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No. 198,
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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.

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.

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.

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

mother liquor, marking 30 to 38° Baumé, is evaporated to 45°, thus separating a new quantity of salt. The liquor is then decanted into stone stills; materials for the production of chlorine are added; and heat is applied in the form of steam, injected directly into the still, until all the bromine has been eliminated and vaporized. It then passes into a condenser, and thence into a receiver.

The production of bromine was first begun in the neighborhood of Parkersburg, Pennsylvania, by Hegeman, a Danish chemist, formerly in the employ of the Pennsylvania Salt Manufacturing Company. His operations were at first rather of an experimental character, and there being but little demand for the product at the time, he realized from $3.60 to $7 per pound for what he made. The use of bromides becoming more general, however, other chemists began the manufacture of bromine, their process differing from Hegeman's only in certain modifications of detail. Herman Lemer is now regarded as the largest producer of bromine in the United States. This manufacturer was originally a poor shoemaker of Natrona, Penn., but by a rare display of energy and ability, notwithstanding his limited education, he has reached his present position. The salt regions of Ohio and the Kanawha furnish salt whose mother waters are twice richer in bromine than those of any other salines as yet discovered. It is a remarkable fact that the mother waters of the saltworks at Syracuse and those of the West contain no bromine, or at least but mere traces of it. The annual production of bromine varies considerably, owing to uncertainties in the salt trade, upon which depends the bromine trade.

The capacity for the production of the article increased during 1875 and 1876 about three times what it was in 1874 (owing to facts just stated), but the actual production has not materially increased. The present production will reach about 1,100 pounds per day. In view of the high prices of bromides in the European markets, several lots have recently been exported. By reason of the great advantages that American manufacturers possess for the production of the bromides, it is believed that the importation of bromine, already quite limited, will soon cease altogether. The consumption of the article, in the form of the bromides, has considerably increased. During the last twelve years, bromide of potassium has been the principal salt used, but for the past three or four years, bromide of sodium, zinc, and several other bromides have become very popular. The only really new application of bromine is the use that has been made of it for some months past by a Paris house in the production of a new aniline color.

BAD WATER IN BALTIMORE.

A short time since Professor William P. Tonry reported to the Health Commissioner of Baltimore the results obtained by the analysis of seventy-one specimens of pump and spring water collected within the city limits. Of these samples 35 were from that part of the city lying to the east of the stream known as Jones' Falls, and 36 were from the west side. Of the former, 10 samples were filthy, 5 bad, 15 suspicious, and 5 good. Of the latter 23 were filthy, 5 bad, 7 suspicious, and but one that could be regarded as good.

The 23 worst samples from West Baltimore, and the 10 worst from East Baltimore, show such very large amounts of ammonia as to point unmistakably to direct and close contact with privy refuse, and it is more than probable that these wells or springs have been drawing part at least of their supply water from some of the privy wells which have been sunk to water. Of these 33 filthy samples 11 from West Baltimore and 4 from East Baltimore contained more free ammonia than a mixture of distilled water and urine, one-tenth of which was urine. Some individual specimens contained twice and three times this amount—enough, indeed, to indicate the presence of one-fourth urine in the samples. As to the bad and suspicious samples the source of contamination will be found in excrementary matter which has had to pass through the earth for a greater or less distance before oozing into the well.

The conclusions arrived at by Professor Tonry, by the study of these samples, are well worthy of consideration by the inhabitants of all towns drawing their water from numerous small and relatively shallow wells. Professor Tonry says that there is hardly any other conclusion to be arrived at than that privy wells cannot be sunk to water in the neighborhood of pumps without affording to the patrons of the pumps a liberal dilute solution of privy refuse for drinking water, nor can the surface of the ground in the neighborhood of the pumps be honeycombed by uncemented privy vaults without supplying the patrons of the adjoining pumps with a less liberal and partially filtered solution from the surrounding sinks.

Around New York there are doubtless many communities, small and large, whose ill repute for "malaria" is due in large part, if not entirely, to the circumstance that their water supply is largely drawn from contaminated wells and cisterns.

ENGLAND'S SOURCES OF MOTIVE POWER.

For a time so much popular apprehension existed among the English people regarding the exhaustion of their coal supply that a royal commission was appointed to inquire into the matter. They reported, after due examination into the subject, that the total available coal within the United Kingdom, was not likely to be exhausted under from 276 to 360 years, at the rate of consumption going on in 1871. Notwithstanding this long period before the coal supply will be exhausted, a writer in *L'Ingénieur Universal* thinks it is worth while for England to be inquiring now what substitute can be drawn upon for coal. For purposes of iron smelting there is no good substitute known except charcoal, and obviously its employment is out of the question in England. Therefore the writer concludes that there is very little prospect at present of inventive ingenuity doing much to supersede the use of coal in this direction. But for many mechanical and useful purposes a substitute would not be difficult to find. The writer thinks it has been demonstrated that coal gas for illuminating puposes can be superseded with advantage, and it is obvious that mechanical genius may any day work similar marvels in other departments where coal has hitherto been considered a necessity. There is no present prospect of such a result occurring in iron smelting; but for mechanical purposes increased attention is now being directed to hydraulic power—a power which has been too much neglected in our times of abundant coal supplies. He then repeats Dr. Siemens' calculations of the power that is daily running to waste at the Falls of Niagara, where 100 million tons of water fall some 300 feet every hour. The force represented by the principal fall alone amounts to 16,800,000 horse power; and to produce the same amount of power by steam would require 266 million tons of coal per annum—an amount which all the coal raised in the world would scarcely be sufficient to supply. Tremendous as this appears, the calculation may be regarded as more curious than useful; for, as the district around Niagara is destitute of minerals, the water power of the Falls is never likely to be utilized. But the calculation might be usefully applied to other places. Sir William Armstrong has done good service in the way of showing how to carry and utilize water power at a distance by conveying it through high pressure mains. For instance, were this power generally employed, where possible, to give motion to dynamo-electrical machines, the electric light could not only be produced altogether without the use of coal, but it could be carried to a great distance, illuminating towns distant from coal fields at less cost and in a superior manner to anything that has ever been done by gas. Another means that is capable of more extensive application is compressed air, which has been employed with wonderful results in some places on the Continent. Still, when all these and other sources of power are brought into more extensive requisition, coal will continue to be indispensable for many purposes. But though our stock in store is immense, the coal trade in the future is likely to experience greater vicissitudes than in the past; and, with the recollection of the fluctuations of the last ten years still fresh in the public memory, it is well as far as it is possible to provide a second string to our bow, so that when one source of power fails another may be readily available.

COLD CLIMATES IN THE TREATMENT OF CONSUMPTION.

No subject perhaps has received a greater share of attention from the medical profession than that of the proper method of treating consumption; and a more important subject has never enlisted the consideration of scientific men; for, of all the diseases with which mankind is afflicted, tuberculous consumption is perhaps the most serious, and, exclud ing epidemics, causes the greatest proportion of deaths. Indeed, statistics show that of the 968,000,000 people inhabiting the globe, 3,000,000 die each year of this dread disease. In view of this fact, Dr. Talbot Jones has prepared and published in the current number of the *New York Medical Journal*, an elaborate paper to show that, of all the resources at our command in warding off this malady where a predisposition to it exists, or in combating it when once established, dependence alone can be placed on climate. When we begin to inquire into the character and comparative merits of climates, he remarks, we are at once struck with the fallacy of the doctrine, which has obtained for generations, that the disease is more frequent in cold than in warm latitudes. Just the reverse of this is true. If there is anything with reference to climate which is definitely settled, it is the fact that phthisis is vastly more common in warm, tropical countries than in cold latitudes. Consumption is relatively as common in our own health resorts as it is in the corresponding warm countries in Europe.

From an extensive series of data, it has been shown that the farther we progress north the greater the immunity the inhabitants enjoy from the disease; and very far north, consumption is either extremely rare or altogether unknown. In the bleakest, coldest, and most exposed portions of the globe, and where sudden and severe changes of the atmosphere hold to a maximum, consumption is very infrequent. Indeed, so true is this that we are forced to the conclusion that extreme cold is inimical to the production of consumption. The primary effect of a cold climate is an increased demand for oxygen; tissue changes take place more rapidly, together with the products of increased tissue metamorphosis. To meet this increased demand on the economy, more food is taken, the digestive power and appetite are increased, and all the processes which govern organic nutrition are improved. The processes of absorption, secretion, sanguification, assimilation, respiration, and circulation, are carried on much more actively than in warm climates. Cold, whether it be water or climatic, is well known to be a powerful tonic. That increased oxidation of the tissues takes place in a cold climate is shown by the increased carbonic acid which is thrown off from the lungs. The most robust health is maintained where constructive and destructive metamorphosis of tissue is most actively carried on, and it is the fair balance of this process of destruction and reparation which constitutes the phenomena of life. The effects of heat on the system are much the opposite of those of cold. Heat is relaxing and enervating. Oxidation of the tissues is greatly lessened when the body is in an atmosphere warmer than itself. The effect of humidity combined with heat is not only immediately harmful and dangerous, but is very likely even to give rise to the tuberculous cachexy through suppression of cutaneous transpiration.

Out of a vast accumulation of facts with regard to climate, there are some upon which the profession are agreed. Among these is that of altitude. Careful investigation of this matter made by competent and trustworthy men, both in this country and in Europe, clearly indicates the importance of altitude in the climatic treatment of consumption. There is much more ozone in the higher than in the lower strata of the atmosphere, and that this is exceedingly valuable in the climatic treatment of phthisis is clearly indicated. Ozone possesses high oxidizing power and purifies the atmosphere by chemically uniting with the products of decomposition. It destroys organisms by combining with them. It also promotes nutrition and blood changes by supplying to the respiratory organs a most active form of oxygen.

A careful study of the facts adduced in his paper leads Dr. Jones to the following conclusions: (1.) No zone enjoys entire immunity from pulmonary consumption. (2.) The popular belief that phthisis is common in cold climates is fallacious; and the idea, now so prevalent, that phthisis is rare in warm climates is as untrue as it is dangerous. (3.) The disease causes a larger proportion of deaths on the seashore—the mortality diminishing with elevation up to a certain point. (4.) Altitude is inimical to the development of consumption, owing chiefly to the greater purity of the atmosphere in elevated situations, its freedom from organic matter, and its richness in ozone. (5.) Moisture arising from a clay soil or due to evaporation is one of the most influential factors in its production. (6.) Dampness of the atmosphere, from whatever cause or in any altitude, predisposes to the development of the disease, and is hurtful to those already attacked. (7.) Dryness is a quality of the atmosphere of decided value. (8.) The most unfavorable climate possible for a consumptive is one of uniform high temperature and of high dew point (warm and moist). (9.) The effects due to change in the atmosphere are by no means so pernicious as are generally supposed, and upon this subject present views require modification.

In conclusion, Dr. Jones adverts to the influence exerted upon consumptives by the climate of Minnesota; and, after pointing out the various facts relating to its geographical position, altitude, geology, character and configuration of its soil, and other physical aspects, gives it as his conviction that those predisposed to the disease, or laboring under its first stages, are likely to be benefited or cured by a residence in that State. Between the pleasant rolling prairie, the wooded lake region, and the dense pine forests of the northern section of the State, they can choose what seems most agreeable and best adapted to them; while the dry, bracing atmosphere will enable them to live much of the time out of doors without fear of taking cold, the latter feature being one of the greatest charms of the climate. The author strongly insists, however, on the inutility of sending phthisical patients to Minnesota who are in the advanced stages of the disease. Where the stage of ulceration and excavation has been reached, this climate does positive harm, although there are numerous exceptions to this rule.

Running a Locomotive Without Fire, Water, or Steam.—An Amusing Incident in the Career of Mr. A. L. Holley.

While working as an engineer on one of the railways he made a wager with some of his fellows that he could run a locomotive a mile without fire, water, or steam, the locomotive to be taken empty and cold from the shop, and towed by another engine to a point at some distance on the road, where a level stretch of track favored the experiment. Young Holley rode in solitary state on his cold locomotive to the scene of trial, and, unsuspected by his escort, so arranged matters that during the trip the motion of the drivers and pistons stored the boilers with compressed air. This gave him, by the time the destined point was reached, an accumulation of power by means of which he ran his mile and won his wager.

Underground Tides.

Our recent notice of the regular tidal rise and fall in the waters of certain South Carolina wells has called out reports of similar phenomena elsewhere. A correspondent in Vienna informs us that the water in the coal mines at Teplitz, Bohemia, exhibits similar tides. Something of the same nature has been observed lately in this city in digging for a foundation for the elevated railroad pier at 102d street and Third avenue, just below the old Bull's Head Hotel.

California Quicksilver.

Five counties in California contain quicksilver mines. During the past three years the aggregate production has been, in flasks: Napa county, Redington mine, 25,494; Lake county, Sulphur Banks, 30,849; Great Western mine, 14,266; Sonona county, Oakland, 4,687; Fresno county, New Ida, 17,846; Santa Clara county, Guadaloupe, 18,952; New Almada, 56,488. A flask of quicksilver contains 76½ lb.