American Cements.

At the recent convention of the American Society of Civil Engineers, an interesting paper on American natural cements was read by Mr. F. O. Norton, from which we condense the following:

The principal deposit of the magnesian limestone producing a cement possessing hydraulic energy occurs in the town of Rosendale, Ulster Co., New York. It was first brought into use about the year 1823, in the construction of the locks and other masonry of the Delaware and Hudson Canal, which passes through that county. Its production has gradually increased until there are now made from one million to one million and a half barrels in each season, of about eight to nine months, or during the period of navigation on the Hudson River between Rondout and New York. It is the chief industry of a large section of country, its reputation is extended, and it is sold in most of the large markets of the United States.

There has been a general impression that the use of a very small amount of water in mixing cement gave greater resulting strength than when sufficient water was used to form a paste of the consistency of stiff mortar. The tests recorded prove that the dry mixture does give decidedly higher tensile strength in twenty-four hours after mixture, and that it continues to be stronger than the stiff mortar for some three months. But after that time the reverse becomes true; the curve of strength of the stiff mortar rises to and passes above that of the dry mixture, and the strength of the cement mixed as a stiff mortar continues greater than that mixed with very little water, and this is the case continuously thereafter.

The strength of Portland cement, unmixed with sand, is, of course, very great. It develops a large proportion of its ultimate strength in the first seven days, say from one-half to two-thirds.

Rosendale cement of the best qualities develops great hydraulic energy in twenty-four hours, being at that time equal to the Portland. The Portland then gains very rapidly upon it up to seven days, the difference between the two then being the greatest; at the end of a month, however, the strength of the Rosendale cement begins to approach nearer to that of the Portland, and the difference between the two seems to be continually reduced after that time, this referring to mixtures of pure cement.

For practical purposes, however, neither of the cements is generally used without an admixture of sand. The addition of sand to Portland cement reduces its strength rapidly.

This reduction of strength is, in round numbers, as follows: One part of sand gives mortar one-half as strong as pure cement; two parts, one-third; three parts, one-fourth; four parts, one-fifth; five parts, one-sixth.

This reduction of strength of Rosendale cement by the admixture of sand seems to be somewhat less. The strength of the mortar of Portland cement in the proportion of one of cement to two of sand is, at the end of six months, say 224 pounds to the square inch. The strength of a mortar of Rosendale cement in the proportion of one of cement to one of sand is, at the end of six months, say 257 pounds to the square inch.

Careful experiments made by General Gillmore, and published in the appendix to the last edition of his treatise on "Limes, Hydraulic Cements, and Mortars," give the quantities of mortar produced from the mixture of cement, sand, and water, in various proportions, and using different kinds of cement. Adopting these results, and assuming the cost of the Rosendale cement at $1.10 per barrel, and the best English Portland at $3 per barrel (the market prices, May, 1880), and the cost of sand at 5 cents per barrel, we find that a mortar of Portland cement, in the proportions of one of cement to two of sand, will cost per barrel $1.22.

We also find that a mortar of Rosendale cement, in the proportions of one of cement to one of sand, will cost 68 cents per barrel.

Summarizing the comparison, we find that a mortar of Rosendale cement, in the proportions of one of cement to one of sand, has a tensile strength of 257 pounds to the square inch, and costs 63 cents per barrel; and that a mortar of foreign Portland cement, in the proportion of one of cement to two of sand, has a tensile strength of 224 pounds to the square inch, and costs $1.22 per barrel.

Therefore, the mortar of Rosendale cement, one to one, is 34 pounds per square inch stronger, and 54 cents per barrel less expensive, than a mortar of foreign Portland cement one to two.

This seems to show that for all uses which will be served by a mortar of the tensile strength of 257 pounds per square inch, the Rosendale cement is economical.

The remaining question is, whether this mortar of Rosendale cement, one to one, is strong enough for the practical purposes to which it may generally be applied.

The facts which answer this question are that for fifty years past, and up to within a very short time, *all* the important masonry in this country has been laid with American cement. The great fortifications on the coast, the Croton aqueduct, the Boston aqueducts, both old and new, all the government dry docks, the lighthouses, the locks, culverts, and aqueducts on the Erie and other canals; all the masonry

Professor Kirchhoff's Views on Connecting Lightning Rods with Gas and Water Pipes.

The city gas company of Berlin, having expressed the fear that gas pipes may be injured by lightning passing down a rod that is connected with the pipes, Professor Kirchhoff has published the following reply:

"As the erection of lightning rods is older than the system of gas and water pipes as they now exist in nearly all large cities, we find scarcely anything in early literature in regard to connecting the earth end of lightning rods with these metallic pipes, and in modern times most manufacturers of lightning rods, when putting them up, pay no attention to pipes in or near the building that is to be protected."

Kirchhoff is of the opinion, supported by the views of a series of professional authorities, that the frequent recent cases of injury from lightning to buildings that had been protected for years by their rods, are due to a neglect of these large masses of metal.

The Nicolai Church, in Greifswald, has been frequently struck by lightning, but was protected from injury by its rods. In 1876, however, lightning struck the tower and set it on fire. A few weeks before the church had had gas pipes put in it. No one seems to have thought that the new masses of metal which had been brought into the church could have any effect on the course of the lightning, otherwise the lightning rods would have been connected with the gas pipes, or the earth connection been prolonged to proximity with the pipe.

A similar circumstance occurred in the Nicolai Church in Stralsund. The lightning destroyed the rod in many places, although it received several strokes in 1856, and conducted them safely to the earth. Here, too, the cause of injury was in the neglect of the gas pipes, which were first laid in the neighborhood of the church in 1859, shortly before the lightning struck it. The injury done to the schoolhouse in Elmshorn, in 1876, and on the St. Lawrence Church, at Itzehoe, in 1877, both buildings being provided with rods, could have been avoided if the rods had been connected with the adjacent gas pipes.

"If it were possible," says Kirchhoff, "to make the earth connection so large that the resistance which the electric current meets with when it leaves the metallic conducting surface of the rod to enter the moist earth, or earth water, would be zero, then it would be unnecessary to connect the rods with the gas and water pipes. We are not able, even at immense expense, to make the earth connections so large as to compete with the conducting power of metallic gas and water pipes, the total length of which is frequently many miles, and the surface in contact with the moist earth is thousands of square miles. Hence the electric current prefers for its discharge the extensive net of the system of pipes to that of the earth connection of the rods, and this alone is the cause of the lightning leaving its own conductor."

Regarding the fear that gas and water pipes could be injured, the author says:

"I know of no case where lightning has destroyed a gas or water pipe which was connected with the lightning rod, but I do know cases already in which the pipes were destroyed by lightning because they were *not* connected with it.

"In May, 1809, lightning struck the rod on Count Von Seefeld's castle, and sprang from it to a small water pipe, which was about eighty meters from the end of the rod, and burst it. Another case happened in Basel, July 9, 1849. In a violent shower one stroke of lightning followed the rod on a house down into the earth, then jumped from it to a city water pipe, a meter distant, made of cast iron. It destroyed several lengths of pipe, which were packed at the joints with pitch and hemp. A third case, which was related to me by Professor Helmholtz, occurred last year in Gratz. Then, too, the lightning left the rod and sprang over to the city gas pipes; even a gas explosion is said to have resulted.

"In all three cases the rods were not connected with the pipes. If they had been connected the mechanical effect of lightning on the metallic pipes would have been null in the first and third cases, and in the second the damage would have been slight. If the water pipes in Basel had been joined with lead instead of pitch, no mechanical effect could have been produced.

"The mechanical effect of an electrical discharge is greatest where the electric fluid springs from one body to another. The wider this jump the more powerful is the mechanical effect. The electrical discharge of a thunder cloud upon the point of a lightning rod may melt or bend it, while the rod itself remains uninjured. If the conductor, however, is insufficient to receive and carry off the charge of electricity, it will leap from the conductor to another body. Where the lightning leaves the conductor its mechanical effect is again exerted, so that the rod is torn, melted, or bent. So, too, is that spot of the body on which it leaps.

"In the examples above given it was a lead pipe in the first case, a gas pipe in the last case, to which the lightning

"Finally, I would mention two cases of lightning striking rods closely united with the gas and water pipes. The first happened in Dusseldorf, July 23, 1878, on the new Art Academy; the other August 19, last year, at Steglitz. In both cases the lightning rod, the buildings, and the pipes were uninjured."—*Deutschen Bauzeitung.*

A Sea-going Steam Pilot Boat.

Unlike the Pilot Commissioners of New York and New Jersey, the Baltimore Pilots' Association have taken kindly to the use of steam pilot boats, and are having built for their use a first-rate sea-going steamer. The new vessel is intended to carry sea pilots, with fuel, stores, and accommodations for a month's cruise. The hull will be of iron, with close iron-bulwarks at each end, and, with iron siding, forming a quarter deck for about 68 feet of the middle run of the boat. The quarter deck will stand $3\frac{1}{4}$ feet above the main deck, which will extend about 30 feet from the stem and 20 feet from the stern. Both the main and quarter decks will have iron deck beams, and will consist of heavy pine deck stuff. The pilot house and captain's room will be on the quarter deck, where the boarding yawls will be carried. The length will be 113 feet between main posts, and $122\frac{1}{2}$ feet over all; extreme moulded beam, 23 feet; depth, $12\frac{3}{4}$ feet; from base line to the top of quarter deck, 18 feet. There will be one iron athwartship collision bulkhead $\frac{3}{16}$ inch iron, braced, and one forward of the boiler. Coal bunkers on either side of the boiler hold 40 tons each. Below the quarter deck will be the main cabin, with 20 sleeping berths, wash room, mess room, kitchen, pantry, chief-engineer's room, and store rooms. The forecastle will contain 10 bunks, store rooms, etc. The vessel will be heated throughout by steam. She will have two masts, schooner-rigged, two 17 foot yawls, two 1,000 gallon water tanks, three anchors of 800, 500, and 175 pounds weight, 120 fathoms chain cable, and a pump brake windlass.

The machinery will consist of an inverted direct-acting compound engine, with 22 and 36 inch cylinders, 26 inches stroke, fitted with tubular surface condenser, and air, feed, bilge, and circulating pumps, one cylindrical return tubular boiler, to carry a working pressure of 70 pounds of steam to the square inch, an independent feed pump to supply boilers, wash decks, fire service, etc.

This pioneer sea-going pilot steamer is now building at Wilmington, Del., by the Harlan and Hollingsworth Company.

CLOTHING IN ITS RELATION TO HEALTH.

The ideas and scientific views of Prof. Dr. Gustave Jaeger, of Stuttgart, regarding the properties of animal wool, gain more and more in popularity with German scientists, and in one of the latest numbers of the *Homœopatische Monatsblatter* (Homeopathic Monthly), which appears in Stuttgart, Dr. E. Schlegel, a well known physician of Tübingen, has published an essay, in which he speaks of Professor Jaeger's theories as follows:

Among the discoveries that have been made during the last few years in medical science, some facts brought to light by Dr. Gustave Jaeger regarding the amount of water contained in the human body may prove to be of the utmost importance. In his paper concerning "The resistibility of the human body against epidemic diseases and the power of constitution," * Professor Jaeger has proved that the specific gravity of several individuals is very different, and that the state of the health of those individuals is closely connected with their specific gravity. The greater the weight of the human body in comparison to the space which it occupies, *i. e.*, the greater its specific gravity, the more it is able to resist epidemic diseases. Persons of a low specific gravity are taken ill from very insignificant causes, such as a cold, and are very susceptible to contagious diseases. Such persons have usually a certain fullness of body, and are even corpulent, but just that which gives them a great size is useless ballast, namely, fat and water. These substances endow the heaviest bodies with a comparatively low specific gravity, giving at the same time to the constitution little power of resistance.

Very different is the case with bodies of high specific gravity. Here neither fat nor water is superabundant, the flesh feels solid, and the bodily constitution possesses a high power of resistance. Professor Jaeger has investigated these differences of constitutional resistibility by comparing the specific gravity of a number of persons with their state of health. An accumulation of water in the tissues of the body he calls "Hydrostasis chronica," an expression which, as the whole discovery itself, reminds us of the teachings of the homeopathist Von Grauvogel respecting hydrogenoid constitutions, while the theory that a chronic accumulation of water in the body is the cause of many sicknesses is in perfect accord with the "Sykosis" described by Hahnemann, and afterward by Wolf.

The investigations and measurements of Jaeger are of an entirely new date, and we would not mention them here had not this discovery proved to be of the highest value for hygiene, and had not the conclusions of Professor Jaeger already been corroborated in a most remarkable manner.