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Contents:

(Illustrated articles are marked with an asterisk.)

ILLINOIS AND ST. LOUIS BRIDGE COMPANY---REPORT OF CAPT. JAMES B. EADS, CHIEF ENGINEER.

The St. Louis bridge, and the great suspension bridge over East River, between New York and Brooklyn, are the two greatest engineering works of the kind now in progress in this country, if not in the world. Both are demonstrating the value of the caisson as an appliance for constructing heavy masonry under water. The former, however, is attended with peculiar difficulties, resulting from the great depth of the abutments, the successful overcoming of which will establish the fame of Capt. Eads as one of the most accomplished engineers of the age.

This gentleman has forwarded to us advance sheets of his report, dated October 1, 1870, from which we shall endeavor to present in the present brief review, and in future extracts, as full as our page space will permit, the more important facts and statements of interest.

The masonry of the west abutment has been carried up from the bed rock of the river to 31 feet above low water. It now contains 6,380 cubic yards of masonry. When completed it will be 115 feet high above the bed rock, and will contain 11,860 cubic yards.

Greater difficulties were encountered in the construction of this pier than in either of the others, owing to the fact that the river at this point had been made the receptacle of every kind of useless material, old sheet-iron, furnace grate-bars, fire-bricks, etc., and two wrecks of vessels had also been sunk on the site of the abutment. More particular mention of these will be found in an extract from the report printed in another column.

The caisson for the east pier was launched October 18, 1869, and on the 25th of October, the first stone was laid upon it. No accident occurred in sinking it, and it reached and rested upon the bed rock on the 28th February, 1870. The bed-rock under this pier is 128 feet below high-water mark. During low water, the depth of sand resting on the bed rock at the site of this pier is 80 feet, at high water it scours down somewhat.

During the sinking of the caisson, the walls at one time sprung a leak, so that the men had to be signaled up. This occurred during extraordinarily high water, and work was suspended till the water subsided.

When the pier had descended 66 feet a telegraphic instrument was placed in the air chamber, and wires led to the office of the Superintendent of construction, and also to the office of the Chief Engineer. The moral effect of the knowledge that means of communicating with the upper world was constantly at hand, is said to have been very salutary on the workmen in the air chamber. The greatest pressure marked by the gages was fifty-two pounds.

Particular attention has been paid to the effect of this great pressure upon the health of the workmen. Capt. Eads' observations on this point are so valuable that we shall publish them in full in a future issue. Suffice it for the present to say that though twelve deaths occurred, one half the men constantly employed from the beginning to the end of the work escaped injury or inconvenience.

Our space is, however, entirely too limited to give anything like an adequate review of this able report. Our extracts from it, one of which will be found in another column, and others which will be found in future issues, will give a better idea of the magnitude of the work, and the ingenious and scientific methods adopted for its accomplishment than a column review could do.

The document is singularly free from any affectation of scientific display, and written in a plain, practical, and common-sense style from beginning to end. It is too full of facts for condensation, and we should be glad had we space to publish it in full, instead of confining ourselves to extracts.

EXPLOSIONS FROM HYDRAULIC PRESSURE.

The very limited compressibility of water and its consequent limited expansion when released from pressure, have led most people to believe that in making hydraulic tests, or in urging the cylinders of hydrostatic presses to their utmost power of endurance, no danger is to be apprehended from explosions. It is reasoned that the smallest rupture of the cylinders would so relieve the pressure that its force would instantaneously be reduced far below that of any expanding gas, and, therefore, that the bursting of a press cylinder could result in nothing more serious than the cost of repairing the damage to the machine.

That this fact does not secure immunity from accident is proved by a casualty which occurred during the testing of a cylinder in Manchester, England, resulting in the death of the man who was performing the test.

The cylinder, which was of steel, was subjected to a pressure of 7,000 lbs. per square inch. It burst under this pressure, fragments of the metal flying off with great force, wounding and killing the person above alluded to.

At the inquest Mr. Ommaney one of the firm owning the works in which the accident occurred, assigned the destructive velocity imparted to the fragments, to the elasticity of the steel.

Had the material of which the cylinder was composed been cast iron, the pieces of iron would have been forced out, and simply have dropped on to the floor, and the water would have flowed out in the usual way, as in a similar case which occurred at their works some time ago. He considered that the damage done was wholly due to the elasticity of the steel, which would be greatly expanded by the water, and when the bolts were displaced it would, as a natural consequence, contract so suddenly as to send the water out with a tremendous force. During the inquest a question was mooted as to whether there was any air left in the cylinder when it was filled, but all the witnesses agreed that such precautions had been taken as to make this absolutely impossible.

A writer in a Manchester paper discussing this accident maintains that the cylinder must have contained air, and such is our opinion. The elasticity of the cylinder does not, to our mind, afford a satisfactory explanation of the accident. The writer referred to argues that in testing such a cylinder (or any other apparatus) as that now under consideration, by means of water pressure, no danger would arise from the fastenings giving way or the metal of the cylinder being ruptured; while, on the other hand, should the vessel contain air, or partly water and air, then the danger is infinitely greater, since the confined air in virtue of its elastic force behaves just as steam of equal pressure would under similar circumstances. The public have read enough of late about boiler explosions to realize the danger attending the use of steam of, say, 50lb. to 100lb., when generated in vessels not sufficiently strong to withstand such a pressure, and yet few can believe that in the case before us a similar force, but exceeding 7,000lb. per square inch, was applied without sufficient precautions being taken to prevent accident. The air in the cylinder should have been completely expelled or displaced by the water before the pressure was applied. Had this been done there would have been no explosion, though the bolts should be too weak to stand the heavy strain upon them. The ram was "hurled a distance of 10 or 12 yards, while the cylinder recoiled about 7ft." Now this is all that any practical man requires to know in order to explain the cause of the accident; and yet, strange to say, the inquest passed without a single ray of light being thrown on the matter. The danger of allowing air to remain in the cylinder during a test has been well recognized, yet it seems that in this case it was overlooked, though the firm in whose works the accident occurred is composed of engineers of established reputation.

The accuracy of the gage used on the occasion is also questioned, and there is little doubt that the gages employed in such tests are often so inaccurate as to be unreliable in their indications of high pressures.

ARTESIAN WELLS.

Some of our readers will remember the article of Professor David Christy, published on page 54, Vol. XVI., SCIENTIFIC AMERICAN, on the subject of artesian wells. His investigations of large areas over the West and South, led him to discredit the common theory, that wells of this character can be obtained anywhere by boring deep enough in the earth's crust. His generalizations were controverted in our columns by several writers.

In addition to the facts then presented, Professor Christy now calls our attention to the late results of the attempts in St. Louis, Mo., to obtain a supply of water for the Insane Asylum at that city. The boring extended to a depth of 3,843½ feet without success. No water flows from it at the surface. The attempt has been a failure, and it has been abandoned. Thus the views of Prof. Christy, step by step, are being sustained. A year previous to the work being discontinued upon the boring at the State House, Columbus, Ohio, he predicted its failure in a lengthened essay. The failure of that enterprise proved the soundness of his deductions made from a knowledge of the geology of the surrounding country. The failure at St. Louis now confirms his views. The boring at Columbus was discontinued at the depth of 2,774½ feet.

The Professor calls our attention to this subject, on account of the views of Mr. Greeley presented at the monthly meeting of the New York Historical Society, a few evenings since, in an address relating to "The American Desert," occupying the country between the base of the Rocky Mountains and the Missouri River. This territory, he said, embraced an area of 400,000 square miles; and that "all this tract needed to make it one of the most productive portions of the continent, was water, which, in his opinion, could be readily furnished by artesian wells and other modern methods of irrigation."

Before emigration sets in to that section of country, it will be necessary to test the question whether a subterranean supply of water exists in it, which will rise to the surface. The experiment of the Government exploring party, a few years since, in boring for water, proved a failure, though conducted under the direction of a geologist.

SCIENTIFIC ADMINISTRATION.

The great want in the conduct of the affairs of our Government is scientific administration.

The number of men who have been appointed to office in the United States at any time during the last thirty years on account of any fitness for the positions is lamentably small. The question of fitness is discarded at once, and political considerations are made to outweigh knowledge. So common has it become to appoint men notoriously ignorant of the first principles of government or of political economy, that an education is looked upon as a defect in a man's training for political promotion and the number of persons who think it worth while to seek a liberal education is actually less at the present time than it was thirty years ago, although the population has vastly increased. It is in view of this startling statement of facts that many of our most enlightened citizens have formed a social science association for the discussion of the best way of remedying the evil. They call loudly for a reform in the civil service, and demand that appointments shall be made after competitive examinations and on grounds of fitness, rather than of political affinities.

It will probably require years to break up the present system, but that it ought to be destroyed, no man of intelligence will hesitate to affirm. But it is not alone in the administration of the affairs of the Government that a reform is needed. We could point out quite as urgent a necessity for a radical change in the conduct of private business, as can be found in the more conspicuous mistakes of office-holders. There are many large manufacturing establishments where scientific knowledge is sadly wanting. When we see "Positively no admittance" over the door, we conclude that somebody is afraid to have his ignorance exposed. Wise men know that the chances are altogether in favor of the workmen in every establishment gaining quite as much knowledge from casual visitors as they can themselves impart. We have heard a scientific friend relate how he was denied admission to an establishment in this city where the success of the works depended upon accurate knowledge, on the plea that the processes employed were secret. Subsequent inquiry revealed the fact that no one of any scientific knowledge was employed on the premises, and the fear of having this omission divulged to the stockholders was the occasion of the "No admittance."

Professor Liebig tells a story about a chemical factory he visited in Scotland. The proprietor politely showed the eminent chemist through an establishment for making Prussian blue. The noise of the machinery was so great as to preclude conversation, and the iron scrapers in a revolving mill rubbed so hard against the sides of the hopper as to wear out the shafting in a few months. After the party had returned to the open air, Liebig inquired why it was that the friction was allowed to destroy the scrapers.

"That is precisely the secret of my success," said the proprietor; "I find the more noise the machine makes, the finer is the quality of my product."

The manufacturer actually introduced iron into the prussiate of potash at the expense of his machinery, and he was not a little astonished when Liebig advised him to throw in the iron in the form of scraps and thus accomplish the same results.

This is a fair illustration of the way many capitalists have of avoiding the expense of employing scientific experts—they prefer to grind up their own machinery to asking a few questions for which they will be compelled to pay.

It is impossible to get on in the government, in the shop, in the factory, in the camp, or on the farm without scientific administration. No one who reads aright the lessons of modern times can deny this fact. The whole world is reading this lesson in the conduct of the affairs of Prussia, and in the great success of that nation. Fifty years ago the German nation was overrun by foreign troops, their villages were burned, their crops destroyed, their cities laid under heavy contributions. They were helpless and divided in council, and wholly unprepared for the shock. As soon as the notes of war ceased and the smoke had cleared from the political horizon, the leading statesman of the day began to inquire into the cause of the humiliating condition of affairs. The great minister, Von Stein, the Bismark of those days, was not slow to detect the utter want of scientific administration in all of the affairs of State as well as in the management of trades and manufactures. His remedy was thorough and complete—his reforms laid the foundation of the future grandeur of the German nation. Under his direction the public schools were re-