

all of the largest and heaviest ships in the navy have been successfully docked therein.

During the Spanish-American war there were 2,200 construction employes, averaging 14 hours per day, under Mr. Bowles' orders. Due largely to his remarkable executive ability and quick and correct decision, there were fitted out at the New York Navy Yard, for auxiliary service, forty-seven vessels—as many as were turned out in all other yards together. Mr. Bowles was further in complete charge of fitting out the army hospital ship "Relief," which for completeness of hospital arrangements is to-day unsurpassed. Secondary batteries were fitted on the "St. Louis," the "Harvard" and "Yale," without interfering with their movements. In many instances, the alterations were outlined, plans made and issued, and work begun within twenty-four hours after a vessel's delivery at the yard.

Mr. Bowles was the prime mover in the organization of the Society of Naval Architects and Marine Engineers. From its incorporation he has been Chairman of the Executive Committee of the Council, and since 1895 has also served as Secretary-Treasurer of the society. In moving him a vote of thanks, Vice-President Loring, of the society, stated "In the work of inception and execution, the master mind and guiding hand have been those of Naval Constructor Francis T. Bowles." Col. Edwin A. Stevens, member of the Council, said: "I take it that we can regard Mr. Bowles' work in fostering this society. . . . as an example of the spirit of the service, taking Mr. Bowles as the type of the re-constructed navy of the United States, of the men that have made that reconstruction possible." Sir Nathaniel Barnaby calls the corresponding English organization "The home for research in naval construction;" and due to the efforts of Mr. Bowles, the American society has come to occupy a similar place and is meeting with great success in its object, "the promotion of practical and scientific knowledge in the arts of shipbuilding and marine engineering and the allied professions."

NEW YORK NAVY YARD, BROOKLYN.

One of the most evident facts demonstrated by our late conflict with Spain was the important part which must always be played by the navy yards of the country in the successful prosecution of a war—a fact too little understood or too long overlooked by Congress. Only those who were *au courant* with our deficiency in dry docks and other essential facilities knew to what straits we might have been brought by the sudden crippling of half a dozen of our deep-draught ships, and the consequent demand for instant docking. Happily, however, Congress seems now to have awakened to the importance of this question, and our various yards will soon be suitably equipped to meet the needs of an ever-growing navy.

By far the most important of the navy yards of the United States is that known officially as the Navy Yard, New York, and popularly as the Brooklyn Navy Yard. It bears the same relation to our navy as Portsmouth and Chatham to the British navy, and Brest and Toulon to the navy of France, and some idea of its capacity may be gathered from the fact that in the course of a single year as many as 120 vessels have visited the yard for repairs or alterations, 50 of these being vessels of the regular service and 70 of them being vessels on which considerable structural changes were necessary in transforming them to suit the needs of naval service. In the same period 66 vessels were docked and painted.

LOCATION AND HISTORY OF THE YARD.—If the reader will take up a map of New York he will notice that the East River for the first mile and a half of its course from the southern end of Manhattan Island, runs in an easterly direction and then turns sharply to the north, making a bend of about 90 degrees. The outer angle of the bend forms what is known as Wallabout Bay in which is situated an island, separated (save for a narrow causeway) from the main land by the Wallabout Channel. The island, the channel and most of the adjoining land encompassing the channel, go to form the 213 acres inclosed within the boundaries of the New York Navy Yard. Historically the site will always possess a mournful interest owing to the fact that during the Revolutionary War the British prison ships were moored in the Wallabout Channel, and that on board of these vessels thousands of American patriots perished. They were buried right in the mud flats of the bay upon which stands the present dry docks and buildings of the Navy Yard, and during the excavations for various new structures, portions of skeletons have frequently been exhumed. This has occurred as recently as February of this year, when in excavating near the clothing factory, fragments of several skeletons were brought to light.

For the origin of the New York Navy Yard we must go back to the year 1801, when the Chief Executive of the United States, John Adams, having exhausted every argument to induce Congress to appropriate the necessary money, purchased on his own responsibility the sites for six navy yards. Among the yards thus secured was the "Waalbought," Brooklyn, now corrupted into "Wallabout." Subsequent additions were

made in 1824, 1848, and 1867, and at a later date two sections were sold to city of Brooklyn, one of which is occupied by the well-known Wallabout Market. The present value of the yard, with its docks, buildings and plant, is estimated at about \$19,000,000.

The extent of quay wall available for the berthing of vessels is approximately one and a quarter miles. The boundary limits are on an average about one-quarter of a mile from the water front and the yard including the island known as Cob Dock, contains as we have said, some 213 acres. The greater part of the buildings were erected prior to the reconstruction period of the navy, which dates from about the year 1883, at which time the buildings and machinery were entirely inadequate to the requirements of a modern navy yard. Subsequently to the date mentioned, and particularly during the last decade, the more generous appropriations and the advent of vigorous and competent officials to the yard, have resulted in a great improvement of its capacity for every kind of naval work. Many old and unsuitable buildings have been torn down, and replaced by modern structures, fully equipped for the necessities of the new navy. Complete arrangements have been made for receiving and disposing the vast quantities of naval stores of all descriptions which pass through this principal supply depot of the navy. Complete electrical plants, both for lighting and power, have been installed, and elaborate hydraulic and pneumatic plants have been laid down. The quay walls have been extended, and, by dredging, have been made available for vessels of great draught of water. At the commencement of the era referred to the yard possessed but one dry dock, the old stone dock, with a length of only 370 feet. Since this two large docks, one 500 feet in length, and the other 670 feet have been constructed, and the 500-foot dock is now being largely rebuilt in concrete.

An important feature in connection with the arrangement of the docks is the system of double-track railways which encircle each dry dock and by means of connecting branches unites them with the boiler shop. On this system there are two large 40-ton locomotive cranes which have a reach of about 60 feet. The arrangement of the tracks is such that it is possible for the crane to pick up a boiler in the boiler shop, carry it to any one of the dry docks, and lower it directly into the hold of the vessel. These cranes are also of the greatest service in handling guns, gun carriages, and the heavier pieces of machinery and ship's framing and fittings. One of our illustrations on the front pages shows the yard floating derrick which has a capacity of 75 tons at the end of a 65-foot boom. One advantageous feature of this derrick is that the boom is capable of rotation about the mast. The floating derrick and the large locomotive cranes just referred to make it possible to handle the heaviest weights with ease and dispatch. There is also an elaborate system of single-track railway, as indicated by the single line on the accompanying plan of the yard. It will be seen that the tracks extend down the whole water front and through the main streets of the yard, short branches being run from the streets into the various shops.

BUILDINGS.—The buildings of the yard are commodious and of a very substantial character. The older structures have been largely rebuilt and refitted and there are several entirely new structures that have either just been completed or are in process of erection. The largest building is the smithery, which measures 300 × 200 feet. The foundry is 350 × 110 feet, and the main machine shop of the Steam Engineering Department measures 350 × 100 feet with a wing 210 × 95 feet. The general storehouse measures 200 × 200 feet, and the joiner and paint shop is contained in a fine granite building which is over half a century old, in which is also the Construction and Repair Electrical Plant. On the summit of the hill, in the northwestern corner of the yard, is situated the commandant's house, now occupied by Rear Admiral J. W. Philip, well known as the commanding officer of the "Texas" during the Spanish-American war. It will interest our readers to know that the first commandant of the yard was Lieutenant Jonathan Thorne, the hero of Washington Irving's "Astoria."

THE DEPARTMENT OF CONSTRUCTION AND REPAIR.—The work undertaken at the Government Navy Yard is so complex as to necessitate its division under various departments. The most important of these is the Department of Construction and Repair, which has charge of all work connected with the hull proper of the vessels. It has charge of the important work of docking, painting and undocking; it installs and supervises all piping in connection with the drainage, water, and ventilation systems; it looks after the necessary work in fitting up the quarters and receiving spaces of ships, and provides the necessary furniture and various details essential to life aboard ship; it has under its supervision the steering machinery and that for the hoisting of anchors and handling of the many boats with which all naval vessels are supplied. It also has charge of building the boats themselves, and in this connection it should be mentioned that a large three-story boat

storehouse has been planned which will be erected on the spot indicated in the accompanying map of the yard. Electric traveling cranes, running from one end to the other on each floor, will enable the boats to be picked up and carried to a well at one end of the building, where they will be lowered on to suitable trucks on the yard railway and carried to the water.

There are thirteen buildings connected with this department, and in addition to these a large steel storehouse is in process of erection. Several of the illustrations on the first page of this issue show the interior of these buildings and the various improved tools and appliances in the shops. Limitations of space prevent any very detailed description, but we draw particular attention to the gas plant which furnishes the necessary fuel for the various forges for the plate-bending sheds and smitheries. It consists of a Root blower which delivers air at a pressure of 2 pounds to the square inch. A part of this air passes through the large tanks of gasoline shown in the illustration, and the gas thus formed is piped to the different forges and bending furnaces. The other part of the air is carried through an air main to the various shops, and by means of an air pipe and a gas pipe at each forge the mixture is regulated according to the work to be done.

A comparatively new feature of this department is the compressed air plant, whose mains are carried to the different shops and are also extended to and around each of the dry docks. The mains at the docks are located a few feet back from the curb, and are provided at intervals with connections from which the air is piped through flexible hose to the various portable machines used for drilling, chipping and caulking both on the inside and outside of the vessel. Among the uses of air in the shops is that of wood boring in the boat shop, brass polishing, hoisting in the blacksmith and machine shops, machine molding in the foundry, and for tests of all auxiliary machinery where steam may not happen to be available.

THE DEPARTMENT OF STEAM ENGINEERING, as the name indicates, has charge of all work connected with the engines and boilers of the ships, and such auxiliary machinery as is not under the direction of the Construction Department. THE DEPARTMENT OF YARDS AND DOCKS has charge of the erection and maintenance of all the yard buildings; attends to the lighting, heating, and furnishing of these buildings, and keeps in repair the dry docks, quay walls and slips, streets and tracks. THE EQUIPMENT DEPARTMENT has charge of all matters relating to the rigging of the ships; furnishes all electrical appliances and the instruments connected with the navigation of the ships, and installs the complicated system of electric wiring which is now such an important item in the vessels of our navy. THE DEPARTMENT OF SUPPLIES AND ACCOUNTS has charge of the accounts of the officers and employes of the yard and the purchase of all material for the use of the various departments. It keeps a general storehouse supplied with naval stores for the use of all the vessels in the navy and in many cases it supplies the other navy yards as well. THE ORDNANCE DEPARTMENT has charge of all matters relating to the ordnance of vessels, their guns, torpedoes, and ammunition. It has to see that the vessels are fully supplied with the ammunition and various stores connected with ordnance. The efficiency of this department was displayed conspicuously during the recent war when our vessels, not merely in Cuban waters, but in the Far East, were never in danger at any time of running short of ammunition.

PROPOSED IMPROVEMENTS.—Although the New York Navy Yard has made such a good record in respect of its ability to turn out a large amount of work, it is a fact that much of the repairs, etc., undertaken at this yard, is done at a great disadvantage, owing to the lack of proper berthing space and the impossibility of placing the ships at wharves reasonably accessible to the shops. The trouble is due to the existence of the Wallabout channel and the fact that on the navy yard side of the channel there are, at present, berths available for not more than five ships, and that of these only two are suitable for large or long vessels. This necessitates the berthing of some of the ships that come to the yard at the Cob Dock, communication with which is only possible by a slow and inadequate rope ferry, which is subject to constant interruption from passing tugs and barges. Moreover, all materials and stores for ships on the Cob Dock have to be hauled fully a mile by teams over poor roads extending around the dry docks and over the causeway.

The accompanying plan shows the scheme of alterations, drawn up by Naval Constructor Bowles, with a view to remedying this serious defect by providing ample berthing space in close proximity to the shops. The plan, which has every probability of being carried out, contemplates the removal of the southern end of the Cob Dock and the building out into the enlarged channel thus formed of six long piers and one shorter one, all projecting from the Brooklyn shore as shown. By abolishing the Cob Dock for berthing purposes, the enlarged berthing space thus afforded on the Brooklyn shore would be sufficient to accommodate at any one time eleven of the largest

and two smaller vessels, while there are the added advantages of an ample and unobstructed channel for the passage of ships from the East River to the dry docks, and that the vessels in taking up their berths at the new piers would be out of the heavy tideway which at present sets up and down the Cob Dock.

The plan of reconstruction also provides for two covered marine railways on the Cob Dock for hauling and storing torpedo boats. At present the boats are hauled out on temporary ways on the Brooklyn side,



CHIEF OF TETUILA—MOUNGA.

where the work of painting and repairs is often seriously delayed by the weather. The New York Navy Yard, as thus reconstructed, will compare favorably with the best of the European navy yards.

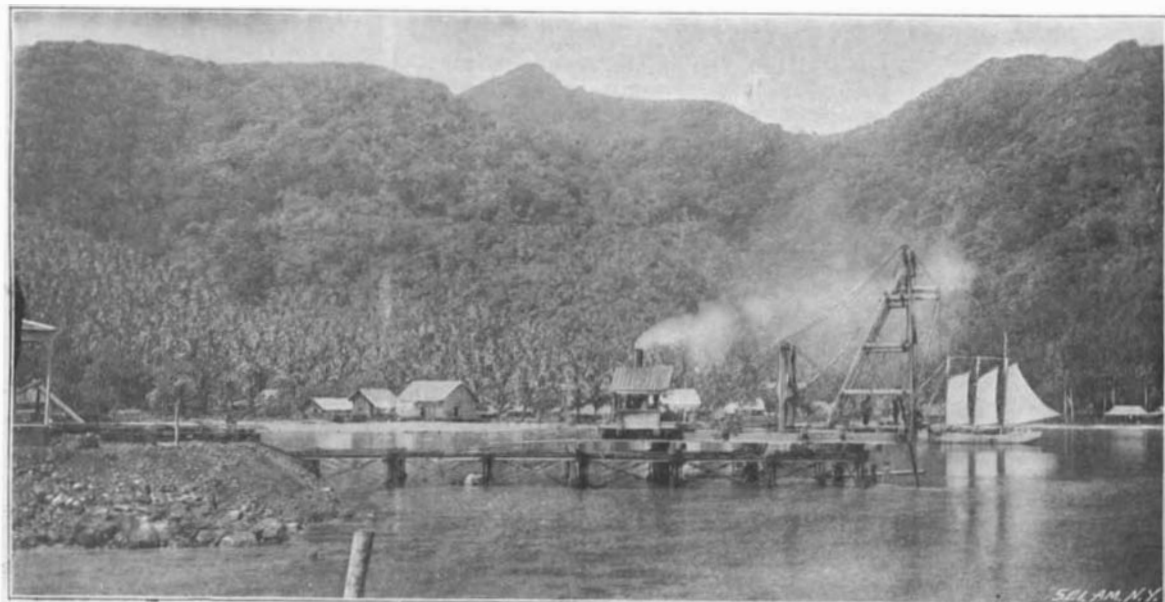
BUILDING WHARF AT PANGO PANGO.

Pango Pango harbor on the island of Tetuila, one of the Samoan group, is a possession of great value to a power like the United States with world-wide commerce and increasing interests and responsibilities so diversified. Though surpassed in extent by some of the harbors of Australia and China, there is not one whose advantages are greater and where the safety of a fleet from storms or attack, is so assured or so easily provided for. The island itself is volcanic and the harbor originally a crater. The dimensions of Tetuila is about thirteen miles in extreme length and is one vast range of mountains, some them 3,500 feet high.

The harbor is an ideal one with a narrow and deep entrance about one-third of a mile in width. Its dimensions are one by one-fourth miles, and throughout its entire extent a depth of forty fathoms is maintained. It is surrounded by high hills and the most violent storms of that latitude do not affect it.

The United States intrusted to a San Francisco firm the construction of a wharf 300 feet in length with a face of 400 feet, to be built of steel, which is now under way and will be completed in September. In addition coalsheds of corrugated steel capable of storing 6,000 tons are being erected and will be completed at the same time. The work is making rapid progress.

The inhabitants of Samoa are said to be delighted at the prospect of becoming attached to the United States. The more intelligent among them realizing the advantages of being protected by a powerful nation.



NEW WHARF BEING BUILT AT THE ISLAND OF TETUILA.

They are all nominally Christians, though not all of one sect. Most of them follow the English missionaries, though a few are Catholics. A good many heathen superstitions and customs survive. The women are the most virtuous savages in the world, though their marriage customs seem to more civilized nations somewhat lax. The marriage relation endures only so long as mutually agreeable, when a separation is at once granted. Several of the workmen who are constructing the wharves have formed alliances with the natives who make good wives and are extremely proud of their white husbands. They are industrious and make good housekeepers. There are many chiefs among the natives and they are accorded certain privileges and great deference, but the paramount chief over all is Mounnga, a magnificent specimen of physical strength, who stands 6 feet 2 inches in his bare feet. His wife is considered a fair type of an island beauty.

The island is productive and yields ample supplies of bread fruit, taro and bananas, which constitute the principal articles of food consumption. The waters also abound in fish, and the natives are very expert in catching them.

Besides the natives raise quantities of pigs and fowls, which they sell to passing vessels. The community is a happy one, and quarrels are infrequent. The climate is very warm and lenervating, though the workmen employed at wharf-building enjoy excellent health.

The distance from Apia to Pango Pango is 82 miles, though the two islands are only separated by a narrow strait.

Electricity from a Snow Storm.

William A. Eddy, at Bayonne, N. J., made some interesting tests on February 17 with a kite, his object being to make an electrical test of a snow storm. A 6-foot single plane kite was used, and it was attached to a steel wire. The brush discharge could be plainly heard followed by a 1-inch spark. The electrical activity with the kite at so moderate an altitude was the greatest that had ever been experienced, the effect being about the same as if a thunderstorm had been near.

Driftwood on the Alaska Coast.

There is an extraordinary deposit of driftwood on the coast of Alaska, some 1,200 or 1,500 miles northwest of Seattle. A constant deposit of logs and driftwood has been going on for hundreds of years, and it is due to the phenomena of the tides, the Pacific Gulf Stream, the ocean currents and the peculiar formations of the shore-lines at that point. According to The Chicago Times-Herald, logs and timbers are readily identified there as having come from Japan, China, India and other localities of Asia, as well as from California, Washington and other parts of the American continent. There are fine logs of camphor-tree, the mahogany, the redwood and the pine. Some of these from the State

of Washington bear the names of the men who felled the trees, and the sawmills for which they were destined. Some logs 8 feet in diameter are often seen there, and some entire trees 150 feet long, evidently uplifted by the roots during some terrible tempest. The newer logs are without bark, and they are as hard as stone, due to their long immersion in salt water.

Luncheons in Schools.

Luncheons were first introduced into the public schools of Boston five years ago, and their practicability has been established. There are now thirteen schools in all that are taken care of by the New England Kitchen managers, says The Sanitarium. The luncheons are served only in the high, Latin, and normal schools, as pupils have but one session, while in the lower grades there are two sessions and the children have about two hours at noon in which to go to their homes. At present the luncheons are served in the basements of the schools, where the light is poor and the facilities for handling the food are not of the best. In the new buildings provisions will be made for lunch rooms. The food is sold in combinations for five cents each, and ten cents supplies a fairly satisfactory meal. At the manual training-school at Cambridge, where the pupils perform considerable hand



SAMOAN METHOD OF PREPARING FOOD.

manual labor, the twenty-five-cent dinner has proved very successful. Only the very best materials are used in the cooking. The bill of fare for one day includes oyster broth, milk, cocoa, three kinds of sandwiches, graham, white, and coffee rolls, corn cake, custard, baked apples, cookies, and fruit. Everything at the schools is strictly home-made and is cooked under the supervision of those in charge of the work of the kitchen.

The March Building Edition.

The Building Edition for March is a unique number being devoted almost entirely to beautiful houses which have been built at "Hillcrest Manor" and "Crag Terrace," in Greenwich, Conn. The houses possess many remarkable and individual features. The literary contents is of unusual importance. This is one of the handsomest numbers of this periodical which has ever been issued.

The Current Supplement.

The current SUPPLEMENT is appropriately called the "Niagara Falls Industrial Number," and forms a most valuable compendium of information relating to Niagara Falls, its history, geology, topography, railways, bridges, power plants, industrial establishments, etc. It is illustrated by thirty-five engravings. We believe that our readers will appreciate having all matters relating to the recent developments of Niagara in concise form within the limits of a single number. It will prove a valuable reference number for many years to come, illustrating as it does some of the largest hydraulic and electric machines ever constructed and some of the most interesting bridges ever built.

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