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CONCRETE WORK AT THE SEA ENDS OF MISSISSIPPI JETTIES.

The largest blocks of concrete ever employed in works of marine engineering are those used to give stability to the sea ends of the South Pass jetties, now approaching completion, at the mouth of the Mississippi Two causes combined to make their adoption an imperative necessity—the entire absence of available rock within a radius of five hundred miles or more, and the enormous force of the waves to be withstood. In an early experiment, masses of rock, in blocks weighing from one to two tons, were placed upon the lower ends of the jetties; but the first gale swept them all away It was accordingly decided to cap the last 3,800 feet of the east jetty and 2,800 feet of the west jetty with blocks of cement concrete, weighing from twenty-five to seventy-two tons each; the largest artificial blocks used in the protection of the great breakwater at Cherbourg, France, and hitherto unrivaled, weighed only forty-four tons.

In a paper read before the American Society of Civil Engineers, last August, Chief Assistant Engineer Max E. Schmidt gave an account of the mode of constructing and depositing these gigantic blocks, a mode which presents several novel and interesting features.

The concrete is made of broken stone, gravel, sand, and cement from the limestone region near Rose Clair, on the Ohio, 1,300 miles up the river. The stone is broken by hand, all the pieces being small enough to pass through a three-inch ring. The gravel is brought from Prophet's Island, La., two hundred and fifty miles up the river, and ranges in size from 1-30th of an inch to 2½ inches in diameter The sand, which comes from the islands near the mouth of Pearl River, Miss., is moderately coarse and sharp grained. The cement is Saylor's American Portland Cement, of which over 5,000 barrels have been used. The proportions of these ingredients employed are by volume, 15 parts broken stone, 4·38 parts gravel, 8·28 parts sand, and 3 parts cement. One hundred and sixty-five cubic yards of these materials (dry) make 100 cubic yards of concrete after final induration. The ingredients are mixed with fresh water in quantity equal to about 10½ per cent of the dry material.

The blocks of concrete are constructed in place on the top of the jetties, and are from 16 to 20 feet long, from 5 to 13 feet wide, and from 2½ to 4 feet thick, the dimensions enlarging by offsets as the jetties approach the sea ends. The mixing is done in a 5 ft. 9 in. cubical box made of quarter inch boiler iron, well riveted and strapped with flat and T iron, and supported by a strong framework of timber resting on the jetty. A separate mixer is used on each jetty. The mixer is suspended by two hollow cast-iron trunnions, 7½ inches in diameter, which are riveted from the inside of box to two corners diagonally opposite, so that the box with its contents is easily revolved by a steam engine on the wharf below.

The mixer is charged and discharged through a triangular door, formed by cutting off one corner of the box, the sliding cover being strongly clasped and secured by screws. The water enters the box through hollow journals while the ingredients are being revolved for mixing. The dry materials are handled and lifted by steam power Twenty-two revolutions of the mixer, requiring about two minutes and a half, suffice to thoroughly incorporate the ingredients. The concrete is discharged into cars beneath, and is quickly drawn to the point of deposition by a small locomotive along a railway running above the surface of the jetty, supported by piles. The cars, which contain about two cubic yards each, are strongly built of boiler iron. By means of two ratchet wheels and wooden levers permanently attached to the axle on each end of the car, the dumping of nearly 9,000 pounds of concrete is done almost automatically, and the car is easily turned back to its upright position by two men. The moulds, constructed almost entirely without nails or spikes, are sawed out in parts and fitted by carpenters, and are carried on trucks over the finished blocks to the place where needed. Then the flooring is laid down and the other parts quickly put in place. As soon as the mould is ready the freshly-prepared concrete is filled in, and the concrete is left to set. Less than twenty minutes are required to transfer the dry material from the wharf to the mixer, to mix the concrete, and transfer it to the mould. Making allowances for rough weather and other causes of delay, an average of 100 cubic yards of concrete is made a day on each jetty. During the earlier part of the construction the concrete was rammed in the moulds, but that process has been abandoned as needless, it having been found that the vertical fall of ten or twelve feet, from the car to the mould, leaves the stuff in a better state of compression than could be obtained by ramming. Four days after the setting has commenced each block is coated with a plastering of mortar, laid on from one to three inches thick, by means of the trowel. This mortar—composed of equal volumes of American Portland cement and sand—is prepared in small quantities and the plastering done quickly. At the end of two weeks the concrete has become hard enough to allow the removal of the moulds, after which the interspaces are filled with mortar or rubble masonry. By far the greater and more difficult part of this concrete work was in place in the fore part of June. At the current rate of progress the main capping would be completed before the end of the month. The plans of the work contemplate the addition of a massive parapet to this capping, the time of beginning it to be determined by the degree of subsidence observed. It is expected that the compression due to the tremendous weight of the blocks will continue until the elasticity of the subaqueous layers of mattresses has been destroyed The greater part of the settling seems to occur within the first ten days after the construction of the blocks.

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USE OF PHOTOGRAPHY IN WOOD ENGRAVING.

In the practice of the ordinary method of wood engraving the artist whitens the surface of the block and makes his drawing thereon with India ink or pencil. The engraver then cuts upon the drawing, endeavoring to keep in mind the general effect of the original; but the latter is of course gradually obliterated as the work of cutting proceeds. To this obliteration of the original drawing is probably due a part of that loss of artistic effect in the finished engraving, of which draughtsmen are apt to complain.

The facilities offered by photography are now, however, being used by engravers and draughtsmen to assist in the production of better engravings. Instead of drawing directly upon the wood, the artist now makes his finished picture upon paper, which is then photographed upon the wood in exact *facsimile;* the engraver then proceeds to cut the photograph, and during the whole time of cutting he has before him the original paper drawing, to which he may refer for assistance in his endeavor to maintain and reproduce the spirit and feeling of the picture.

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THE HUDSON RIVER TUNNEL.

The Hudson Tunnel Company, which began excavations almost five years ago for a submarine passage to connect the cities of New York and Jersey City, lately resumed operations after a litigation of several years begun by railroads and private citizens to restrain the work. The courts of New Jersey decided that the company were legally entitled to build their tunnel, and Colonel DeWitt C. Haskin, the President, immediately set to work a force of about fifty masons and laborers at the original point of departure, Jersey avenue and Fifteenth street, Jersey City. The tunnel was begun in November, 1874, after extensive borings which had been begun a year before in the bottom of the Hudson River. A circular working shaft thirty feet in diameter, walled with four feet of brick, was begun 100 feet inland, it being intended to make it 65 feet deep, at which point the tunnel was to be constructed. Colonel Haskin informs the *World* that he expects to get well under the river before winter sets in. It is estimated that the tunnel will cost $10,000,000. It will be 12,000 feet long, including the river approaches, and the greatest depth under water will be over sixty feet. The location of the New York terminus has not been fixed upon, but Washington Square has been suggested. It is now proposed, to gain time, to work at once on each side of the river, as many men to be employed as possible at one time in gangs, which are to be relieved every eight hours. The company claims that by the aid of compressed air, as applied in the patent obtained by Colonel Haskin, it will be able to complete the work at much less expense than any similar work has ever been constructed for. It is believed that its present capital of $10,000,000 will be abundant for that purpose. The plan of construction contemplates no coffer-dam, caissons, or Brunel shields, the compressed air introduced into the face of the tunnel being expected to exert sufficient pressure to hold in place and prevent any irruption of silt, clay, or water. The air pressure is also expected to carry back to the working-shaft through pipes all sand, mud, or water that may accumulate in the heading during the course of the excavation. It is believed that the tunnel can be advanced five feet a day, and that the whole work can be completed in two years.

All this, of course, is contingent upon the success of Col. Haskin's method of tunneling. That it will succeed without radical modifications is highly questionable, indeed altogether impossible, since the air in the tunnel would have to be maintained at a density at least equal to that of the semifluid materials to be supported.

The object of the tunnel (which is to be circular in form, 26 feet wide and 24 feet high) is to establish direct railway connection between New York and the railways having termini at Jersey City—the Erie, Pennsylvania, Delaware, Lackawanna and Western, and New Jersey Central. It is estimated that more than 400 trains of cars could be passed through the tunnel every twenty-four hours, the time of travel from Jersey City to Broadway to be six minutes.

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THE PRODUCTION OF BROMINE IN THE UNITED STATES.

The only important source of bromine in the United States is the liquid which remains after the extraction of salt, and which is known in the salt-making industry as the "mother waters." The *Moniteur Scientifique* gives a short description of the process employed in separating this important element from the saline liquors. The latter, when first pumped up from the pit, mark 9° Baumé. They are evaporated in long iron boilers to 15° Baumé, allowed to settle, then further evaporated to the crystallizing point in wooden tubs heated by steam. The first crystallization forms the salt of commerce. The tubs, five in number, are placed side by side, and every day the liquor is decanted from one to another—from No. 1 to No. 2, then to No. 3, and so on to No. 5. The crystallized salt is removed from each tub after draining off the liquid. When the brine reaches tub No. 5 it has become mother liquor, and consists principally of chlorides of calcium, magnesium, sodium, and a little chloride of aluminum, with varying proportions of bromides of sodium and calcium. Tub No. 1 is filled every day with fresh brine, so that the process becomes continuous. The