derrick at the front end of the traveler. The tracks for the latter were laid above the first line of longitudinal stringers inside the bottom chords of the truss, and as the floor framing was built up, the traveler moved forward over it. Across the top of the front bent of the traveler was a strong, transverse lattice girder, at the center of which was pivoted the 62-foot boom of the derrick, and the foot of the derrick mast. The two stiff-legs were carried back to the last bent of the traveler as shown, and when a heavy load was to be lifted, the bottom frame of the traveler was clamped to the upper flanges of the floor stringers.

The material for the floor system was brought on scows to a landing near the foot of the towers, hoisted on to a tramway, run out to the front of the base of the towers, and then hoisted to the level of the floor system by a crane which placed it on a trolley, the trolley in turn carrying it out to the erecting traveler on the bridge. The chords were built out in 60-foot sections, representing each a length of three panels, the weight of each section being 25 tons. The floor beams which were the next heaviest single load, weighed 10 tons each. As soon as the 60-foot chord lengths with the floor beams and stringers between them had been bolted up, the traveler moved forward 60 feet, and another section of the floor was built out, the operation being repeated until the two gangs of workmen met at the center of the span. The whole 1,600 feet of floor, weighing no less than 2,750 tons, was erected and bolted up in six weeks' time, a most creditable performance, and a rate of speed which, if it had been observed on some other portions of the work, would have hastened the final completion of the bridge materially. The next operation will be to erect the 50-foot stiffening trusses, the lateral carrying trusses for the floor beams, and the various details of the lateral wind truss system. Second only in importance to the erection and bolting up of the floor and truss is the work of riveting, which follows along close after the first erection. The riveting purposes an air-compressing plant has been built on the Brooklyn shore, and a 6-inch main has been laid across the bridge.

To facilitate erection, and to insure that when the final riveting up takes place the bridge will hang at its proper designed curves and level, the contractors have drawn up a blue-print showing where the material of the trusses and lateral system is to be placed along the bridge ready for erection. Every one of the many thousands of angles, posts, girders, etc., is numbered, and has its place assigned it somewhere on the great 1,600-foot span. Each piece will be laid upon the floor in the reverse order in which it is required, so that when the erectors start work there will be no time lost in hunting for particular sections, but they will be right at hand ready to be put in place, and incidentally performing the important function of loading the flexible structure to the true lines, in which it will be inflexibly held when the stiffening truss has been erected and riveted up. We are indebted to Mr. Walter T. Brown, the Resident Engineer of the Pennsylvania Steel Company at the bridge, for courtesies extended during the preparation of this article.

THE HUNTER'S POINT DRY DOCK, SAN FRANCISCO.

The Pacific Coast now has at Hunter's Point, San Francisco, the newest and one of the finest dry docks in the United States, and one of the largest and best in the world. It is the property of the San Francisco Dry Dock Company, and its construction was begun about two years ago. Its dimensions are: 750 feet long, 122 feet wide at the top and 80 feet wide at the level of the top of the keel-blocks. At high tide there is 28 feet of water over the sill of the dock, which can accommodate comfortably the largest vessel in existence. It was built by Mr. Howard Holmes.

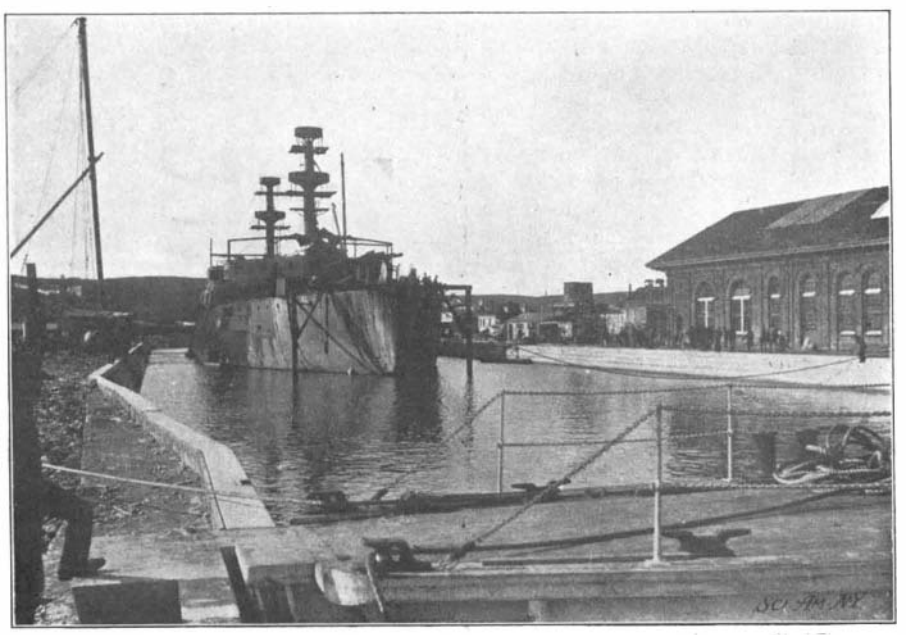
During the visit of the late President McKinley to the Pacific Coast, he was present at the launching of the United States battleship "Ohio" on May 18, 1901, at the Union Iron Works, San Francisco. On Thursday, January 29, the new dock was officially opened to receive the battleship, which is 393 feet long and 72.2 feet wide. With her crew, stores, armament, ammunition, and coal aboard, she will displace 12,440 tons.

The battleship was towed from the Union Iron Works by three tugs, and was pushed by them into the dock, the pontoon gate of which had been floated away. The gate was then placed in position and filled with water until it sank into snug contact with the rubber cushions of the sill.

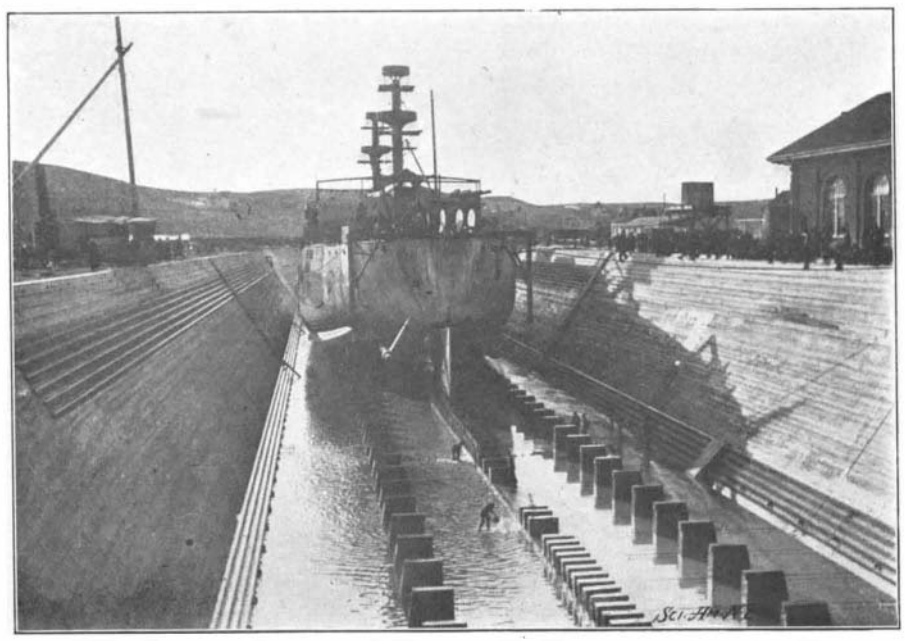
The dock engineer started the three centrifugal pumps, which together draw out 120,000 gallons of water per minute, at 12:45 P. M., and at 2:50 P. M. the battleship stood high and dry on the keel blocks. A copy of the battleship's plans had been given to the dock superintendent, and the shape of the keel and hull, together with the draught and displacement, had been carefully considered and the position of the keel-blocks calculated. The stationary blocks were set to conform as nearly as possible to the curve of the keel, and above these were placed blocks in such a position that, when the water was pumped out, the vessel would rest evenly and without strain or danger of buckling her bottom plates. The lines on which the stem and stern of the vessel were to rest were marked by stakes on either side of the dock. As the water receded and exposed the underbody of the battleship, an army of laborers, with scrapers and brushes, removed the marine growth and barnacles, so that, by the time the water was all out, the vessel was nearly clean. The "Ohio" had not been docked for ten months, but there was not so large an accumulation of barnacles upon her bottom as had been expected.

When the battleship entered the dock, there was eleven feet of water between the sill and her keel. As she rested easily in position after the water had been pumped out, there was four feet of water on each side of her at the narrowest part of the dock. Between the gate of the dock and the stern of the "Ohio" there was room enough to dock another great vessel more than 300 feet in length. The battleship received two coats of antifouling paint, her under-valves were examined, and her immersed body was put in excellent condition.

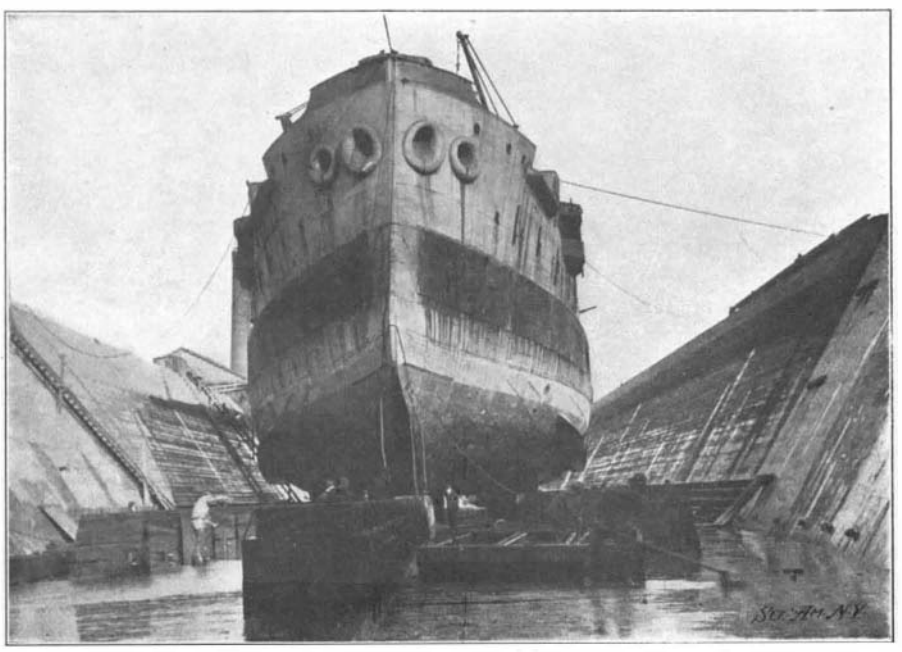
THE GATE OF THE NEW DRY DOCK AT HUNTER'S POINT, SAN FRANCISCO.



THE "OHIO" IN THE NEW DRY DOCK, VIEWED FROM THE GATE.



VIEW SHOWING GREAT LENGTH OF DOCK, SUFFICIENT FOR ANOTHER BATTLESHIP.



U. S. BATTLESHIP "OHIO" IN THE NEW DRY DOCK AT HUNTER'S POINT, AFTER THE WATER HAD BEEN PUMPED OUT.

The British Admiralty has definitely decided to adopt the French gray color as the official war paint for all the vessels in the navy. This decision has been arrived at after prolonged experiments with various tints, but French gray is the color which renders a vessel the least conspicuous and renders it a difficult target to hit. Hitherto the vessels have always been painted in three or four colors—black for the hull, white upper works above the deck level, yellow funnels, and often a red band along the water line, corresponding with the Plimsoll mark upon vessels of the mercantile marine. The new color is a mixture of black and white paints in the proportion of 11 ounces of the former to 6 pounds of the latter. The vessels of the Channel squadron are being transformed, and the Mediterranean and other fleets will be similarly treated as soon as possible. The painting of each ship costs $5,000.

THE RESTORATION OF THE FOUNDATIONS OF THE PHILÆ TEMPLES.

BY OUR LONDON CORRESPONDENT.

When the designs for the Aswan dam, situated 600 miles above Cairo, and formally opened on December 10 last, were first prepared, the contemplated high level of the water thus held back would have submerged the greater part of the ruined temples on the historic island of Philæ, which is situated just above the point where the barrage has been erected. Egyptologists and archæologists raised a great outcry against what was termed an unwarrantable act of vandalism, and the result of their agitation was that it was decided to lower the maximum level of the water to be stored up, to R. L. 106, and thus spare the temples. But even at this amended level the greater number of the temples on Philæ Island, with the solitary exception of the Temple of Isis, are covered when the reservoir is full, with water varying from two to four meters in depth.

To preserve the buildings against the head of water it was decided to underpin them and thus insure their stability, and a comprehensive exploratory survey as to the best means of accomplishing this object and its probable extent was carried out. The engineers in charge of the survey were cognizant of the fact that the Temple of Isis was founded on rock, and that the great pylons were on massive foundations sunk into the silt of the Nile to the depth of R. L. 101.5; but their knowledge of the rock depths, nature and extent of the foundations of the numerous buildings on Philæ Island was vague. A special grant was thereupon voted by the Egyptian government, to carry out a thorough exploration of the foundations, and the task was commenced in April, 1901.

Fifty-six shafts were sunk, and a number of trenches and headings were excavated, and all exposures of the foundations and levels were duly recorded.

Owing to the limited knowledge possessed by the engineers as to the stability of the ruins, this survey work had to be conducted with extreme care. The trenches, headings, and shafts were very strongly timbered, and the superstructures were shored up. Approximately three months were occupied in this examination, during which time 690 cubic meters of excavations were completed. The shafts sunk varied from 1 to 1.30 meters in diameter, and were continued down for the most part to a depth of 13 meters before the bedrock was reached. When sufficient excavations had been made to supply all the information required concerning the extent of the underpinning, the excavations were untimbered and filled in.

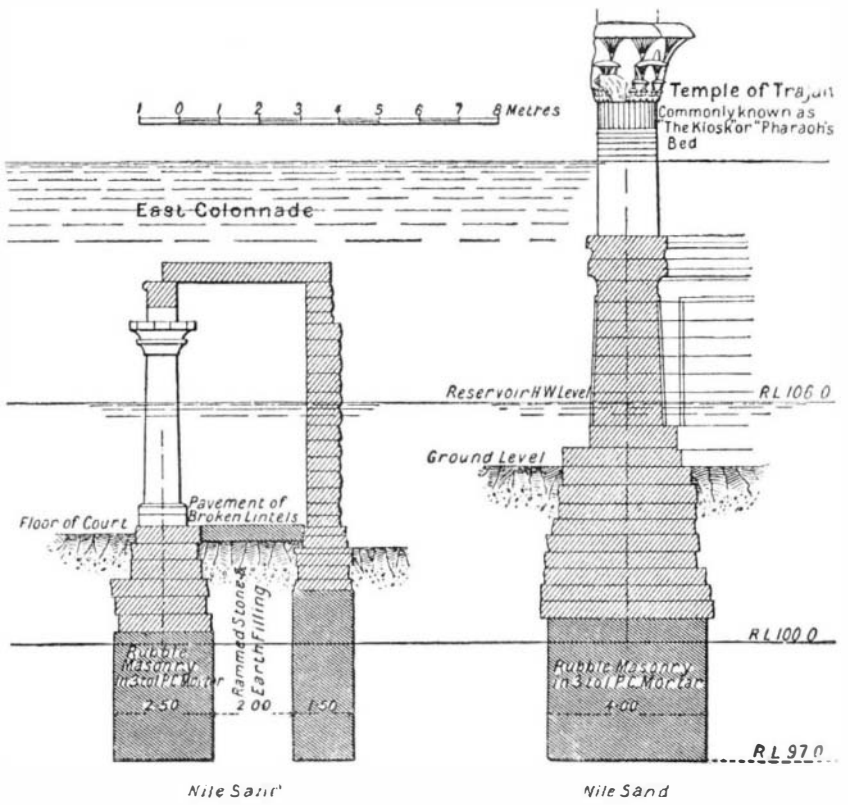
The results of the explorations showed that the necessary underpinning to preserve the ruins would be more extensive than was at first anticipated. In fact, it practically demonstrated that nearly the whole island would have to be provided with a new foundation.

The East Colonnade rested on an almost continuous masonry foundation, approximately 2½ meters wide, and descended to the average depth of R. L. 100.60, but the wall behind it, supporting the last end of the lintels, was much shallower, reaching to only R. L. 101.60. At no point were the colonnade and wall touching the solid bedrock, the level of which varies from R. L. 91.50 at the north end to R. L. 98 at the south end. The space between the bottom of the masonry foundations of the monument and the solid bedrock was filled with Nile silt, muddy at the top but gradually passing into fine clear sand as the bedrock was approached.

The West Colonnade, however, was found to be quite differently and much more solidly constructed. Counterforts 1.80 meters thick were found to project eastward from the quay wall, at intervals of about 3 meters, and in each case they were carried down to a great depth, and in some places even to the solid bedrock. The colonnade is supported on these counterforts by stone beams, but in the majority of cases it was found that the safety of the colonnade was seriously affected, owing to the majority of the stone beams having been fractured, due to two reasons: the tremendous weight of the structure, and the gradual undermining of the ground between the counterforts.

The foundations of the Temple of Trajan, familiarly known as the "Kiosk" or "Pharaoh's bed," were found to descend to R. L. 100.60, and for the most part were 4 meters in breadth. The bedrock of the river at this point is at R. L. 90 in the front of the building, rising slowly to the maximum of R. L. 95.10. When the exploratory shafts were sunk at this point, some ancient foundation walls were unearthed, which are supposed to be the foundations of a site that was subsequently abandoned.

The Temple of Nectanbeo was found to be constructed in a curious manner. The foundation walls were carried down to the bedrock, but the superstructure is placed askew to the foundation walls, being supported upon heavy stone beams, which, however, as in the West Colonnade, had for the most part broken under the combined influences of heavy top weight and subsidence of the subso

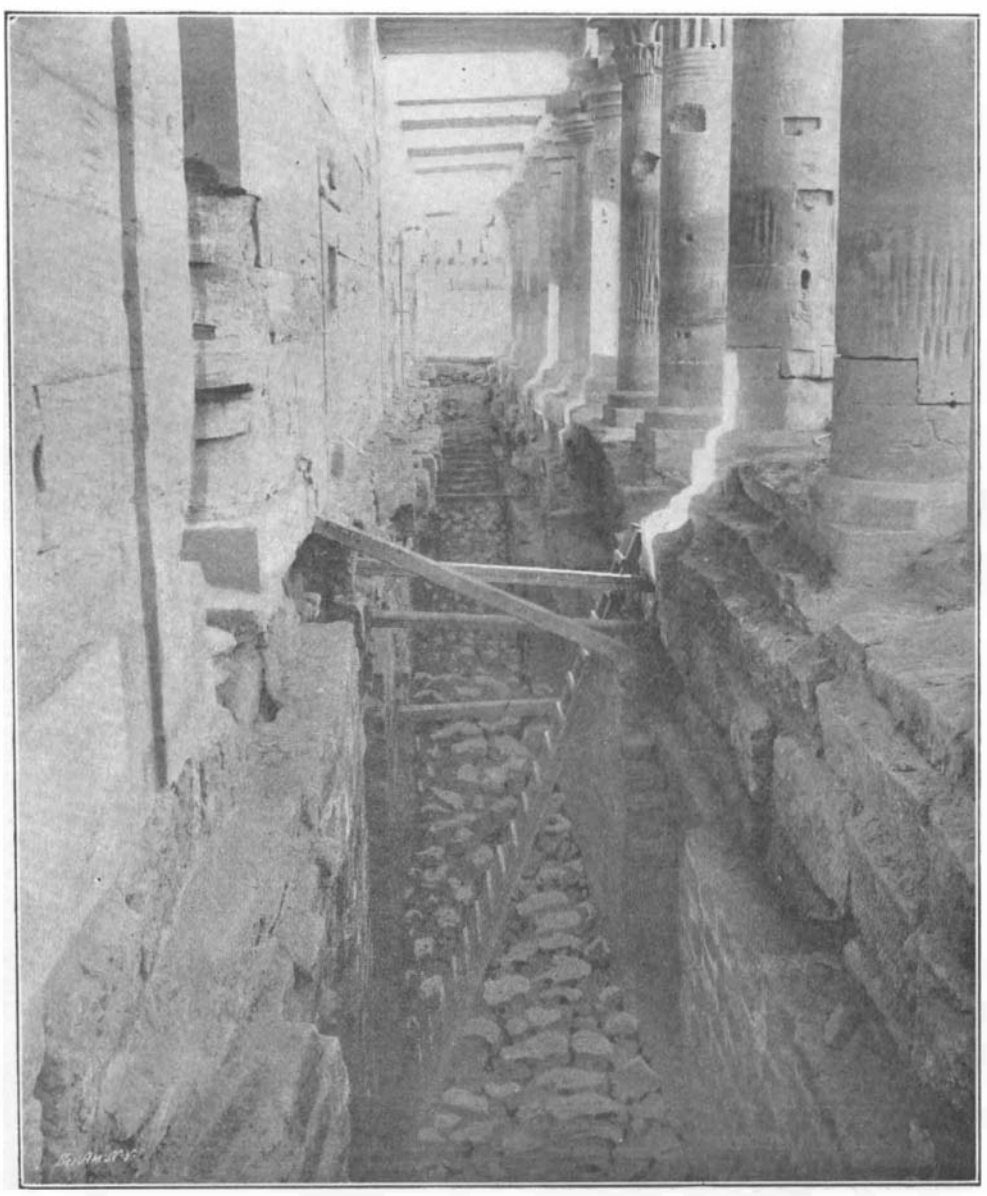


UNDERPINNING OF THE SUBMERGED BUILDINGS OF THE ISLAND OF PHILAE.

Other temples on the island were carefully examined, but they were not found to be in such a precarious and unstable condition as the foregoing, though it was eventually decided to strengthen their foundations and supports to a sufficient extent to prevent collapse. A section of the Coptic village was also revealed, and a quantity of sandstone of good quality, suitable for being utilized in the underpinning work, was found. The discovery upon this island of this masonry, which was for the most part in roughly-hewn square blocks, was of immense value, since it saved the expense, time, and trouble of conveying the requisite stone from the mainland to the island. The Egyptian government, upon the report of this exploratory survey, granted the sum of £22,000 for the work of restoring the valuable monuments, and a comprehensive scheme of underpinning was commenced. In addition it was decided to clear the whole of the Coptic village, and to carry out a thorough system of drainage and investment of the terraces. In compiling the scheme of underpinning, it was considered that the earth and sand below the existing saturation level would not subside any more.

The sectional drawings accompanying this article will afford a comprehensive idea of the scope of the operations and the principle of underpinning which was adopted throughout with slight variations according to the nature of the buildings treated. The West Colonnade was the first upon which operations were commenced. The ground was opened along the east face outside the colonnade proper, in widths corresponding to the intervals between the counterforts. Beneath the fractured stone beams, rolled steel girders 14 inches deep by 6 inches wide, and weighing 54 pounds per lineal foot, were laid in pairs, their ends resting in seats cut into the existing counterforts. These girders were surrounded with rubble masonry in 3 to 1 p. c. mortar, care being taken that they were well grouted, so that all possibility of the water gaining access to the steel, and thus corroding it, was absolutely removed. The total depth of the masonry is practically 5 feet 3 inches, so that this superstructure now rests upon a substantial and solid foundation. A similar scheme of underpinning was adopted with the Temple of Isis. With regard to "Pharaoh's bed" a much more elaborate scheme was necessary. Although old foundation walls were discovered beneath this famous ruin, it was found that they did not afford much resistance to the underpinning action constantly in progress. Beneath the original foundations of the building, which extended to R. L. 100.60, a new solid rubble masonry foundation was built right down to R. L. 97. The ground was opened inside the building. The diameter of the shaft was 1.20 meters, and it was sunk to a total depth of 7.45 meters. The shaft was well timbered up with 1½-inch boards in one meter lengths, with 9 x 3 walings and struts at intervals. By this means the engineers were able to excavate right beneath the structure. The original foundations of the temple were supported upon pitch pine head trees 12 x 8, securely wedged and packed, and side trees 10 x 7. The rubble masonry is 3 to 1 p. c. mortar, 4 meters in thickness, carried down for a depth of 3.40 meters, so that now the old building rests upon a solid masonry foundation, which rests in turn upon the Nile sand at saturation level.

A similar rubble masonry foundation was built beneath the East Colonnade and its wall, and carried down to the same level. In carrying out this part of the work the shafts were sunk between the columns and the wall behind, headings being driven both ways from the central shafts. The masonry supporting the columns is 2.50 meters thick, and that of the wall behind 1.50 meters in thickness. The space between the foundations of the columns and walls, 2 meters



COLONNADE LOOKING SOUTH. READY FOR THE LAST LENGTH OF MASONRY. THE TRENCH IS PARTLY FILLED IN AT THE FARTHER END.