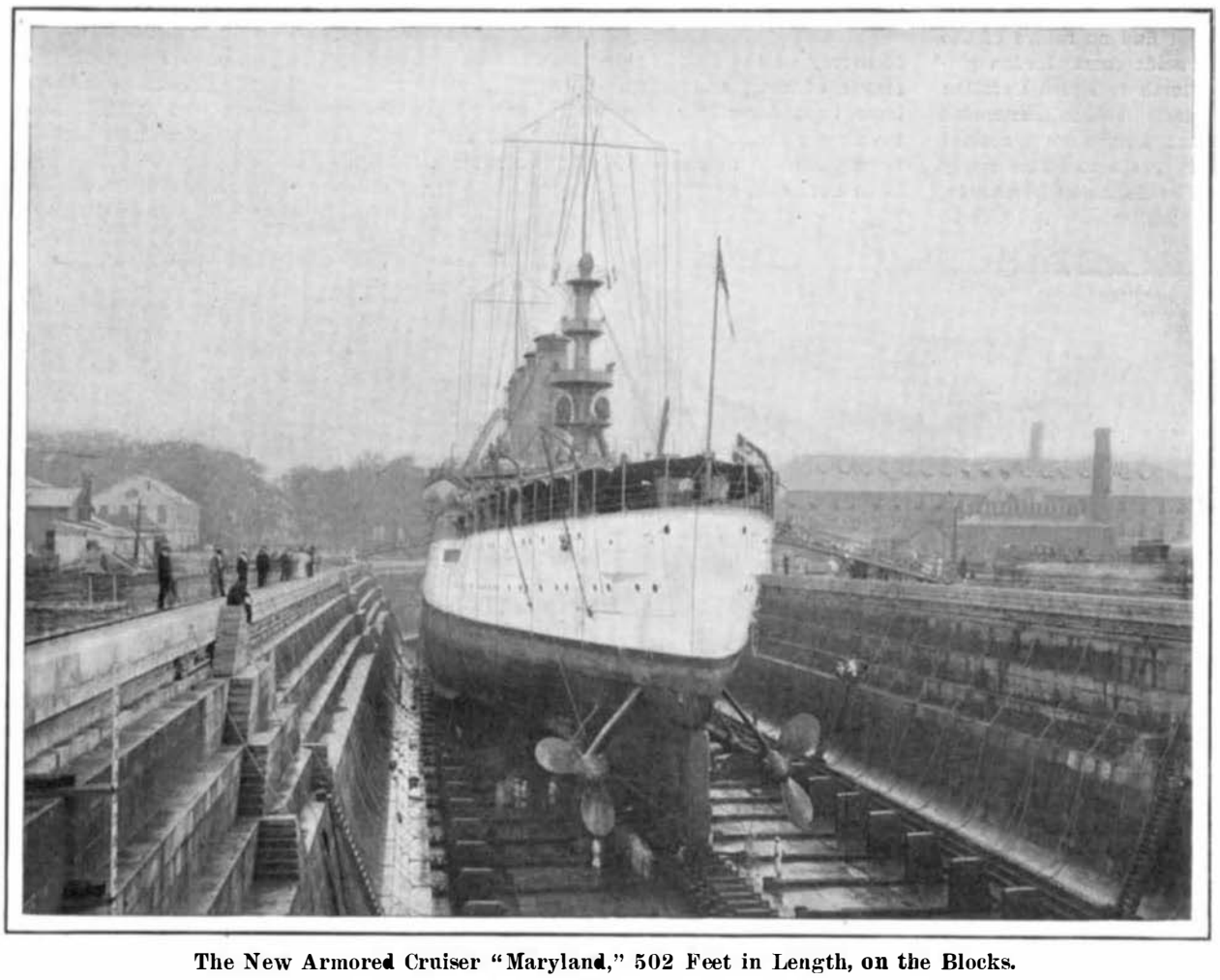


View Showing the Point at Which the Bridge was Rammed by a Steamer.



After the Collision; the Car is Resting Partly on the Bridge and Partly on the Street.

A CURIOUS DRAWBRIDGE ACCIDENT AT MILWAUKEE.



The New Armored Cruiser "Maryland," 502 Feet in Length, on the Blocks.

OPENING OF THE BOSTON NAVY YARD DRYDOCK.

A CURIOUS BRIDGE ACCIDENT.

An unusual combination of circumstances rendered an accident that recently occurred on a street car on one of the bridges of the Milwaukee River of very special interest. A large and heavy street car had just crossed the bridge, which was of the ordinary draw-span type, and its forward trucks were already on the abutment, when a steamer, through some misunderstanding, ran into the opposite half of the draw span, causing it to turn on its turntable and twisting the street car into the perilous position shown in our engraving. As the bridge swung round the side of the car carried away the end of the panel of the truss, and the floor of the bridge, having no support, sagged down, leaving the outer end of the car suspended in the perilous position shown. The street railway company immediately made the necessary arrangements to place the car back on the track, and this they did by floating a scow beneath the car and building up a mass of blocking, by means of which the car was jacked up and run on to the tracks on shore. A fortunate feature of the accident was that no lives were lost, and that all the passengers made their immediate escape. The forward set of trucks remained on the abutment, but the after set fell into the river when the floor of the bridge collapsed.

OPENING OF THE STONE DRYDOCK AT THE BOSTON NAVY YARD.

Time was when all the drydocks of this country, including those built for the government, were constructed of timber. Considerations of economy of first cost alone determined this selection, for the timber drydock has proved in many cases to be a troublesome